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Pinnacles

- Traveling Salesman Problem
- Hand Gesture Interaction
- Column Oriented Databases
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The Computational Complexity of the Traveling Salesman Problem

By Craig Alan Feinstein

Abstract - In this note, we show that the Traveling Salesman Problem cannot be solved in polynomial-time on a classical computer.

GJCST Classification : F.2.2, F.2.3

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The Computational Complexity of the Traveling Salesman Problem

Craig Alan Feinstein

Abstract - In this note, we show that the Traveling Salesman Problem cannot be solved in polynomial-time on a classical computer.

Consider the following well-known NP-hard problem :

Traveling Salesman Problem - A traveling salesman starts at city 1, travels to cities $2, \ldots, n-1$ in any order that the salesman chooses, and then ends his trip in city n. Let us denote $\delta(i, j)$ to be the distance from city i to city j. The goal of the Traveling Salesman Problem is to find the minimum total distance possible for the traveling salesman to travel. There are no restrictions on the possible distances $\delta(i, j)$ between each of the cities other than the requirement that each $\delta(i, j)$ is a positive integer and $\delta(i, j) = \delta(j, i)$ [1, 3, 4].

We give a simple proof that no deterministic and exact algorithm can solve the Traveling Salesman Problem in $o(2^n)$ time:

For any nonempty subset $S \subseteq \{2, \ldots, n\}$ and for any city $i \in S$, let us define $\Delta(S, i)$ to be the length of the shortest path that starts at city 1, visits all cities in the set $S - \{i\}$, and finally stops at city i. Then the Traveling Salesman Problem is equivalent to the problem of computing $\Delta(\{2, \ldots, n\}, n)$. Clearly, $\Delta(\{i\}, i) = \delta(1, i)$ and

$$\Delta(S, i) = \min\{\Delta(S - \{i\}, j) + \delta(j, i) \mid j \in S - \{i\}\},$$

when $|S| \geq 2$.

This recursive formula cannot be simplified, so the fastest way to compute $\Delta(\{2, \ldots, n\}, n)$ is to apply this recursive formula to $\Delta(\{2, \ldots, n\}, n)$. Since this involves computing $\Delta(S, i)$ for all $\Theta(2^n)$ nonempty subsets $S \subsetneq \{2, \ldots, n\}$ and each $i \in S$, we obtain a lower bound of $\Theta(2^n)$ for the worst-case running-time of any deterministic and exact algorithm that solves the Traveling Salesman Problem.

This lower bound is confirmed by the fact that the fastest known deterministic and exact algorithm which solves the Traveling Salesman Problem was first published in 1962 and has a running-time of $\Theta^*(2^n)$ [2, 4].

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Hand Gesture Interaction with Human-Computer

By Dejan Chandra Gope

Dhaka University of Engineering and Technology, Gazipur

Abstract - Hand gestures are an important modality for human computer interaction. Compared to many existing interfaces, hand gestures have the advantages of being easy to use, natural, and intuitive. Successful applications of hand gesture recognition include computer games control, human-robot interaction, and sign language recognition, to name a few. Vision-based recognition systems can give computers the capability of understanding and responding to hand gestures. The paper gives an overview of the field of hand gesture interaction with Human-Computer, and describes the early stages of a project about gestural command sets, an issue that has often been neglected. Currently we have built a first prototype for exploring the use of pie- and marking menus in gesture-based interaction. The purpose is to study if such menus, with practice, could support the development of autonomous gestural command sets. The scenario is remote control of home appliances, such as TV sets and DVD players, which in the future could be extended to the more general scenario of ubiquitous computing in everyday situations. Some early observations are reported, mainly concerning problems with user fatigue and precision of gestures. Future work is discussed, such as introducing flow menus for reducing fatigue, and control menus for continuous control functions. The computer vision algorithms will also have to be developed further.

Keywords : *Human Computer Interaction, Hand Tracking, Hand gesture, Computer Vision Based Gesture Recognition, HCI, Gesture Command, Marking Menu.*

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Keywords : Human Computer Interaction, Hand Tracking, Hand gesture, Computer Vision Based Gesture Recognition, HCI, Gesture Command, Marking Menu.

I. Introduction

Vision-based hand gesture recognition is an active area of research in human-computer interaction (HCI), as direct use of hands is a natural means for humans to communicate with each other and more recently, with devices in intelligent environments. The trend in HCI is moving towards real-time hand gesture recognition and tracking for use in interacting with video games [1], remote-less control of television sets, and interacting with other similar environments. Given the ubiquity of mobile devices such as smartphones and notebooks with embedded cameras, a hand gesture recognition system can serve as an important way of using these camera-enabled devices to interact more intuitively than traditional interfaces. The trend towards embedded, ubiquitous computing in domestic environments creates a need for human-computer interaction forms that are experienced as natural, convenient, and efficient. The traditional desktop paradigm, building on a structured office work situation, and the use of keyboard, mouse and display, is no longer appropriate. Instead, natural actions in human-to-human communication, such as speak and gesture, seem more appropriate for what Abowd and Mynatt [1] have named everyday computing, and which should support the informal and unstructured activities of everyday life. Interaction in these situations implies that it should not be necessary to carry any equipment or to be in a specific location, e.g., at a desk in front of a screen. Interfaces based on computational perception and computer vision should be appropriate for accomplishing the goals of ubiquitous, everyday computing. This paper presents an overview of the field of gesture-based interfaces in human-computer interaction as a background, and the first stages of a project concerning the development of such interfaces. Specifically, in the project we intend to study the use of hand gestures for interaction, in an approach based on computer vision. As a starting point, remote control of electronic appliances in a home environment, such as TV sets and DVD players, was chosen. This is an existing, common interaction situation, familiar to most. Normally it requires the use of a number of devices, which can be a nuisance, and there are clear benefits to an appliance-free approach. In the future the application could easily be extended to a more general scenario of ubiquitous computing in everyday situations. Currently we have implemented a first prototype for exploring the use of pie- and marking menus [9], [20] for gesture-based interaction. Our main purpose is not menu-based interaction, but to study if such menus, with practice, could support the development of an autonomous gestural command sets. The application will be described in more detail later in this paper.

II. Related Work

Hand gesture recognition and tracking has been an important and active area of research in the field of HCI, and sign language recognition. The use of glove-based devices to measure hand location and shape, especially for virtual reality, has been actively studied. In spite of achieving high accuracy and speed in measuring hand postures, this approach is not suitable for certain applications due to the restricted hand motion caused by the attached cables.

Computer vision techniques measure hand postures and locations from a distance, providing for unrestricted movement. Numerous approaches have been explored by the vision community to extract human skin regions either by background subtraction or skin-color segmentation. Methods based on background subtraction are not feasible when applied to images with

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complex backgrounds or real-world scenarios where the user wants to use the application on-the-go. Once the image regions are identified by the system, the image regions can be analyzed to estimate the hand posture. Specifically, for finger gesture recognition and tracking, a common approach is to extract hand regions and then locate the fingertip to determine the pose orientation. In a 3D pointing interface using image processing is presented to estimate the pose of a pointing finger gesture. This system however, suffers from various drawbacks in real-world scenarios due to the use of a fixed threshold for image binarization and the use of pre-determined finger length and thickness values. Also, low-cost web cameras and infrared cameras have been used for finger detection and tracking. In finger detection is performed by fitting a cone to rounded features, and in a template matching approach is used to recognize a small set of gestures.

III. Hand Gestures for Computer Vision

Gestures are expressive, meaningful body motions with the intent to convey information or interact with the environment [36]. According to Cadoz [8] hand gestures serve three functional roles, semiotic, ergotic, and epistemic. The semiotic function is to communicate information, the ergotic function corresponds to the capacity to manipulate objects in the real world, and the epistemic function allows us to learn from the environment through tactile experience. Based on this classification Quek [30] distinguishes communicative gestures, which are meant for visual interpretation and where no hidden part carries information critical to understanding, from manipulative gestures, which show no such constraints. Thus, it may be more appropriate to use special tools for interaction, like data gloves, rather than computer vision if the intent is realistic manipulation of objects in, e.g., a virtual environment. Pavlovic et al. [28] makes a similar classification, but also point out the distinction between unintentional movements and gestures.

For communicative, semiotic gestures, Kendon [14] distinguishes gesticulation, gestures that accompany speech, from autonomous gestures. These can be of four different kinds: language-like gestures, pantomimes, emblems, and sign languages. When moving forward in this list the association with speech diminishes, language properties increase, spontaneity decreases and social regulation increases. Detailed descriptions and taxonomies concerning hand gestures from the point of view of computer vision can be found in Quek [30], Pavlovic & Sharma [28] and Turk [36]. Here only a brief overview will be presented.

Most work in computer vision and HCI has focused on emblems and signs because they carry more clear semantic meaning, and may be more appropriate for command and control interaction [37]. It is important to note, however, that they are largely symbolic, arbitrary in nature, and that universally understandable gestures of this kind hardly exist. There is also one important exception worth mentioning. In the gesticulation category, McNeill [24] defines deictic gestures as pointing gestures that refer to people, objects, or events in space and time. Deictic gestures are potentially useful for all kinds of selections in human-computer interaction, as illustrated, e.g., by the early work of Bolt [4]. The deictic category itself can be further subdivided, but from a computer vision point of view all deictic gestures are performed as pointing, and the difference lies in the higher level of interpretation [30].

In the following we limit ourselves to intentional, semiotic, hand gestures. From a computer vision point of view, we focus on the recognition of static postures and gestures involving movements of fingers, hands and arm with the intent to convey information to the environment.

IV. Perceptive and Multimodal User Interfaces

The aim is to develop conversational interfaces, based on what is considered to be natural human-to-human dialog. For example, Bolt [4] suggested that in order to realize conversational computer interfaces, gesture recognition will have to pick up on unintended gestures, and interpret fidgeting and other body language signs, and Wexelblatt [41] argued that only the use of natural hand gestures is motivated, and that there might even be added cognitive load on the user by using gestures in any other way. Two main scenarios for gestural interfaces can be distinguished. One aims at developing Perceptive User Interfaces (PUI), as described by Turk [36], or Perceptive Spaces , e.g., Wren [42], striving for automatic recognition of natural, human gestures integrated with other human expressions, such as body movements, gaze, facial expression, and speech.

However, in this paper the focus is on using hand gestures given purposefully as instructions, and we restrict our work to deliberate, expressive movements. This falls within the second approach to gestural interfaces, Multimodal User Interfaces, where hand poses and specific gestures are used as commands in a command language. The gestures need not be natural gestures but could be developed for the situation, or based on a standard sign language. In this approach, gestures are either a replacement for other interaction tools, such as remote controls and mice, or a complement, e.g., gestures used with speech and gaze input in a multimodal interface. Oviatt et al. [27] noted that there is a growing interest in designing multimodal interfaces that incorporate vision-based technologies. They also contrast the passive mode of PUI with the active input mode, addressed here, and claim that although passive modes may be less obtrusive, active

modes generally are more reliable indicators of user intent, and not as prone to error.

V. Gesture-Based Applications in HCI

In traditional HCI, most attempts have used some device, such as an instrumented glove, for incorporating gestures into the interface. If the goal is natural interaction in everyday situations this might not be acceptable. However, a number of applications of hand gesture recognition for HCI exist, using the untethered, unencumbered approach of computer vision. Mostly they require restricted backgrounds and camera positions, and a small set of gestures, performed with one hand. They can be classified as applications for pointing, presenting, digital desktops, and virtual workbenches and VR.

Pavlovic [28] noted that, ideally, naturalness of the interface requires that any and every gesture performed by the user should be interpretable, but that the state of the art in vision-based gesture recognition is far from providing a satisfactory solution to this problem. A major reason obviously is the complexity associated with the analysis and recognition of gestures. A number of pragmatic solutions to gesture input in HCI exist, however, such as:

- use props or input devices (e.g., pen, or data glove)
- restrict the object information (e.g., silhouette of the hand)
- restrict the recognition situation (uniform background, restricted area)
- restrict the set of gestures

Pointing: A number of applications that use computer vision for pointing (deictic) gestures have been developed, either in a scenario for some special kind of interaction situation, such as Put-That-There [4], or, as a replacement for some input device in general, mostly the mouse. An example is Finger Mouse [31], where a down-looking camera was used to create a virtual 2D mousepad above the keyboard, allowing users to perform pointing gestures to control the cursor. Mouse clicks were implemented by pressing the shift key. Kjeldsen and Kender [16] used a camera position below the screen, facing the user, to compute the x,y coordinates that control the cursor. For window control they used a neural network to classify hand poses (point, grasp, move, menu) with a simple grammar, based on pausing and retraction. They note that users had difficulties to remember the sequence of motions and poses and that there were unexpected interface actions, because gestures were dependent on timing. O´Hagan [25] used a commercial system with a single video camera for Finger Track, which performed vision-based finger tracking on top of the workspace. A pointing gesture (one finger) and a click gesture (two-fingers extended) could be used. A similar application, FingerMouse for controlling the mouse pointer was presented by von Hardenberg and Berard [39]. The finger, moving over a virtual touchscreen, is used as mouse and selection is indicated by a one sec delay in the gesture.

Presenting: Baudel et al. [2] used a glove-based system for controlling Microsoft PowerPoint-presentations. Even if the focus in this paper is on computer vision, their work should be mentioned, because it addresses the question of developing gestural command sets. They suggest that command gestures should be defined according to an articulatory scheme with a tense start position (e.g. all fingers outstretched), a relaxed dynamic phase (e.g. a hand movement to the right) and a tense end position (e.g. all fingers bent). In a similar application, based on computer vision, Lee & Kim [21] use hand movements for controlling presentations. The detection of the hand is entirely based on skin color, which requires a controlled background. The gesture-based virtual touchscreen of von Hardenberg et al. [39] included command gestures for slide changes and menu selection, in addition to general pointing gestures (see above). Hand detection relies on a time filtered background subtraction, i.e., it requires a reference image. In a more advanced multimodal scenario, Kettebekov and Sharma [15] performed an observational study to develop a gesture grammar for deictic gestures when presenting a weather map.

Digital Desks: A third kind of application aims at developing mixed reality desktops, using free hand pointing and manipulation of digital objects. Kruegers VideoDesk [19] was an early desk-based system in which an overhead camera and a horizontal light was used to provide hand gesture input for interactions, which were then displayed on a monitor at the far end of the desk. The work was built on the early research of the VideoPlace system [18]. Wellner [40] developed DigitalDesk, a more advanced digital desk system, mixing projected and electronic documents on a real desktop, and using an image processing system to determine the position of the users' hands, and to gather information from documents placed on the desk. Similarly, Maggioni and Kämmerer [23] explored pointing gestures in vision-based virtual touchscreens for office applications, public information terminals and medical applications. The detection is based on a skin segmentation step, and the approach requires controlled backgrounds. More recently, Koike et al. [17] developed an augmented desk interface, EnhancedDesk, with computer vision as a key technology. EnhancedDesk uses a projector for presenting information onto a physical desktop, an infrared camera for detecting users arms, hands, and hand poses, and a pan-tilt camera for giving detail. Users can manipulate digital information directly by using their hands and fingers. The system is reported to be able to track fingertip movements in real time under any lighting condition.

Virtual workbenches and VR: The distinction between virtual workbenches and digital desktops is not

sharp. Here, a workbench is described as primarily intended for navigation and object manipulation in 3D environments. As mentioned earlier, computer vision might not be suitable for these tasks. Glove-based input might be better suited for intricate 3D manipulation tasks, due to the problem of occluded fingers. Recently, however, Utsumi and Ohya [38] proposed a multiple-viewpoint system for three-dimensional tracking of position, pose and shapes of human hands, as a step towards replacing glove-based input. Also, many gestures for navigation and object manipulation in virtual environments have a deictic component, i.e., are pointing gestures, which simplifies the problem from a computer vision point of view. Segen and Kumar [33] investigated a vision-based system for 3D navigation, object manipulation and visualization. The system used stereo cameras against a plain background and with stable illumination, and has been used for movement control in a 3D virtual environment, for building 3D scenes, and for a 2D game. Fatigue is reported as an issue, especially when the system is used for object manipulation. Leibe et al. [22] experimented with 3D terrain navigation, games, and CSCW, using a FakeSpace immersive workbench with infrared illuminators placed next to the camera. IR light is reflected back to the camera by objects placed on the desk. A second IR camera provides a side view of users arms for recovering 3D pointing gestures. O'Hagan et al. [26] implemented a virtual, 3D workbench where two cameras were used to provide stereo images of the users' hand. As with Segen [33], the system could be used for object and scene translations, rotations, object resizing, and zoom. By combining feature-based tracking with a model-based system, tracking with cluttered backgrounds and changing illumination is claimed to be possible. O'Hagan et al. also point out user fatigue as a problem in this kind of application. Other examples of 3D object manipulation and navigation can be found in Sato et al. [32] and Bretzner and Lindeberg [6].

Finally, the work of Wren et al. regarding perceptive rooms and spaces [42] should be mentioned in this context, even if it might rather be characterized as an attempt at mixed reality, multimodality and ubiquitous computing in a PUI scenario. An interactive space is created in a room with constant lighting, controlled background, and a large projection screen. Stereo computer vision is used to track key features of body, hand and head motion. The authors point out that the possibility for users to enter the virtual environment just by stepping into the sensing area is very important, not having to spend time donning equipment. Also, the importance of social context is noted. Not only can the user see and hear a bystander, the bystander can easily take the users place for a few seconds, without any need to "suit up", as is the case with most scenarios requiring equipment.

VI. Current Work

With the exception of Baudel et al. [2], very little attention has been paid to the selection of gestures in gesture-based interaction, and to the development on gestural command sets. Often the reason is that the gestures are deictic. However, even under circumstances when they are not, there has not been much discussion about what gestures or hand poses should be used.

VII. Gestural Command Sets

The design space for gestural commands can be characterized along three dimensions: Cognitive aspects, Articulatory aspects and Technological aspects. Cognitive aspects refer to how easy commands are to learn and to remember. It is often claimed that gestural command sets should be natural and intuitive, e.g. [4] [41], mostly meaning that they should inherently make sense to the user. This might be possible for manipulative gestures, but, as noted above, for communicative gestures there might not exist any shared stereotypes to build on, except in very specific situations. If the aim is gestural control of devices, there is no cultural or other context for most functions. Baudel et al. [2] recommend that ease of learning should be favored and that a compromise must be made between natural gestures that are immediately assimilated by the user and complex gestures that give more control. They define "natural gestures" as those that involve the least effort and differ the least from a rest position, i.e., that "naturalness" in part should be based on an articulatory component, according to the classification used here. Articulatory aspects refer to how easy gestures are to perform, and how tiring they are for the user. Gestures involving complicated hand or finger poses should be avoided, because they are difficult to articulate and might even be impossible to perform for a substantial part of the population. They are common in current computer based approaches, because they are easy to recognize by computer vision. Repetitive gestures that require the arm to be held up and moved without support are also unsuitable from an articulatory point of view because of fatigue.

Technological aspects refer to the fact that in order to be appropriate for practical use, and not only in visionary scenarios and controlled laboratory situations, a command set for gestural interaction based on computer vision must take into account the state-of-the art of technology, now and in the near future. For example, Sign Language recognition might be desirable for a number of reasons, not least for people who need to use Sign Language for communication. Although difficult to learn, once learned a Sign Language is easy to remember because of its language properties, and might provide a good candidate framework for developing gestural languages for interaction. Some attempts to Sign Language recognition also exist. For

example, recently Starner et al. [34] developed a recognition system for a subset of American Sign Language. However, Braffort [5] points out that if the real aim is to deal with Sign Language, then all the different varied and complex elements of language must be taken into account. This is currently far from feasible. Still, much work can be done with reduced sets of Sign Language, limited to standard signs, as a first step towards a long-term objective.

Menu-based Systems for Gesture-Based Interaction: Our current work represents the first stages in a research effort about computer vision based gesture interaction, primarily aimed at questions concerning gesture command sets. The point of departure is cognitive, leaving articulatory aspects aside for the moment, mainly for reasons of technical feasibility. We focus on the fact that the learning curve for a gestural interface of any complexity will be steeper than for a menu-based interface, because commands need to be recalled, rather than recognized. As noted earlier, there are very few natural, generally understandable signs and gestures that could be used. And, however desirable it might be to use some standard Sign Language it is not technically feasible, except at the level of isolated signs. Using signs from Sign Language, if not the language itself, will be addressed in this project in the future. Currently gestures and hand poses are kept simple, for technical reasons and for reasons of articulatory simplicity.

As was mentioned above, menu-based systems have the cognitive advantage that commands can be recognized rather than recalled. Traditional menu-based interaction, however, is not attractive in a gesture-based scenario for everyday situations. Menu navigation would be far from the directness that gestural interaction could provide. However, by using pie- and marking menus, it might be possible to support directness, and to provide a solution for developing gestural command sets.

Pie- and Marking Menus: Pie menus were first described by Callahan et al. [9]. They are pop-up menus with the alternatives arranged radially. Because the gesture to select an item is directional, users can learn to make selections without looking at the menu. In principle this could be learned also with linear menus, but it is much easier to move the hand without feedback in a given direction, as with a pie menu, than to a menu item at a given distance, as in a linear menu. This fact can support a smooth transition between novice and expert use. For an expert user, working at high speed, menus need not even be popped up. The direction of the gesture is sufficient to recognize the selection. If the user hesitates at some point in the interaction, the underlying menus could be popped up, always giving the opportunity to get feedback about the current selection. Hierarchic marking menus [20] is a development of pie menus that allow more complex choices by the use of submenus. The same principles apply: expert users could work by gesture alone, without feedback. The shape of the gesture with its movements and turns can be recognized as a selection, instead of the sequence of distinct choices between alternatives. A recent example can be found in Beaudouin-Lafon et al. [3]. Hierarchic Marking Menus for Gesture-Based Interaction: Here the assumption is that command sets for computer vision based gesture interfaces can be created from hierarchical marking menus. As to articulatory characteristics, a certain hand pose, e.g., holding the hand up with all fingers outstretched, could be used for initiating a gesture and activating the menu system. This would correspond to the pen-down event in a pen-based system. The gesture could then be tracked by the computer vision algorithms, as the hand traverses the menu hierarchy. Finally, a certain hand pose could be used to actually make the selection, e.g., the index finger and thumb outstretched, corresponding to a pen-up event in pen-based interface. Put differently, the gestures in the command set would consist of a start pose, a trajectory, defined by menu organization, for each possible selection, and, lastly, a selection pose. Gestures ending in any other way than with the selection pose would be discarded, because either they could mean that the user abandoned the gesture, or simply that tracking of the hand was lost.

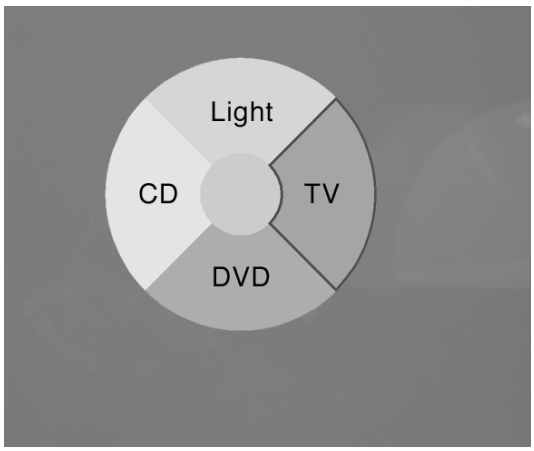

Fig. 1 : An example of a pie menu in the prototype.

For a novice user, this would amount to a traditional menu-selection task, where selections are made by navigating through an hierarchical menu structure. This, as such, could provide for unencumbered interaction in remote control situations but, as noted above, the directness of a gesture-interface would be lost. The assumption here, however, is that over time users will learn the gesture corresponding to each selection and no longer need visual feedback. The interaction would develop into direct communication, using a gestural language. In addition to providing for a natural transition from novice to expert, such a gestural language makes no assumptions about naturalness or semantics of gestures, because it is defined by the menu structure. In principle, if not in practice, the command set is

unlimited. A further advantage is that the demands put on the computer vision algorithms are reasonable. Fast and stable tracking of the hand will be required, however.

VIII. A Prototype for Hand Gesture Interaction

The prototyping and experimental work is still in an early stage and only a brief overview and some early impressions can be given here. Inspired by Freeman et al. [11], [12], we chose remote control of appliances in a domestic environment as our first application. Freeman et al. used only one gesture to control a TV set: an open hand facing the camera. An icon on a computer display followed the users hand, and by moving the icon (hand) along one of two sliders, a user could control the volume or select channels. Our prototype is more intricate and intended to test the hypothesis, discussed above, that hierarchical marking menus can be used to develop gestural command sets. However, so far, we have only designed a first example of a hierarchic menu system for controlling some functions of a TV, a CD player, and a lamp. The prototype has been set up in a generally accessible, open lab/demo space at CID (fig. 2).

Fig. 2 : The demo space at CID.

IX. Technical Aspects

The Computer Vision System: We have chosen a view-based representation of the hand, including both color and shape cues. The system tracks and recognizes the hand poses based on a combination of multi-scale color feature detection, view-based hierarchical hand models and particle filtering. The hand poses, or hand states, are represented in terms of hierarchies of color image features at different scales, with qualitative inter-relations in terms of scale, position and orientation. These hierarchical models capture the coarse shape of the hand poses. In each image, detection of multi-scale color features is performed. The hand states are then simultaneously detected and tracked using particle filtering, with an extension of layered sampling referred to as hierarchical layered sampling. The particle filtering allows for the evaluation of multiple hypotheses about the hand position, state, orientation and scale, and a likelihood measure determines what hypothesis to chose. To improve the performance of the system, a prior on skin color is included in the particle filtering step. In fig. 3, yellow (white) ellipses show detected multi-scale features in a complex scene and the correctly detected and recognized hand pose is superimposed in red (gray). A detailed description of the algorithms is given in [7].

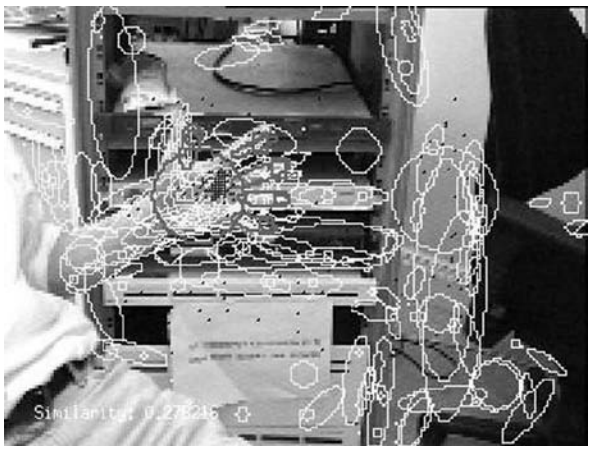

Fig. 3 : Detected multi-scale features and the recognized hand pose superimposed in an image of a complex scene.

As the coarse shape of the hand is represented in the feature hierarchy, the system is able to reject other skin colored objects that can be expected in the image (the face, arm, etc). The hierarchical representation can easily be further extended to achieve higher discrimination to complex backgrounds, at the cost of a higher computational complexity. An advantage of the approach is that it is to a large extent user and scale (distance) invariant. To some extent, the chosen qualitative feature hierarchy also shows view invariance for rotations out of the image plane (up to approx. 20-30 degrees for the chosen gestures).

There is a large number of works on real-time hand pose recognition in the computer vision literature. Some of the most related to our approach are, e.g., Freeman and Weissman [11] (see above) who used normalized correlation of template images of hands for hand pose recognition. Though efficient, this technique can be expected to be more sensitive to different users, deformations of the pose and changes in view, scale, and background. Cui and Weng [10] showed promising results for hand pose recognition using an appearance based method. However, the performance was far from real-time. The approach closest to ours was presented by Triesch and von der Malsburg [35] representing the poses as elastic graphs with local jets of Gabor filters computed at each vertex.

Equipment: A Dell Workstation 530 with dual 1,7 GHz Intel Xeon P4 processors running Red Hat Linux

was used. The menus were shown on a 19" Trinitron monitor, placed next to the TV screen. The menu system was developed in Smalltalk. An Mvdelta 2 framegrabber, IRdeo remote IR control, and a DI-01 Data interface (X10) was used for image acquisition and to control a table lamp, a Samsung 29" TV, and a Hitachi CD player. In order to maximize speed and accuracy, gesture recognition is currently tuned to work against a uniform background within a limited area, approximately 0,5 by 0,65 m in size, at a distance of approximately 3 m from the camera, and under relatively fixed lighting conditions.

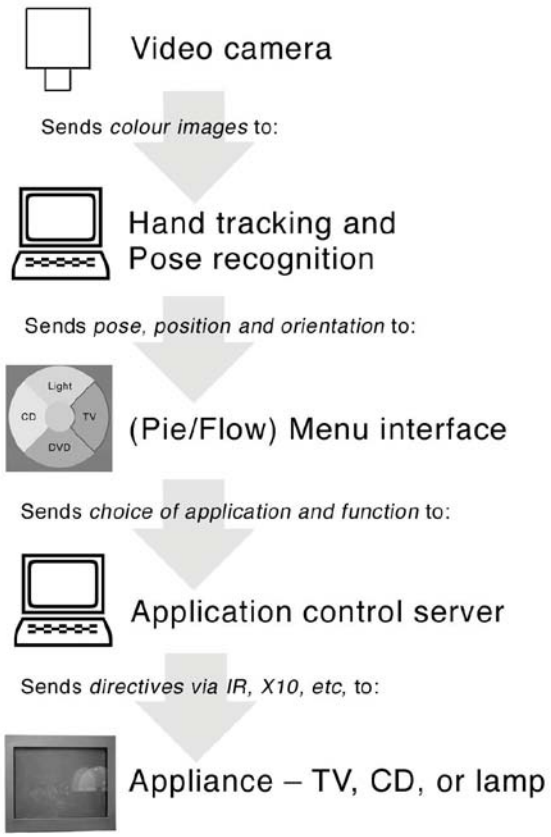

Fig. 4 : An overview of the functional components and the information flow in the prototype.

X. Menu System

An incomplete version with three hierarchical levels and four choices in each menu currently exists. Only a few of choices are active, however: TV on/off, Previous/Next channel, CD Play/Stop/Back/Forward, Lamp on/off. An example of a menu is shown in fig. 1. An overview of the functional components and the information flow in the prototype is presented in fig. 4 above. We have only recently begun working on the design, the arrangement, and the organization of the menus.

A hand pose with the index finger and thumboutstretched is used as the start pose for activating the menus, corresponding to pen-down in a pen-based interface. A hand with five fingers outstretched is used as the selection pose, corresponding to pen-up. Evidently, any two hand poses could be used for these purposes. Menus are activated when the start hand pose is detected by the computer vision system in the active area. The hand is tracked as long as the start pose is held. If the hand is moved over the periphery of a sector that has a submenu, the parent menu disappears, and the submenu appears. Showing the selection hand pose in an active field, e.g., TV on, makes a selection. All other ways of ending the interaction are ignored. The menus are currently shown on a computer screen, placed by the side of the TV (fig. 2). This is inconvenient, and in the future menus will be presented in an overlay on the TV screen.

XI. Results and Discussion

Menu-based systems are more complex, and there is simply more to learn at the outset. However, learning the principles for using the menus was not a main issue, and the principles are the same no matter the number of choices in the menu system. There are major drawbacks with using static hand poses for direct control as in the earlier prototype. First, the number of usable poses is limited. Second, many people have difficulties using finger poses. Third, the association of poses to functions is arbitrary, and difficult to remember. There are also culturally specific hand poses (emblems) that have to be avoided. We have not yet been able to bring the technical performance (speed and accuracy) of the menu-based system to a level where true gesture-based control without feedback can be accomplished. However, observations with the current system, as it is, indicate that gesture-based control with simple, single-level pie menus is feasible, but that gestures based on hierarchical menus create some problems. It is difficult for users to make the gestures for multiple-level selections sufficiently distinct, based on feedback only from the proprioceptive system of the arm. Thus, computer algorithms for recognition of fuzzy gestures might also be required. Another solution could be to reduce the number of choices at each level. The current setup, with subjects seated facing the TV and making gestures with one arm and hand held out by the side of the body without support, is not suitable from an articulatory point of view. It is inconvenient and fatigue quickly sets in. This is also a consequence of the fact that gestures have to cover a relatively large area if the hierarchy is deep. Also, the gesture might end up outside of the recognition area. The problem of fatigue is known from earlier attempts with gesture-based interfaces and must be addressed. In the current application much could be gained by providing support for the arm, by making gestures smaller, and by making

the recognition system more tolerant as to the whereabouts of the user and the hand.

XII. Future Work

As to the computer vision algorithms there is ongoing work to increase the speed and performance of the system, to acquire more position independence for recognition of gestures, to increase the tolerance for varying lighting conditions, and to increase recognition performance with complex backgrounds. The main effort, however, is currently aimed at the design and organization of menus. Recently we have begun development of Flow Menus, a version of hierarchical marking menus in which successive levels of the hierarchy are shown in the same position [13]. In our application this would greatly reduce the area which the gestures have to cover when the hierarchy is deep. An additional problem we faced is that not all kinds of functions, e.g., increasing sound volume, are suitable for standard pie menus. Thus, we are working on including a version of control menus [29] into the hierarchy. With control menus, repeated control signals are sent as long as the hand is kept within the menu item in a selection pose.

We have started to implement a Hidden Markov Model for gesture learning and recognition in hopes to be able to create better and more natural gestures. The gestures currently implemented all use a heuristic approach. HMMs have been used extensively for gesture recognition in pen computing [DT04] and in vision [ER98] before. Using a type of machine learning instead of heuristics for a gesture recognizer is no more difficult to have interact with our system.

We are also considering a different scenario in which a few gestures (hand poses or deictic gestures) are used for direct control of common functions, such as controlling the sound level or lighting, and menu-based gestures are used for more complex selections. In this situation it seems attractive to investigate if signs from Sign Language could be used for the static hand poses and poses for menu control.

XIII. Conclusions

Human-computer interaction is still in its infancy. Visual interpretation of hand gestures would allow the development of potentially natural interfaces to computer controlledenvironments. In response to this potential, thenumber of different approaches to video-based hand gesturerecognition has grown tremendously in recent years.Thus there is a growing need for systematization and analysis of many aspects of gestural interaction. Several simple HCI systems have been proposed that demonstrate the potential of vision-based gestural interfaces. However, from a practical standpoint, the developmentof such systems is in its infancy. Though most current systems employ hand gestures for the manipulation of objects, the complexity of the interpretation of gestures dictates the achievable solution. For example, the gestures used to convey manipulative actions today are usually of the communicative type. Further, hand gestures for HCI are mostly restricted to single-handed and produced only by a single user in the system. This consequently downgrades the effectiveness of the interaction. We suggest several directionsof research for raising these limitations toward gestural HCI. For example, integration of hand gestures with speech, gaze and other naturally related modes of communication in a multimodal interface. However, substantial research effort that connects advances in computer vision with the basic study of human-computer interaction will be needed in the future to develop an effective andnatural hand gesture interface.

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The Problems and Prospects of New Public Sphere for Global Civil Society

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Abstract - Information and communication technologies (ICTS) have revolutionized almost every aspect of life particularly it has created a new global public sphere by providing endless list of tools for global communication thereby establishing a new global society with novel norms and mundane issues. This paper is an effort to review the state of affairs in new public sphere with a focus on the digital tools under use, their role in creating the global society and the threats and opportunities available for the international citizens for behaving effectively to utilize the opportunities and manage threats to the maximum. The paper explores interlinks between the digital gadgets, emerging global public sphere and the mundane issues emanating from this situation. The paper ends with a theoretical model constructed out of the themes floating across the review and analysis.

Keywords : *New Global Society, New Public Sphere, ICTS, Social Software.*

GJCST Classification : *K.4.m*

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The Problems and Prospects of New Public Sphere for Global Civil Society

Muhammad Zubair Khan[α], Dr. Ijaz Shafi Gilani[Ω], Dr. Allah Nawaz[β]

Abstract - Information and communication technologies (ICTS) have revolutionized almost every aspect of life particularly it has created a new global public sphere by providing endless list of tools for global communication thereby establishing a new global society with novel norms and mundane issues. This paper is an effort to review the state of affairs in new public sphere with a focus on the digital tools under use, their role in creating the global society and the threats and opportunities available for the international citizens for behaving effectively to utilize the opportunities and manage threats to the maximum. The paper explores interlinks between the digital gadgets, emerging global public sphere and the mundane issues emanating from this situation. The paper ends with a theoretical model constructed out of the themes floating across the review and analysis.

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I. Introduction

The 'public-sphere' is a sphere which mediates between society and state, in which the public organizes itself into a bearer of public opinion (Habermas, 1974). 'Cyberspace' is promoted as a 'new public space', which enables the people to follow the objectives of self-fulfillment and personal development (Papacharissi, 2002). The contemporary global public sphere is largely dependent on the global and local communication media system including television, radio, and the print press, as well as a diversity of multimedia and communications systems, among which the Internet and horizontal communication networks are playing a decisive role (Castells, 2008).

The fundamental principle of the public sphere is the 'principle of public information' which once had to be fought for against the cryptic policies of monarchies and which since then has made possible the democratic control of state activities-the sphere of public authority (Habermas, 1974). Particularly, the internet and related technologies are increasing avenues for personal expression and promoting citizen activity (Papacharissi, 2002). Since the rise of the Internet in the early 1990s, the global civil society has grown from millions into billions. At the same time, social media have become a fact of life for civil society worldwide, involving many actors like regular citizens, activists, nongovernmental organizations, firms of telecommunications, software providers, and government agencies (Shirky, 2011).

The public sphere is a domain of social life in which public opinion can be formed and based on the transposition of the model of face-to-face communication to that of mediated communication. Habermas closely ties the notion of public sphere, its constitution, structure and change with the rational debate (Habermas, 1989). With the emergence of Internet several questions have surfaced about whether the new form of computer-mediated communication will contribute to a higher degree of social integration? How can it connect and reintegrate individuals? How can it enrich the interaction between citizen, social groups and their governments? Critical dilemmas are appearing from the emergence of the 'electronic' or 'virtual' public sphere (Oblak, 2002).

Undoubtedly, the rapid penetration of the communication technologies into different aspects of public life was mainly enhanced by its potential for interactive, unmediated and synchronous communication that was unthinkable before (Oblak, 2002). The process of globalization has shifted the debate from the national domain to the global level, prompting the emergence of a global civil society and different forms of global governance. Furthermore, the public sphere as a discussion forum for debate on public affairs has also transformed from national to the global and is increasingly constructed around global communication networks (Castells, 2008).

The creation of special interest groups fosters the development of several online publics, which reflect the collective ideologies of their members. It is in consonance with the Habermas' vision as it was one of 'coffeehouse' or small group discussions (Papacharissi, 2002). While their key technological features are fairly consistent, the cultures that emerge around cyberspace are varied. Most sites support the maintenance of legacy social networks, but others allow strangers connect based on shared interests, political views, or activities (Boyd & Ellison, 2007). In addition to basic demographic and socioeconomic factors, however, factors such as individuals' Internet skills and political motivations should also be prioritized. Skills and motivations are the two most important factors that would explain individuals' differential Internet use for politics (Min, 2010:26).

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The global civil society is the organized expression of values and interests of a society (Kean, 2003, Castells, 2008). It is supposed to be an arena for fostering the regimes of tolerance, civility and pluralism and its advocates assume that activism within civil society will promote these values globally (Chandler, 2007). The decreasing ability of the nationally political systems to manage the world's problems on a global scale has induced the rise of a global civil society (Castells, 2008). However, it is generally agreed that global civil society is a 'fuzzy concept' (Anheier et al., 2001b, p. 11; An-Na'im, 2002; Chandhoke, 2002). Its 'organizational infrastructure' is still in a 'state of flux' (Anheier and Themudo, 2002, p. 191), nonetheless Keane's (2001, p. 23) description provides the essence of the issue: 'Global civil society is a vast, interconnected, and multilayered social space that comprises many hundreds of self-directing or non-governmental institutions and ways of life'. Through its 'cross border networks' global civil society is constituted of 'chains of interactions linking the local, regional and planetary orders' (p. 24), This new social world is constituted by 'networks, coalitions, partnerships and social movements' (Anheier and Themudo, 2002).

Voluntary organizations and the public sphere of discourse are rapidly shifting from the mass media to the interactive Internet channels. The most obvious transformations can be witnessed in the global and national communications systems. ICTs have facilitated several other changes, like (1) convergence of telecommunication and computers, (2) miniaturization of personal communication devices, (3) rapid expansion of the wireless and (4) application of information storage, processing and retrieval in nearly all industries and services (Tehranian, 2004). The internet age through its new technology and information flow offer 'digital publics' unlimited social possibility to innovate and form discursive communities of their choice around diverse issues (Drache, 2008).

From their humble beginnings, virtual worlds have evolved to become major hubs of entertainment, education, and community. Although the development of these virtual worlds has been driven by the game industry, by now these worlds are used for far more than play, and soon they will be widely adopted as spaces for research, education, politics, and work (Messinger et al., 2008).

II. New Public Sphere

Habermas (1962/1989) traced the development of the public sphere in the 17th and 18th century and its decline in the 20th century. He saw the public sphere as a realm of our social life in which public opinion could be formed out of rational public debate. 'Ultimately, informed and logical discussion, Habermas argued, could lead to public agreement and decision making, thus representing the best of the democratic tradition' (Papacharissi, 2002). This public sphere first emerged in Great Britain at the end of the 17th Century - the Licensing Act of 1695, which allowed newspapers to print without the Queen's censorship, is regarded as a crucial enabler (Gordon, 2004).

The story of public-sphere begins with the invention of press by Gutenberg in 1438 and continued progressing with the help of emerging technologies like the electric telegraph invented by Morse in 1837, telephone by Bell in 1876, radio, invented by Marconi in 1895 and in 1923 Baird's television – all brought with it the most speculation of its democratizing power (Gordon, 2004). Digital revolution by computers, networks, Internet and now social networking have raised the notion of not only public sphere rather 'global public sphere' to its heights (Nawaz, 2010, 2011).

Our interactions with one another today are increasingly multimodal. We conduct our relationships face-to-face, over the phone, and online through modes as varied as e-mail, instant messaging, social network friending, personal messages, comments, shared participation in discussion forums and online games, and the sharing of digital photos, music, and videos. Research is increasingly signifying that the closer the relationship, the more modes people use to communicate with one another (Haythornthwaite, 2005:721). The public sphere is the space of communication of ideas and projects that emerge from society and are addressed to the decision makers in the institutions of society (Castells, 2008).

There is transformation of a public sphere anchored around the national institutions of territorially bound societies to a public sphere constituted around the media system (Volkmer 1999; El-Nawawy and Iskander 2002). There is a public sphere in the international arena. It exists within the political and institutional space that is not subject to any particular sovereign authority but, instead, is shaped by the variable geometry of relationships between states and global nonstate actors (Volkmer 2003). It is widely recognized that diverse social interests express themselves in this international arena: multinational corporations, world religions, cultural creators, public intellectuals, and self-defined global cosmopolitans (Castells, 2008).

The Internet in many ways changed our established conceptions not only about space, time, and access, but also about publicness, activity and interaction (Oblak, 2002). For example, a virtual world on Internet is a spatially based depiction of a persistent virtual environment, which can be experienced by numerous participants at once, who are represented within the space by avatars (Koster, 2004). Koster begins to draw out some of the essential characteristics of a virtual world, but lacks the explicit mention of the technology needed to bring these environments into existence (Bell, 2008).

If communication networks of any kind shape the public sphere, then our society-the network society, organizes its public sphere, more than any other historical form of organization, and it does so on the basis of media communication networks (Lull 2007; Cardoso 2006; Chester 2007). These communication networks are distinctive feature of contemporary society (Castells, 2008) these networks and information technologies are creating virtual spaces or worlds (Papacharissi, 2002). A 'virtual world' is the 'crafted places inside computers that are designed to accommodate large numbers of people'. This definition contains the technological element but does not include the ideas of persistence or synchronous communication (Bell, 2008). In the digital epoch, this includes the diversity of both the mass media and Internet and wireless communication networks (McChesney 2007:79).

III. Digital Technologies

ICT is a shorthand for the computers, software, networks, satellite links and related systems that allow people to access, analyze, create, exchange and use data, information, and knowledge in ways that were unimaginable before. ICT is used almost interchangeably with the Internet (Beebe, 2004). Internet technologies (now incorporating "Web 2.0" technologies such as wikis, blogs, RSS), virtual reality applications and/or videogames and mobile devices are some of the many technologies used today for communication and entertainment (Chan & Lee, 2007; Nawaz & Kundi, 2010).

In the new public sphere much activity is growing in the areas of business, education, and culture. Concerning advertising and promotions, there is a list of 126 prominent real life brands in Second Life as of August 31, 2007, including IBM, Mercedes, Pontiac, Nissan, Dell, BMG (in the media Sector), and PA Consulting (Barnes, 2007). In retailing and service businesses, there were 25,365 business owners in Second Life in February 2007, most of whom owned stores, rented real estate, or managed clubs (DMD et al., 2007). Business, public organizations, and cultural groups are using this environment for conferencing, public meetings, delivering informational services, and performances or exhibits (Messinger et al., 2008).

Acquiring and dispersing political communication online is fast, easy, affordable, and convenient (Abramson et al., 1988). New technologies provide information and tools that can extend the role of the public in the social and political spheres. The emergence of online political groups and activism certainly reflects political uses of the internet (Bowen, 1996; Browning, 1996). PC and Internet created the facilities to connect and interact with other users across the globe (Messinger et al., 2008). The current media system is multi-layered. It is local and global at the same time (Castells, 2008:90). Thus the cyberspace translates into a virtual world and specific locations with in this vast digital space become identical with eighteenth century European cafés that facilitated intellectual forum identified by Habermas as the 'bourgeois public sphere'. Within this framework, despite the structural transformations in society, geographically dispersed intelligence can converge in cyberspace to engage in rational and critical debate (Ubayasiri, 2006).

The distinctive feature of open virtual worlds is the social interaction among people and their avatars that take place in a 3D immersive shared environment with user-chosen objectives, user-generated content and social networking tools. In these worlds, people can form relationships in a variety of ways; as friends, romantic partners, virtual family members, business partners, team members, group members, and online community members (Lederman, 2007). They can also create things, and save, give, or even sell what they created to other people. And, as the objects that are created might be desired by others, so they suddenly have value in the real-world economy (Lastowka & Hunter, 2006). These features make virtual worlds as desirable virtual spaces for collaborative play, learning, and work (Messinger et al., 2008).

The new public sphere is emerging out of the digital gadgets starting from a 'computer' then connecting these computers together into 'Network', these networks first started within a building, then cities, states and finally 'global-networks' came up with the concepts of 'Internet', which is now working as real global platform thereby giving every citizen an opportunity to become an 'international-citizen' (Chan & Lee, 2007). This platform has offered global discussion and dialogue opportunities that can be continued 24/7. Internet, like other digital tools, works with hardware and software devices to communicate and exchange messages and files (Nawaz, 2010).

'Social-software' is that creed of software which helps in conducting social activities and socializing process at any temporal level including the international communications. As a result a 'new environment' of global interaction is being established, which has both positive and negative consequences for the international community (Oblak, 2002). The social software has created and activated 'new public sphere' as a backdrop of global communications for the novel 'global society' which never existed in a form that every member of this community can instantly communicate or interact with another member beyond the traditional limits of time and space (Bell, 2008).

IV. Social Software

Social software can be broadly defined as tools and environments that facilitate activities in digital social networks (Chatti et al., 2006). Digital social networks are social networks mainly realized by means of computer-mediated communication. Most social software research concentrates on the relations between social

entities in digital social networks and their interaction, while community information systems contain and group social entities (Klamma et al., 2007). What makes social network sites distinctive is not that they allow individuals to meet strangers, but rather that they enable users to articulate and make visible their social networks. This may lead to connections between individuals that would not otherwise be made, but that is often not the goal, and these meetings are frequently between ''latent ties'' (Boyd & Ellison, 2007).

Social software is a very difficult concept to define. The term encompasses a wide range of different technologies, along with the social aspect of the technologies that often emerges from a combined use of different technologies. Commonly used social software includes weblogs, wikis, RSS feeds and social bookmarking (Dalsgaard, 2006). The social network sites are web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and navigate their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site (Boyd & Ellison, 2007).

The blogs are a class of software often used in organizations nowadays, e.g. corporate wikis, social bookmarks, and RSS web feeds (Kumar et al., 2004). The term 'Blog' is a contraction of 'Weblog' and the act of 'Blogging' is the making of such logs. For some businesses, the 'real' news isn't just a ticker-tape-like news feed from Reuters or the BBC. In business, the most significant news is what you and those you have reason to care about, did yesterday, are doing today, and plan to do tomorrow (Klamma et al., 2007).

Finally, wikis can also be catalogued as social software tools. A wiki is a web page which can be edited dynamically directly from the web page itself. In principle, everybody with access to a wiki can amend it. It is possible to either edit a current page or create new pages through new hyperlinks. A wiki keeps track of changes meaning that one can view previous versions of each page on a wiki. The most renowned implementation of a wiki is wikipedia (http://www.wikipedia.org/), an online encyclopaedia which everybody can edit. Wikis support collaborative construction, development and production. (Dalsgaard, 2006).

V. Opportunities of the New Public Sphere

Current technologies enable the Internet to be fairly decentralized and open, free from censorship and with the ability of anonymity. New technologies can further enhance these features of the Internet in future. Through these characteristics the Internet can, indeed, at least provide the basis for a public sphere that approximates to Habermas' vision (Gordon, 2004). Online spheres are no longer contained within their own boundaries (if they ever were). What appear to be single online groups often turn out to be multi-modal. Group members connect with one another in multiple online spaces, using multiple media–social network sites to make their identity and social connections visible, YouTube for video sharing, Flickr for sharing pictures, blogs for instantaneous updates, web sites for amassing collective intelligence, and so on (Baym, 2009).

The greater pluralism promoted through the Internet offers a similar source of empowerment for geographically dispersed subordinate groups. These groups may be based on identity or on a common interest. Such forms of global resistance politics may be symbolic of a form of mutual affinity that is not delimited to territorial borders: indeed, that openly rejects the institutional and imaginative constraints imposed in a nation-state frame (Crack, 2007). As the communications become more sophisticated, and more participatory, the networked population is gaining greater access to information, more opportunities to engage in public speech, and getting more powerful to work collaboratively (Shirky, 2011).

There is inherent tendency of networks to produce fragmented audiences. Historically, segmented groups prove valuable for societal transformation and civil rights movement is the best example. Each has pressed for recognition and greater inclusion within mainstream society, but has mobilized through counter publics of alternative and independent media (Fraser, 1992; Warner, 2002). Social media can compensate for the disadvantages of undisciplined groups by reducing the coordination costs. Resultantly, larger, looser groups can now take on some kinds of coordinated action, such as protest movements and public media campaigns that were previously reserved for formal organizations (Shirky, 2011). Recent uprising in Egypt and London riots can be good examples in this regards.

Anonymity online assists users to overcome identity boundaries and communicate more freely and openly, thus promoting a more enlightened exchange of ideas (Papacharissi, 2002). ICTs have increased dialogic opportunities between geographically disparate actors, thus opening up the prospect of extending public spheres beyond the nation state (Crack, 2007).

VI. Threats of New Public Sphere

Internet enthusiasts' rhetoric on the advantages of the internet as a public sphere is based on the fact that it provides a place for personal expression. It makes it possible for little-known individuals and groups to reach out to citizens directly and restructure public affairs, and connects the government to citizens (Papacharissi, 2002). Most Realist scholarship perceives technology as a passive and exogenous factor,

contributing to the power capabilities of states, which strive for security and welfare in an anarchic environment. Technological leadership and control of large technological systems is imperative to maintain or improve a relative power position in the international system. Technology is instrumental in achieving political goals (Fritsch, 2011).

Mere access to the internet does not guarantee increased political activity or enlightened political discourse. Moving political discussion to an online space excludes those with no access to this space. Moreover, connectivity does not ensure a more representative and robust public sphere (Papacharissi, 2002). There is a concern that ICTs, which are expected to contribute to the development of all humans, actually widen the inequalities between the developed world and the underdeveloped world, the rich and poor, whites and blacks, the educated and less-educated, etc., creating the so-called 'digital divide' (Warschauer, 2003; Van Dijk, 2005; Min, 2010).

The network society is marked by a trend towards individualization, social fragmentation and new forms of mediated community. The logic of networked organization is horizontally differentiated and polycentric. The old cohesive hierarchies are replaced by a multitude of strategically important 'nodes' in the network, which can cooperate and conflict with one another. Network structures encompass all spheres of society, including politics, government, the economy, technology, and the community (Crack, 2007). The decreased ability of territorially based political systems to manage the world's problems on a global scale has induced the rise of a global civil society (Castells, 2008).

VII. Impacts on Global Society

Interaction between citizens, civil society, and the state, communicating through the public sphere ensure that the balance between stability and social change is maintained in the conduct of public affairs (Castells, 2008). Nongovernmental Organizations (NGOs), grassroots activists, and social movement actors are becoming more intertwined to leverage their strengths and make an impact on local, national, and global realities. NGOs are key players in this global network. These influence international and state policies by researching and disseminating information, launching awareness campaigns, lobbying, and organizing direct action in collaboration with other organizations and networks (Custard, 2008).

It is through the media, both mass media and horizontal networks of communication, that non-state actors influence people's thinking and foster social change. Ultimately, the transformation of consciousness does have impact on political behavior, on voting patterns, and on the decisions of governments. It is at the level of media politics where it appears that societies can be moved in a direction that diverges from the values, norms and interests institutionalized in the political system (Castells, 2008). Social media may be thought as a long-term tool that can strengthen civil society and the public sphere. In contrast to the instrumental view of Internet freedom, this can be called the "environmental" view. According to this view, positive changes in the life of a country, including pro-democratic regime change, follow, rather than precede, the development of a strong public sphere (Shirky, 2011).

The rise of NGOs with a global or international frame of reference in their action and goals is referred to as "global civil society" by many analysts (Kaldor, 2003). The key tactics of NGOs to accomplish results and build support for their causes is media politics (Gillmor 2004; Dean et al., 2006). These organizations reach the public and mobilize support for their causes by using media. They put pressure on governments threatened by the voters or on corporations fearful of consumers' reactions. Hence, the media become the space for an NGO's campaign. Since these are global campaigns, global media are the key target. The globalization of communication leads to the globalization of media politics (Castells, 2008).

ICTs impact on individual, society and state is though drastic, however it is arguable to say that national public sphere has transformed into global public sphere. There are social and political prerequisites too, and it is debatable whether transnational analogues to domestic conditions exist (Crack, 2007). For example, there is not a well-defined moral or political community outside of the nation-state. Computer mediated communication across borders may represent nothing more than an 'aggregate audience' of individuals, who lack a sufficient sense of commonality to engage in normatively structured discourse (Bohman, 1998:211). Further, in an international 'anarchic' environment, there is not a sovereign authority comparable to the state that could serve as an addressee of public opinion. It is therefore questionable whether the concept of the public sphere can make the transition from the domestic to the transnational level (Crack, 2007). On the other hand some suggest that though there is no global state at planetary level however global networks of governance are emerging and may play the role that nation state play within its territory (Castells, 2008). Anyhow, the global ICT-infrastructure continues to grow as does the use of this media to negotiate social change and justice (Custard, 2008).

Internet and wireless communication, by enacting a global, horizontal network of communication, provide both an organizing tool and a means for debate, dialogue, and collective decision making (Castells, 2008). Internet enthusiasts have argued that the Internet can contribute to democracy by bonding people, regardless of territory, and by creating public spheres and new social movements. Many studies (Ott & Rosser, 2000; Hill & Sen, 2005) have shown how

citizens use computers and the Internet for enhanced political and democratic initiatives. For the so-called cyber pessimists, however, the Internet is a digital replica of the real world where one observes politics as usual (Min, 2010).

VIII. Discussions

Advocates of cyberspace expect that online discourse will increase political participation and open vistas for democracy. They claim that the alleged decline of the public sphere lamented by academics, politicos, and several members of the public will be halted by the democratizing effects of the internet and its surrounding technologies. On the other hand, skeptics caution that technologies not universally accessible and ones that frequently provoke fragmented, nonsensical, and enraged discussion, otherwise known as 'flaming', far from guarantee a revived public sphere (Papacharissi, 2002).

The notion of public sphere necessarily relies on the existing communication processes and it may be said that it depends heavily on the working of the dominant forms of communication (Oblak, 2002). Temporal and spatial obstacles in distanced communication have been effectively eradicated by ICTs, opening up deliberative spaces that may hold emancipator potential. A communicative network is the precondition of transnational public spheres that enable broad participation across state borders. The technologies of the networked society do not merely expanded previous communication media, but are qualitatively different in terms of structure, speed, and scope. Consider the Internet. It is a matrix of networks based on a 'many-to-many' model of information distribution, as opposed to the 'one-to-many' structure of mass media of 20th century (Crack, 2007).

Internet-based technologies can help to connect, motivate, and organize dissent however, whether the expression of dissent is powerful enough to bring social change is a question of human character and a more complex issue. Digital technologies offer additional tools, but they cannot single-handedly transform a political and economic structure that has thrived for centuries (Papacharissi, 2002). It is important to appreciate the complex problems that are implicated in the task of restructuring the public sphere in an internationally anarchic environment. These emanate from the traditional association of the virtual space of the public sphere with the physical space of the territorial nation-state (Crack, 2007). However, a researcher argues that the current Internet 'access divide' will persist in the form of 'usage-divides (Min, 2010).

The internet may actually enhance the public sphere, but it does so in an unprecedented way that is not comparable to our past experiences of public discourse. Perhaps the internet will not become the new public sphere, but something radically different. This may enhance democracy and dialogue, but not in a way that we would expect it to, or in a way that we have experienced in the past (Papacharissi, 2002). The network society is marked by a trend towards individualization, social fragmentation and new forms of community. The old hierarchies are replaced by strategically important connections in the network, which can cooperate and conflict with one another. Network structures have penetrated into every sphere of life, including politics, government, economy, technology, and the community as a whole. These processes symbolize a disruption in conventional understandings of space, borders, and territory, and directly impact on the institutional foundations of public sphere (Crack, 2007; Castells, 2008).

Figure 1 : Theoretical Structure of New Public Sphere

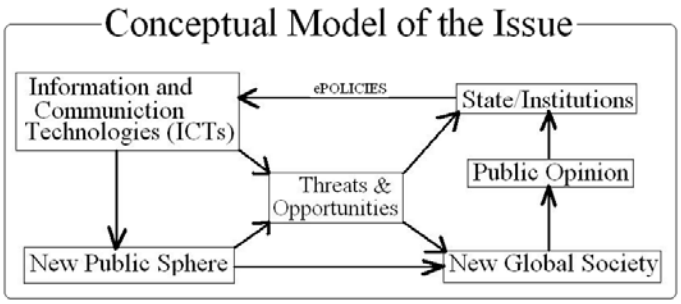

Figure 1 is the diagrammatic presentation of the issue discussed across the paper containing all the critical factors and their interrelationships to portray the whole story with a holistic view. 'ICTs' have created the 'New Public Sphere' with a 'New Global Society' whose 'Public Opinion' affects the 'State/Institutions'. However, ICTs and the emergent new public sphere offer both threats and opportunities for the state as well as new global society. Similarly, the role of ICTs is mediated by the ePolicies of the state or government about the purchase and operations of digital systems in the country.

IX. Conclusions

ICTs have created a new 'global-village' with 'international-citizens' who use social software to stay connected (24/7) with each other to socialize internationally and discuss matters of mutual interest like global warming and terrorism. Traditionally, the global interactions depended mostly on the physical tools and then mass media. However, the interaction was limited, one-way and very slow. The internet has created a cyberspace where anybody from anywhere can log on the system at any time and continue interacting with the world community. A diversity of tools are popularly used at the moment like facebook, twitter and blogging are the buzzwords across the global civil society.

It should however be noted that new public sphere is not a blessing in itself rather it requires legal,

social, political and ethical guidelines for operating in the favor of the global civil society. Thus there are both opportunities and threats from the new public space or virtual platform for the international citizenship. Both positive and negative aspects must be identified continuously so that both the international institutions as well as the individual states can formulate their ePolicies and policies for international affairs in an effective manner thereby making the new public sphere as an opportunity of the newly emerging new global civil society.

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An Analytical Review of Orientation Based Concurrency Control Algorithm

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Abstract - There is an ever-increasing demand for higher throughputs in transaction processing systems leading to higher degrees of transaction concurrency.Concurrency control in Database management systems ensures that database transactions are performed concurrently without violating the data integrity of the database. Thus concurrency control is an essential element for correctness in any system where two database transactions or more, executed with time overlap, can access the same data. There are problems like Deadlock,Livelock and prevention of these problems is vital in concurrency control of distributed database systems.Many techniques have been proposed for managing concurrent execution of transactions in database systems.A new method for concurrency control in distributed DBMS's,is discussed which will improve system performance by reducing the chances of deadlock and livelock and reducing restart ratio.

Keywords : *concurrency,deadlock,timestamp,lock etc.*

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An Analytical Review of Orientation Based Concurrency Control Algorithm

Sumit Kumar [α], Ms. Ritu Devi [Ω]

Abstract - There is an ever-increasing demand for higher throughputs in transaction processing systems leading to higher degrees of transaction concurrency.Concurrency control in Database management systems ensures that database transactions are performed concurrently without violating the data integrity of the database. Thus concurrency control is an essential element for correctness in any system where two database transactions or more, executed with time overlap, can access the same data. There are problems like Deadlock,Livelock and prevention of these problems is vital in concurrency control of distributed database systems.Many techniques have been proposed for managing concurrent execution of transactions in database systems.A new method for concurrency control in distributed DBMS's,is discussed which will improve system performance by reducing the chances of deadlock and livelock and reducing restart ratio.

Keywords : concurrency,deadlock,timestamp,lock etc.

I. Introduction

Concurrency control is the activity of coordinating concurrent accesses to a database in a multiuser database management system (DBMS). Concurrency control permits users to access a database in a multiprogrammed fashion while preserving the illusion that each user is executing alone ona dedicated system[2]. The main technical difficulty in attaining this goal is to prevent database updates performed by one user from interfering with database retrievals and updates performed by another. The concurrency control problem is exacerbated in a distributed DBMS (DDBMS) because (1) users may access data stored in many different computers in a distributed system, and (2) a concurrency control mechanism at one computer cannot instantaneously know about interactions at other computers.

II. Background of Concurrency Control Methods

Many methods for concurrency control exist[1] [4][5][6][8][9][10].The major methods, which have each many variants,are:

1. Locking - Locking is a mechanism commonly used to solve the problem of synchronizing access to shared data[6].Controlling access to data by locks assigned to the data.Several types of locks are used in concurrency control such as Binary(1 or 0) locks,Shared/Exclusive locks. each data item has a lock associated with it. Before a transaction T, may access a data item, the scheduler first examines the associated lock. If no transaction holds the lock, then the scheduler obtains the lock on behalf of T,. If another transaction T, does hold the lock, then T, has to wait until T2 gives up the lock. That is, the scheduler will not give T, the lock until T releases it. The scheduler thereby ensures that only one transaction can hold the lock at a time, so only one transaction can access the data item at a time.When a lock is set, other transactions that need to set a conflicting lock are blocked until the lock is released, usually when the transaction is completed. The more transactions that are running concurrently, the greater the probability that transactions will be blocked, leading to reduced throughput and increased response times.One variation of basic locking protocol that ensure serializability is two phase locking protocol[10].This protocol requires that each transaction issue lock and unlock requests in two phases:

1. Growing phase – A transaction may obtain locks,but may not release lock.
2. Shrinking phase – A transaction may release locks,but may not obtain any new locks.

A method called optimistic method with dummy locks is also there for concurrency control in distributed databases. The advantage of using dummy locks is that although they are long-term locks, they do not block the execution of transactions in any way[]

2. Serialization graph checking (also called Serializability, or Conflict, or Precedence graph checking) – Although two phase locking ensure serializability,they may lead to a deadlock.Deadlock occurs when each transaction T in a set of two or more transaction is waiting for some item that is loked by some other transaction T1 in the set. There are otherways one could enforce serializability as well.Deadlock can be precisely detected by constructing a directed graph called wait-for-graph.The nodes of WFG are labelled with active transaction names.In a WFG there exist an edge from Ti to Tj iff transaction Ti is waiting for transaction Tj to release some lock.Is there exist a cycle in WFG,it means deadlock has occure and broken by aborting a transaction.The transaction chosen for abort is called the victim. While such a scheme is possible, it is hardly practical.

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3. Timestamp ordering (TO) – In an alternative approach to locking is use of timestamps[4][10]. Ordered timestamps are assigned to transactions, and controlling or checking access to data by timestamp order. The general idea is to give each transaction a "timestamp" which indicates when the transaction began (serial number or system time). To generate timestamp values,transaction manager can use system clock value i.e TS(T) is equal to value of clock when T has entered the system.Alternatively,the transaction manager can use a counter that is incremented after a new timestamp has been assigned.To implement this scheme,the timestamp ordering algorithm associates with each data item X two timestamp values:

A. write_TS(X) – the maximum timestamp value of a transaction that successfully executed write_item(X).
B. read_TS(X) – the maximum timestamp value of a transaction that successfully executed read_item(X).

1. When T tries to write(X)
   - if Read_TS(X) > TS(T) or Write_TS(S) > TS(T)
     Intuition: X has been read or written by a "later" transaction
   - Abort T
     else
   - Execute and set write-TS(X) = TS(T)
2. When T tries to read(X)
   - if Write_TS(X) > TS(S)
     X was written by a "later" transaction
   - Abort T
     else
   - Execute and update read-TS(X)

III. Rules for a Database Transaction

A database transaction is a unit of work, typically encapsulating a number of operations over a database (e.g., reading a database object, writing, acquiring lock, etc.).Every database transaction obeys the following rules:

- Atomicity - Either the effects of all or none of its operations remain ("all or nothing") when a transaction is completed (committed or aborted respectively). In other words, to the outside world a committed transaction appears (by its effects on the database) to be indivisible, atomic, and an aborted transaction does not leave effects on the database at all, as if never existed.
- Consistency - Every transaction must leave the database in a consistent (correct) state.A transaction must transform a database from one consistent state to another consistent state. Thus since a database can be normally changed only by transactions, all the database's states are consistent. An aborted transaction does not change the database state it has started from, as if it never existed (atomicity above).
- Isolation - Transactions cannot interfere with each other.Moreover, usually (depending on concurrency control method) the effects of an incomplete transaction are not even visible to another transaction. Providing isolation is the main goal of concurrency control.
- Durability - Effects of successful (committed) transactions must persist through crashes (typically by recording the transaction's effects and its commit event in a non-volatile memory).

IV. Requirements for Database Transcation

Every database transaction should fullfill following requirements:

- Safety Property: The safety property states that at any point of time, only one transaction can access the data.
- Liveness Property: This property states the absence of deadlock and starvation. Two or more transactions should not endlessly wait for a particular object which will never arrive. In addition, a transaction must not wait indefinitely to access an object while other transactions are repeatedly acquiring the same.
- Fairness: Fairness property states that each transaction should get chance to access an object. In concurrency control algorithms, the fairness property generally means the requests are executed in the order of their arrival (time is determined by a logical clock) in the system.

V. Need for Concurrency Control

If transactions are executed serially, i.e. sequentially with no overlap in time, no transaction concurrency control required.However if concurrent transactions with interleaving operations are allowed in an uncontrolled manner, some unexpected, undesirable result may occur. Here are some typical examples:

1. The lost update problem: when a transaction writes a new value of a data-item on top of a first value written by a first concurrent transaction, and the first value is lost to other transactions running concurrently which need to read the first value.
2. The dirty read problem: when Transactions read a value written by a transaction that has been later aborted. This value disappears from the database upon abort, and should not have been read by any transaction ("dirty read"). The reading transactions end with incorrect results.
3. The incorrect summary problem: While one transaction takes a summary over the values of all the instances of a repeated data-item, a second transaction updates some instances of that data-

item. The resulting summary does not reflect a correct result for any precedence order between the two transactions (if one is executed before the other), but rather some random result, depending on the timing of the updates, and whether certain update results have been included in the summary or not.

VI. Review of Timestamp and Orientation Based Currency Control Algorithm

In the concept of timestamp ordering[4][7], transaction timestamp TS(T) is a unique identifier assigned to each transaction based on the order in which transaction are started.Hence if transaction T_1 starts before transaction T_2 then TS(T1)<TS(T2).There are two method for preventing deadlock using the concept of timestamp ordering:

a. Wait-die: suppose that transaction T1 wants to lock an item X but is not able to do so because X is locked by some other transaction T2 with a conflicting lock.Now if TS(T1)<TS(T2).Then T1 is allowed to wait,otherwise abort T1 and restart it later with the same timestamp.
b. Wound-wait: if TS(T1)<TS(T2) then abort T2 and restart it later with the same time stamp;otherwise T1 is allowed to wait.

In wait-die protocol, only the requester with smaller timestamp can wait for the holder with larger timestamp and in the wound-wait protocol, only the requester with larger timestamp can wait for the holder transaction with smaller timestamp. The constraints of these protocols are so strong that only one-way waiting is allowed.Algorithm based on orientation will try to make the condition somehow weaker. This algorithm allows both side waiting i.e the older waits for the younger (as wait-die protocol) and younger waits for the older (as wound-wait protocol).In the reviewedalgorithm, a new term is introduced which is called as orientation of a transaction.It uses combination of time stamp and orientation to decide which transaction will wait and which transaction will be wounded when conflict exists among transactions. An orientation of a transaction T, denoted as Ot(T),can have three values:neutral, forward, and backward. Following are the orientation determination rules for the system:

*Rule 1:*The initial orientation of a transaction is 'n'.

Rule 2: When Tr requests for Th, if TS(Th)> TS(Tr) and Tr can waitfor Th, then Ot(Tr):= Ot(Th):= 'f'. We call this kind of waiting as forwardwaiting.

Rule 3: When Tr requests for Th, if TS(Th)< TS(Tr) and Tr can waitfor Th, then Ot(Tr).'= Ot(Th):= 'b'. We call this kind of waiting as backwardwaiting.

Rule 4: When Tr requests for Th, but Tr is not allowed to wait for Th,then one of them may be rolled back and restarted (the rolled-backtransaction is always the younger). The time stamp of restarted transactiondoes not change but its orientation is changed to 'n'.This algorithm based on orientation minimizes no. of restarts than other standard algorithm.

VII. Conclusion and Future Work

Standard wait die and wound wait only logically keep forward or backward orientation WFG, respectively, in its protocol. But in the algorithm based on orientation it keeps both backward and forward orientation WFG in the protocol. More importantly, it is not necessary to physically maintain any WFG in the system.The new algorithm is deadlock free and livelock free.This algorithm will require much fewer restarts than standard wait-die or wound-wait protocol and thus will achieve high throughout and efficiency of distributed database system.There is still a issue to research as future work,after finding a transaction conflicting withanother transaction how much time should have to wait torestart the aborted transaction. If it is restarted very soon thereremains probability to conflict again. On the other hand if thetransaction is restarted after some period of time the abortedtransaction, especially if is it a real time one, may fail to meetits deadline.

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"Globally Recorded binary encoded Domain Compression algorithm in Column Oriented Databases"

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Abstract - through this study, we propose two algorithms. The first algorithm describes the concept of compression of domains at attribute level and we call it as "Attribute Domain Compression". This algorithm can be implemented on both row and columnar databases. The idea behind the algorithm is to reduce the size of large databases as to store them optimally. The second algorithm is also applicable for both concepts of databases but will optimally work for columnar databases. The idea behind the algorithm is to generalize the tuple domains by giving it a value say (n) such that all other n-1 tuples or at least maximum can be identified.

Keywords : *Compression, Columnar database, tuples, tables.*

GJCST Classification : *H.2.4*

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"Globally Recorded binary encoded Domain Compression algorithm in Column Oriented Databases"

Mehul Mahrishi[α], Devendra Kr. Sharma[Ω], Anita Shrotriya[β]

Abstract - through this study, we propose two algorithms. The first algorithm describes the concept of compression of domains at attribute level and we call it as "Attribute Domain Compression". This algorithm can be implemented on both row and columnar databases. The idea behind the algorithm is to reduce the size of large databases as to store them optimally. The second algorithm is also applicable for both concepts of databases but will optimally work for columnar databases. The idea behind the algorithm is to generalize the tuple domains by giving it a value say (n) such that all other n-1 tuples or at least maximum can be identified.

Keywords : Compression, Columnar database, tuples, tables.

I. Introduction

Till now we have studied that a database is a collection of inter-related data which is organized in a matrix with rows and columns. Each column represents the attribute of that particular entity which is converted into the database table, while each row of the matrix generally called a tuple represents the different values that an attribute can possess. Each row in a table represents a set of related data, and every row in the table has the same structure.

For example, in a table that represents employee, each row would represent a single employee. Columns might represent things like employee name, employee street address, his SSN etc. In a table that represents the relationship of employees with departments, each row would relate one employee with one department.

Table 2.1 : a Typical Row oriented Database

	Column 1	Column 2	Column 3
Row 1	Row1 & Column 1	Row1 & Column 2	Row1 & Column 3
Row 2	Row2 & Column 1	Row2 & Column 2	Row2 & Column 3

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II. Rise of Column Database

The relational databases present today are designed predominantly to handle online transactional processing (OLTP) applications. A transaction (e.g. an online purchasing a laptop through internet dealer) typically maps to one or more rows in a relational database, and all traditional RDBMS designs are based on a per row paradigm. For transactional-based systems, this architecture is well suited to handle the input of incoming data.

Data warehouses are used in almost every large organizations and research states that their size doubles after every third year. Moreover the hourly workload of these warehouses is huge and approximately 20lakhs SQL statements are encountered hourly.

Warehouses contain a lot of data and hence any leak or illegal publication of information risks the individuals' privacy. However, for applications that are very read intensive and selective in the information being requested, the OLTP database design isn't a model that typically holds up well. Business intelligence and analytical applications queries often analyze selected attributes in a database. The simplicity and performance characteristic of columnar approach provides a cost effective implementation.

Column oriented database generally known as *"columnar database"* reinvents how data is stored in databases. Storing data in such a fashion increases the probability of storing adjacent records on disk and hence odds of compression. This architecture suggests a different model in which inserting and deleting transactional data are done by a row-based system, but selective queries that are only interested in a few columns of a table are handled by columnar approach.

As we know that logical and critical queries requires more number of rows that that of physical I/O queries which are comparatively slower queries, the performance gap between row-oriented architectures and column-oriented architecture oftentimes widens as the database grows.

Different methodologies such as indexing, materialistic views, horizontal partitioning etc. are provided by row oriented databases which are rather better ways of query execution, but they also have some

disadvantages of their own. For example, in business intelligence/analytic environments, the ad-hoc nature of such scenarios makes it nearly impossible to predict which columns will need indexing, so tables end up either being over-indexed (which causes load and maintenance issues) or not properly indexed and so many queries end up running much slower than desired.

III. Anonymization

Warehouses contain a lot of data and hence any leak or illegal publication of information risks the individuals' privacy. N-Anonymity is a major technique to deidentify a data set. The idea behind the technique is to determine the value of a tuple, say n, such that other remaining n-1 tuples or at least maximum tuples can be identified by the value of n.

The intensity of protection increases with increase the number of n. One way to produce n identical tuples within the identifiable attributes is to generalize values within the attributes, for example, removing city and street information in a address attribute.

There are many ways through which data unidentification can be done and one of the most appropriate approaches is generalization. Various generalization techniques include global recoding generalization multidimensional recoding generalization, and local recoding generalization. Global recoding generalization maps the current domain of an attribute to a more general domain. For example, ages are mapped from years to 10-year intervals.

Multidimensional recoding generalization maps a set of values to another set of values, some or all of which are more general than the corresponding premapping values. For example, {male, 32, divorce} is mapped to {male, [30, 40), unknown}. Local recoding generalization modifies some values in one or more attributes to values in more general domains.

IV. Problem Definition and Contribution

From the very beginning we have cleared that our objective is to make every tuple of a published table identical to at least n-1 other tuples. Identity-related attributes are those which potentially identify individuals in a table. For example, the record of an old-aged male in the rural area with the postcode of 302033 is unique in Table 4.1, and hence, his problem of asthma may be revealed if the table is published. To preserve his privacy, we may generalize Gender and Postcode attribute values such that each tuple in attribute set {Gender, Age, Postcode} has at least two occurrences.

Table 4.1 : Published Table

No.	Gender	Age	Postcode	Problem
01	Male	Young	302020	Heart
02	Male	Old	302033	Asthma
03	Female	Young	302015	Obesity
04	Female	Young	302015	Obesity

Table 4.2 : View of published table by Global recording

No.	Gender	Age	Postcode	Problem
01	*	Young	3020*	Heart
02	*	Old	3020*	Asthma
03	*	Young	3020*	Obesity
04	*	Young	3020*	Obesity

A view after this generalization is given in Table 4.2. Since various countries use different postcode schemes, we adopt a simplified postcode scheme, where its hierarchy {302033, 3020*, 30**, 3***, *} corresponds to {rural, city, region, state, unknown}, respectively.

a) Identifier attribute set

A set of attributes that potentially identifies the individuals in a table is a set of identifier attribute. For example, attribute set {Gender, Age, Postcode} in Table 1a is an identifier attribute set.

b) Equivalent Set (€)

An equivalent set of a table with respect to an attribute set is the set of all tuples in the table containing identical values for the attribute set. Table 4.1 forms a equivalent set with respect to attributes {Gender, Age, Postcode, Problem}. Therefore table 4.2 is the 2-Anonymity view of the table 4.1 since two attribute are used to deidentify the published table.

V. Quality Measures of Anonymization

After the study we can easily conclude that larger the size of equivalent set easier the compression and obviously cost of anonymization is a factor of equivalent set. On the basis of this theory, we can determine that:

$$CAVG = \frac{\left(\sum RECORDS\right)}{\sum €}$$

VI. Domain Compression Through Binary Conversion

We integrate two key methods, namely binary encoding of distinct values and pair wise encoding of attributes, to build our compression technique.

a) Encoding of Distinct values

This compression technique is based on the assumption that the table we have published contains minimum distinct domain of attributes and these values repeat over the huge number of tuples present in the database. Therefore, binary encoding of the distinct values of each attribute, followed by representation of the tuple values in each column of the relation with the corresponding encoded values would transform the entire relation into bits and thus compress it.

We will find out the number of distinct values in each column and encode the data into bits accordingly. For example consider an instant given below which represents the two major attributes of a relation Patients.

Table 4.3 : an instance of relation Student

Age	Problem
10	Cough & Cold
20	Cough & Cold
30	Obesity
50	Diabetes
70	Asthma

Now if we adopt the concept of N-Anonymization with global recording *(refer 4.2)*, we can map the current domain of attributes to more general domain. For example Age can be mapped into 10-Age interval as shown in the figure 4.4.

To examine the compression benefits achieved by this method assume that Age is of integer type and has 5 distinct values as in Table 4.3. Suppose if there are 50 patients then the total storage required by Age attribute will be 50*size of (int) = 50*4 = 200 bytes.

With our compression technique, we find that there are 9 distinct values for age therefore we need the upper bound of log (9) i.e. 4 bits to represent each data value in the Age field. It is easy to calculate that we would need 50*4 (bits) = 200 bits = 25 bytes which are reasonably less.

We call this as our *stage 1* of our compression which just transforms one column into bits. If we apply this compression to all columns of the table, the result will be significant.

Table 4.4 : Representing Stage 1 of compression technique

Age	Problem
10-20	Cough & Cold
30-40	Obesity
50-60	Diabetes
70-100	Asthma

Table 4.5 : Representing Stage 1 with binary compression

Age	Problem
00	Cough & Cold
01	Obesity
10	Diabetes
11	Asthma

b) Paired Encoding

It can be easily seen from the above example that besides optimizing the memory requirement of the relations, above encoding technique is also helpful in reducing redundancy (repetition values) from the relation. That is, it is likely that they are few distinct values of even (column1, column2) taken together, in addition to just column1's distinct values or column2's distinct values. We then represent the two columns together as a single column with pair values transformed according to the encoding. This constitutes Stage 2 of our compression in which we use the bit-encoded database from Stage 1 as input and further compress it by coupling columns in pairs of two, applying the distinct-pairs technique outlined. To examine the further compression advantage achieved, suppose that we couple 'Age' and 'Problem' columns. We can see in our table 4.3 that there are 5 distinct pairs (10, Cough & Cold), (20, cough & cold), (30, obesity), (50, Diabetes), (70, Asthma) and hence our upper bound is log (5) = 2 bits approx. Table 4.6 shows the result of *stage 2* compression.

Table 4.6 : Representing Stage 2 compression

Age	Problem
00	00
01	01
10	10
11	11

After compressing the attribute, pairing or coupling of attributes is done. All the columns are coupled in pair of two in a similar manner. If the database contains even number of columns it is straightforward. If the columns are odd, we can intelligently choose any of the columns to be uncompressed.

Table 4.7 : Representing Stage 2 compression coupling

Age- Problem
00
01
10
11

After this compression technique is applied we can easily calculate the space required i.e.

Before compression: 5*(4) +4*(4) = 36 bytes

After Compression and coupling: 4*2 = 8 bits.

VII. Conclusion

In this study we discuss two different compression techniques embedded with each other to form a "Globally Recorded binary encoded Domain Compression".

The first study defines generalization and discuss its different type in anonymization the attributes. It discusses how to handle a major problem in global recoding generalization, inconsistent domains in a field of a generalized table, and propose a method to approach the problem. The tables in the examples proposed global recoding method based on n-anonymity, and consistency.

The second technique focuses on the extension of existing compression by encoding the domain in binary form and further encoding pairs of column values. It shows how coupling of columns can be effective if attributes are properly rearranged. In particular I found that in most cases it is beneficial to couple the primary key with the column having the maximum number of distinct values. Also, columns with very few distinct values should be paired with columns with a large number of dissimilar values. Functional dependencies should be determined to achieve better compression of related attributes. Overall, a better knowledge of the data distribution leads to better compression. Based on the database and the application environment being targeted, the optimum stage up to which compression is feasible and worthy also needs to be determined, i.e. we need to decide the point at which the extra compression achieved is not worth the performance overhead involved.

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Performance Analysis of Routing Metrics for Multi Radio Multi Channel in Wireless Mesh Networks

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Abstract - Wireless mesh is a collection of wireless devices that can communicate with peers in single or multiple hops. Mesh networks are self-configuring systems where each Access Point (AP) can relay messages on behalf of others, thus increasing the range, utilizing Multiple Radios over mesh routers increases capacity and available bandwidth. Efficient utilization of Multiple Radios is assured through proper channel assignment and routing schemas. Routing metrics are used for selection of routes obtained by routing protocols. Routing metrics provide measurable values that can be used to judge how useful a route will be, quantitative value assigned by routing metrics indicate the specific characteristics of the route.

Keywords : *Wireless Mesh Networks, Routing, AODV, WCETT.*

GJCST Classification : *C.2.2, C.2.1*

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Performance Analysis of Routing Metrics for Multi Radio Multi Channel in Wireless Mesh Networks

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Abstract - Wireless mesh is a collection of wireless devices that can communicate with peers in single or multiple hops. Mesh networks are self-configuring systems where each Access Point (AP) can relay messages on behalf of others, thus increasing the range, utilizing Multiple Radios over mesh routers increases capacity and available bandwidth. Efficient utilization of Multiple Radios is assured through proper channel assignment and routing schemas. Routing metrics are used for selection of routes obtained by routing protocols. Routing metrics provide measurable values that can be used to judge how useful a route will be, quantitative value assigned by routing metrics indicate the specific characteristics of the route.

Expected Transmission Time (ETT) is one of the routing metrics. The ETT is a function of the loss rate and the bandwidth of the link. It considers the impact of both packet size and link quality. For a routing path, the expected transmission time can be the sum of ETTs of all links on the path. However, ETT does not take into account the channel diversity in WMNs using Multiple Radios and Multiple channels at wireless nodes on the path. To resolve this issue we evaluate a new metric called Weighted Cumulative ETT (WCETT) for routing in multi-Radio, multi hop wireless networks. The goal of WCETT metric is to choose a high-throughput path between a source and destination.

In this paper, we would like to integrate WCETT and AODV to realize better routing for WMNs. The implementations and performance of AODV enhanced with multi Radio, multichannel support and WCETT is analyzed using a standard network simulator (NS2).

Keywords : Wireless Mesh Networks, Routing, AODV, WCETT

I. Introduction

Wireless mesh networks (WMNs) are dynamically self-organized and self-configured, in which the nodes automatically establishing an Ad Hoc network and maintaining the mesh connectivity. WMNs are comprised of three types of nodes Mesh router, Mesh Gateways and Mesh client. Mesh router (MR) relay packets to / from other mesh routers and clients. Mesh Gateway is a mesh router that connects other mesh router to internet through high speed wired link. Mesh clients connects to nearest mesh routers for access internet.

Wireless mesh networks have, in the recent years, increased in popularity due to their properties of self configuration, self healing and robustness. The motivation to build high throughput mesh networks has been fuelled by the relatively low cost of network hardware. This has allowed routers to incorporate two or more Radio interfaces on a single node in order to increase throughput and tackle the problems of co-channel interference in dense networks. Wireless mesh networks can be categorized into three basic types according to architecture and topology.

Client Mesh Networks are essentially the same as traditional Mobile Ad-hoc Networks (MANET) [2], in which the entire network consists of mobile client devices which implement routing and forwarding functionalities themselves.

In *Infrastructure Mesh Networks*, dedicated infrastructure nodes (Mesh Routers) provide a multi-hop wireless backbone infrastructure. Mesh Routers are typically equipped with Multiple Radio interfaces and are generally less resource constrained than client devices (Mesh Clients). In an Infrastructure Mesh Network, client devices do not perform any routing or forwarding functionality, and simply access the network via the nearest Mesh Router.

Hybrid Mesh Networks blend features from Client Mesh and Infrastructure Mesh Networks. Mesh Routers in Hybrid Mesh configurations still form the backbone of the topology and may provide backhaul access to external networks. However, in order to increase the reach of the network, client devices can be involved in routing. For example, if a client is not within communication range of a Mesh Router, another client device can act as a relay to the nearest router.

Recently, a lot of research effort has been focused on multi Radio wireless mesh networks. Due to the relatively low cost of commodity wireless hardware such as Radio interfaces based on IEEE 802.11 standards, it is now feasible to include Multiple Radios on a single node. By operating these interfaces on orthogonal channels, the capacity of a Mesh Router can

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be significantly increased, and overcomes the limitation of half duplex operation of single-Radio nodes. However, routing protocols must be designed to take advantage of the availability of multiple interfaces efficiently.

Routing protocols are at the heart of Wireless Mesh Networks and control the formation, configuration and maintenance of the topology of the network.

Much of the development of protocols for wireless mesh networks has been derived from protocols developed within the IETF MANET working group. As the MANET protocols are designed for highly dynamic scenarios and therefore provide self-healing and self-configuring capabilities, they are also highly desirable in the context of wireless mesh networks. Routing metrics are a key element of any routing protocol since they determine the creation of network paths.

In this paper, we provide an extensive qualitative comparison of the most relevant routing metrics for multi-Radio wireless mesh networks.

II. Metric Components

In this section, we identify and discuss the key components that can be utilized to compose a routing metric for multi-Radio wireless mesh networks.

a) Number of Hops

Hop count can serve as a routing metric in itself, such as in most MANET routing protocols, but can also be a component in a more complex metric. Hop count as a routing metric for wireless mesh networks has significant limitations. It has been shown in [5] that a path with a higher number of high-quality links demonstrates significant performance improvements over a shorter path comprised of low-quality links. Additionally, the authors of [6] found that hop count tends to route through a few centrally-located nodes, leading to congestion and hot spots.

b) Link Capacity

Measuring the link capacity gives the metric a view at the current throughput capability of a link. There are a few ways this can be done, from actively probing the link to measuring transfer speeds, to relying on the Radio interface's current rate. Furthermore, as most Radio interfaces have the ability to automatically lower their transmission speeds in order to deal with lossy links, finding links with higher capacity will lower medium access time and increase the performance of the topology [7].

c) Link Quality

Finding high-quality links will greatly improve the overall performance of a path through higher transfer speeds and lower error rates. Link quality can be measured in a number of ways. The most common metrics are Signal to Noise Ratio (SNR) and Packet Loss Rate (PLR). This information is typically available from the device driver of a wireless interface. Alternatively, the PLR value can be determined through active probing [8].

d) Channel Diversity

Using the same channel on multiple consecutive hops of a path results in significant co-channel interference, and in a reduction of overall throughput. Ideally, all links of a path within interference range of each other should be operating on non-overlapping channels, resulting in significant performance gains [9, 10]. The extent to which this can be achieved can be expressed as *channel diversity*. Obviously, channel diversity is only relevant for multi-Radio networks, since in single-Radio networks all interfaces are required to operate on the same channel to guarantee connectivity.

III. Routing Metrics

In this section, we will describe the major routing metrics for multi-Radio mesh networks. We will begin by describing some metrics applicable to single-Radio mesh networks as much of the later work is based on these metrics.

A metric is a measurement of performance in some product or system, such as a program or a network. A router use metrics to make routing decisions and metric is one of the fields in a typical routing table. The metric consists of any value used by routing algorithms to determine the best route among multiple routes to a destination. It is typically based on such information as bandwidth, hop count, path cost, delay, load, MTU (maximum transmission unit), reliability and communication cost. A hop is the number of links or routers that are crossed en route to the destination. MTU is the largest packet size, measured in bytes, which can be transmitted over a network.

Routing metrics are assigned to routes obtained by routing protocols to provide measurable values that can be used to judge how useful (how low cost) a route will be. Metrics provide a quantitative value to indicate the specific characteristics of the route.

a) Hop Count

This is the base metric used in most MANET [2] protocols and is a simple measure of the number of hops between the source and destination of a path.

However, hop count maintains a very limited view of links, ignoring issues such as link load and link quality. De Couto et al. [5] showed that a route with a higher number of short links can outperform a route with a smaller number of long distance and therefore lower quality links.

This can lead the hop count metric to choose paths with low throughput and cause poor medium utilization, as slower links will take more time to send packets.

Furthermore, hop count tends to select long distance links with low quality, which typically already operate at the lowest possible rate, due the link layer's auto rate mechanism. This leaves the auto rate mechanism no further flexibility in dealing with channel quality fluctuations, resulting in reduced link and path reliability [7].

Hop count does not take into account link load, link capacity, link quality, channel diversity or other specific node characteristics. Neither does it consider any form of interference.

While it has been shown that the hop count is not necessarily an optimal metric to establish high throughput paths [8], comparisons have demonstrated that under scenarios of high mobility, hop count can outperform other load-dependent metrics [4].

Hop count is also a metric with high stability, and further has the isotonicity property, which allows minimum weight paths to be found efficiently.

b) ETX

Expected Transmission Count (ETX) [8] is a measure of link and path quality. It simply considers the number of times unicast packets need to be transmitted and re-transmitted at the MAC layer to successfully traverse a link.

The ETX path metric is simply the sum of the ETX values of the individual links. ETX considers the number of transmission in both directions of a link, since the successful transmission of a unicast frame requires the transmission of the frame in one direction plus the successfully transmission of an acknowledgement in the reverse direction.

The ETX metric for a single link is defined as shown below, where df is the measured rate or probability that a packet will be successfully delivered in the forward direction and dr denotes the probability that the corresponding acknowledgement packet is successfully received. Assuming these two probabilities are independent, we can say that the probability of a successful transmission, including Acknowledgement, is $df * dr$. By utilizing the inverse of this value, the ETX calculation, defined below, provides a minimum-weight cost to higher quality links:

$$ETX = \frac{1}{df * dr}$$

ETX is mostly determined by means of active probing, in which the number of successfully received packets is compared with the number of packets sent in a given time window, which is typically around 10 seconds [8].

While ETX outperforms hop count in single-Radio and single-rate networks, it does not perform well in multi-rate and multi-Radio networks due to its lack of knowledge of co-channel interference and its insensitivity to different link rates or capacities [16]. As a consequence, ETX tends to select links with lower rate. Links with lower transmission rates take up more medium time to transmit data and forces neighboring nodes to back off from their own transmissions. This phenomenon leads to poor medium fairness in the network [7].

Additionally, ETX does not consider the load of a link and will therefore route through heavily loaded nodes without due consideration, leading to unbalanced resource usage. ETX does not discriminate between node types and makes no attempt to minimize intra-flow interference by choosing channel-diverse paths. It has been shown in [4] that in highly-mobile single Radio environments, ETX demonstrates poor agility due to the long time window over which it is obtained. However, ETX does deal with inter-flow interference indirectly, through the measurements of link-layer losses. Links with a high level of interference will have a higher packet loss rate and therefore a higher ETX value. EXT is isotonic, and therefore allows efficient calculation of minimum weight and loop-free paths.

As many implementations of ETX [8] utilize small broadcast probe packets to detect losses there lies an issue where the measurements do not accurately reflect the loss rate of actual traffic due to the smaller size of the probe packets compared to the average packet size of network traffic.

These effects could be mitigated by utilizing a cross-layer approach and directly obtaining the number of retransmissions from the link layer.

c) ETT

The Expected Transmission Time (ETT) metric [10] is designed to augment ETX [8] by considering the different link rates or capacities. This allows ETT to overcome the limitation of ETX that it cannot discriminate between links with similar loss rates but have a massive disparity in terms of bandwidth. This is particularly useful in multi-rate networks. ETT is simply the expected time to successfully transmit a packet at the MAC layer and is defined as follows for a single link:

$$\text{ETT}=\text{ETX}*\frac{S}{B}$$

S denotes the average size of a packet and B the current link bandwidth. The ETT path metric is obtained by adding up all the ETT values of the individual links in the path.

ETT retains many of the properties of ETX, but can increase the throughput of the path through the measurements of link capacities, and therefore increase the overall performance of the network.

However, ETT still does not consider link load explicitly and therefore cannot avoid routing traffic through already heavily loaded nodes and links.

ETT was not designed for multi-Radio networks and therefore does not attempt to minimize intra-flow interference by choosing channel diverse-paths.

To resolve above issue we evaluate a new metric called Weighted Cumulative ETT (WCETT) for routing in multi-Radio, multi hop wireless networks.

The goal of WCETT metric is to choose a high-throughput path between a source and destination. Metric assigns weights to individual links based on the Expected Transmission Time (ETT) of a packet over the link. The individual link weights are combined into a path metric called Weighted Cumulative ETT (WCETT) explicitly consider interference among links that use the same channel, link quality and minimum hop-count. It can achieve good tradeoff between delay and throughput because it considers channels with good quality and channel diversity in the same routing protocol.

IV. Computing Path Metric

a) Design Goals

- Consider both loss rate and bandwidth.
- Path metric combining weight of individual links should be increasing.
- The path metric accounts for the reduction in throughput due to interference among links that operate on the same channel.

In keeping with the design goals, we assigns a weight to each link that is equal to the expected amount of time it would take to successfully transmit a packet of some fixed size S on that link. This time depends on the link bandwidth and loss rate. For now, let us assume that given a link i from node x to node y, we know how to calculate the expected transmission time (ETT) of the packet on this link. We denote this value by $ETTi$. The next question is how to combine the individual ETT link weights of hops along a path into a metric that reflects the overall "goodness" of the path.

Our path metric is called Weighted Cumulative ETT (WCETT).In keeping with our second design goal, we want WCETT to increase in value as we add more links to an existing path. If we set WCETT to be the sum of the ETTs of all hops on the path, this property will be ensured. Furthermore, the total sum of ETTs has a physical meaning as well: it is an estimate of the end-to-end delay experienced by a packet traveling along that path. Thus, for a path consisting of n hops, we may say:

$$WCETT = \sum_{i=1}^{n} ETT$$

However, we also want WCETT to consider the impact of channel diversity. Simply adding up ETTs will not ensure this property, since we are not distinguishing between hops that are on different channels. To reflect this, our metric will require an additional term.

Consider a two-hop path, in which both hops interfere with one another. In other words, only one of the hops can operate at a time. Assume that each hop has a bandwidth of B. If we ignore packet losses for the moment, then the expected transmission time of a packet along each hop will also be equal. Let us denote this by T. Note that T is inversely proportional to B. Due to interference, the maximum bandwidth a flow can achieve along this path is equal to B/2. Since T is inversely proportional to B, the notion of the reduced bandwidth along the path can be captured by giving the path a weight that is equal to the sum of the packet transmission times on the interfering hops; in this case 2*T.

We can generalize this intuition by assuming that that if two hops on a path are on the same channel then they always interfere with one another. This assumption is usually true for short paths, but the assumption is somewhat pessimistic for longer paths.

Consider an n-hop path. Assume that the system has a total of k channels. Define Xj as:

$$Xj = \sum_{Hop\ i\ is\ on\ channel\ j} ETTi \quad 1 \le j \le k$$

Thus, Xj is the sum of transmission times of hops on channel j. The total path throughput will be dominated by the bottleneck channel, which has the largest Xj. Thus, it is tempting to simply use the following definition for WCETT:

$$WCETT = \max_{1 \le j \le k} X j$$

It is easy to see that this metric will favor paths that are more channel-diverse. However, it is evident that the value of this metric will not always increase as more hops are added to the path, because additional hops using non-bottleneck channels do not affect the value of the metric. So this metric achieves our third design goal but not the second goal.

We can combine the desirable properties of the two metrics described in Equations (3) and (5) by taking their weighted average:

$$WCETT = (1-\beta) \sum_{i-1}^{n} Wi + \beta * \max_{1 \le j \le k} X j$$

Where β is a tunable parameter subject to $0 \le \beta \le 1$. There are a two possible ways to interpret the expression in Equation. First, we can view it as a tradeoff between global good and selfishness. The first term is the sum of transmission times along all hops in the network. This reflects the total resource consumption along this path, where the resource being consumed is the "air time." The second term reflects the set of hops that will have the most impact on the throughput of this path. The weighted average can be viewed as an attempt to balance the two. Note that this average implicitly assumes that the network is not too heavily loaded. If every channel is being fully utilized, then

simply minimizing overall resource consumption (setting $\beta = 0$) may be preferable.

Second, we can view Equation (6) as a tradeoff between throughput and delay. The first term can be considered as a measure of the latency of this path. The second term, since it represents the impact of bottleneck hops, can be viewed as a measure of path throughput. The weighted average is an attempt to strike a balance between the two.

V. Comparision and Simulation Results

The simulation is conducted in three different scenarios. In the first scenario, the comparison of the three routing metrics is compared in various numbers of nodes. In the second scenario, the routing metrics are evaluated in different network load. In the third scenario, the routing protocols are evaluated in single Radio and multi Radio support.

a) Performance evaluation of Hop count, ETT, WCETT by increasing Number of nodes

i. *Number of the Nodes Vs Throughput*

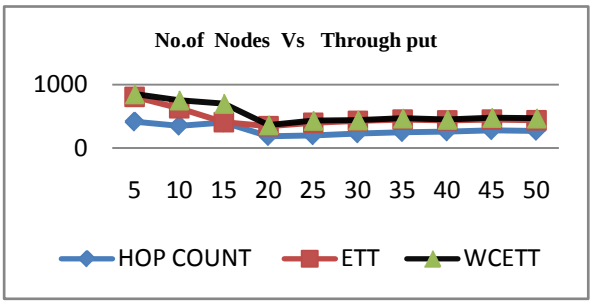

Figure 5.1 : No. of nodes Vs Throughput for routing metrics Hop count, ETT, WCETT

In the above graph we took number of nodes on X-axis and throughput in Y-axis to compare the routing metrics. When we observe the throughput of WCETT, ETT and hop count routing metrics, the WCETT performance is better than the remaining routing metrics hop count and ETT.

ii. *Number of the Nodes Vs End-to-end delay*

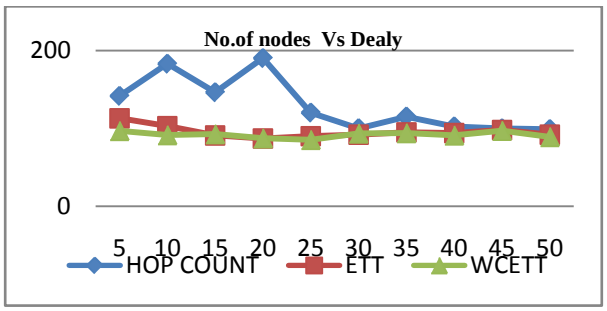

Figure 5.2 : No. of nodes Vs end-to-end delay for routing metrics Hop count, ETT, WCETT

In the above graph we took number of nodes on X-axis and end-to-end delay in Y-axis to compare the routing metrics. When we observe the end-to-end delay of WCETT, ETT and hop count routing metrics, the WCETT end-to-end delay is lower than the remaining routing metrics hop count and ETT, but the hop count end-to-end delay is very high when compare to WCETT.

iii. *Number of the Nodes Vs Packet deliver ratio*

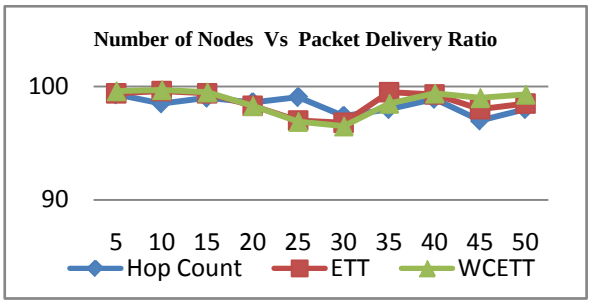

Figure 5.3 : No. of nodes Vs Packet delivery ratio for routing metrics Hop count, ETT, WCETT

In the above graph we took number of nodes on X-axis and packet delivery ratio in Y-axis to compare the routing metrics. When we observe the packet delivery ratio of WCETT, ETT and hop count routing metrics, when we take the nodes as 30 the packet delivery ratio of hop count is greater than that of remaining metrics, but when we compare the overall packet delivery ratio of WCETT is higher than that of the remaining routing metrics.

b) Performance evaluation of Hop count, ETT, WCETT by increasing in network load

i. *Load Vs Throughput*

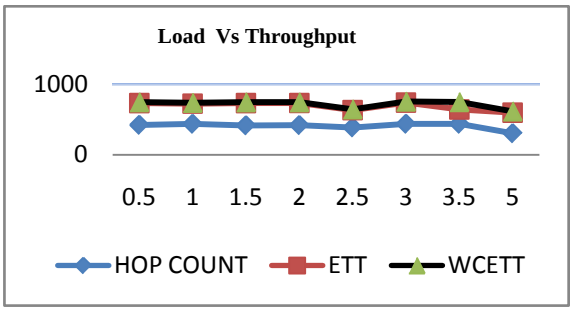

Figure 5.4 : Load Vs Throughput for routing metrics Hop count, ETT, WCETT

In the above graph we took the total flow load on X-axis and throughput in Y-axis to compare the routing metrics. When we observe the throughput of WCETT, ETT and hop count routing metrics, the WCETT performance is better than the remaining routing metrics hop count and ETT.

ii. *Load Vs End –to- end delay*

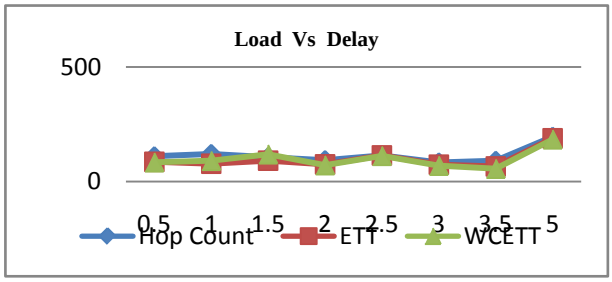

Figure 5.5 : Load Vs end-to-end delay for routing metrics Hop count, ETT, WCETT

In the above graph we took the total flows load on X-axis and end-to-end delay in Y-axis to compare the routing metrics. When we observe the end-to-end delay of WCETT, ETT and hop count routing metrics, the end-to-end delay is vary based on the loads, but the overall WCETT end-to-end delay is lower than the remaining routing metrics hop count and ETT.

iii. *Load Vs Packet delivery ratio*

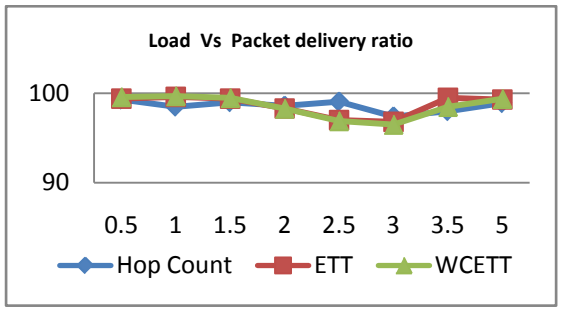

Figure 5.6 : Load Vs Packet delivery ratios for routing metrics Hop count, ETT, WCETT

In the above graph we took the total load on X-axis and packet delivery ratio in Y-axis to compare the routing metrics. When we observe the packet delivery ratio of WCETT, ETT and hop count routing metrics, when you take load as 2.5 the packet delivery ratio of hop count is greater than that of remaining metrics, but when we compare the overall packet delivery ratio of WCETT is higher than that of remaining routing metrics.

c) Performance evaluation of Hop count, ETT, WCETT with single Radio and multi Radio support

i. *Single Radio Vs multi Radio*

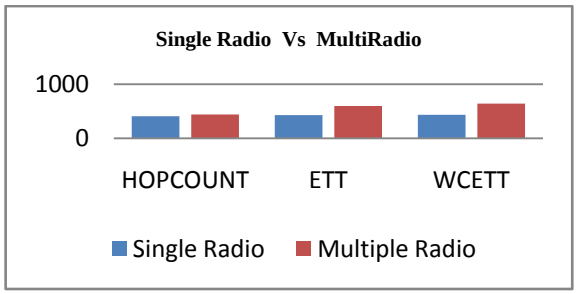

Figure 5.7 : Comparison of routing metrics in terms TCP throughput with single and multi Radio

When we see the above graph we come to know that the HOPCOUNT multi Radio throughput is greater than that of single Radio throughput. The same thing is happened in other two routing metrics. But when we compare the three routing metrics the throughput of WCETT is greater than that of other two single Radio and multi Radio throughput.

VI. Conclusion

a) Summary

We discussed importance of channel diversity by addressing limitations of hop count and ETT. It also shown that when nodes are equipped with Multiple Radios, it is important to select channel diverse paths in addition to accounting for the loss rate and bandwidth of individual links. Initially we implemented multi Radio, multichannel support for an AODV then its WCETT routing metric is incorporated to improve quality of route selection. We performed simulation for various scenarios in NS2 in order to show that performance of well known routing metrics hop count, ETT, WCETT with and without multi Radio and multichannel support. Our results shown that WCETT outperforms Hop count, ETT. WCETT allows us to trade off channel diversity and path length by changing the value of the control parameter β.

We experimented with different values of control parameter for analyzing performance in terms of throughput, end-to-end delay, and load and packet delivery ratio. It is shown that the routing Metric WCETT is exploiting channel diversity in order to brings significant benefits than hop count and ETT

b) Scope for future work

As it is observed from results section WCETT works better than hop count and ETT, WCETT has got following limitations

- WCETT simply considers the number of links operating on the same channel and their respective ETTs but does not consider the relative location of these links.
- It assumes all links of a path operating on same channel interfere with each other which can lead to selection of non- optimal paths.

- Because of the second term in WCETT equation, WCETT is not isotonic .i.e. it may not guarantee optimal and loop free path to destination. If a metric is not isotonic, then it is very difficult to use with link state routing protocols it can be implement further enhance of WCETT.

A new routing metric can be proposed which addresses above said limitations.

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GJCST Classification : H.5.1, I.2.10

A COLLABORATIVE AUGMENTED REALITY SYSTEM BASED ON REAL TIME HAND GESTURE RECOGNITION

Strictly as per the compliance and regulations of:

A Collaborative Augmented Reality System Based On Real Time Hand Gesture Recognition

Akhil Khare[α], Vinaya Kulkarni[Ω], Dr. Akhilesh Upadhayay[β]

Abstract - Human computer interaction is a major issue in research industry. In order to offer a way to enable untrained users to interact with computer more easily and efficiently gesture based interface has been paid more attention. Gesture based interface provides the most effective means for non-verbal interaction. Various devices like head mounted display and hand glove could be used by the user but they may be cumbersome to use and they limits the user action and make them tired. This problem can be solved by the real time bare hand gesture recognition technique for human computer interaction using computer vision Computer vision is becoming very popular now a days since it can hold a lot of information at a very low cost. With this increasing popularity of computer vision there is a rapid development in the field of virtual reality as it provides an easy and efficient virtual interface between human and computer. At the same time much research is going on to provide more natural interface for human-computer interaction with the power of computer vision .The most powerful and natural interface for human-computer interaction is the hand gesture. In this project we focus our attention to vision based recognition of hand gesture for personal authentication where hand gesture is used as a password. Different hand gestures are used as password for different personals.

I. Introduction

It is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithm. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait, proxemic, and human behaviors is also the subject of gesture recognition techniques.

Gesture recognition can be seen as a way for computers to begin to understand human body language, this building a richer bridge between machines and humans than primitive text user interfaces or even GUI's (graphical user interfaces), which still limit the majority of input to keyboard and mouse.

Gesture recognition enables humans to interface with the machine (human-machine interaction) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant. Gesture recognition can be conducted with techniques from computer vision and image processing.

In computer interfaces, two types of gestures are distinguished:

I. *Offline gestures:* Those gestures that are processed after the user interaction with the object. An example is the gesture to activate a menu.
II. *Online gestures:* Direct manipulation gestures. They are used to scale or rotate a tangible object.

Gesture recognition is useful for processing information from humans which is not conveyed through speech or type. As well, there are various types of gestures which can be identified by computers.

a) *Sign language recognition.* Just as speech recognition can transcribe speech to text, certain types of gesture recognition software can transcribe the symbols represented through sign language into text.
b) *For socially assistive robotics.* By using proper sensors (accelerometers and gyros) worn on the body of a patient and by reading the values from those sensors, robots can assist in patient rehabilitation. The best example can be stroke rehabilitation.
c) *Directional indication through pointing.* Pointing has a very specific purpose in our society, to reference an object or location based on its position relative to ourselves. The use of gesture recognition to determine where a person is pointing is useful for identifying the context of statements or instructions. This application is of particular interest in the field of robotic.
d) *Control through facial gestures.* Controlling a computer through facial gestures is a useful application of gesture recognition for users who may not physically be able to use a mouse or keyboard. Eye tracking in particular may be of use

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for controlling cursor motion or focusing on elements of a display.

e) *Alternative computer interfaces.* Foregoing the traditional keyboard and mouse setup to interact with a computer, strong gesture recognition could allow users to accomplish frequent or common tasks using hand or face gestures to a camera.

f) *Immersive game technology.* Gestures can be used to control interactions within video games to try and make the game player's experience more interactive or immersive.

g) *Virtual controllers.* For systems where the act of finding or acquiring a physical controller could require too much time, gestures can be used as an alternative control mechanism. Controlling secondary devices in a car or controlling a television set are examples of such usage.

h) *Affective computing.* In affective computing, gesture recognition is used in the process of identifying emotional expression through computer systems.

II. Literature Analysis

Wu Yueming, He Hanwu, Ru Tong, Zheng Detao have proposed a method for hand segmentation in their paper 'Hand Segmentation for Augmented Reality System'. This method uses Color-based and appearance-based skin detection technologies to separate the hand from the background. As compared with the traditional segmentation method this method has two benefits One is that it does not require a stationary camera or a static background; another is that it is not sensitive to intensity different, and requires no special object model with relative high performance. These two benefits make the system applicable to the augmented reality systems or other real-time systems. Hand segmentation is producing better quality results since appearance-based skin detection technology reduces the misjudged pixels along with the color based skin detection technique. The experimental result shows the accuracy, performance and robustness of this method.

The performance of the system is shown to be similar to state-of-the-art hand geometry authentication techniques but without sacrificing the convenience of the user. In the field of virtual reality and interactive graphics, communication between human and computer becomes more and more important. Wei Du and Hua Li presented a real-time system in "Vision based gesture recognition system with single camera" for human-computer interaction through gesture recognition and hand tracking [10]. Stable detection can be achieved by extracting two kinds of features: statistic-based feature and contour-based feature. Unlike most of previous works, our system recognizes hand gesture with just one camera, thus avoids the problem of matching image features between different views. This system can serve as a natural and convenient user input device, replacing mouse and trackball.

Hand gesture is a natural and intuitive interactive method. Shuying Zhao, Wenjun Tan, Chengdong Wu, Chunjiang Liu and Shiguang Wen presented in "A Novel Interactive Method of Virtual Reality System Based on Hand Gesture Recognition" [11] a novel interactive method of virtual reality system based on hand gesture recognition. The hand gesture segmentation method is proposed based on building complexion model by Gaussian distribution and the background model by automatically update the background parameters to improve the ability of adaptation environment. According to the good describing ability of Fourier Descriptor and the good self-learning ability of BP neural network, an improved algorithm of hand recognition is presented. Experiment result indicates that this method is flexible, realistic and exact, and fit for many virtual reality systems.

With the rapid emergence of 3D applications and virtual environments in computer systems; the need for a new type of interaction device arises. This is because the traditional devices such as mouse, keyboard, and joystick become inefficient and cumbersome within these virtual environments. In other words, evolution of user interfaces shapes the change in the Human-Computer Interaction (HCI). Intuitive and naturalness characteristics of "Hand Gestures" in the HCI have been the driving force and motivation to develop an interaction device which can replace current unwieldy tools. Considering this need Reza Hassanpour and Asadollah Shahbahrami have presented a survey on the methods A survey on the methods of analyzing, modeling and recognizing hand gestures in the context of the HCI in their paper 'Human computer interaction using vision based hand gesture recognition. This paper provides different methods for gesture taxonomy, gesture modeling, hand modeling and advantages and disadvantages of different methods.

III. Proposed System

a) Video Capturing

Video capture is the process of converting an analog video signal such as that produced by a video camera to digital form. The resulting digital data are referred to as a digital video stream, or more often, simply video stream. This is in contrast with screen casting, in which previously digitized video is captured while displayed on a digital monitor.

The video capture process involves several processing steps. First the analog video signal is digitized by an analog-to-digital converter to produce a raw, digital data stream. In the case of composite video, the luminance and chrominance are then separated; this is not necessary for S-Video sources. Next, the chrominance is demodulated to produce color difference video data. At this point, the data may be

modified so as to adjust brightness, contrast, saturation and hue. Finally, the data is transformed by a color space converter to generate data in conformance with any of several color space standards, such as RGB and YCbCr. Together, these steps constituted video decoding, because they "decode" an analog video format such as NTSC or PAL.Special electronic circuitry is required to capture video from analog video sources. At the system level this function is typically performed by a dedicated video capture card. Such cards often utilize video decoder integrated circuits to implement the video decoding process.

b) Image extraction from video

Here we have to select captured video as input. We are now ready to start extracting frames from the videos. After getting frame from video start to extract images from those frames. Store those extracted files in particular folder.

c) Image enhancement and Remove noise

Noise reduction is the process of removing noise from a signal. Noise reduction techniques are conceptually very similar regardless of the signal being processed, however a priori knowledge of the characteristics of an expected signal can mean the implementations of these techniques vary greatly depending on the type of signal. The median filter is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because under certain conditions, it preserves edges while removing noise. The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the "window", which slides, entry by entry, over the entire signal. For 1D signal, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically.

d) Background suppress

An algorithm that detects and removes background shadows from images in which the pattern set occupies the upper-most intensity range of the image and the image is background dominant outside the pattern set is presented. The algorithm will remove background shadows and preserve any remaining texture left behind by the shadow function. A mathematical model of the histogram modification function of the shadow-removal algorithm is developed. An analysis of the sequential nature of the algorithm is included along with simulated results to verify the mathematical model developed and to show the effectiveness of the algorithm in removing background pattern shadows.

e) Hand region segmentation

The initial step of hand gesture recognition is the detection of hand region from the background This step is also known as hand detection. It involves detecting and extracting hand region from background and segmentation of hand image. Previous methods made use of following two approaches that is the color based model and statistical based model. This system uses the additional third approach i.e. haar like feature with adaboost technology. Different features such as skin color, shape, motion and anatomical models of hand are used in different methods. The output of this step is a binary image in which skin pixels have value 1 and non-skin pixels have value 0.

The characteristics of hand shape such as topological features could be used for hand detection. Hands can be found from their appearance and structure such as Adaboost algorithm. 3D model based detection. Using multiple 3D hand models multiple hand postures can be estimated.

f) Feature extraction and gesture recognition

The next important step is hand tracking and feature extraction. Tracking means finding frame to frame correspondence of the segmented hand image to understand the hand movement. Following are some of the techniques for hand tracking.

1. Template based tracking: If images are acquired frequently enough hand can be tracked. It uses correlation based template matching. by comparing and correlating hand in different pictures it could be tracked.
2. Optimal estimation technique: Hands are tracked from multiple cameras to obtain a 3D hand image.
3. Tracking based on mean shift algorithm: To characterize the object of interest it uses color distribution and spatial gradient. Mean shift algorithm is used to track skin color area of human hand.

Two types of features are there first one is global statistical features such as centre of gravity and second one is contour based feature that is local feature that includes fingertips and finger-roots. Both of these features are used to increase the robustness of the system. Hand posture can be distinguished using the number of fingers of the hand and if the number of fingers are same then the angle between two fingers can be measured to recognize the specific gesture.

The goal of hand gesture recognition is interpretation of the meaning gesture of the hands location and posture conveys. From the extracted features multiple hand gestures are recognized. Different methods for hand gesture recognition can be used such as template matching, method based on principle component analysis, Boosting contour and

silhouette matching, model based recognition methods, Hidden Markov Model (HMM). Hand gesture is movement of hands and arms used to express an idea or to convey some message or to instruct for an action. From psychological point of view hand gesture has three phases.

g) Register user

The Register User action registers the user information with the installer to identify the user of a product. it provides a unique user id for every user. a large set of postures and gestures is stored on the computer one for each individual.

h) Login

When a user wants to login he/she has to perform the desired hand gesture. This hand gesture can be performed using single hand. That gesture will be compared with the already recorded gesture that works as a password for that particular person, if that gesture matches with the performed gesture then only that person will be authenticated and will be allowed to access his/her account or product. Basic idea is that the number of fingers are counted and the password is created Ex, 123,432,531,23,4532,123451 etc. the password can be any combination of the numbers from 0,1,2,3,4,5. This password performed by the user is authenticated by the system and he/she will be allowed to access the application or is rejected the access.

This proposed system could be used by any application to authenticate the authorized user. The major benefit of this system is that it could be used by blind users also, but the accuracy is the major concern, the system may not give accurate results in intricate background.

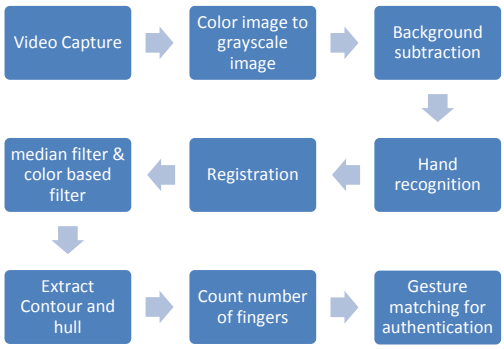

Figure 1 : System Architecture

IV. Result

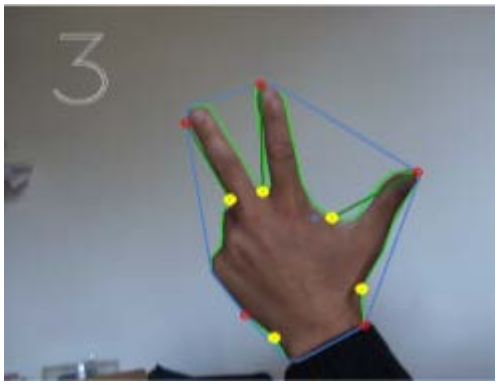

Fig 1(a)

Fig 1(b)

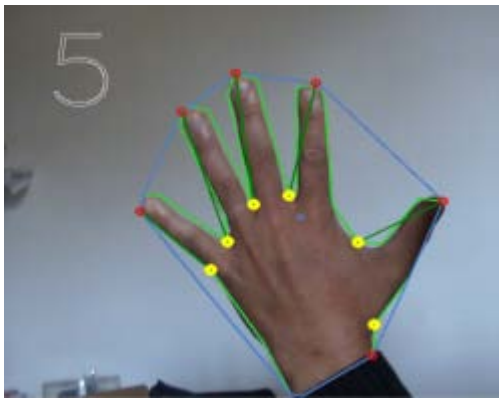

Fig 2(a)

Fig 2(b)

Fig 1 : (a) and 2(a) original picture and fig 1(b) and 2(b) segmentation result

IV. Conclusion

Vision based hand gesture recognition has major applications in human-computer interaction as well as in intelligent service robot. A lot of work has been done for hand gesture recognition such as color based method for hand region segmentation, contour based method, statistical analysis based method, some methods make use of A boosted classifier tree for hand shape detection. This project describes a collaborative vision based hand gesture recognition system where a hand gesture could be effectively used by a person as her password for the personal authentication. Initially the hand is segmented and separated from the background using haar-like features and topological features along with the color model so that the hand could be effectively separated from the background and the features could be easily extracted to recognize the hand gesture. This system accepts the password by the user through the hand gesture. For the password the user performs the required gesture to create a unique combination of the numbers 0,1,2,3,4,5 according to the number of fingers the users gesture has. If this number matches with the already recorded password for that user then the user will be authenticated and the login will be successful. This system provides an easy interface for human-computer interaction. This system will provide a more efficient system with greater accuracy that makes use of both the hands separately as well as the drawback of previous techniques have been tried to remove such as complexion problem could be effectively removed by using background model alongwith the complexion model. Using this method a rich set of possible combinations of the numbers could be made since there are no restrictions on the number, the only thing is that it should be the combination of 0,1,2,3,4,5 so the system will be more secure.

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Segmentation and Counting of People through Collaborative Augmented Environment

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Abstract - People counting system have wide potential application including video surveillance and public resources management. Also with rapid development of economic society, crowd flowing in varies public places and facility is more and more frequent. Effectively managing and controlling crowd in public places become an important issue. People counting system based on this kind of demand arises, which can be used in commercial domain such as market survey, traffic management as well as architectural design domain. For example suppose there is a crowd gathering at specific place then it indicates an unusual situation and second one if counting of people is done in shopping mall then it provides valuable information for optimizing trading hours, as well as evaluating the attractiveness of some shopping areas.

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Akhil Khare[α], Kanchan Warke[Ω], Dr. Akhilesh Upadhayay[β]

Abstract - People counting system have wide potential application including video surveillance and public resources management. Also with rapid development of economic society, crowd flowing in varies public places and facility is more and more frequent. Effectively managing and controlling crowd in public places become an important issue. People counting system based on this kind of demand arises, which can be used in commercial domain such as market survey, traffic management as well as architectural design domain. For example suppose there is a crowd gathering at specific place then it indicates an unusual situation and second one if counting of people is done in shopping mall then it provides valuable information for optimizing trading hours, as well as evaluating the attractiveness of some shopping areas.

I. Introduction

With the rapid development of economic society, the crowd flowing in various public places and facility is more and more frequent. Effectively managing and controlling the crowd in public places become an important issue. People counting system based on this kind of demand arises, which can be used in the crowd surveillance and management, but also can be used in commercial domain such as market survey, traffic safety as well as the architectural design domain and so on. The research on counting people has the profound significance and the broad prospect because it directly or indirectly improves the staffs' working efficiency and the utilization of building facilities in various places. In the past history of this project different methods have been developed to count the number of people. But some of them have problems associated with them; hence we are trying to overcome them in this system. In developing the method for counting the number of people in complex indoor spaces, our goal is to develop a method such that it should be robust, easily realizable and effective. It should have high recognition rate in relatively stable environment and relatively sufficient light.

A people counter is a device used to measure the number and direction of people traversing a certain passage or entrance per unit time. The resolution of the measurement is entirely dependent on the sophistication of the technology employed. The device is often used at the entrance of a building so that the total number of visitors can be recorded. Many different technologies are used in people counter devices, such as infrared beams, computer vision, thermal imaging and pressure-sensitive mats.

II. Literature Survey

Authors like Lin SF, Chao HX, T.Zhao, R. Nevatia addressed issue of people counting. It consist of methods like: fitting method based on low level feature, feature point tracking, object detection method. Fitting method is easy to use, but as it has neglected individual concept and skipped single object tracking process, it becomes difficult to acquire correct people counting information. Object tracking method has high precision because it detects directly object. And feature point tracking method acquires people counting information by tracking moving feature point, then applying cluster analysis for further point track. But though this method is insusceptible of camera angle, but has lower accuracy.

Hence to overcome these difficulties and problems new method should be invented. And this method can be easily realized and suitable for environment. It can also be useful for understanding personal information.

Author Xi Zhao, Emmanual, Dellandrea and liming Chen mensioned in paper "People counting System Based on Face Detection and Tracking in video." that in literature most of work is relied on moving object detection and tracking, based on the assumption that all the moving objects are people.They proposed an approach in which people counting is based on face detection , tracking and trajectories classification. Scale invariant Kalman filter combined with kernel based object tracking algorithm is used to handle face occlusion. They proposed a strategy to count people by automatically classify face trajectories. Then two Earth Movers Distance based classifier is used to discriminate true and false trajectories.

Due Fehr, Ravishankar Sivalingam, Osama Lotfallah, Youngchoon Park described in paper "Counting People in Groups" the importance of camera surveillance in the era of growing security concerns, and

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it is also necessary. They mentioned that there is successful development of detecting abandoned objects and people tracking. People tracking is relatively easy as compared to people counting in groups. Mutual occlusion is the most problematic in group counting. Several techniques for group counting estimation is suggested such as foreground \detection using mixture of Gaussian, foreground detection using pixel layering, shadow Emoval.

Duan-Yu Chen, Chih-Wen Su, Yi-Chong Zeng, Hong –Yuan Mark Liao proposed a system "An Online People Counting System for Electronic Advertising Machine" for counting the number of people watching a TV-wall advertisement or electronic billboard without countingrepetitions by using stationary camera. In this first of all face detection and face filtering is done, in which, SVM based face detector is used. Face filtering is used to filter false positive face. Then feature extraction is performed on torso of human subject. Then an online classifier trained by Fisher's Linear discriminant strategy is developed.

Fang Zhu and Xinwei Yang suggested "People Counting Based on Support Vector Machine" infrared people counting method. In data processing procedure pattern recognition idea can be introduced according to characteristics of time continuous data collected by infrared sensors. In this method people counting is based on two steps. First is data acquiring in which infrared signal information is collected. Second is data processing in which noise removing and normalization is done by standardization and data segmentation. Then feature extraction is performed. Lastly classification and identification of people who go through infrared area is done. When several people go through infrared signal at the same time, this method counts number of people accurately.

III. Proposed System

In this paper, a new robust method for counting people in complex indoor spaces is presented. As shown in Fig.1 the method for counting people diagram, the method has counted the number of people in the indoor spaces through four modules: image pre-processing module, morphology processing module, image marking module and people counting module, in order to master the information of the indoor for increasing efficiency and utilization of building facilities. Image pre-processing module chooses image greying, background subtraction based on threshold, median filtering algorithm and threshold segmentation to eliminate background interference. The morphology processing module uses the improved erosion operation and the improved dilation operation to extract target feature. Then the following image marking module uses connected component detection algorithm, setting the object feature and shape judgment condition to remove false contouring and marking object region by rectangle frame. Finally, people counting module is used to count the number of people.

a) Image Processing Module

The captured video images need pre-processing in the method for counting people. In our method, the main function of image pre-processing module is to eliminate background interference and extract the foreground object information, that is, the foreground object in the image sequence will be extracted from the background. The result of this module as the basis of the people counting will directly affect the accuracy of people counting result. First, in image pre-processing module we capture images using a single camera, which is hanged in the middle of the roof in order to cover the entire housing and own a better sensitivity. Secondly, we use image greying turn current image and background image into two gray images. Thirdly, we use background subtraction based on threshold process the two gray images to extract the foreground object for detecting the relative static and moving human object. Finally, we use median filtering method eliminate noise and then use maximum between-cluster variance threshold segmentation method turn the foreground object image into a binary image. Now we detail the image pre-processing module.

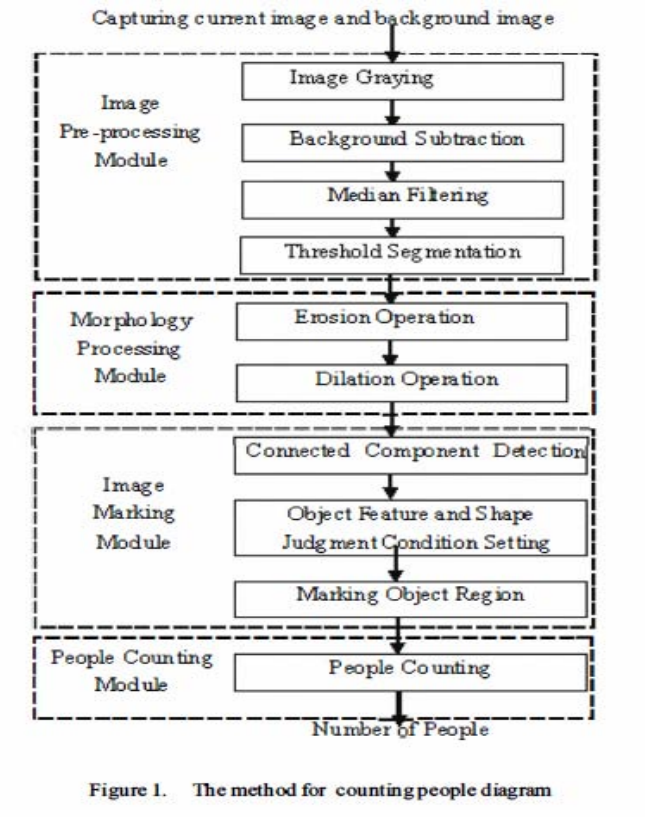

Figure 1. The method for counting people diagram

i. *Image greying*

Image greying is defined by throwing away the colour information and using gray express image

luminance. In the beginning of image pre-processing module, we use image greying turn the current colour image and the background colour image into two gray images. Image greying is to make the colour components R, G, B equal. Gray image has 256 Gray Levels because R, G, B range is from 0 to 255. In this paper we perform image greying thought weighted average method, which gives R, G, B different weights and makes the value of R, G, B weighted average as follow:

$$R=G=B=rR+gG+bB \quad (1)$$

Among analysis, we can gain the most reasonable gray image when r=0.299 , g=0.587, b=0.114 as follow:

$$R=B=G=0.299*R+O.587*G+0.114*B \quad (2)$$

ii. *Background subtraction based on threshold*

Using image greying, two gray images which include the current gray image and the background gray image are received. We use background subtraction based on threshold process the two gray images to eliminate background interference and extract the foreground object information image.

Threshold selection is a key issue. As the gray values of head generally below 90, we choose maximum between cluster variance adaptive threshold method whose threshold is chosen within the range [0, 90]. If the pixel gray difference is bigger than the threshold, the pixel value in input gray image is seen as foreground stored in the image, else the pixel is considered as white pixel which value is 255. Through those processing, the majority of background disturbance is eliminated. Moreover, in some public spaces such as cyber bar, computer room, laboratory, the computer frame to the object extracting influence should be considered. Because computer frame and the top of head have approximate gray value, the head which locates near computer will be divided into two sections only using background subtraction. Allowing for this question, if the frame gray value of current image below 90 and the number of pixels which variation of the frame upper and lower or the frame left and right are bigger than the threshold is bigger than the set number, the pixel value in input gray image is seen as foreground stored in the result image, else the pixel is considered as white pixel which value is 255.This improved method effectively resolves the computer frame disturbance question.

iii. *Median filtering method*

After background subtraction based on threshold, the foreground object images have a certain extent noise interference. The noise makes image quality deteriorated, causes the image blurred, even submerges the image feature and affects the analytic result. Therefore in the pre-processing module we adopt median filtering method to eliminate noise. Median filtering commonly uses a sliding template including the odd number of points, with the median of each template window gray value instead of the gray value of designated point. In this system, + template median filtering is used to eliminate the noise of foreground object image. After arranging the values of five pixels including the pending pixel and 4-neighbors of the pending pixel from small to big, we choose the median of the gray levels as the value of the pending pixel. Median filtering can obvious reduce noise and make image smoothing, which filters the small object blocks and highlights the feature information we need.

iv. *Threshold segmentation*

Threshold segmentation is fundamental approach to segmentation that enjoys a significant degree of popularity. It needs a right threshold to divide the image into object and background. Maximum between-cluster variance threshold segmentation algorithm is used to change the object image after median filtering into a binary image. This algorithm as follows:

In our method, threshold value T is chosen within the range [0, 90] because gray values of head generally below 90. The result of threshold segmentation is a binary image including object information. After image pre-processing module, we receive a clear binary object image, which is eliminated background interference and beneficial to the next processing.

b) Morphology Processing Module

Mathematical morphology processing (6) is widely applied to image processing, which mainly includes dilation, erosion, opening and closing operation. Because the binary object images after image pre-processing module often have the discrete noise and holes in object region, morphology processing module is used to remove the isolated noise and fill the hole in the object region, which first uses an improved erosion operation and then uses an improved dilation operation.

i. *Improved erosion operation*

In this system, an improved erosion operation is proposed, which does the first erosion operation using 3 x3 template as B to process the binary object image, then does the second erosion operation using r template as B. Through two times erosion operation, the binary image is removed isolated noise and becomes clean.

ii. *Improved dilation operation*

After erosion operation, an improved dilation operation is used in the method, which performs the first dilation operation using template as B, then performs the second dilation operation using 3x3 template as B. Through two times dilation operation, those holes in the object region are filled and some gaps are bridged.

Morphology processing module can improve the accuracy of counting system through enhancing the object feature. This step has laid a good foundation for the further image marking.

c) Image Marking Module

Image marking module aims to mark the head region. First, image marking module uses connected component detection algorithm, then sets the object feature and shape judgment condition, fmally, removes false contouring based on the object feature and shape judgment condition, simultaneously uses rectangle frame mark object region.

i. *Connected component detection algorithm*

Connected component detection algorithm[7] is to fmd all the pixels which belong to the same connected component and to give the same marking to the same connected component pixels. Through this algorithm, we gain a marking image in which the value of each pixel is the value of its regional marking. As shown in Fig.2 the image marking scheme, the connected component detection algorithm has been done as follows:

Setting the initialization of marking counter is 0 and using column-based scan method to mark those pixels (the gray values are equal to 0)based on those marking of those pixels' four neighbor pixels which have been scanned, at the same time carrying on the following marking algorithm judgment:

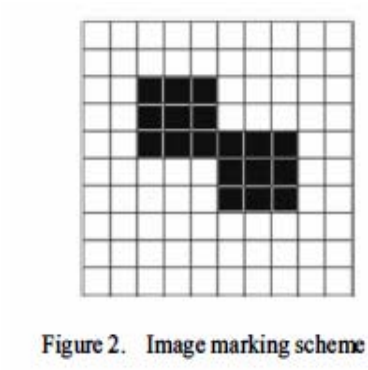

Figure 2. Image marking scheme

Step I: If the gray values of four pixels which separately lie the lower left, the left, the upper left, the up of current pixel are 255, the marking counter adds one.

Step 2: If the gray values of four pixels which separately lie the lower left, the left, the upper left, the up of current pixel have the same marking but not all are equal to marking value 0 , the marking is given current pixel.

Step 3: If the gray values of four pixels which separately lie the lower left, the left, the upper left, the up of current pixel have different marking and two kind of marking (not including the marking is zero), judge the size of two kind of marking, the small marking is given current pixel, then scanning the whole image, changing the marking of pixel which has already been labeled as the big marking value into small marking value, the marking counter subtracts one.

Step4: All pixels carry out the 2nd step .when all pixels processing are completed, the algorithm is over.

ii. *Object feature and shape judgment condition setting*

After connected component detection algorithm, we should scan the whole marking image to count the area ,barycentric coordinates, upper left coordinate and lower right coordinate of rectangle frame which belongs to different connected components with different marking value.

In order to extract real head information, we choose object area and shape characteristics as object feature. If the connected component isn't in line with the shape attribute, then we judge it as false object and the counter subtracts one, else if it is in line with area classification judgment condition, then we judge it as object, else judge it as false object and the counter subtracts one. Allowing that two head possible connected together, we count the average area of head (avgs2) when the connected component was in line with the shape attribute condition. If avgs2 is in line with the following judgment condition of two people connected together, then we judge the connected component region as two people and the counter adds two.

iii. *Marking object region*

After the above processing, we get the real head object information, including the area, barycentric coordinates, upper left coordinate and lower right coordinate of rectangle frame. Using the coordinates of rectangle frame, we can mark the real rectangle frame region including object features. Image marking module is the foundation of the following people counting module.

d) People Counting Module

From the above analysis we can draw the conclusion that the value of marking counter is the number of people head and can receive the head average area of object through taking the average of the sum about the head pixels in those rectangle frames, therefore the outputs of the system include the image size, the number of people head and the goal (number of people) average area. In people counting module, the number of people head is the people counting result we need. The method for counting people is a robust method and low cost for using a single camera, which can be used in complex indoor spaces.

IV. Conclusion

Uptill now people counting system is used for the purposes such as to facilitate security management as well as urban planning. In military application for instance in urban warfare, soldiers might not be able to check every room of building. Sending a camera into a room that could autonomously report how many people are present can help soldiers assess threat level.

But apart from this we can use this system in shopping malls. We can count number of people going in particular section and if there is too much crowd in

that section then we can segregate the crowd by applying some technique. For example in shopping mall if too much crowd is in ladies clothes especially for jeans clothes, then we can suggest the manager to provide separate section for jeans clothes, so that crowd get segregated. We can also find out which section is more crowded on particular day of a week. Also we can use this system in public places such as cyberbar, computer room, laboratory classroom, conference room etc.

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Maintenance vs. Reengineering Software Systems

By Dr. Ashok Kumar, Bakhshsish Singh Gill
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Abstract - Maintenance and reengineering terms are closely coupled with each other. These terms came from the world of hardware objects. Now these entered the world of software and are well suitable for software systems. It is difficult to draw a clear cut line between these two terms. Many a times these are used interchangeably. Reengineering of software systems is a topic of importance and in coming time it will be gaining more attention in the world of software systems. Software managers are often confused over maintenance and reengineering. These two terms should be separated to promote the subject matter because one is problem for the other. I will try to put them in different non overlapping regions. Maintenance and reengineering are two different areas in software engineering. Maintenance is for running the system till the age of the system where as the reengineering make the system new to work for another life span. Scope of reengineering is vast and challenging as compared to maintenance. Reengineering is to reduce the expenses on software systems in the organizations. Reengineering has more scope in the world of software than in the world of hard ware objects. Software systems and software objects do not wear and tear out like hardware objects in the real world. Maintenance is close to repair/mend where as reengineering is very close to new development.

Keyterms : *Object, reengineering zone, maintenance zone, transition state, reverse engineering*

GJCST Classification : *D.2.7*

Strictly as per the compliance and regulations of:

Maintenance vs. Reengineering Software Systems

Dr. Ashok Kumar [α], Bakhshsish Singh Gill [Ω]

Abstract - Maintenance and reengineering terms are closely coupled with each other. These terms came from the world of hardware objects. Now these entered the world of software and are well suitable for software systems. It is difficult to draw a clear cut line between these two terms. Many a times these are used interchangeably. Reengineering of software systems is a topic of importance and in coming time it will be gaining more attention in the world of software systems. Software managers are often confused over maintenance and reengineering. These two terms should be separated to promote the subject matter because one is problem for the other. I will try to put them in different non overlapping regions. Maintenance and reengineering are two different areas in software engineering. Maintenance is for running the system till the age of the system where as the reengineering make the system new to work for another life span. Scope of reengineering is vast and challenging as compared to maintenance. Reengineering is to reduce the expenses on software systems in the organizations. Reengineering has more scope in the world of software than in the world of hard ware objects. Software systems and software objects do not wear and tear out like hardware objects in the real world. Maintenance is close to repair/mend where as reengineering is very close to new development.

This paper will help the software managers to recognize and make the best use of these two terminologies for right treatment of software systems.

Keyterms : Object, reengineering zone, maintenance zone, transition state, reverse engineering.

I. Introduction

Software engineering is a topic of importance in the age of software and is gaining attention. It is developing fast area and not existing from centuries. Software maintenance and software reengineering both fall in the ambit of software engineering. Both terms came from the real hard ware objects. These are more suited to software systems and software objects as these do not wear or tear out like real world physical objects.

These two terms are yet young and developing. There is not clear cut line between them. These terms are mingled and the people are using them interchangeably. One is the problem in the developing the subject matter of the other. Now software is gaining importance in every sphere of life and these two are very closely associated to software system life cycle. It is time to differentiate the two and promote the subject matter of these two concepts.

II. Software Maintenance

Software maintenance is one of the stages in the software development life cycle. It starts after the deployment of software in the working field. It is to remove the defects and deficiencies which encounters while starts actually working in the field.

According to IEEE Std. 610.12 [7] 'Software maintenance is the process of modifying a software system or component after delivery to correct faults, improve performances or other attributes, or adapt to a changed environment'.

a) Nature and Scope of Maintenance

Software maintenance has good scope in future times. In the world of fast changes, maintenance expertise will gain more importance which can sustain the working of software systems. Maintenance means modifying software system or a component of the software system to make it working on the platform and adapt to the minor changes in the requirements, environment or technology. Every system needs maintenance for the whole life period. Maintenance is preservation of the legacy software system.

Many surveys have shown that software maintenance can account for 60 to 80 percent of the cost of total life cycle of software product. According to Erlikh more than 90 % of the total cost of software goes to maintenance and evolution of the software product [1]. According to Lientz and Swanson many organizations were spending 20% to 70% of their computing efforts on maintenance [8].

Software maintenance is of following four types

1. Corrective maintenance:

   As its name implies, activities of correcting bugs in the software are included in this type of maintenance. It is for making the software system to conform to the real situation.

2. Adaptive Maintenance

   It deals with making the software adjustable to the changed environment

3. Preventive Maintenance

   Modification of the software to detect and correct hidden faults (bugs) before becoming active.

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4. Perfective maintenance

It is modification of the software for better performance, maintenance and reliability. The activities related to updating the software are included in this type of maintenance.

The efforts (cost) distributions for these four types of maintenance are as under

- Corrective maintenance 21%
- Adaptive Maintenance 25%
- Preventive Maintenance 4%
- Perfective maintenance 50% [6].

It is suggested from the above figure that perfective maintenance consumes major part of cost estimation. Preventive maintenance is not taken to any significant level in software industry.

Software maintenance and reengineering are hot topics in theses days. Software managers use these two interchangeably. It is time to differentiate maintenance and reengineering in software industry. Software maintenance is last stage in the software development life cycle. Maintenance starts after the delivery of the software. The ability to accurately estimate the time and cost of software maintenance is the key factor for successful of maintenance project.

Software maintenance starts after delivery of the software system. It goes on increasing with the increasing age of software as depicted in the following figure 1.

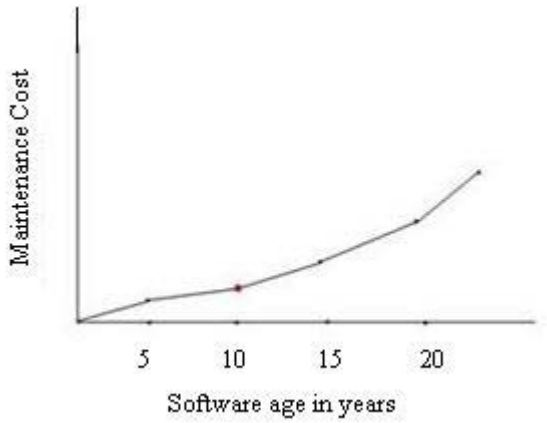

Figure 1

Accumulated affects of maintenance makes the system complex and deteriorate the system's architecture. Software system goes on aging with time and maintenance cost increases. When maintenance cost is too much high or difficult to maintain, it means system is to retire. Then reengineering is solution at this point. Reengineered software starts working with normal maintenance for another life span. Reengineering should be done at right time. If we overlook this time, reengineering will be costly or even not feasible and then we have to throw the costly legacy software under utilized.

III. Reengineering

Reengineering is the analysis of existing software system and modifying it to constitute into a new form. Chikofsky and Cross define reengineering as 'the examination and alteration of a subject system to reconstitute it in a new form and subsequent implementation of that form' [9].

According to IEEE Std. 1998 'A system-changing activity that results in creating a new system that either retains or does not retain the individuality of the initial system' [10].

a) Nature and Scope of Reengineering

When maintenance cost is not feasible, we go for reengineering the software system. Reengineering makes the software system new. Reengineering has the following three stages.

1. Reverse engineering
2. Architecture transformations
3. Forward engineering

Reverse engineering

In this stage software is thoroughly understood. It is untied and underlying technology is perceived. Business process is improved and requirements are updated. Objects are added or deleted according to the new system planned. In this stage we go from code level to higher level abstraction. It is vertically upward step shown in the fig. 2

Architecture transformations

Software architecture is changed. It is modified, improved to fit in the new technology and new environment. It is the architecture designing stage. It is horizontally right ward step as shown in the figure 2

Forward engineering

In this stage, we move from higher level of abstraction to code level. In this stage software integrated according to new design. It is vertically downward step as shown in the fig. 2.

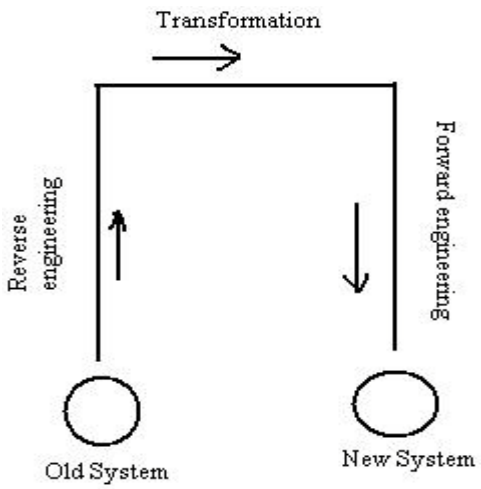

Figure 2

In the above figure, updation of user's requirements and improvement in architecture of software is done in transformation phase.

We can express reengineering by the following equation.

$$\text{Reengineering} = \text{Reverse engineering} + \blacktriangledown + \text{forward engineering}$$

The symbol in the above equation represents the enhancement and design change. In the coming future, reengineering can solve the problem of software backlogs and it can lower the software investment in organizations. Reengineering can increase the software age.

IV. Maintenance vs. Reengineering

Maintenance and reengineering are closely related to each other. Software maintenance starts after delivery of the software to correct faults, to improve performance and other attributes of the software. Maintenance plays an important role in the life cycle of a software system. Maintenance is the last stage of the software development life cycle. When maintenance exhaust, reengineering is called. Maintenance problems are a driving force behind re-engineering. Reengineering is the only way to avoid new development cost. Following are the models for diversification of maintenance and reengineering.

a) Thoroughfare model

According to this model, life span (age) of software system is divided into two zones as depicted in figure 3. Software life span is from point A to point B. Point T is the transition state from maintenance to reengineering zone. Transition state is new term defined by the author of this paper. It is the state in the life of software when reengineering is best possible with optimal cost. Software system is candidate for maintenance in the first zone and candidate for reengineering in the second zone. Maintenance phase is always first and reengineering phase starts after maintenance phase. When maintenance exhausts, reengineering phase is ready to serve the software system. Both zones are separated by red point T and must not overlap each other.

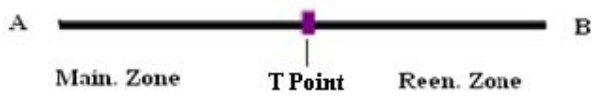

Figure 3

Maintenance increases the age of the software and reengineering gave a fresh age period to software system. T is the transition point, beyond point T; it is not feasible to maintain the system. System should be reengineered at the point T. Reengineering cost will be optimal at the critical point T. If we do not reengineering the System at T and go on maintaining the software with high cost, reengineering zone will be exhausted and reengineering is not possible with feasible cost. Then there is no other option than to throw the legacy software and purchase costly new one. Legacy software will be added to the backlog of wasted software.

Maintenance phase keeps the software up to date with environment changes and changing user requirements. Reengineering will give another life span to software with normal maintenance.

b) Cost based Model

Following figure 4 depicts the graph of maintenance cost and reengineering cost of Software system. Maintenance cost starts from the point O (Origin) and goes on increasing with time. It starts increasing rapidly from point T because software completes ten years, the normal age of the software. According to literature, software age is seven years for structured systems and ten years for object-oriented software systems. Reengineering cost is all most same up to point T because software is within age at the point T. After point T reengineering cost also starts increasing but with normal rate but maintenance cost increases at high rate. This happens because maintenance zone is over and the software is in reengineering zone beyond point T. Maintenance cost and reengineering cost are equal at the point T as depicted in the figure 4. If both the costs are equal then we must go for reengineer. Reengineering will make the system new on the new platform with new design. Reengineering of the system is needed to bring down the maintenance cost. At this point we think of reengineering or retiring the software. If we retire the system then we have to bear the cost of new software. Cost of new software is much high than the cost of reengineering.

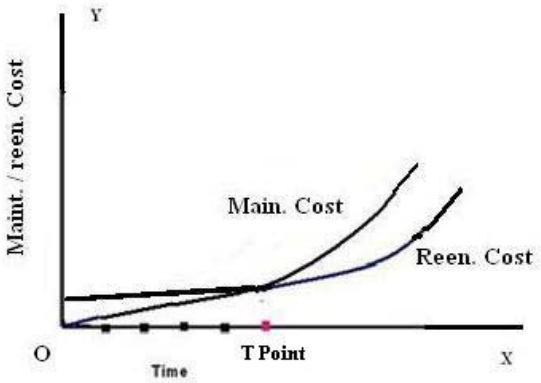

Figure 4

If we do not reengineering the software system at point T, maintenance cost will increase sharply (as shown in the figure 4) it will be difficult to maintain the system at such a high cost. Maintenance after the point T increases the complexity of the system and decreases

the quality of software where as reengineering improves the quality of the software, controls the maintenance cost and increases the life span of the software system.

The software system is old at the point T and high maintenance cost is required. It is difficult to maintain the system with such a high maintenance cost. At this point system should be reengineered or retired. If we reengineer the software at this point, Reengineering cost will be lowest (optimal). Reengineered Software will be new one with another life span and Maintenance cost will be ordinary.

c) Object based Model

This is object based model for differentiation of maintenance and reengineering. Maintenance is done to make the faulty object fine. As the system ages, software architecture deteriorate with ripple effects of maintenance. System object becomes faulty and maintenance makes it fine. The number of faulty objects increases with time and maintenance becomes difficult. Then what to Do? Software should be reengineered but when? This is the question. It is to be determined on the basis of the faulty objects. In this work, object is seen at a higher level of abstraction and is taken as conceptual module that can be plugged in and plugged out from the software system. Reengineering identifies reusable components (objects) and analyzes the changes that would be needed to regenerate them for reuse within new software architecture. The use of a repeatable, clearly defined and well understood software objects, has make reengineering more effective and reduced the cost of reengineering. Maintenance and reengineering will be separated on the basis of faulty objects.

The object oriented approach attempts to manage the complexity inherent in the real world problems by abstracting out knowledge and encapsulating it [2]. Object is an instance of a class and has an identity and stores attribute values [3].

All objects of the candidate software system are untied (***Reverse engineering***). Faulty objects are indentified and modified. Then redesigning of the structure (***transformation of the architecture***) of the system according to new modern design is done. Then according to new design objects are integrated (***Forward Engineering***).

Abstraction is good tool for reengineering object oriented design as it helps in reducing complexity. Large systems are complex having more objects as each additional object increases the complexity of the system [4]. Reengineering of software system is accomplished by reengineering the faulty objects in the system. Software system is untied, objects are identified for reengineering. Identified objects for reengineering are called faulty objects. Faulty objects are reengineered independently and made Fine objects, software architecture is changed, and all the objects (now all objects are fine) are integrated according to the new architecture.

Fine object is an object which conforms to our requirements and functions well in the system. As software ages some objects becomes faulty. Faulty object is an object which does not conform to our requirements and does not function well with in the system. We go on maintaining the faulty objects to maintain the software system. With maintenance of the faulty objects again and again, architecture of the software deteriorates. We reach at a point where reengineering of the system is needed. But what is that point? Let us suppose there are N objects in system which is our candidate system. Let it be $O1$, O_2, O_3,……..O_N.

Go on maintaining the software till half of the objects are not faulty. When half of the objects (N/2) are faulty in your application go for reengineering the software. The reengineering cost of the candidate system with N/2 faulty objects will be one forth (25%) of the new development cost [5]. This is the optimal cost according to the research paper 'Cost of Reengineering (Object-Oriented Software Systems) versus Developing new One- A Comparison' by the same author. Hence you reach the stage where reengineering starts.

When N/2 or more objects are faulty (System with N objects) stop maintenance and reengineer software system. When N/2 objects become faulty; it is a transitional state from maintenance to reengineering. This is vital stage in the software life span for transition from maintenance to reengineering. If the software managers pay no heed to this transitional stage and go on maintaining with high cost, it means they are overlapping the reengineering zone. It this way, they will strike in a situation when reengineering is not feasible. The cost of reengineering is very much high or equal to the new development. Then they will have to retire the legacy software. It will be financial loss to the organization as more investment on software is needed to purchase new software.

d) Discrete Model

Software issues	Maintenance	Reengineering
When software is delivered	yes	No
When software is young	yes	no
When software is old	No	Yes
Cost comparison (software is not old)	Less	more
Cost comparison (software is old)	More	Less
Cost comparison (Transitional state)	equal	equal
Software age	Age increases	New life span started
Subject Area	Software engineering	Software engineering
Architecture	No change	change
Business process	No change	change
Addition of attributes	yes	yes
Additions of objects	yes	yes
System change	renovate	fresh (New)
Type of activity	Repair	development
Man power	Skilled	Highly skilled
Scope	equal	equal
Origin	Hardware objects	Hardware objects
Software managers (Interest)	More	Less
functioning	More	less
No. faulty objects less than half	yes	no
No. faulty objects greater than half	no	yes

Table 1

V. Summary and Conclusions

In this piece of work four models are presented for differentiation in maintenance and reengineering as under

1. Thoroughfare differentiation model
2. Cost comparison model
3. Object based model
4. Discrete model

These models are valuable to software managers for reengineering the software systems at the right time. Reengineering is not feasible before and after the transition state. These models will help to reengineering the software and escape the burden of purchasing costly new software. Software investment expenditure curve will fall in the organizations. There will be full utilization of the software and software backlog will be decreased.

In this work three new terms 'Transition state', 'Reengineering Zone' and 'Maintenance Zone' are coined and added to reengineering subject matter.

VI. Future Works to be Done

These given Models are new in the field of Reengineering of object oriented software systems. The future work is to test these models for suitability to fit on the basis of analysis of current and past data. These models can be accepted as it is or improved or rejected. Once fit and fine these models will help in reengineering the legacy software with optimal cost.

This work will be beneficial to the both communities, the software managers and the software engineers. Software managers can order for reengineering at transitional point where maintenance zone ends and reengineering zone starts.

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Data Driven Data Mining to Domain Driven Data Mining

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Abstract - In the preceding decade data mining has came into sight as one of the largely energetic areas in information technology. Traditional data mining is seriously dependent on data itself, and relies on data oriented methodologies. So, there is a universal necessity in bridging the space among academia and trade is to provide all-purpose domain-related matters in surrounding real-life applications. Domain-Driven Data Mining try to build up general principles, methodologies, and techniques for modelling and reconciling wide-ranging domain-related factors and synthesized ubiquitous intelligence adjacent problem domains with the data mining course of action, and discovering knowledge to hold up business decision-making.

Keyterms : *Data Mining, Domain driven data mining, decision-making.*

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I. Introduction

In the last ten years, data mining is a field which becomes the most active, dynamic and lively area in information and communication technologies. The rapid growth of the global economy and heavy usage of computing and networking across every sector and business, results in data and its deep analysis becomes a particularly important issue for the soft control of an organization , and also equally important for the production system , decision making powers and performance of the organization. Now these days, there is a rapid increase in the applications of the data mining in various fields like business, government, social networks and the like ones. But due to the data driven data mining's limited decision support power in the real world, it hinders from playing a strategic decision support role in all these areas. In order to sort out this problem, a new approach Domain Driven Data Mining is evolved, this new approach will handle all the issues which are faced by the traditional data mining and also tackle the findings, thoughts and lessons learned in conducting several large scaled real world data mining business applications. The motivation of Domain Driven Data Mining is to study effective and efficient methodologies, techniques, tools and applications that can discover and deliver actionable knowledge that can be passed directly to the business people for the direct decision making and action taking.

If we apply current data mining algorithms and techniques on to the real world problem solving and decision making tasks then we have to face the crucial need to lessen the differences between academic world and commerce. Also we have to tackle the space between estimation systems and real business requirements. Not only this, we also have to manage the inequilibrium between the huge number data mining algorithms existing in the market in opposition to those few data mining algorithm that are in fact deployed in problem areas and resulting in those patterns which are of real use and these patterns can be suggested for decision support actions.

Real world data mining applications have projected critical desires for discovering actionable knowledge of foremost interest to real user and business wishes. As the actionable knowledge discovery is noteworthy and also very demanding.

In order to overpass the above mentioned gaps, it is vital to boost the decision support power of data mining and knowledge findings. It is crucial to expand the actionability of the discovered patterns and to make available the results that can sustain decision making, in the right and beneficial route.

Domain driven data mining provides an efficient overview of the issues in discovering actionable knowledge and advocates the methodology of mining the actionable knowledge in constraint based context through human mining cooperation in a loop closed iterative improvement manner. It is valuable for promoting the paradigm shift from data driven hidden pattern mining to area driven actionable data discovery. Further, progress in studying domain driven data mining methodologies and applications can facilitate the deployment swing from standard and artificial data set based testing to genuine data and business atmosphere based back testing and development.

II. Data Driven Data Mining

A distinctive feature of traditional data mining is that KDD (Knowledge Discovery From Data). One of the elementary objectives of KDD is to discover knowledge that is of key concentration to genuine business requirements and user preferences but KDD is a presumed and preset process. It targets the production of predefined and automatic algorithms and tools. As a consequence, the algorithms and tools developed have no potential to adapt to external environment constraints. Millions of patterns and algorithms have

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been available in literature but sorry to say that a small number of them have been transferred into real business.

In data driven data mining lots of patterns are generated according to the problems but they are not enlightening and clear to business individuals. They can't straightforwardly acquire truly remarkable and operable patterns for their business. A large fraction of the indentified patterns may be either commonsense or of no particular attention to business desires. Business grassroots are puzzled as to why and how they should be concerned regarding those conclusions. Activities extracted or summarized through post investigation and post processing without in view of business concerns do not replicate the authentic expectations of business desires. Therefore they cannot bear smart decision making. Business people often don't know and also not well-versed regarding, how to understand and utilize the discovered patterns and what undemanding activities can be taken to engage those discovered patterns in business functioning systems and decision making.

Conventional KDD is a data centred and technically dominated course targeting automated hidden pattern mining. The core objective of conventional data mining research is to let data verify research innovation, track the elevated performance of the algorithms and express novel algorithms. As a consequence, the mining process stops at discovering knowledge that is primarily of importance to academic or industrial individuals.

In the real world, determining and transporting knowledge that is actionable in answering business problems has been analyzed as the fundamental nature of KDD. However, the existing data mining is principally data-centred and technically conquered, and stops at hidden pattern mining favouring technical concerns and expectation, while many other features surrounding business problems have not been thoroughly or exhaustively considered and balanced. It will be one of the great challenges to the existing and future KDD society.

A distinctive fashion in real world data mining applications is to treat a data mining system as a problem solving systems within a certain atmosphere. Looking at the problem solving from the domain driven point of view, a lot of unwrap matters and opportunities arise, demonstrating the need of next generation data mining and knowledge discovery far further than the data mining algorithms themselves. In order to sort out these troubles a new methodology is proposed i.e. Domain driven data mining. Domain driven data mining tends to create next generation methodologies, techniques and tools for a probable idea shifting from data driven hidden pattern mining to domain driven actionable data delivery.

III. Domain Driven Data Mining

Intending at complementing the inadequacy of conventional data mining, in particular, reinforcing the problem-solving-oriented ability and deliverables in enterprise data mining, we recommend a realistic methodology, called Domain Driven Data Mining by following the extensively acknowledged jargon 'Data Mining'.

Domain Driven Data Mining is proposed as a methodology and a collection of techniques targeting domain driven actionable knowledge delivery to drive Knowledge Discovery from Data (i.e. KDD) toward enhanced problem-solving infrastructure and capabilities in real business state of affairs. On top of the data-centred framework, Domain Driven Data Mining aims to build up proper methodologies and techniques for targeting domain knowledge, human role and interaction, organizational and social factors, as well as capabilities and deliverables toward delivering actionable knowledge and supporting business decision-making action taking in the KDD process. In other words we can say that Domain Driven Data Mining intend to create subsequent generation methodologies, techniques and tools for a probable paradigm transfer from data centred out of sight pattern mining to domain driven actionable knowledge delivery.

As a result of the Domain Driven Data Mining investigation and development, we can deliver business-friendly and decision-making rules and actions that are of solid technical and business importance.

"Domain driven data mining refers to the set of methodologies, frameworks, approaches, techniques, tools and systems that deliver for human, domain, organizational and social, and network and web factors in the environment, for the innovation and delivery of actionable knowledge. Actionable knowledge means business responsive and comprehensible, reflects user preferences and business needs, and can be effortlessly taken over by business individuals for decision-making and action-taking"

The existing data mining methodology, usually chains self-governing pattern discovery from data. By contrast, the suggestion of domain driven knowledge discovery is to engage ubiquitous intelligence into data mining. The Domain Driven Data Mining highlights a procedure that discovers in-depth patterns from a constraint-based environment with the contribution of domain specialists and their acquaintance. Its intention is to maximally accommodate equally naive users as well as practised analysts, in addition to satisfy business goals. The patterns discovered are expected to be integrated into business systems and to be aligned with existing business rules. To formulate domain driven data mining successful, user guides and intellectual human-machine interaction interfaces are indispensable through incorporating mutually human qualitative aptitude and machine quantitative aptitude. In totalling, appropriate mechanisms are obligatory for dealing

through multiform restraints in addition to domain knowledge.

IV. Key Elements of Domain Driven Data Mining

In domain-driven data mining, the following seven key elements play a very important role. They have capability of building a KDD which is dissimilar from the alive data-driven data mining if they are properly considered and supported from technical, procedural, and business point of view.

a) Restraint -Based framework

In human society, everyone is restrained either by communal regulations or by individual situations. Similarly, actionable knowledge only can be discovered in a restraint-based framework such as environmental authenticity, opportunities, and restraints in the mining procedure. Particularly, in the first section, we catalogue some types of restraints that play noteworthy roles in a process, effectively discovering knowledge actionable to business. In practice, a lot of other aspects, such as data stream and the scalability and effectiveness of algorithms, may be enumerated. They consist of domain-specific, functional, nonfunctional, in addition to environmental restraints. These ubiquitous restraints create a restraint-based framework for actionable knowledge discovery. All of the preceding restraints to varying degrees have to be considered in significant phases of real-world data mining. In this case, it is even called restraint-based data mining.

b) Incorporate Field Awareness

It is accepted gradually that field awareness can play noteworthy roles in real-world data mining. For instance, in trade (buy and sell) pattern mining, brokers often take "beating market" as an individual liking to judge a recognized rule's actionability. In this case, stock mining system requires to set in the formulas calculating market return and rule return, and set an interface in order for traders to specify a most wanted threshold and comparison relationship between the two returns in the evaluation process. Therefore, the key is to take advantage of field awareness in the KDD process.

The incorporation of field awareness is subject to how it can be signifying and filled in to the knowledge discovery process. Ontology-based field awareness representation, transformation, and mapping between business and data mining systems is one of the proper approaches to form field awareness.

c) Collaboration Among Human beings and Mining Systems

The genuine requirements for discovering actionable knowledge in restraint-based framework is more expected to be human involved rather than automated. Human involvement is embodied through the collaboration among humans (including users and business analysts, essentially domain experts) and data mining systems. This is accomplished through the complementation between human qualitative brainpower, such as field awareness and field supervision, and mining quantitative brainpower like computational potential. Therefore, real-world data mining possibly presents as a human-machine-cooperated interactive knowledge discovery process.

For example, skills, metaknowledge, and invented philosophy of field experts can lead or help out with the selection of characteristics and models, adding industry features into the modelling, generating high-quality assumptions, designing interestingness measures by injecting business concerns, and rapidly estimating mining results. This help basically can progress the effectiveness and competence of drawing out actionable knowledge.

d) Mining Exhaustively Patterns

Sometime there is a situation that numerous mined patterns are attention-grabbing more to data miners than to businesspersons and such type of situations slowed down the deployment and implementation of data mining in real applications. For that reason, it is vital to estimate the actionability of a pattern in addition to to further find out actionable patterns to hold up smarter and more effectual decision making. This leads to exhaustively pattern mining.

Mining exhaustively patterns should think as how to get better both scientific and business interestingness in the previous restraint-based framework. Technically, it could be through enhancing or generating more effective interestingness measures. Additional awareness has to be remunerated to business desires, intentions, field acquaintance, and qualitative intelligence of field experts for their impact on taking out deep patterns.

e) Improving Knowledge Actionability

Patterns that are motivating to data miners may not guide essentially to business reimbursement, if deployed. For instance, a large number of association rules often are found, while most of them might not be workable in business state of affairs. These rules are generic patterns or technically interesting rules. Further actionability upgrading is mandatory for producing actionable patterns which is practically useful to commerce.

The measurement of actionable patterns is to follow the actionablilty of a pattern. Both technical and business interestingness measures must be satisfied from both objective and subjective point of view. For those generic patterns identified based on technical measures, business interestingness needs to be checked and emphasized so that the business requirements and user preference can be put into proper consideration.

f) Loop - clogged repetitive Improvement

Actionable knowledge discovery in a restraint - based framework is probably to be a clogged rather

than an open course of action. It includes repetitive feedback to varying phases such as sampling, assumption, feature selection, modelling, evaluation, and interpretation in a human-involved approach. On the other hand, real-world mining process is highly repetitive, because the evaluation and refinement of features, models, and outcomes cannot be completed once but, rather, is based on repetitive feedback and interaction before reaching the concluding juncture of knowledge and decision-support report delivery.

The previous key elements indicate that real-world data mining cannot be dealt by means of just an algorithm; rather, it is truly essential to assemble a suitable data mining infrastructure in order to find out actionable knowledge from restraint-based situations in a loop-clogged repetitive manner.

g) Interactional and Concurrent Mining Supports

To support domain-driven data mining, it is noteworthy to develop interactional mining supports for human-mining dealings and to estimate the findings. And also concurrent mining supports often are necessary and can deeply promote the real-world data mining performance.

For interactional mining supports, clever agents and service-oriented computing are a number of high-quality technologies. They can support flexible, business-friendly, and user-oriented human-mining interaction through building facilities for user modeling; user knowledge achievement; domain knowledge modeling; personalized user services and recommendation; run-time supports; and mediation and management of user roles, interaction, security, and cooperation.

The facilities for interactional and concurrent mining supports largely can improve the performance of real-world data mining in aspects such as human-mining interaction and cooperation, user modeling, domain knowledge capturing, reducing computation complexity, and so forth. They are a few crucial ingredients of subsequent generation of KDD infrastructure.

VII. Conclusion

Real-world data mining applications have projected critical desires for discovering actionable knowledge especially for real-users and industry needs. Actionable knowledge discovery is significant and also very challenging. It is listed as one of great challenges of KDD. The research on this issue has latent to revolutionize the alive state of affairs in which a huge quantity of rules are mined but still few of them are interesting to business, and to endorse the extensive deployment of data mining into business.

This research paper had tried to provide a novel data mining methodology referred to as Domain-Driven Data Mining. It provides a systematic indication of the issues in discovering actionable knowledge and advocates the methodology of mining actionable knowledge in restraint-based framework through human mining system cooperation in a loop-clogged repetitive refinement manner. It is useful for promoting the paradigm shift from data-driven hidden pattern mining to domain-driven actionable data discovery.

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Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Color Charges: It is the rule of the Global Journals Inc. (US) for authors to pay the full cost for the reproduction of their color artwork. Hence, please note that, if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a color work agreement form before your paper can be published.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

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Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

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the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

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9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

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16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. **Pick a good study spot:** To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be

sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page

- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to

shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.
- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic

principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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- Do not give permission to anyone else to "PROOFREAD" your manuscript.

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- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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