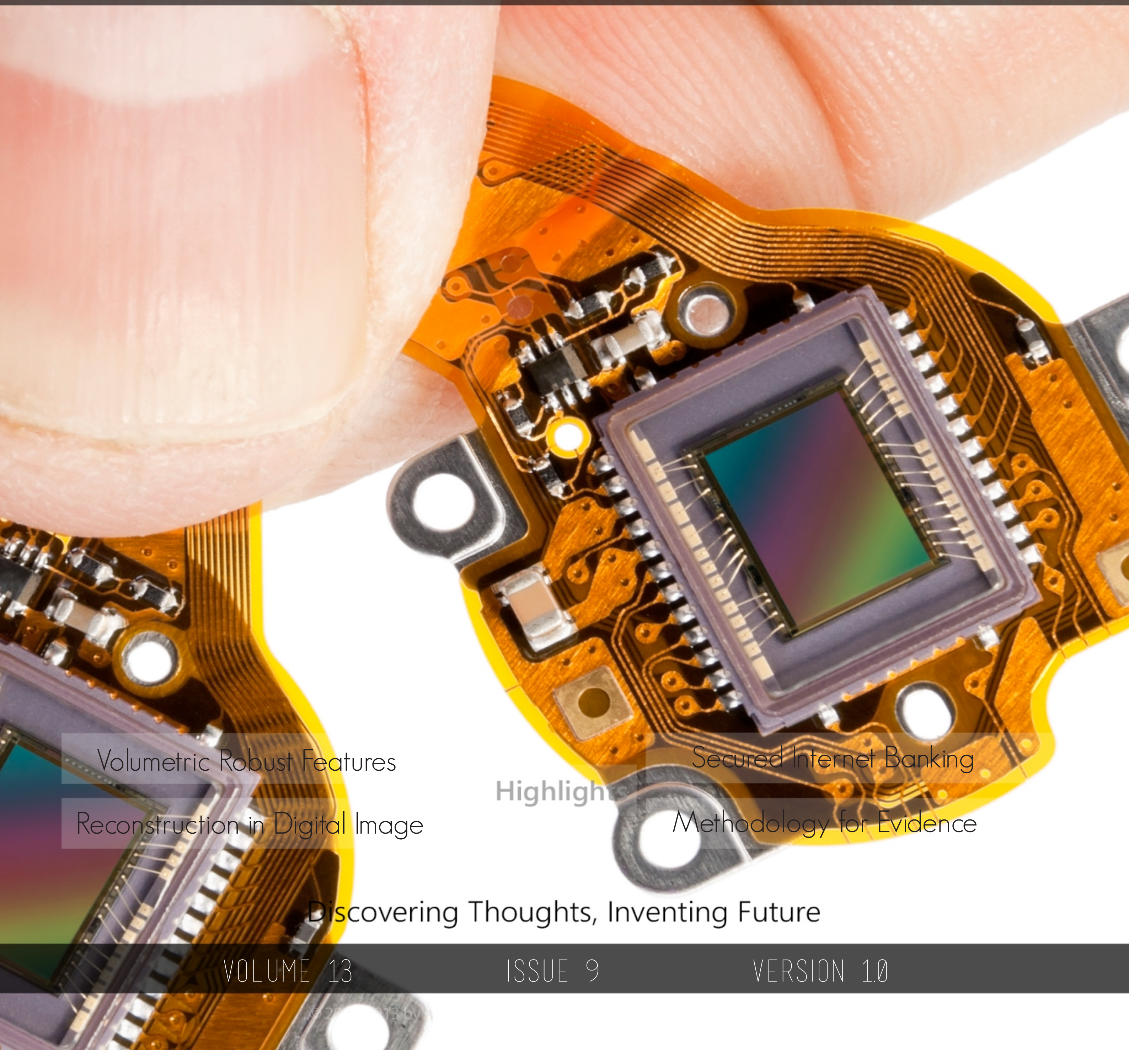
Online ISSN : 0975-4172
Print ISSN : 0975-4350

Global Journal of Computer Science and Technology: F

Graphics & Vision



Highlights

Volumetric Robust Features

Reconstruction in Digital Image

Secured Internet Banking

Methodology for Evidence

Discovering Thoughts, Inventing Future

VOLUME 13 ISSUE 9 VERSION 1.0

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Volume 13 Issue 9 (Ver. 1.0)

Open Association of Research Society

Incorporation No.: 0423089
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USA Tax ID: 98-0673427

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Contents of the Volume

Global Journal of Computer Science and Technology
Graphics & Vision
Volume 13 Issue 9 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Implementation of FPR for Safe and Secured Internet Banking

By N.Subbarao, S.M.Riyazoddin & M.Janga Reddy
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Abstract- In this paper, we present an enhanced approach for fingerprint segmentation based on Canny edge detection technique and Principal Component Analysis (PCA). The performance of the algorithm has been evaluated interms of decision error trade-off curve so fan over all verification system. Experimental results demonstrate the robustness of the system.

Keywords: FPR, canny edge detection, PCA, NN, etc.

GJCST-F Classification: K.6.5

IMPLEMENTATIONOFFPRFORSAFEANDSECUREDINTERNETBANKING

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Implementation of FPR for Safe and Secured Internet Banking

N.Subbarao [α], S.M.Riyazoddin [σ] & M.Janga Reddy [ρ]

Abstract- In this paper, we present an enhanced approach for fingerprint segmentation based on Canny edge detection technique and Principal Component Analysis (PCA). The performance of the algorithm has been evaluated interms of decision error trade-off curve so fan over all verification system. Experimental results demonstrate the robustness of the system.

Keywords: FPR, canny edge detection, PCA, NN, etc.

I. Introduction

Human beings use physical characteristics such as finger, voice, gait, etc. to recognize each other from their birth itself. With new advances in technology, biometrics has become an emerging technology for recognizing individuals using their biological traits. This technology makes use of the fact that each person has specific unique physical traits that are one's characteristics which can't be lost, borrowed or stolen.

By using biometrics it is possible to confirm or establish identity based on "who the individual is", rather than by "what the individual possesses" (e.g., an ID card) or "what the individual remembers" (e.g., a password). Passwords determine identity through user knowledge, if someone knows the password, then that person can get access to some restricted areas or resources of a certain system. The drawback is that a password has nothing to do with the actual person using it. Passwords can be stolen, and users can give their passwords to others, resulting in systems that are vulnerable to unauthorized people. There is no foolproof way to make password-protected systems safe from unauthorized users. There is no way for password-based systems to determine user identity beyond doubt.

The initial intent of such schemes is, however, to ensure that the provided services are accessed only by an authorized user, and not anyone else. Several systems require authenticating a person before giving access to their resources.

Biometrics has been long known to recognize persons based on their physical and behavioral characteristics. Examples of different biometric systems include fingerprint recognition, finger recognition, iris recognition, retina recognition, hand geometry, voice recognition, signature recognition, etc. Finger recognition in particular, has received a considerable attention in recent years both from the industry and the research communities. The real-life challenge here is the identification of individuals in everyday settings, such as offices or living-rooms. The dynamic, noisy data involved in this type of task is very different to that used in typical computer vision research, where specific constraints are used to limit variations. Historically, such limitations have been essential in order to limit the computational burden required to process, store and analyze visual data. However, enormous improvements in computers in terms of speed of processing and size of storage media, accompanied by progress in statistical techniques, is making it possible to realize such complex systems.

a) Applications

1. Commercial applications such as computer network login, electronic data security, e-commerce, Internet access, ATM, credit card, physical access control, cellular phone, PDA, medical records management, distance learning, etc.,
2. Government applications such as national ID card, correctional facilities, driver's license, social security, welfare-disbursement, border control, passport control, etc., and
3. Forensic applications such as corpse identification, criminal investigation, terrorist identification, parenthood determination, missing children, etc.

Finger recognition has received considerable interest as a widely accepted biometric, because of the ease in collecting finger images of persons. Finger recognition is being used in various applications like crowd surveillance, criminal identification, and criminal record, access to entry etc. Finger recognition developers, however, have to consider a number of major issues before finger recognition systems become standard systems. The requirements for a useful, commercial finger recognition and identity logging system, for small groups of known individuals in busy unconstrained environments, (such as domestic living rooms or offices) can be split into several groups: -

1. General requirements that need to be satisfied by all components of the system,
2. Acquisitions requirements concerned with monitoring and extraction,

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3. Finger recognition requirements for the recognition stage, and
4. Identity requirements which are concerned with how the recognition output is used.

II. Literature Survey

Neeta et.al.(2010) proposed alignment-based elastic matching algorithm is capable of finding the correspondences between minutiae without resorting to exhaustive research. In this work is based on the concept of segmentation using Morphological operations, minutia marking by especially considering the triple branch counting, minutia unification by decomposing a branch into three terminations and matching in the unified x-y coordinate system. After a 2-step transformation in order to increase the precision of the minutia localization process and elimination of spurious minutia with higher accuracy. There is a scope of further improvement in terms of efficiency and accuracy which can be achieved by improving the hardware to capture the image or by improving the image enhancement techniques. So that the input image to the thinning stage could be made better this could improve the future stages and the final outcome.

a) Shashi et.al.(2010)

Proposed Fingerprint Verification based on fusion of Minutiae and Ridges using Strength Factors in which the minutiae and ridge methods are combined. In FVMRSF method in the preprocessing stage the Fingerprint is Binarised and Thinned. The Minutiae Matching Score is determined using Block Filter and Ridge matching score is estimated using Hough Transform. The strength factors Alpha (α) and Beta (β) are used to generate Hybrid matching score for matching of fingerprints. Then the minutiae and the ridge parameters are fused using the Strength Factors to improve the performance. But the performance could have been improved by adding the wavelet transform as it helps in compact fingerprint recognition.

b) Kazuya et.al.(2010)

Proposed a method to select pixels used for camera identification according to the texture complexity to improve the accuracy of camera identification. In this method camera identification accuracy is reduced by the image processing engine such as motion blur correction, contrast enhancement, and noise reduction.

Also suggested a method for improving the identification accuracy by the image restoration method.

In this paper, we have shown the improved camera identification method. The identification accuracy is improved by selecting pixels used for correlation calculation according to the texture complexity. And the identification accuracy is also improved by the image restoration which restores the PNU noise varied by the image processing engine. But still there is big concern to have a systematic method to correctly estimate the restoration function. is left to the future work.

c) Miroslav et.al.(2010)

Developed a fast algorithm for finding if a given fingerprint already resides in the database and for determining whether a given image was taken by a camera whose fingerprint is in the database. Here they realized that in worst-case complexity is still proportional to the database size but does not depend on the sensor resolution. The algorithm works by extracting a digest of the query fingerprint formed by the most extreme 10,000 fingerprint values and then approximately matches their positions with the positions of pixels in the digests of all database fingerprints. The algorithm requires a sparse data structure that needs to be updated with every new fingerprint included in the database. The algorithm is designed to make sure that the probability of a match and false alarm for the fast search is identical to the corresponding error probabilities of the direct brute-force search. After that they also claim that the fast algorithm does not rely on any structure or special properties of the fingerprints in the database. Hence it can be utilized in any application where a database contains n-dimensional elements and n is a fixed large number. The only requirement is that the elements consist of real numbers or integers from a large range.

But integers from a small range would lead to ill-defined ranks. An extreme case when the rank correlation and consequently, the fast search algorithm cannot be used, are binary vectors.

d) Sara et.al. (2010)

Suggested a reliable authentication mechanism which is not dependent on a series of characters, but rather on a technology that is unique and only possessed by the individual called FingerID. This technique is aims to promote the convenience for the internet user since he/she will not have to remember multiple passwords for a multiple number of accounts.

The accessibility, usability and security guidelines have been tested on the Fingered website and browser by means of numerous activities and found that the web accounts a more secure, accessible and usable one. But this increases the cost of the system.

e) Chandra et.al. (2011)

Proposed a method how to get a noise-free fingerprint image they proposed the finger print classifications, characteristics and preprocessing techniques. Where they applied the histogram on 256 gray scale finger print image with the default threshold value; then the histogram-equalized image is obtained.

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Next, histogram-equalized image is given under the binarization process. Finally the binarized fingerprint image is filtered with the implementation of the Median filtering technique in order to produce the noise free image. The comparison of the median filtered image with the original noisy image shows the depth of the noise spread in the original image. Their experimental result shows the noise rate which was eliminated in the input fingerprint image and quality of the filtered image using the Statistical –Correlation tool.

f) Bay ram et.al. (2012)

Proposed a method to represent sensor fingerprints in binary-quantized form as the large size and random nature of sensor fingerprints makes them inconvenient to store. In their work they analyzed the change in the performance caused due to loss of information due to binarization. Hence, binarization of sensor fingerprints is an effective method that offers considerable storage gain and complexity reduction without a significant reduction in fingerprint matching accuracy. But this will not be effective for noisy or information lost fingerprints leading to the misclassification.

g) Yoon et.al.(2012)

Proposed an algorithm based on the features extracted from the orientation field and minutiae satisfies the three essential requirements for alteration detection algorithm:1) fast operational time, 2) high true positive rate at low false positive rate, and 3) ease of integration into AFIS. The proposed algorithm and the NFIQ criterion were tested on a large public domain fingerprint database (NIST SD14) as natural fingerprints and an altered fingerprint database provided by a law enforcement agency.

h) Romany et.al.(2012)

Proposed a new technique to fingerprint recognition based a window that contain core point this window will be input ANN system to be model. This method is aadaptive singular point detection method that increases the accuracy of the algorithm. This robust method for locating the core point of a fingerprint. The global threshold reduces chances of falsely locating a core point due to presence of discontinuities like scars or wrinkles, which may occur in the existing processes.

Since the detection is based on a global threshold, the method only gives us an approximate location of the core point. For exact detection of the core point, we use the geometry of region technique over a smaller search window using ANN. They show that as image size window that contain core point in center decreases the system performance also decrease but not the size but also the number of minutiae.

III. Fingerprint Classification Algorithm

In this section, we introduce a basic version of the algorithm for fingerprint classifying (FPC), which has aspreliminary input a database of fingerprint images (Train Database). A test fingerprint image (Test Database) is then entered, and the algorithm returns whether or not the test image is in the stored finger print bank. The steps followed in this process of classification are.

a. Store previously the fingerprint database denoted by
b. Build the image space by using the PCA technique;
c. Acquire and project the fingerprint testing image into image space;
d. Define a criterion for classifying the (IX);
e. Decide whether the test image belongs or not to the stored base.

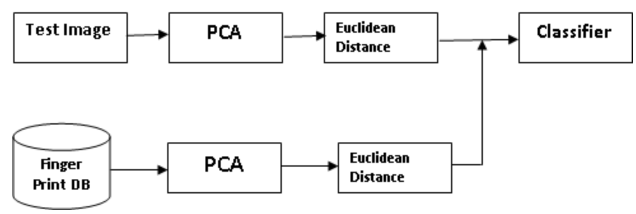

Figure1 : Finger print Recognition System

a) Building Image Space Using PCA

Principal Component Analysis (PCA) [3] is a statistical technique used to transform dimensions of the space from a higher one to a lower. It helps to find patterns in data. It uses standard deviation, mean value, variance, covariance and matrix algebra concepts from statistics and mathematics. As image is a high dimension data. Work with images is high source demanding and complex. All the image data is represented in the form of long vectors. It has two methods covariance and correlation.

Let we have a data set S= {s1, s2, s3, Sn} then mean denoted by SM will be.

$$SM = \sum S_i / n \qquad i = 1,2,3,\ldots\ldots n \qquad (2.1)$$

Standard deviation SD will be as

$$SD = \sqrt{(S_i - SM)^2 / n-1} \qquad i = 1,2,3,\ldots\ldots n \qquad (2.2)$$

Variance is very similar to the standard deviation and the formula for the data set S can be calculated as

$$Var(S) = \sum (S_i - SM)^2 / n-1 \; i = 1,2,3,\ldots\ldots n \qquad (2.3)$$

Covariance another term is used in statistics. Standard Deviation and Variance deal with one dimensional data where as the Covariance is similar

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measures between 2 dimensional data. Let consider S and L two data sets then the covariance will be as.

$$Cov(S) = \sum (S_i - SM)(L - LM) / n - 1 \; i = 1,2,3.n \quad (2.4)$$

If covariance is calculated for one dimensional data then it will be equal to the variance [27].

Principal Component Analysis is defined as a dimensionality reduction technique which transforms a random vector say x, say of size n, to a random vector of y, say of size k where k is chosen smaller than n. This transformation is defined below:

b) Calculating the Eigen Values and Eigen Vectors

Let e_i and $\lambda_i = 1,2,......n$ be the eigenvectors and corresponding eigenvalues of the covariance matrix C_X of the random vector x (where λ1, λ2 ……λn). Since we know that x takes real values (e.g. image data). The covariance matrix C_X is real and symmetric. It follows that the Eigen values of are real. A transformation matrix is formed whose columns are the eigenvectors of C_X which is given by:

$$[e_1, e_2, ...e_n] \quad (2.5)$$

Principal Component Analysis is defined by a transformation obtained as follows:

$$y = W^T (x - mx) \quad (2.6)$$

The transformation given by equation 2.6 has several important properties.

The first property we examine here is the covariance matrix of the random vector y. This is defined as

$$C_y = E[(y - my)(y - my)^T] \quad (2.7)$$

Wheremy is equal to zero vector 0, since:

$$\begin{aligned} my &= E[y] \\ &= E[W^T (x - mx)] \\ &= W^T E[x] - W^T m \\ &= 0 \end{aligned} \quad (2.8)$$

By substituting 2.6 and 2.8 into 2.7 gives the following expression for C_Y in terms of C_X

$$\begin{aligned} C_y &= E(W^T x - W^T mx)(W^T x - W^T mx)^T \\ &= E[W^T (x - mx)(x - mx)^T]W \\ &= W^T E[(x - mx)(x - mx)^T]W \\ &= W^T C_X W \end{aligned} \quad (2.9)$$

It is shown by Lawley and Maxwell [30] that is a diagonal matrix with elements equal to the Eigen values of C_X that is λ

$$C_y = \begin{bmatrix} \lambda_1 & & & & 0 \\ & \lambda_2 & & & \\ & & \cdots & & \\ & & & \ddots & \\ 0 & & & & \lambda_n \end{bmatrix}$$

This is an important property, since the terms other than the main diagonal are 0; the elements of y are uncorrelated. In addition, each Eigen value λ_i is equal to the variance of the i^{th} element of y.

The second important property deals with reconstruction of random vector x from random vector y. Since we consider x whose observations are real, the covariance matrix C_X is real.It follows that the set of eigenvectors of C_X form an orthonormal basi $W^{-1} = W^T$ Using this property, x can be reconstructed from y by using the relation:

$$x = W_y + m_x \quad (2.10)$$

Suppose, however, that instead of using all eigenvectors of C_X ,we construct W from the first k eigenvectors corresponding to the largest eigenvalues.

The y vector will then be k dimensional and the reconstruction giving by equation follows:

$$\hat{X} = W_k y + mx \quad (2.11)$$

$\hat{X}$ Represents an approximation of x obtained from the transformation matrix W composed of first k eigenvectors of C_X .

c) Euclidean Distance for FPC

The mean square error between x and $\hat{X}$ is given by the expression [30]:

$$\begin{aligned} e_{ms} &= \sum_{j=1}^{n} \lambda_j - \sum_{j=1}^{k} \lambda_i \\ &= \sum_{j=k+1}^{n} \lambda_j \end{aligned} \quad (2.12)$$

The first line of equation 12 indicated that the error is zero, if k = n. additionally since the ¸j's decrease monotonically, equation 12 also shows that the error can be minimized by selecting the k eigenvectors associated with the largest eigenvalues.

Thus PCA is optimal in the sense that it minimizes the mean square error between the vector x and its approximation $\hat{X}$.

Thus Recognition of images using PCA takes three basic steps. The transformation matrix is first created using the training images. Next, the training images are projected onto the matrix columns. Finally, the test images are identified by projecting these into the subspace and comparing them to the trained images in the subspace domain. But finding the finger discriminating features like minutia, valleys or ridges is very difficult task using PCA whose basic task is dimension reduction and also used as a classifier. To mitigate this problem a new method is proposed where the finger features are located first with help of canny edge detection technique and then classification is done using PCA.

IV. Proposed Method

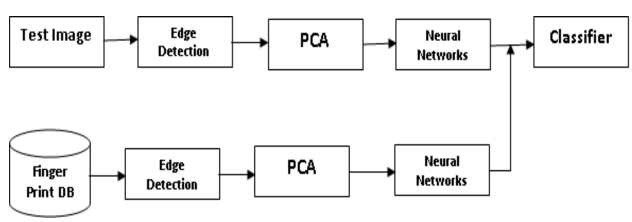

Figure 2 : Finger print Recognition System Using Canny Edge Detection

Depending on the noise level, no clear separation can be found, thereby restricting the use of the Euclidean distance. In this section we show that the use of type canny edge or Sobel edge detection [10]-*ba* can help mitigating the influence of noise. The edge detection is applied at the moment that the image is inserted into the base and when the test image is acquired. With the inclusion of edge detection component the complete sequence of the algorithm is:

Step 1: Store previously the fingerprint database
Step 2: Apply Edge Detections:
Stepv3: Build the image space by using the PCA
Step4: Define the criteria for classification using neural networks.
Step5: Acquire, apply edge detection and project thefingerprint testing image into image space
Step6: Decide whether Test Imagebelongs or not to the stored base.

We apply "Canny" edge detection component of the

a) Canny edge detection algorithm

The purpose of edge detection in general is to significantly reduce the amount of data in an image, while preserving the structural properties to be used for further image processing. The aim of John F. Canny [ref1, ref2] was to develop an algorithm that is optimal with regards to the following criteria:

i. *Detection*

The probability of detecting real edge points should be maximized while theProbability of falsely detecting non-edge points should be minimized. This corresponds toMaximizing the signal-to-noise ratio.

ii. *Localization*

The detected edges should be as close as possible to the real edges.

iii. *Number of responses*

One real edge should not result in more than one detected edge Canny's Edge Detector is optimal for a certain class of edges (known as step edges).

Step I: Noise reduction by smoothing

Noise contained in image is smoothed by convolving the input image I (i, j) with Gaussian filterG. Mathematically, the smooth resultant image is given by

$$F(i, j) = G * I(i, j)$$

Prewitt operators are simpler to operator ascompared to sobeloperator but more sensitive tonoise in comparison with sobel operator.

STEP II: Finding gradients

In this step we detect the edges where the change in grayscale intensity is maximum. Required areas are determined with the help of gradient of images. Sobel operator is used to determine thegradient at each pixel of smoothened image. Sobel operators in i and j directions are given as

$$D_i = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} \text{And } D_j = \begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

These sobel masks are convolved with smoothed image and giving gradients in i and j directions.

$$G_i = D_i * F(i, j) \text{ And } G_j = D_j * F(i, j)$$

Therefore edge strength or magnitude of gradient of a pixel is given by

$$G = \sqrt{G_i^{\,2} + G_j^{\,2}}$$

The direction of gradient is given by

$$\theta = \arctan\left(\frac{G_j}{G_i}\right)$$

G_i And G_j are the gradients in the i- and j-directions respectively.

STEP III: Non maximum suppressions:

Non maximum suppression is carried out to reserves all local maxima in the gradient image, anddeleting everything else this results in thin edges. For a pixel M (i, j):

1. Firstly round the gradient direction θ nearest45°, then compare the gradient magnitude of the Pixels

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in positive and negative gradient directions i.e.If gradient direction is east thencompare with gradient of the pixels in east and west directions say E (i, j) and W (i,j)respectively.

2. If the edge strength of pixel M (i, j) is largest than that of E (i, j) and W (i, j), then preservethe value of gradient and mark M (i, j) as edge pixel, if not then suppress or remove.

Step IV: Hysteresis thresholding:

The output of non-maxima suppression still contains the local maxima created by noise. Insteadchoosing a single threshold, for avoiding the problem of streaking two thresholds t_{high} and t_{low} are used.

For a pixel M (i, j) having gradient magnitude G following conditions exists to detect pixel as Edge:

- If G < than discard the edge.
- If G > than keep the edge.
- If t_{low} < G < and t_{high} and any of its neighbors in a 3 ×3 region around it have gradientmagnitudes greater than t_{high} keep the edge.
- If none of pixel (x, y)'s neighbors have high gradient magnitudes but at least one fallsbetween t_{low} and t_{high} search the 5 × 5 region to see if any of these pixels have a
- Magnitude greater than thigh. If so, keep the edge.
- Else, discard the edge.

Result Analysis

The proposed system is analyzed using sample Caltech fingerprint database. In this method the total number of 21Train Databaseand 5 Test Database images are used.

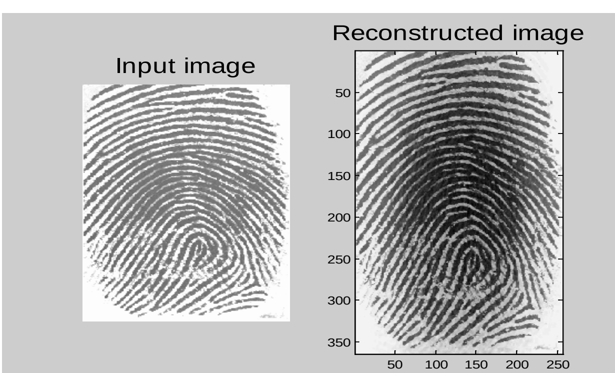

Figure 3 : Reconstructed or Recognized Fingerprint Image

Method	Training Samples	Test Samples	True Classification	False Classification	Accuracy (%)
PCA	50	31	25	6	80.64
PCA+canny	50	31	28	3	90.32

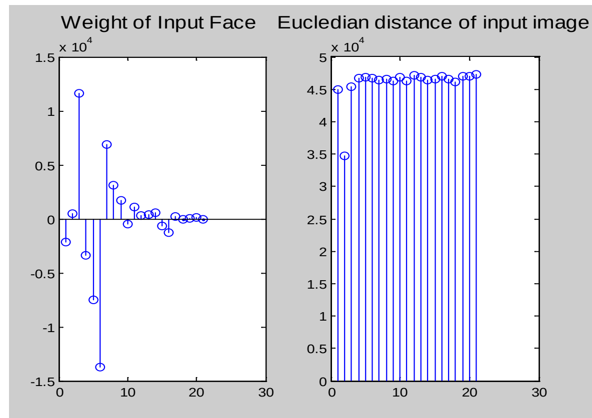

Figure 4 : Histogram Analysis of Reconstruction

Further this method is extended to improve the recognition accuracy by using multilayer perceptron neural network.

b) RBF Neural Network – Classifier

An RBF neural network as shown in figure 2 with a mapping $\Re^T \rightarrow \Re^S$ .Let $P \in \Re^T$ be the input vector and $C_i \in \Re^T$ $(1 \le i \le u)$ be the prototype of the input vector. The output of each RBF unit is as follows: [3].

$$R_i(P) = R_i(\|P - C_i\|) \qquad i = 1,2,.....u$$

Where (||-||) indicates the Euclidean norm on the input space. Usually, the Gaussian function is preferred among all possible radial basis functions due to the fact that it is factorizable. Hence

$$R_i(P) = \exp\left[-\frac{\|P - C_i\|^2}{\sigma_i^2}\right]$$

where σ_i^2 is the width of the ith RBF unit.The jth output $y_i(P)$ of an RBF neural network is

$$y_i(P) = \sum_{i=1}^{u} R_j(P) \times W(i, j)$$

where Ro =1, w(j,i) is the weight or strength of the i th receptive field to the j th output and w(j,0) is the bias of the j th output. In order to reduce the network complexity, the bias is not considered in the following analysis. We can see from (2.17) and (2.18) that the outputs of an RBF neural classifier are characterized by a linear discriminant function. They generate linear decision boundaries (hyperplanes) in the output space.

Consequently, the performance of an RBF neural classifier strongly depends on the separability of classes in the k-dimensional space generated by the nonlinear transformation carried out by the u RBF units.

Method	Training Samples	Test Samples	True Classification	False Classification	Accuracy (%)
PCA	50	31	25	6	80.64
PCA+canny	50	31	28	3	90.32
PCA+Canny+NN	50	31	29	2	93.54

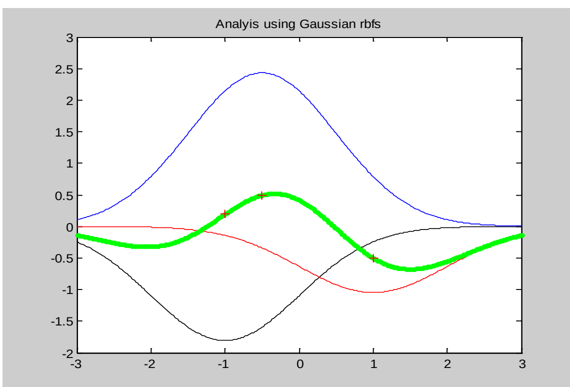

Figure 5 : RBF Analysis using Gaussian Function

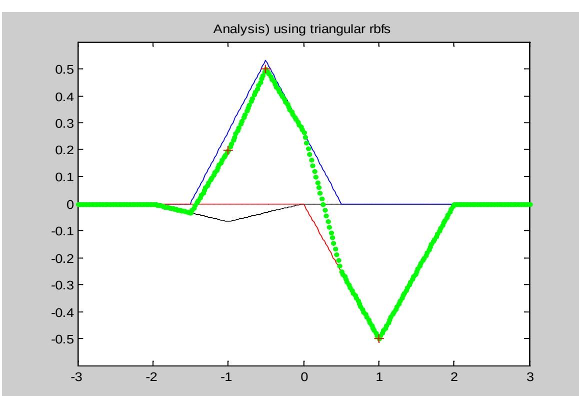

Figure 6 : RBF Analysis using Triangular RBF Function

V. Conclusion

We have presented an enhanced Canny edge detection based fingerprint segmentation method and PCA is used for accurate classification and authentication of the individual for safe and secured internet banking. The performances of the proposed and existing algorithms have been evaluated interms of True classifications using a database with medium-high quality fingerprint images .Experimental results show that the proposed enhanced algorithm robust than the existing system.

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Global Journal of Computer Science and Technology
Graphics & Vision
Volume 13 Issue 9 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Methodology for Evidence Reconstruction in Digital Image Forensics

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Keywords: digital forensics, copy-move forgery, keypoint, feature extraction, reconstruction.

GJCST-F Classification: I.4.0

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Methodology for Evidence Reconstruction in Digital Image Forensics

Kalpana Manudhane [α] & Mr. M.M. Bartere [σ]

Abstract- This paper reveals basics of Digital (Image) Forensics. The paper describes the ways to manipulate image, namely, copy-move forgery (copy region in image & paste into another region in same image), image splicing (copy region in image & paste into another image) and image retouching. The paper mainly focuses on copy move forgery detection methods that are classified mainly into two broad approaches – block-based and key-point. Methodology (generalized as well as approach specific) of copy move forgery detection is presented in detail. Copied region is not directly pasted but manipulated (scale, rotation, adding Gaussian noise or combining these transformations) before pasting. The method for detection should robust to these transformations. The paper also presents methodology for reconstruction (if possible) of forged image based on detection result.

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I. Introduction

With the rapid development of computer networks, almost the daily work of all trades is more and more dependent on computer. As a result, high-tech crimes, commercial fraud and other phenomena involve computers. So, people pay more & more attention to digital forensics. Digital forensics is concerned with the use of digital information (image or document file) as source of evidence in investigations and legal proceedings. This paper focuses on image as evidence.

Digital image forensics has emerged as a new research field that aims to reveal tampering in digital images [1]. Tampering the image means illegally manipulating image with intent to damage.

From the early days an image has generally been accepted as a proof of occurrence of the depicted event. Use of digital image in almost all fields has become a common practice. The availability of low-cost hardware and software, make it easy to create, alter, and manipulate digital images As a result, we are rapidly reaching a situation where one can no longer take the integrity and authenticity of digital images for granted [2]. So, detecting forgery in digital images is an emerging research field. In the recent years large amount of digital image manipulation could be seen In magazine, fashion Industry, Scientific Journals, Court rooms, main media outlet and photo hoaxes we receive in our email.

Digital image forensics is called passive [3] if the forensic investigator cannot interfere with the image generation process. On the other hand, for Active approaches the generation process is purposely modified at an earlier stage to leave behind identifying traces. Typical instances of active approaches attach metadata to the image e. g., a cryptographic signature or a robust hash or embed a digital watermark directly into the image itself.

Digital image forensics is called blind [3] if the forensic investigator is confined to examine the final output of the generation process. In particular, knowledge neither of the original scene nor any intermediate result of the generation process is available at the time of analysis. Contrary, Non–blind forensic investigators have such a data available. Such data may be available from alternative sources (for instance, earlier versions of a processed image that have been published elsewhere). This paper focuses on passive–blind image forensics.

Digital Image Forensics can be subdivided into three branches as-1) image source identification; 2) Computer generated image recognition and 3) Image forgery detection. Further, digital image forgery categorized in three groups [4]- Copy-Move, Image splicing and Image retouching. Copy-Move forgery or Region-Duplication forgery is the most important type of forgery, in Copy-Move some part of the image copies and pastes into another part of the same image to create a new thing or to hide an important scene. Image splicing is the procedure of creating a fake image by cutting one part of an image and paste it to another image. Image Retouching doesn't obviously change the image, it just enhance some features of image. It is famous among magazine photo editors and most of magazine covers use this technique to change some features of an image but it is ethically wrong.

The rest of paper is organized as follows. Section II reveals literature survey. In section III, the details of the block-based and keypoint-based method are presented with the general flowchart of the methods.

Section IV gives details to reconstruct image based on detection results. Section V gives details of comparison metrics and dataset. Section V describes factors to be considered to prove robustness of method. Proposed system & conclusion is presented at the end.

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II. Literature Survey

Detection of Copy-Move forgery is difficult as compared to other forgeries because the source and destination of forgery is same image, also the original image segment and the pasted one have same properties such as dynamic range, noise component and color palette.

The simplest way to detect a Copy-Move forgery is to use an exhaustive search. In this approach, the image and its circularly shifted version are overlaid looking for closely matching image block. This approach is simple and effective for small-sized images. However, this method is computationally expensive and even impractical for medium size image. Another technique for detecting forgery is based on autocorrelation. All Copy-Move forgery introduces a correlation between the original segment and the pasted one. Though this method does not have large computational complexity it often fails to detect forgery.

Basically, given an original image, there are two approaches for Copy move forgery detection (CMFD) - block-based and keypoint-based. Block-based method subdivide image into blocks, whereas keypoint-based method searches keypoints in image without dividing the image. Although a large number of CMFD methods have been proposed, most techniques follow a common pipeline, as shown in Fig.1. According to approach selected, each phase has different working methodology. Let us see these phases in brief [5]

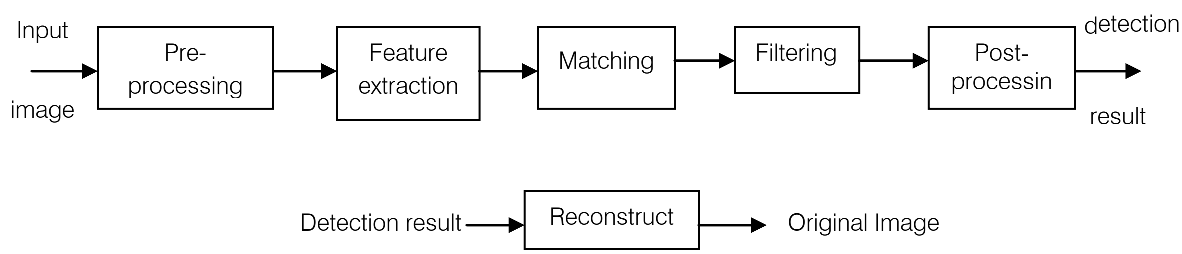

Figure 1 : Common processing pipeline for detection of copy-move forgery & image reconstruction

Most methods operate on grayscale images. So, preprocessing involves color image to be converted to grayscale image. In feature extraction, a feature vector is computed for block or keypoint. Similar feature vectors are subsequently determined in matching step.

High similarity between two feature descriptors is interpreted as an indication for a duplicated region.

Filtering schemes have been introduced in order to reduce the probability of false matches. For instance, neighboring pixels often have similar intensities, which can lead to false forgery detection.

Different distance criteria were also proposed in order to filter out weak matches. The goal of this last phase i.e. post-processing is to preserve matches that exhibit a common behavior. A set of matches that originate from the copy-move action are expected to be spatially close to each other in both the source and the target blocks or keypoints. Furthermore, these matches should exhibit similar amounts of translation, scaling and rotation. In reconstruction, we try to recover original image if possible.

Literature survey of CMFD methods is as follows-

Fridrich et al. (2003) [6] is the first to propose CMFD method. In this method, image is divided into overlapping small blocks. Then he used of discrete cosine transform (DCT) as block feature, this method is not robust to transformation. B. Mahdian and S. Saic (2007)[7] used blur invariant moments as block feature. S. Ryu, M. Lee and H. Lee (2010) [8] use of magnitude of zernike moments as a feature of block. The method is invariant to rotation but still weak for scale & other affine transformation. Somayeh Sadeghi et al. (2012) [4] had used Fourier transform as block feature, though computation time is improved, the method is not so much accurate. Other block-based methods are based on-DWT (Discrete Wavelet Transform), PCA (Principle Component Analysis), Hu moment, SVD (Singular Value Decomposition) and KPCA (kernel-PCA) etc. These block-based methods accurately detect forged region, but require more computation time and memory.

B. L. Shivakumar and S. Baboo (2011) [9] uses SURF (Speeded Up Robust Features) as keypoint feature. The method detects forgery with minimum false match for images with high resolution. But it failed to detect small copied regions. I. Amerini et al.(2011) [10] presented a new technique based on Scale invariant Feature Transform (SIFT) [11] features to detect and localize copy-move forgeries. G2NN method is used for keypoint matching and clustering is used to detect forgery. The method also deals with multiple cloning.

The method also determines geometric transformation. Xunyu Pan(2011) [1][12], in his dissertation, detect region duplication by using Scale invariant feature transform(SIFT) method to extract keypoint and Best-bin-first algorithm for keypoint matching. His method also deals with geometric transformation. These keypoint based methods show good performance with very less computation time and minimum memory requirement.

So, it can be concluded that though block-based methods improve detection result, keypoint based methods are more efficient if we consider factors of computation time and memory requirement. They are reliable and give good performance in case of affine transformation such as large scaling and rotation as compared to block-based methods. However, keypoint based methods are sensitive to low-contrast and repetitive image contents.

III. Approaches to CMFD

As it is cleared that there are basically 2 approaches to CMFD, namely, block-based and key-point based, let us see methodology in depth for each.

a) Block-based approach

Firstly, image is subdivided into overlapping or non-overlapping blocks. For detecting forged area, the characteristics of each block of the image calculated and compared with each other.

Fig.2 shows the general procedures of detecting block-based copy-move forgery.

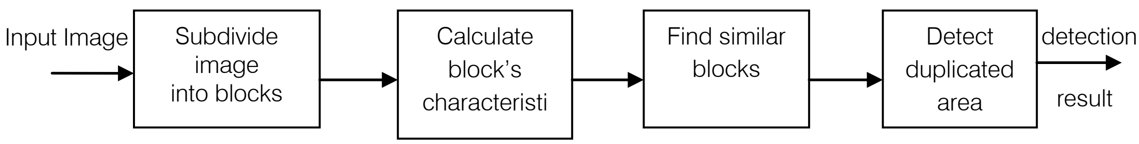

Figure 2 : Block-based CMFD procedure

Extracting image features or characteristics can be done by different technique as discussed in Literature survey such as frequency based approaches(DCT, DWT, FT, etc), moment-based approaches (blur, Zernike), dimension-reduction techniques(PCA, SVD, KPCA).

Similar blocks are identified by lexicographic sorting. In lexicographic sorting a matrix of feature vectors is built so that every feature vector becomes a row in the matrix. This matrix is then row-wise sorted. Thus, the most similar features appear in consecutive rows. Similarity criteria may be Euclidian distance, correlation etc.

The block size also affects performance of algorithm. If it is very large then can not locate small copied regions. If it is too small, more computation time and memory will be required. 16×16 will be choice of most researchers.

b) Keypoint-based approach

The first step in keypoint-based method is to find image keypoints and collect image features at the detected keypoints. Keypoints[1] are locations that carry distinct information of the image content. Each keypoint is characterized by a feature vector that consists of a set of image statistics collected at the local neighborhood of the corresponding keypoint. Fig.3 shows the general procedures of detecting keypoint-based copy-move forgery [10].

Figure 3 : keypoint-based CMFD procedure

c) Keypoint extraction methods

SIFT (Scale Invariant Feature Transform) is one of the methods to extract keypoint. SIFT keypoints are found by searching for locations that are stable local extrema in the scale space[11]. Scale space is obtained by Gaussian and difference of Gaussian. At each keypoint, a 128 dimensional feature vector is generated from the histograms of local gradients in its neighborhood. To ensure that the obtained feature vector is invariant to rotation and scaling, the size of the neighborhood is determined by the dominant scale of the keypoint, and all gradients within are aligned with the keypoint's dominant orientation. Furthermore, the obtained histograms are normalized to unit length, which renders the feature vector invariant to local illumination changes.

Another method proposed by Herbert Bay et. al. for fast detectors and descriptors, called SURF (Speeded Up Robust Features). SURF's detector and descriptor is said to be faster and at same time robust to noise, detection displacements and geometric and photometric deformations.

d) Keypoint matching methods

Given a test image, a set of keypoints X={x1,….,xn} with their corresponding SIFT descriptors {f1,….,fn} are extracted. Best-Bin-First search method derived from the kd-tree algorithm (bins in feature space are searched in the order of their closest distance from the query location) used to get approximate nearest neighbors. Matching with a kd-tree yields a relatively efficient nearest neighbor search. The Euclidean

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distance is used as a similarity measure. It has been shown that the use of kd-tree matching leads, in general, to better results than lexicographic sorting, but the memory requirements are significantly higher.

Another is the 2NN algorithm. For the sake of clarity let D={d1, d2, ,….,dn-1} gives sorted Euclidean distance of a keypoint with respect to other keypoint descriptors. The keypoint is matched only if following condition is satisfied

$$d_1/d_2 < T \quad where\ T \in (0,1) \qquad (1)$$

That's why this procedure is called as 2NN test. Drawback of this method is cannot handle multiple keypoint matching. So, Amerini et. al. [10] proposed generalized 2NN test (called as g2NN) starts from the high dimensional feature space such as that of SIFT features. The generalization consists of iterating the 2NN test between d_i/d_(i+1) until this ratio is greater than T (in their experiments this value is set to 0.5). Finally, by iterating over each keypoints, we can obtain the set of matched points. All the matched keypoints are retained, but isolated ones are discarded. But it can be possible that images that legitimately contain areas with very similar texture yield matched keypoints that might give false indicator.

IV. Clustering

Cluster is a collection of data objects such as objects that are similar to one another will be placed within the same cluster and dissimilar objects to the clusters. Clustering problem is to find similarities between data according to the characteristics found in the data and group similar data objects into clusters.

There are various approaches to clustering discussed in brief as follows-

Cluster analysis[13] try to subdivide a data set X into C subsets (clusters) which are pair wise disjoint, all non-empty and reproduce X via union. These clusters are termed as hard clusters (non-fuzzy). Whereas fuzzy clusters allow one piece of data to belongs to two or more clusters. C-means clustering is fuzzy based while k-means is hard clustering. Hierarchical clustering [10] creates a hierarchy of clusters which may be represented by a tree structure. The algorithm starts by assigning each keypoint to a cluster; then it computes all the reciprocal spatial distances among clusters, finds the closest pair of clusters, and finally merges them into a single cluster.

Other major clustering approaches are partitioning, Density-based, grid-based, model-based, frequent-pattern-based and constraint-based. Swarm optimization based approaches such Particle swarm optimization and Ant colony optimization can also be successfully applied to clustering [14].

a) Comparison between Block-based and Keypoint based approach

Comparison in simple terms is represented in following table-

	Block-based approach	Keypoint based approach
1	Subdivide image into blocks for feature extraction	Without dividing image determine keypoints for feature extraction
2	Feature vector matching is done mostly by lexicographic sorting	Feature vector matching is done by 2NN, g2NN, best-bin-first algorithm
3	Cannot detect large transformations	Can detect large transformations
4	More memory required and consequently more computation time	Less memory and computation time as keypoints are less in number
5	More accurately detect duplication	Some what less accurate

V. Image Reconstruction

After detection of forgery, next step is to try to reconstruct image to original. If forgery is done for highlight something and background is simple then it can be reconstructed easily by region growing. But if forgery is to hide something underlying then it is not possible to reconstruct it. Further more detection method is not able to distinguish original and copied region. It just claims that two regions are identical to each other. If we assume that copied region is one on which some transformations are performed. But in that case it will confuse in situation in which there is plain copy-move (without any transformation). In that case we will assume first region encountered is original and second is duplicated. Let us see region growing in brief.

a) Region Growing

As name suggests, region growing is a procedure that group pixels or sub-regions into larger regions based on predefined criteria for growth [15]. The basic idea is to start with a set of seed points and from these grow regions by appending to each seed those neighboring pixels that have predefined properties similar to the seed (such as specific intensity range or color). Following are the problems in region growing where decision is needed to be taken.

- Selecting a set of one or more starting points many times can be based on the nature of problem. When the prior information is not available, set of properties at every pixel is needed to be computed, so that can be used to assign pixels to regions during growing process. If these computation results in clusters, then pixels whose properties place them near the centroid of these clusters can be used as seeds.
- Selection of similarity criteria depends on problem under consideration and type of image data available.
- Formulation of stopping rule is another problem. The growing process should stop when no more pixels satisfy criteria for inclusion in that region. Additional criteria to increase power of algorithm are- size, likeliness between candidate pixel, shape of region being grown, pixels grown so far etc..

VI. COMPARISON METRICS & DATASET

There should be a criteria on basis of which various methods can be compared. Measures for checking performance of method are mainly Precision, p, and Recall, r [5]. They are defined as:

$$p = \frac{T_P}{T_P + F_p} \qquad r = \frac{T_P}{T_P + F_n} \qquad (2)$$

Where, $T_P =$ number of correctly detected forged images,

F_p = number of images that have been erroneously detected as forged,

and $F_n =$ number of falsely missed forged images.

Here, precision denotes the probability that a detected forgery is truly a forgery; while recall shows the probability that a forged image is detected. Recall is often also called true positive rate. Score F1 is a measure which combines precision and recall in single value given as follows-

$$F_1 = 2 \cdot \frac{p \cdot r}{p + r} \qquad (3)$$

Along with this traditional measures such as memory requirement and computation time are also significantly considered.

Now, question arises – on which images we can test our method? Amerini et al. have published two ground truth databases for CMFD, namely, MICC F220 and MICC F2000 consists of 220 and 2000 images respectively. Half of images are tampered. The image size is 2048×1536 pixels. Type of processing is limited to rotation and scaling. Also original image is not available. Fig. shows some of images of dataset MICC-F8multi.

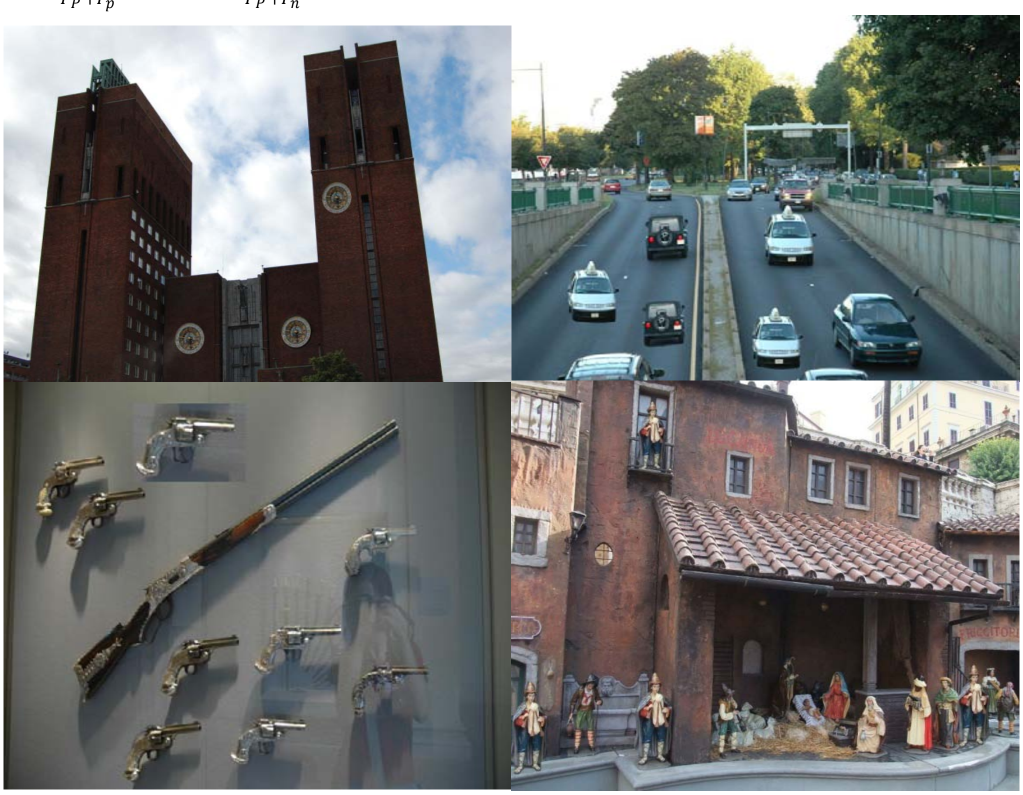

Figure 4 : Forged images of dataset MICC-F8multi

Another one is a project1ims set of 5 object images (named [name].pgm, where [name] = {book1, book2, kit, ball, juice} is the object shown), and two sets of 10 cluttered scene images. One set is the training set and the images are named Img0[i].pgm, where i=1...10.

The other set is the test set, and the images are named TestImg0[i].pgm, where i=1...10. Every image (in training and test sets) contains 0-5 of the objects represented in the object images. Each object is contained in exactly five images in each set (training and test), and is not present in the other five. There is a file gt.txt, which contains the ground truth for the cluttered images - it shows which of the five objects are present in each images. Steps to analyze method is as follows-

1. By looking through the images and comparing to the ground truth, make sure that how the two are related.
2. Using the method to be analyzed, compute the number of matches between each object image and each training image. You should compute a 5x10 matrix of integers.
3. Design a simple classifier for each object separately (based only on the training data) that tells whether the object is present in an image by thresholding the number of matches.
4. Evaluate your classifier on each image in the training set. Note: Designing a classifier means coming up with a method for computing a threshold based only on the training data, which will eventually work well on test data. An example of such a method is to set the threshold to the largest number of matches for an image that did not contain the object. Another is to set the threshold to the smallest number of matches for an image that did contain the object.
5. Now compute the number of matches between the each object image and each test image. Again, you should compute a 5x10 matrix of integers. Using your classifiers, classify each test image now as either containing each object or not.
6. Compare your classifications to the ground truth. You should compute the number of misses (number of images that contained the object that were classified as not containing the object) and the number of false positives (number of images that do not contain the object that were classified as containing the object). Ideally, you want zero in both.

VII. Robustness of Method

Method for CMFD should able to detect forgery invariant to rotation, (up and down) scaling, noise added to copied region before pasting it. Also method is expected to detect combinations of these manipulations. Method should detect multiple copies of the same region. Also, the method be able to detect multiple forgeries i.e. more than one region copied and pasted. Let us consider these factors one by one.

a) Scale and rotation invariance

If copied region is up-scaled or down-scaled then pasted, method should detect it accurately. Bayram et. al.[16] suggested a method by applying Fourier Mellin Transform (FMT) on the image block. The authors showed that their technique was robust to compression up to JPEG quality level 20 and rotation with 10 degree and scaling by 10%.

Hwei-Jen Lin et. al. [17] proposed a method in which each block B of size 16x16 by a 9-dimensional feature vector. The feature vector extracted stored in floating numbers is converted into integer values for fast processing and then sorted using the radix sort, which makes the detection more efficient without degradation of detection quality. The difference (shift vector) of the positions of every pair of adjacent feature vectors in the sorted list was computed and then evaluated and the large accumulated number was considered as possible presence of a duplicated region. The scheme performed well when the degree of rotation was 90, 180 and 270 degree. The figure 5 [2] shows duplicated region with and without rotation.

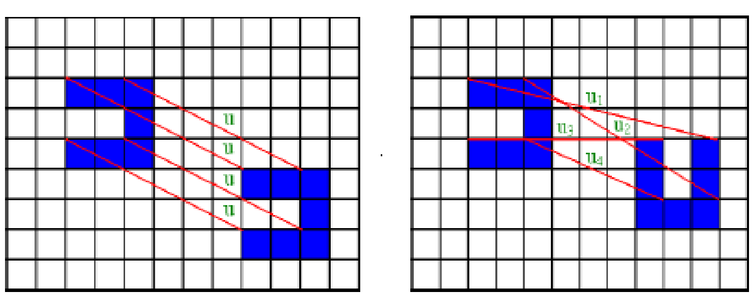

Figure 5 : (a) Duplicated regions form several identical shift vector u. (b) Duplicated region from several (different) shift vector(u1 u4) , rotated through 90 degree.

We already seen than the method scale invariant features transform (SIFT) is more robust for scaling and Zernike moments based method is robust to rotation.

b) Robustness to Gaussian noise

Copied region is not just pasted but often some noise is added to it before pasting. Gaussian noise [15] represents statistical noise having probability distribution function equal to normal distribution. Gaussian noise model is frequently used in image processing.

Irrespective of noise added either in small or large in mount, method should choose to leave the ground truth clean [5].

c) Robustness to combined transformation

The method is robust if it can detect combined transformation consisting of rotation, scale and Gaussian noise.

d) Detection of multiple copies of same region

This factor depends on algorithm used for keypoint/block feature vector matching. 2NN algorithm is not able to detect multiple copies while g2NN is able to detect.

e) Robustness to multiple copy-move

The method should detect multiple forgeries of copy-move with accuracy. Note that performance of method should not become less for one factor when trying to attempt to improve another factor.

f) Complexity of algorithm

Though lot of work is done in the field of copy move forgery detection, methods are very complex. If we want to achieve above factors, complexity further increases. Some simplification in current approaches or different way of approaching the problem is needed.

VIII. Proposed System

We will try to implement keypoint-based Scale Invariant Feature Transform (SIFT) algorithm for keypoint and feature extraction; generalized 2NN (g2NN) algorithm for keypoint feature matching; fuzzy c-means clustering for forged region detection. Hope so, almost all types of transformations being detected. We will also try to reconstruct original image whenever possible using region growing algorithm.

IX. Conclusion

This paper gives basic of Digital (Image) Forensics. The paper also put light on the ways to image manipulation, namely, copy-move forgery, image splicing and image retouching. The literature survey is presented for copy move forgery detection methods that are classified mainly into two broad approaches- block-based and key-point. Methodology (generalized as well as approach specific) of copy move forgery detection is presented in detail. Many authors have proposed good methods with lot of experiments. Some authors also provided dataset for experimental testing. Though lot of work had been done in the field of copy move forgery detection, methods are very complex. If we want to achieve robust method against all manipulations complexity further increases. Some simplification in current approaches or different way of approaching the problem is needed. Accuracy is also needed to be improved. This paper make familiar to new researchers in this field with current methodology and robustness requirement for the methods to be proposed.

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Global Journal of Computer Science and Technology
Graphics & Vision
Volume 13 Issue 9 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Comparison of Different Algorithm for Face Recognition

By Hemant Makwana & Taranpreet Singh
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Abstract- This paper is about the different algorithms which are used for face recognition. There are so many algorithms which are available for face recognition .There are two approaches by which the face can be recognize i.e. face Geometry based and face appearance based. The appearance based technique is also sub divided into two technique i.e. local feature and global feature based. The technique of local feature based are Discrete Cosine Transform (DCT).In this paper we study the two global features (holistic) appearance based algorithm i.e. Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) in which every face image is converted into 1D, we are using 1D for all the calculation and then compare these two algorithm with the help of FAR (False Acceptance Rate),FRR (False Rejection Rate),Time, Memory and checks which algorithm gives the better result.

Keywords: euclidean distance, false acceptance rate, false rejection rate, linear discriminant analysis, principle component analysis, scatter matrix.

GJCST-F Classification: I.4.8

COMPARISONOFDIFFERENTALGORITHMFORFACERECOGNITION

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Comparison of Different Algorithm for Face Recognition

Hemant Makwana [α] & Taranpreet Singh [σ]

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Keywords: euclidean distance, false acceptance rate, false rejection rate, linear discriminant analysis, principle component analysis, scatter matrix.

I. Introduction

There are so many faces which the any normal human being seen in his daily life, but out of which they remember few of them. The faces which they remember are based on some feature based means they not exactly know the correct face but they know the feature of the particular face of the person. There are some special feature by which a exact person are recognize, like his color of eyes, shape of the ear which are remain same his all life. There are some features which are changes as the age is increase like shape of nose, shape of the lips etc. face Recognition is very complex process that find the exact match or minimum threshold value face to find out because the face image which are coming for recognition may contain noise or may be the light in the face or the color in the face image is not proper. the face which are coming for recognition purpose contain many useful information but using all these information is very much time consuming and consume lots of cost, so we reduce the some data like in this manner by which the useful information are not discarded. For this we are using PCA which is the reduction technique which reduces the parameter of the images.PCA uses Eigenfaces and Euclidean distance for matching the correct face from the database. We also use the LDA algorithm for face recognition, which is quite better then PCA algorithm. We seen later how lda is better then pca? The Face Recognition are used in many places like Air ports, Military bases, Government offices, also use for daily attendance purpose in the multinational companies. Face Recognition has two phases first phase is the training of the faces which the faces are saved in the database and second face is the verification phase in which they have to find the exact match of the face which are present in the database.

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II. Overview of the System

The proposed face recognition system consists of two module which are the enrollment and verification phases as depicted in Fig. 1.It consists of several sub modules which are Sensor, Feature, Extraction, Score Generation and the threshold. The Enrollment Module contains the Sensor and Feature Extraction while verification module contains score generation and threshold.

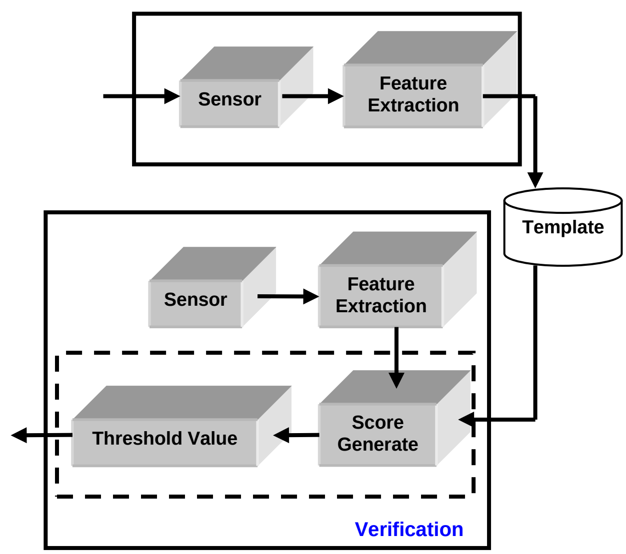

Figure 1 : Block Diagram of Face Recognition System

a) Enrollment Module

The image is taken using a web camera and stored in a database. Next, the face image is detected and trained. During training, the face image is preprocessed. The features of the face image are extracted using several feature extraction techniques. The features data is then stored together with the user identity in a database.

i. *Preprocessing*

The purpose of the pre-processing module is to reduce or eliminate some of the variations in face due to illumination. It normalized and enhanced the face image to improve the recognition performance of the system. In preprocessing technique the color image is first converted into gray scale or in black & white image. After that according to the algorithm the steps are apply into the image to store in the database and calculate the threshold value of those images, threshold value is also saved in the database. The first and second steps are completed in the enrollment module. By using the normalization process, system robustness against scaling, posture, facial expression and illumination is increased.[5][6]

b) Verification Module

A user's face is once again acquired and system uses this to either identify who the user is, or verify the claimed identity of the user. The input to the face verification module is the face image, which is derived from two sources from the camera or from the database. While identification involves comparing the acquired biometric information against templates corresponding to all users in the database, verification involves comparison with only those templates corresponding to claimed identity. The image are again go for the respective algorithm and generated the score this score is compare with the threshold value which are saved in the database, the third and the forth step are completed in this module and respective output are shown in front of the user screen.

III. Algorithm for Face Recognition

There are two approaches by which the face can be recognize i.e. face Geometry based and face appearance based. The appearance based technique is also sub divided into two technique i.e. local feature and global feature based. The technique of local feature based are Discrete Cosine Transform(DCT).In this paper we study the two global features (holistic) appearance based algorithm i.e. Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA).

a) Principal Component analysis (PCA)

PCA for face recognition is based on the information theory approach. It extracted the relevant information in a face image and encoded as efficiently as possible. It identifies the subspace of the image space spanned by the training face image data and decorrelates the pixel values. The classical representation of a face image is obtained by projecting it to the coordinate system defined by the principal components. The projection of face images into the principal component subspace achieves information compression, decorrelation and dimensionality reduction to facilitate decision making. In mathematical terms, the principal components of the distribution of faces or the eigenvectors of the covariance matrix of the set of face images, is sought by treating an image as a vector in a very high dimensional face space [7] [8][9].We apply PCA on this database and get the unique feature vectors using the following method .Suppose there are P patterns and each pattern has t training images of m x n configuration.

- The database is rearranged in the form of a matrix where each column represents an image.
- With the help of Eigen values and Eigen vectors covariance matrix is computed.
- Feature vector for each image is then computed. This feature vector represents the signature of the image. Signature matrix for whole database is then computed.
- Euclidian distance of the image is computed with all the signatures in the database.
- Image is identified as the one which gives least distance with the signature of the image to recognize.

Advantage of this Algorithm

- It completely decorrelates any data in the transform domain.
- it packs the most energy (variance) in the fewest number of transform coefficient.
- It minimizes the MSE (mean square error) between the reconstructed and original data for any specified data compression.
- It minimizes the total entropy of the data.

Disadvantage of this Algorithm

- There is not fast algorithm for its implementation.
- The PCA is not a fixed transform but has to be generated for each type of data statistics
- There is considerable computational effort are needed for generation of Eigen values and Eigen values of the covariance matrix.

b) Linear Discriminant Analysis (LDA)

LDA seeks directions that are efficient for discrimination between the data.LDA maximizes the between-class scatter and minimizes the within-class scatters. This criterion tries to maximize the ratio of the determinant of the between-class scatter matrix of the projected samples to the determinant of the within-class scatter matrix of the projected samples. Fisher discriminants group images of the same class and separates images of different classes. Images are projected from *N*2-dimensional space to *C* dimensional space (where *C* is the number of classes of images). To identify an input test image, the projected test image is compared to each projected training image, and the test image is identified as the closest training image. The within class scatter matrix represents how face images are distributed closely within classes and between class scatter matrix describes how classes are separated from each other. When face images are projected into the discriminant vectors *W*, face images should be distributed closely within classes and should be separated between classes, as much as possible. In other words, these discriminant vectors minimize the denominator and maximize the numerator. The use of Linear Discriminant Analysis for data classification is applied to classification problem in speech recognition. We decided to implement an algorithm for LDA in hopes of providing better classification compared to Principle Components Analysis.[13].The prime difference between LDA and PCA is that PCA does more of feature classification and LDA does data classification.

Figure 2 : Face Images for the database

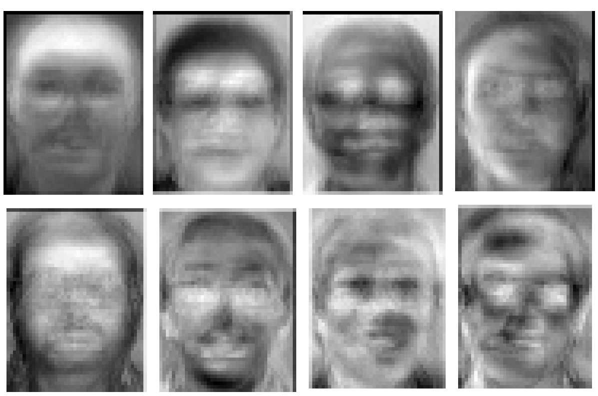

Figure 3 : Calculated Eigen Faces of the person

IV. Comparison Between the Algorithms

We will compare these two algorithms with respect of FAR (False Acceptance Rate), FRR (False Rejection Rate), memory and time.

False Rejection Rate: The probability that system will fail to identify an enrollee. This is also called type I error rate.

FRR=NFR/NEIA

Where

NFR= Number of false rejection rates

NEIA= Number of enrollee identification attempt.

False Acceptance RATE (FAR): The probability that system will incorrectly identify an individual or fail to reject an imposter. It is also called type II error type.

FRR=NFR/NIIA

Where

NFR= Number of false rejection rates

NIIA= Number of imposter identification attempt.

Feature Extractor	No. of Images	FAR = FRR (%)	
		FAR	FRR
PCA	8	15	85
	12	17	83
	15	20	80
LDA	8	13	83
	12	12	88
	15	07	92.33

Figure 4 : Comparison of FAR &FRR of different Images

In Fig-5, 6 we calculate how much time is spend in recognizing the face which is coming for recognizing process in the individual algorithm.fig-5 show the result of PCA algorithm & fig-6 show the result of LDA algorithm. With the help of below figures we conclude that PCA consumes more time than LDA algorithm for recognizing the face.

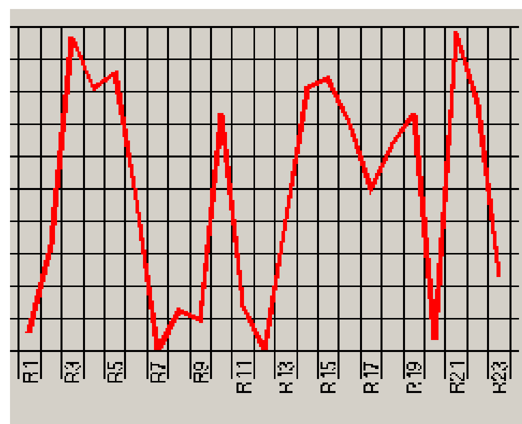

Figure 5 : Calculate time for Calculating the PCA Result

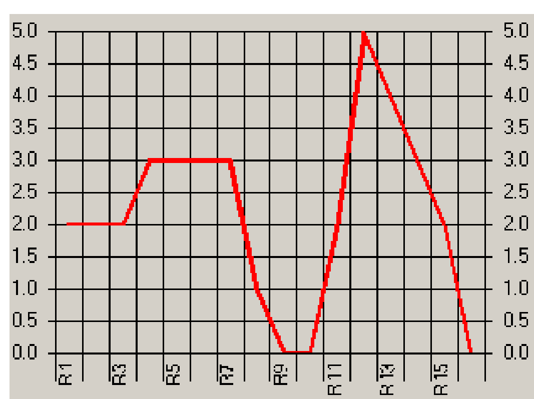

Figure 6 : Calculate time for Calculating the LDA Result

In Fig-7, 8 we calculate how much memory is spend in recognizing the face which is coming for recognizing process in the individual algorithm.fig-7 show the result of PCA algorithm & fig-8 show the result of LDA algorithm. With the help of below figures we conclude that PCA occupies more memory than LDA algorithm.

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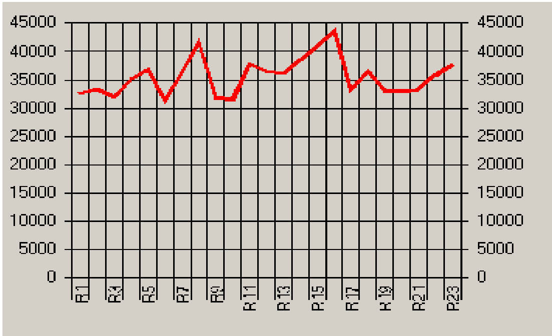

Figure 7 : Calculate memory for Calculating the PCA Result

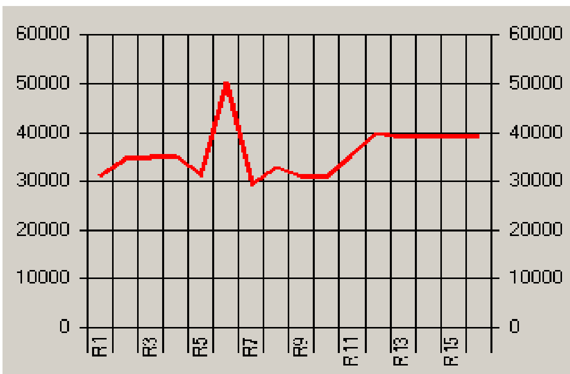

Figure 8 : Calculate memory for Calculating the LDA Result

Principal Component Analysis (PCA)

- Project faces onto a lower dimensional sub-space.
- No distinction between inter- and intra-class variability
- Reduce the dimension of the data from N*2* to M
- Verify if the image is a face at all.
- Problems with illumination, head pose, etc.
- Optimal for representation but not for discrimination.

Linear Discriminant Analysis (LDA)

- Find a sub-space which maximizes the ratio of inter class and intra-class variability.
- Same intra-class variability for all classes.
- Work also with various illuminations, etc
- Reduce dimension of the data from N2 to P-1
- Can only classify a face which is "known" to the database.

V. Conclusion

The paper has presented a comparison of different type of face recognition algorithm like PCA, LDA algorithm. The overall performance for verification of image by using theses two algorithm we concluded that the LDA gives the better performance as comparison with the PCA algorithm. The main difference between these algorithm when we perform Analysis and experimental results indicates that the PCA works well when the lightening variation is small. LDA works gives better accuracy in facial expression. We also notice that PCA are time consuming as compare with the LDA algorithm. Also we test with the help of FAR&FRR term than we concluded that LDA shows better result than PCA.

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Global Journal of Computer Science and Technology (F) Volume XIII Issue IX Version I Year 2013

Global Journal of Computer Science and Technology
Graphics & Vision
Volume 13 Issue 9 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

An Analysis of H.264/AVC Encryption Techniques

By Dinesh Goyal, Srawan Nath & Dr. Naveen Hemrajani

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Abstract- The video coding standards are developed to satisfy the requirements of different applications for various purposes, higher coding efficiency, better picture quality, and more error robustness. The new international video coding standard H.264/AVC aims at having significant improvements in coding efficiency, and error robustness in comparison with the previous standards. Most of the video compression algorithms are designed based on the H.264/AVC. In this paper, the video encryption techniques of H.264/AVC are analyzed. Performance analysis of the three algorithms namely Selective, Layered and Naïve is reported and its strength is discussed.

Keywords: *h.264/avc; video encryption techniques; selective; layered; naïve.*

GJCST-F Classification: *E.3*

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Keywords: h.264/avc; video encryption techniques; selective; layered; naive.

I. Introduction

Multimedia is the combination of two or more media. The media in multimedia is in various forms such as graphics, photography, text, audio, video and animation. Each one serves as a powerful communication vehicle for both expressive and practical purposes.

H.264/MPEG-4 AVC is the latest international video coding standard. It was jointly developed by the Video Coding Experts Group (VCEG) of the ITU-T and the Moving Picture Experts Group (MPEG) of ISO/IEC. It uses state-of-the-art coding tools and provides enhanced coding efficiency for a wide range of applications including video telephony, video conferencing, TV, storage (DVD and/or hard disk based, especially high-definition DVD), streaming video, digital video authoring, digital cinema, and many others.

ITU H.263, H.263L, H.26L, H.263E, ISO/IEC 14496. These video codecs are the Basis for MPEG4 Simple Profile. MPEG-4 adds advanced error detection and correction services on top of H.263. 3GPP and ISMA are versions of H.263 and MPEG-4 for streaming and mobile applications. These are really a variation of Transport stream.

H.264 is being widely accepted as the future platform of video compression for applications such as new HDTV services, portable game console, mobile broadcast video services, and video on solid-state camcorders, instant video messaging on cell phone. H.264 is the most advanced video coding standard available today. It uses many new coding techniques not available in MPEG2, MPEG4 and H.263.

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II. Encoding & Decoding

The H.264/MPEG-4 Advanced Video Coding standard (H.264/AVC) has achieved a significant improvement in compression performance compared to prior standards.

The main objectives of the H.264/AVC standard are focused on coding efficiency, architecture, and functionalities. More specifically, an important objective was the achievement of a substantial increase of coding efficiency over MPEG-2 Video for high-delay applications and over H.263 version 2 for low-delay applications, while keeping implementation costs within an acceptable range. Doubling coding efficiency corresponds to halving the bit rate necessary to represent video content with a given level of perceptual picture quality. It also corresponds to doubling the number of channels of video content of a given quality within a given limited bit-rate delivery system such as a broad-cast network.

The architecture-related objective was to give the design a "network-friendly" structure, including enhanced error/loss robustness capabilities, in particular, which could address applications requiring transmission over various networks under various delay and loss conditions. The functionalities-related objectives included—as with prior video coding standards—providing support for random access (i.e., the ability to start decoding at points other than the beginning of the entire stream of encoded data) and "trick mode" operation (i.e., fast-forward, fast and slow reverse play, scene and chapter skipping, switching between coded bit streams, etc.), and other features.

H.264 Advanced Video Coding defines a format for compressed video data and it provides a set of tools that can be used in a variety of ways to compress and communicate visual information. Also, it is a stage in an evolving series of standardized methods for video compression. It is an industry standard for video coding, but it is also a popular format for coded video, a set of tools for video compression and a stage in a continuously evolving digital video communication landscape.

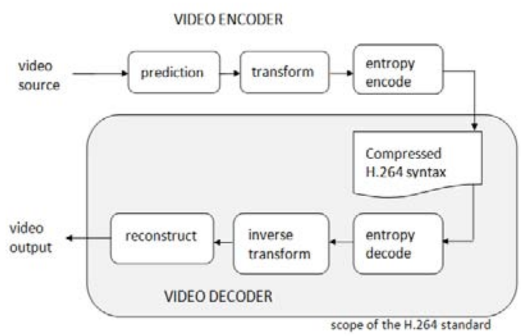

Figure 1 : H.264 video encoding and decoding process

III. Video Compression Techniques

Role of video compression technology is to reduce the redundancies in the spatial and temporal directions. Spatial reduction physically reduces the size of the video data by selectively discarding up to a fourth or more of unneeded parts of the original data in a frame. Temporal reduction, Inter-frame delta compression or motion compression, significantly reduces the amount of data pixels needed to store a video frame by encoding only the pixels that change between consecutive frames in a sequence.

Several important standards like the Moving Picture Experts Group (MPEG) standard, H.261, H.263 and H.264 standards are the most commonly used techniques for video compression.

- MPEG 1: MPEG-1 is mainly for storage media applications. Due to the use of B-picture, it may result in long end-to-end delay. The MPEG-1 encoder is much more expensive than the decoder due to the large search range, the half-pixel accuracy in motion estimation, and the use of the bi-directional motion estimation.
- MPEG 2: The MPEG-2 standard consists of several parts, of which the most important to us is the video part. The standard defines a compressed video bitstream and describes how it can be decoded. It is important to recognize that it does not describe how to take an input picture and compress it to make an MPEG-2 bitstream – it is not a coder specification.
- MPEG 4: MPEG-4 compression methods are used for texture mapping of 2-D and 3-D meshes, compression of time-varying streams, and algorithms for spatial, temporal and quality scalability, images and video. Scalability is required for video transmission over heterogeneous networks so that the receiver obtains a full resolution display. MPEG-4 provides high coding efficiency for storage and transmission of audio visual data at very low bit rates.
- MPEG 7: The MPEG-7 standard was approved in July 2001 (Chang, et al., 2001) to standardize a language to specify description schemes. MPEG-7 is a different kind of standard as it is a multimedia content description standard, and does not deal with the actual encoding of moving pictures and audio.
- H.261: The International Telecommunication Union (ITU) developed the H.261 standard for data rates that are multiples of 64Kbps. The H.261 standard uses motion compensated temporal prediction. It supports two resolutions, namely, Common Interface Format (CIF) with a frame size of 352 × 288, and Quarter CIF (QCIF) with a frame size of 172 × 144.
- H.263: The H.263 standard uses an encoding algorithm called test model (TMN), which is similar to that used by H.261 but with improved performance and error recovery leading to higher efficiency.
- H.263+: H.263+ is an extension of H.263 but has higher efficiency, improved error resilience, and reduced delay. It allows negotiable additional modes, spatial, and temporal scalability.

IV. Video Encryption Techniques

In today's scenario there is an increasing demand for remote video communication. The development of encryption systems main objective is to provide a secure and reliable way of information exchanges. However, the security aspects of video exchanges have yet to be fully addressed. Existing video coding standards do not incorporate requirements to have encryption capabilities.

Recently, researchers are focusing a lot of attention on secure digital media over the network. The field of multimedia security is growing extremely fast. In order to deal with the problem of processing overhead and to meet the security requirements of real -time video applications with high quality video compression, several encryption algorithms to secure video streaming have been proposed which are as follows:

- Pure permutation algorithm which simply scrambles the bytes within a frame of an MPEG stream by permutation. It is extremely useful in situations where the hardware decodes the video, but decryption must be done by the software.
- Zig-Zag permutation approach maps the individual 8x8 block to a 1x64 vector using a random permutation instead of mapping 8x8 blocks to a 1x64 vector in a Zig-Zag order using a random permutation list (secret key).
- Video encryption algorithm: Bhargava, Shi, and Wang in 1996 and 1998 introduced four different video encryption algorithms : Algorithm I, Algorithm II (VEA); Algorithm III (MVEA); and Algorithm IV (RVEA).

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The Joint Video Team (JVT) finalized the draft of the new coding standard for formal approval submission as H.264/AVC and was approved by ITU-T in March 2003. Researchers started work to make the H.264/AVC bit stream secure. Most of them tried to optimize the encryption process with respect to the encryption speed, and the display process.

V. Comparative Analysis of Video Encryption

Security and privacy issues in multimedia technology have become an important concern.

Many multimedia applications require secure transmission, the level of security required depends on the sensitivity of the information in these applications. Due to which various video encryption techniques are developed. From these techniques three of them are discussed as follows:

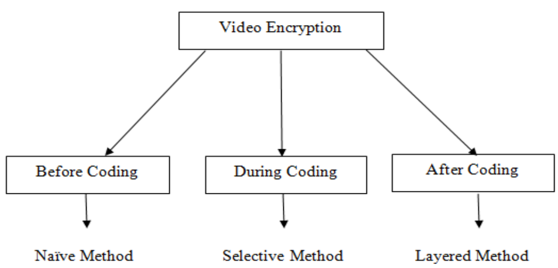


Figure 2 : Video Encryption Techniques

- *Fully Layered Encryption*: In this case the complete content of video is first compressed and then encryption is done with the use of standard algorithms like DES, RSA, AES, etc. This encryption technique is not appropriate in real time video applications because of heavy computation and slow speed.

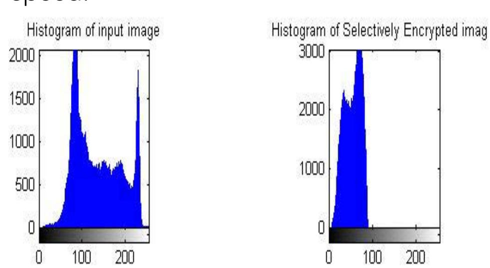


Figure 3 : Layered Encryption Histogram

Table 1 : Results of Fully Layered Method

Fields/Variables	I Frame	P Frame
No. of Frames	1	10
Time Taken Encryption	21.9	285.4
Time Taken for Encoding	71.1	216.73
Size of Frames Before Encryption & Encoding	4.52 KB	45 KB
Size of frame After Encryption & Encoding	604 Bytes	5.41 KB

- Selective Encryption: A communication encryption of many video and audio multimedia is not simply the application of established conventional encryption algorithms to their binary sequence. Current research is focused towards exploiting the format specific properties of many standard multimedia formats in order to achieve the desired performance. This is referred to as the selective encryption. This type of encryption is obviously preferred when compression and decompression algorithms can hardly keep up with the required bit rate, even when these algorithms are accelerated by a dedicated hardware. In few cases, encryption and decryption algorithms could also be accelerated by hardware. However, software implementations are often preferred due to their flexibility and low cost. Selective encryption is a technique to save computational power, overhead, speed and time. Selective encryption using chaotic map technique is used for encryption and compressing the data. The encryption process is divided into two first is to generate chaos based key and secondly, selective encryption. Also, in selective encryption the concentration is not on the image but on a single frame only which is to be encrypted and encoded after selection.

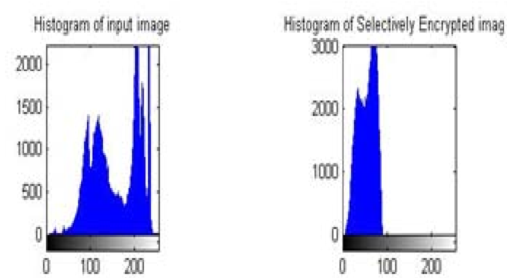


Figure 4 : Selective Encryption Histogram

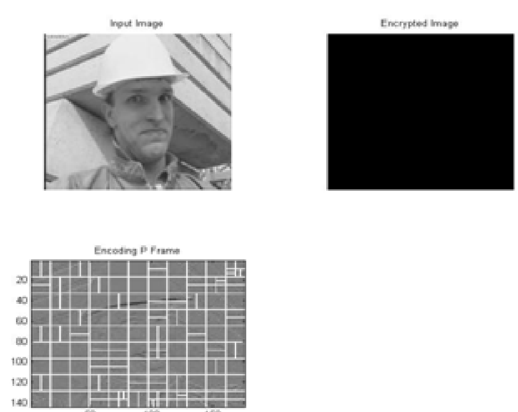


Figure 5 : Statistics of Selective Encryption

Table 2 : Results of Selective Method

Fields/Variables	I Frame	P Frame
No. of Frames	1	10
Time Taken Encryption	21.9	-
Time Taken for Encoding	71.1	248
Size of Frames Before Encryption & Encoding	4.52 KB	45 KB
Size of frame After Encryption & Encoding	8 KB	40 KB (notEncr.)

- Naïve Encryption: Encrypting the entire multimedia stream using standard encryption methods is often referred to as the naïve approach. The naïve approach is usually suitable for text, and sometimes for small bit rate audio, image and video files that are being sent over a fast dedicated channel.

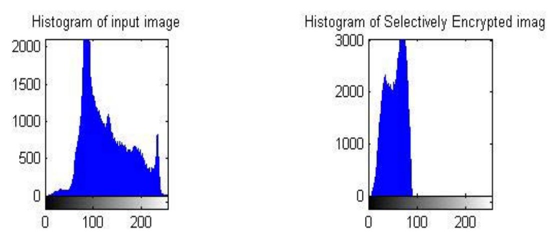


Figure 5 : P Frame Encryption Histogram

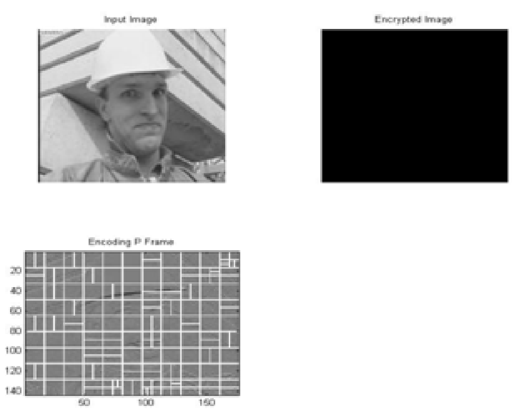


Figure 6 : Selective Naïve P Frame

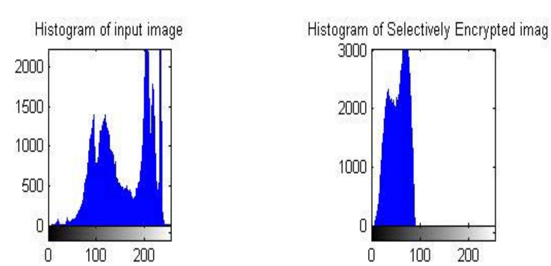


Figure 7 : Selective Naïve i Frame

Fields/Variables	I Frame	P Frame
No. of Frames	1	10
Time Taken Encryption	21.9	30
Time Taken for Encoding	43	43.9
Size of Frames Before Encryption & Encoding	4.52 KB	45 KB
Size of frame After Encryption & Encoding	4.1KB	5.49 KB

Table 3 : Results of Naïve Method

VI. Result Analysis of Video Encryption Methods

In this the results of three of the video encryption techniques are executed namely Selective, Naïve and Fully Layered Method and compared with their respective results.

The results shown above are taken after performing chaotic map based selective encryption on monochrome video.

1. In this work in Naïve encryption the normal input video is encrypted using pre-defined chaotic map based selective encryption (symmetric key).
2. In case of Selective encryption i.e. during encoding we have encrypted only the I frame and not the p frames as they are the following frames and have tried to optimize the results by implementing chaotic map based encryption.
3. For Fully layered encryption the encryption is performed on each layer of the encoded video i.e. I-Frame & P-Frames.

In figure 1, we have compared the time taken for encryption and encoding of I Frames in the Selective, Layered and Naïve Method.

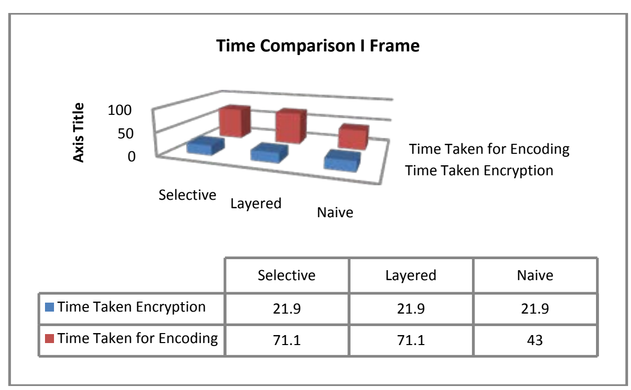
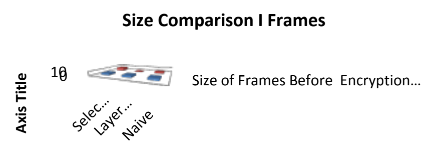


Figure 1 : Time Comparison of I Frames in Selective, Layered and Naïve

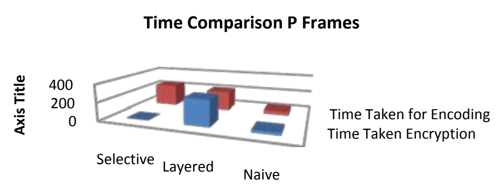
In figure 2, we have compared the size of I Frames before and after encrypted and encoded in the Selective, Layered and Naïve Method.



	Selective	Layered	Naive
Size of Frames Before Encryption &Encoding(KB)	4.52	4.52	4.52
Size of frame After Encryption &Encoding(KB)	8	0.59	4.1

Figure 2 : Size Comparison of I Frames in Selective, Layered and Naïve

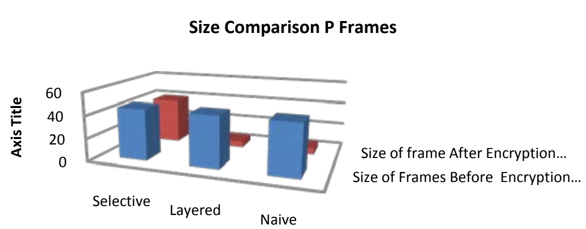
In figure 3, we have compared the time taken for encryption and encoding of P Frames in the Selective, Layered and Naïve Method.



	Selective	Layered	Naive
Time Taken Encryption	0	285.4	30
Time Taken for Encoding	248	216.73	43.9

Figure 3 : Time Comparison of P Frames in Selective, Layered and Naïve

In figure 4, we have compared the size of P Frames before and after encrypted and encoded in the Selective, Layered and Naïve Method.



	Selective	Layered	Naive
Size of Frames Before Encryption &Encoding(KB)	45	45	45
Size of frame After Encryption &Encoding(KB)	40	5.41	5.49

Figure 4 : Size Comparison of P Frames in Selective, Layered and Naïve

VII. Conclusion & Future Work

The H.264/AVC technology is designed to support the coding of video for a wide variety of applications. In addition to this H.264/AVC enabling efficient compression of digital video, it supports error/loss resilience, random-access operation, "trick-mode" operation, region-of-interest preferential coding, stereo-view indicators, film-grain analysis/synthesis processing, and a variety of additional capabilities.

Further work is underway to add enhanced application capabilities for scalable and multi-view/three-dimensional video coding.

In this paper the comparative analysis of mainly three video encryption schemes is being performed using H.264/AVC. And the video encryption schemes will be analyzed to observe the percentage of encryption in H.264/AVC and to determine the delay in transmission of video after encryption, using MATLAB and Image Processing Tool.

Analysis of results prove that naïve encryption is the best as it takes less time and encodes the video up to the minimum size. Though the selective encryption takes lesser time but its encoding space is more and encryption time is less, while layered requires more time for encryption and more time for encoding. Selective requires bit more time for encryption then naïve at the same time selective encodes video less.

Selective gives a benefit that its decoding process will be shorter as p frames are not be decrypted after decoding, while in case of naïve decoding time will be higher as the decoding time will involve both decryption and decoding process, also selective helps in ensuring the content of the video more readable for the end user, while in case of naïve decoding process can also lead to loss in data.

This work has been performed on monochrome H.264 video and this can be extended to the RGB and YUV H.264 video as a future research work. In which the above three video encryption schemes (Selective, Naïve and Layered) will be performed using H.264/AVC. And the video encryption schemes will be analyzed to observe the percentage of encryption in H.264/AVC and to determine the delay in transmission of video after encryption, using MATLAB Image and Video Processing Tool. The above encryption schemes are performed using chaotic map based and the same can also be performed using block based method as a future work.

New encryption tools can also be designed with the help of MATLAB, to reduce the encryption time.

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Global Journal of Computer Science and Technology
Graphics & Vision
Volume 13 Issue 9 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Contemporary Affirmation of SPIHT Improvements in Image Coding

By Ms. Trupti Ahir & Dr.R.V.S.Satyanarayana
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Keywords: DWT, image compression, memory requirement, SPIHT, wavelet transforms.

GJCST-F Classification: I.4

CONTEMPORARYAFFIRMATIONOFSPIHTIMPROVEMENTSINIMAGECODING

Strictly as per the compliance and regulations of:

Contemporary Affirmation of SPIHT Improvements in Image Coding

Ms. Trupti Ahir [α] & Dr. R.V.S. Satyanarayana [σ]

Abstract- Set partitioning in hierarchal trees (SPIHT) is actually a widely-used compression algorithm for wavelet altered images. On most algorithms developed, SPIHT algorithm from the time its introduction in 1996 for image compression has got lots of interest. Though SPIHT is considerably simpler and efficient than several present compression methods since it's a completely inserted codec, provides good image quality, large PSNR, optimized for modern image transmission, efficient conjunction with error defense, form information on demand and hence element powerful error correction decreases from starting to finish but still it has some downsides that need to be taken away for its better use therefore since its development it has experienced many adjustments in its original model. This document presents a survey on several different improvements in SPIHT in certain fields as velocity, redundancy, quality, error resilience, sophistication, and compression ratio and memory requirement.

Keywords: DWT, image compression, memory requirement, SPIHT, wavelet transforms.

I. Introduction

Wavelet-based image coding as SPIHT offered by Said and Pearlman in 1996 is widely used in the field of image compression than other methods because of its large firmness performance and many other features [1]. These calculations have embedded coding enabling simple bit rate control with progressive transmission of information to get a wavelet transformed image. Also it's a completely embedded codec, offers great image quality, high PSNR, optimized for progressive picture transmission, efficient combination with error protection, variety information on demand and therefore element powerful error correction diminishes from beginning to end. It's another advantage that we can download just little element of record with a lot more usable outcomes and create very streamlined output bit stream with large bit variation and no additional entropy code required. In addition, it has skill of modern image transmission [2]. SPIHT though having many advantages over other firmness methods still requires many modifications because it has many disadvantages as one bit error introduce important image aberration depending upon its location. It's bit synchronization house as loss in a single bit can result in finish misinterpretation from decoder aspect.

It implicitly finds job of considerable coefficients therefore hard to perform operation on compressed information that's completely dependent upon position of significant change values. So various improvements to SPIHT is performed in prior years as in relation to storage requirement, redundancy, quality, error resilience, complexity, and pace and compression ratio. This document presents various developments to SPIHT in previous years from way back its progression in 1996 in terms of above factors.

The business of the papers is as follows: Part II covers the original SPIHT algorithm. In area III, various modifications done to SPIHT are introduced and also the document is concluded with section IV.

II. Principles Behind Compression

A feature of the majority of images is the fact that the nearby pixels are related and consequently feature redundant information. The foremost job then is to locate less linked representation of the Image. Two fundamental parts of compression are irrelevancy and redundancy reduction. Redundancy reduction aims at eliminating duplication in the signal source (image/video).Irrelevancy reduction omits sections of the signal that won't be seen from the signal receiver namely Human Visual System (HVS).In general three sorts of redundancy can be identified

- Spatial Redundancy or connection between neighboring pixel.
- Spectral redundancy or connection between dissimilar color planes or spectral bands.
- Temporal redundancy or connection between adjacent frames in a succession of images (in video applications).

Image compression research aims at lessening the amount of pieces needed to represent an image by removing the spatial and spectral redundancies around really possible. In numerous areas, digitized images are changing normal analogue images as photograph or x-rays. The quantity of data required to describe such pictures greatly slow transmitting and makes storage excessively expensive. The info contained in images must, consequently, be compressed by extracting only obvious elements, which

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e-mail: v.s.ravinutala@gmail.com

Table 1 : Multimedia Data

Multimedia Data	Size Per duration	Bits/pixel (or) Bits/sample	Uncom pressed size (B-bytes)	Transmission Bandwidth (b-bits)	Trans Mission Time (28.8K
Page of text	11" X 8.5"	Varying resolution	4-8 KB	32-64 Kb/page	1.1-2.2 Secs
Telephone Quality speech	10 Secs	8 bps	80 KB	64 Kb/Sec	22.2 Secs
Grayscale image	512X512	8 bpp	262 KB	2.1 Mb/image	1min 13 Secs
Color Image	512X512	24 bpp	786 KB	6.29 Mb/image	3min 39Secs.
Medical image	2048 X 2048	12 bpp	5.16 MB	41.3 Mb/image	23min 54Secs

are subsequently secured. The quantity of data involved is so lowered well. The fundamental goal of image compression would lower the bit-rate for transmitting or storage while preserving a suitable fidelity or image quality.

Some of the most successful applications of wavelet techniques is transform based image compression (also called coding). Whilst the personality of the wavelet decomposition results in superior energy compaction and perceptual quality of the decompressed image, the overlapping feature of the wavelet change relieves blocking items. What's More, the multi resolution transform domain means that wavelet compression methods weaken a lot more beautifully than block DCT methods since the compression percentage increases. Big smooth areas of an image may be displayed with hardly any bits), because a wavelet basis consists of functions with both brief support (for high frequencies) and extended support (for low-frequencies, and depth added where it is desired [27].

Wavelet based coding [27] provides substantial developments in image quality at higher compression ratios. In the last several years, a variety of strong and innovative wavelet-based techniques for image compression, as discussed later, were created and implemented. On account of the numerous advantages, wavelet- based compression algorithms are the suitable applicants for the new JPEG 2000 standard [34].

The loss of information is launched by the quantization stage which purposefully denies less important parts of the image information. Because of their exceptional energy compaction properties and messages together with the human visual system, wavelet compression techniques have created superior objective and subjective outcomes [4].

With wavelets, a compaction speed as high as 1:300 is achievable [22]. Wavelet compression allows the integration of numerous compression techniques into one formula. With loss-less compression, the initial image is restored exactly after decompression. Unfortunately, with pictures of natural scenes, it is seldom feasible to obtain error free compression at a rate beyond 2:1 [22]. Much higher compression ratios could be obtained if some problem, which is normally hard to see, is enabled between the image and also the first image.

This is lossy compression. In many circumstances, it isn't needed as well as desired there be error free reproduction of the first image. Such a case, the modest number of problem introduced by lossy compression may be acceptable. Lossy compression can also be okay in rapid transmission of still images over the Web [22]. Over the past couple of years, various novel and sophisticated wavelet-based image coding schemes are created. These include Embedded Zero tree Wavelet (EZW) [13], Set-Partitioning in Hierarchical Trees (SPIHT) [1], Set Partitioned Embedded bloCK coder (SPECK) [2], Wavelet Difference Reduction (WDR)[28], Adaptively Scanned Wavelet Difference Reduction (ASWDR) [29], Space -Frequency Quantization (SFQ) [42], Compression with Reversible Embedded Wavelet (CREW) [3], Embedded Predictive Wavelet Image Coder (EPWIC) [5], Embedded Block Coding with Optimized Truncation (EBCOT) [25], and Stack- Run (SR) [26]. This listing is by no means exhaustive and many more such innovative techniques are getting developed. A couple of the algorithms are shortly discussed here.

III. Set Partitioning in Hierarchical trees (Spiht) Coding

The SPIHT coder [1], [2] is a very processed variant of the EZW algorithm and it is a strong image compression algorithm that generates an embedded bit stream from which the best reconstructed pictures in the mean square error sense can be extracted at different bit rates. Some of the greatest results--maximum PSNR values for specified compression ratios -- for a broad variety of images have been acquired with SPIHT. Hence, it's become the benchmark state - of – the art algorithm for image compression [22].

1. *Set partitioning sorting algorithm*

One of many principal characteristics of the SPIHT algorithm is that the ordering information is not clearly transmitted. Instead, it is based in the reality the execution path of any criteria is explained by the results of the comparisons of its own branching factors. So, if the encoder and decoder have the same working criteria, then the decoder can replicate the encoder's performance route when it receives the outcome of the size comparisons, as well as the order information could be restored from the execution path.

One important reality in the design of the working algorithm is that there is no requirement type all coefficients. Actually, an algorithm which merely selects

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the coefficients such that $2^n \le |c_{i,j}| \le 2^{n+1}$, with n decremented in every pass. Given n, if $|c_{i,j}| \ge 2^n$ then the coefficient is said to be considerable; otherwise it is called inconsequential .The sorting algorithm divides the sets of pixels into separation subsets T_m and executes the magnitude test.

$$2^n \le \max_{(i,j)\varepsilon T_m} \{|c_{i,j}|\} \ge 2^n$$

If the decoder receives a "no" as that response, that is the subset is insignificant, then it recognized that all coefficients in T_m are insignificant. If the response is "yes", that is the subset is significant, then a confident rule shared by the decoder and encoder is used to separation T_m into new subsets and the importance test is then applied to the new subsets. This set distribution process continues awaiting the magnitude test is done to all single organize significant subsets in order to identify each important coefficient.

To lower the amount of size comparisons, a set-partitioning rule which utilizes an expected ordering within the structure defined by the sub-band pyramid, is used. The object is to make new partitions such that sub-sets anticipated to be insignificant contain a significant number of components, and element is contained only one by subsets expected to be significant.

The relationship between size comparisons and information bits is provided by the significance function

$$S_n(T) = \{1, \max_{(i,j)\varepsilon T_m} \{|c_{i,j}|\} \ge 2^n$$

$$0,\text{otherwise}$$

2. *Spatial orientation trees*

Typically, all of the image's energy is focused in the lower frequency components. Consequently, the variance decreases as you move from the highest to the lowest of the sub-band pyramid. There's a spatial self similarity between sub bands, and also the coefficients are anticipated to get better magnitude-ordered as you move downward in the pyramid following same spatial orientation.

A tree structure, called spatial orientation tree, naturally identifies the spatial connection to the hierarchical pyramid.

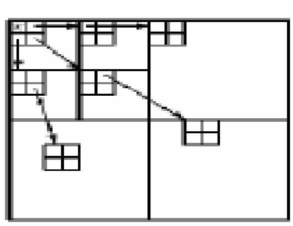

Figure 1 : Parent -offspring dependencies in spatial orientation tree

Exhibits how a spatial orientation tree is defined in a chart built with recursive four-band splitting. Each node of the tree refers to some pixel, and it is identified by the pixel coordinate. Its direct descendants (offspring) match the pixels of the same spatial positioning in the next better degree of the pyramid. The tree is defined in such a manner that each node has either no offspring or four offspring's, which always form a group of 2X2 adjoining pixels. The pixels in the maximum degree of the chart are the shrub roots and are additionally gathered in 2X2 adjacent pixels. But, their offspring branching is distinct, and in each group one (suggested by the star in Fig) doesn't have any descendants. Parts of the spatial orientation trees serve since the partitioning subsets in the searching.

With these specific criteria the speed might be precisely controlled as the inherited info is formed of single parts. The encoder may halt at a desired distortion worth and estimate the progressive distortion reduction.

In the algorithm all branching circumstances based on the importance data S_n, which can only be intended with the knowledge of $c_{i,j}$ are output by the encoder. Thus, to obtain the desirable decoder's criteria, which duplicates the encoder's performance path because it types the important coefficients, the words output by input within the formula must be replaced. If the coordinates of the significant coefficients are added to the end-of the LSP, in other words, the coefficients directed by the coordinates in the LSP are categorized the ordering info is recovered. But whenever the decoder inputs information, its three control databases (LIS, Top, and LSP) are just like those employed by the encoder at the moment it outputs that information, which means that the decoder indeed recovers the order in the execution path. It isn't difficult to see that with this plan decoding and code have the same computational complexity.

An added task achieved by decoder is really to update the reconstructed image. For the worth of n each time a co-ordinate is transferred to the LSP, it is known that $2^n \le |c_{i,j}| \le 2^{n+1}$. So, the decoder uses that in sequence, plus the sign bit that is input just after the addition in the LSP, to set $|c_{i,j}| = \pm 1.5 * 2^n$. Similarly, through the refinement pass the decoder adds or subtracts 2^{n-1} to $c_{i,j}$ when it inputs the bits of the binary illustration of $|c_{i,j}|$. In this manner the distortion progressively decreases through both the sorting and refinement passes.

3. *Features of SPIHT*

The SPIHT method is not a easy extension of traditional methods for image compression, and signifys an important advance in the field. The technique provides the following:

- Good image excellence, high PSNR, particularly for color images;
- It is optimized for progressive image broadcast;
- Produces a entirely embedded coded file;
- Effortless quantization algorithm;
- Fast coding/decoding (practically symmetric);
- Has wide applications, absolutely adaptive;
- Can be worn for lossless compression.
- Can code to accurate bit rate or distortion;
- Efficient grouping with error protection.

What makes SPIHT really excellent is that it yields all those qualities concurrently.

Table 2 gives the Compression ratio and PSNR results for SPIHT algorithm. It may be observed the compression ratio increase, once the levels of decomposition are increased. This is because, when the degree of decomposition is increased, coefficients with higher magnitude focus largely in the main levels. Also the majority of the coefficients may have reduced magnitudes. These coefficients require just less number of parts to be transmitted. Hence the compression ratio may improve when decomposition level is raised. However, the resolution of the reconstructed image will reduce for higher decomposition levels.

The perceptual image quality, however, isn't guaranteed to be optimal, as seen from Fig. 2, because the developer isn't made to expressly consider the human visual system (HVS) characteristics. Substantial HVS research has shown there are three perceptually important task regions within an image: smooth, border, and textured or detailed regions [20]. By integrating the susceptibility of the HVS to these areas in image compression techniques including SPIHT, the perceptual quality of the pictures might be improved at all bit rates.

Efficiency of the algorithm can be enhanced by entropy- coding its output, but at the expenditure of a superior coding/decoding time. On the other hand, the consequence values are not equally probable, and nearby a statistical dependence connecting $S_n(i, j)$ and $S_n(D(i, j))$ and also connecting the significance of adjacent pixels.

Table 1: Compression ratio & PSNR Results using SPIHT for Lena 256 x 256

Lena	Level	Bitplans Discarded	Cr	Psnr
256x256	3	3	6.57	31.28
256x256	3	5	13.03	26.81
256x256	4	3	9.44	29.00
256x256	4	5	28.38	25.87
256x256	5	3	10.38	26.76
256x256	5	5	38.94	24.66

Table 2 : Compression ratio & PSNR Results for Barbara

Barbara	Level	Bitplanes Discarded	Cr	Psnr
256x256	3	3	4.92	28.01
256x256	3	5	12.83	23.76
256x256	4	3	6.32	26.67
256x256	4	5	28.07	23.11
256x256	5	3	6.73	25.68
256x256	5	5	38.77	22.58

Table 3 : Compression ratio & PSNR Results for cameraman

Camera	Level	Bitplanes Discarded	Cr	Psnr
256x256	3	3	5.3053	29.66
256x256	3	5	11.5411	25.81
256x256	4	3	6.3262	26.67
256x256	4	5	22.3606	25.17
256x256	5	3	7.9141	27.36
256x256	5	5	29.3538	24.70

(a) (b) (c)

Figure 2 : SPIHT results (a) Original image (b) levels of decomposition=3, 0.7 bpp (c) levels of decomposition= 9, 0.1 bpp

IV. SPIHT in Image Compression

SPIHT is a very powerful image compression technique released in 1996. SPIHT is an entirely embedded wavelet coding algorithm that gradually refines the most significant coefficients in organize of decreasing energy levels.

It is an advanced version of Embedded Zero Tree Wavelet (EZW) developer predicated on building of coefficient trees and effective approximations that can be put into place as bit plane running. Due to its consecutive-approximation character, it really is SNR scalable, even though at the expense of sacrificing spatial scalability. SPIHT includes two concepts: transferring the most significant bits first and buying the coefficients by magnitude. LIS, LSP [1]. LIP is listing of minor pixels which retailers these pixels which are insignificant in comparison to certain tolerance. LIS is listing of insignificant sets having those sets who's each pixel is below some specific limit. LSP is list of significant pixels containing those pixels that are significant in comparison with specific limit. If it's worth is greater than or equal to specific limit a pixel is substantial.

Another type of SPIHT, no list SPIHT was introduced suitable for fast and easy components implementation. Rather than lists, a state desk with nibble per coefficient keeps track of data and set partitions protected. NLS sparsely mark chosen descendent nodes of minor trees such a manner that big groups of predictably insignificant pixels are easily identified and skipped during coding process. The image data is saved in an one dimensional recursive zig zag assortment for algorithmic simplicity and computational performance. Functionality of NLS is virtually identical to SPIHT. The initial SPIHT launched has several drawbacks and thus numerous are improvements are complete inside.

V. Contemporary Affirmation of Recent Modifications in Spiht

SPIHT method though having many advantages because it's a completely embedded codec, offers great image quality, large PSNR, optimized for modern picture transmission, effective conjunction with error safety, variety info on demand and hence requirement of strong error correction diminishes from starting to finish. It has another edge that obtain just small section of record can be saved with considerably more usable results and create very streamlined result bit stream with big bit variation and no added entropy code required. In addition, it has skill of progressive image transmission.

But still it has many disadvantages as significant image distortion is introduced by a single bit error depending upon its location. It's bit synchronization house as leak in bit can result in complete misinterpretation from decoder aspect. It implicitly situates position of significant coefficients so hard to do operation on compressed data which is wholly dependent upon position of significant transform values. Therefore various developments to SPIHT is performed in prior years as in relation to quality, redundancy, speed, error resilience, complexity, storage requirement, and compression ratio.

Advancement in rate was made for multi-spectral images by an formula released by Minghe, Cuixiang[3]. This algorithm comprises a whole lot of unnecessary search, greatly reducing encoding rate in addition to decreasing the demand of period and area. As a way to solve the problem of velocity, the writers released a fast lookup algorithm that reads the wavelet coefficient matrix merely once to determine the significance of all D(i,j) and L(i,j) needed during the performance of SPIHT. Another formula, Block-Established Pass-Parallel SPIHT [4] was introduced that decomposes a wavelet transformed image into 4 * 4 blocks and simultaneously encodes all the pieces in a bit plane of a 4 * 4 prevent.

The pre calculation of the flow length of every move enables the concurrent and pipelined delivery of these three passes by a decoder but in addition not only an encoder. The change of the processing order somewhat degrades the compression performance and hence PSNR decreases but increases speed.

With regard to decreasing redundancy, An Embedded image compression using differential code and marketing [5] is suggested. For reducing the redundancy one of the coefficients during coding within the wavelet-area, differential system is proposed. In the standard quantization of wavelet coefficients, the sub-band depending on the framework of modeling the chance of the statistical characteristics based on feature of the coefficients' submission in sub-band, working pass is altered and differential process is optimized, to be able to minimize the redundancy coding in each subband. The image code outcome, calculated by certain threshold, demonstrate that through differential marketing, the speed of compression get greater, and quality of rebuilt image have also been raised substantially.

Primarily, a brand new kind of shrub with digital root was introduced to hold more wavelet coefficients. Secondly, an extra matrix was used to hasten the thinking of the meaning of trees. Third, a pre-processing is done to smooth the coefficients before SPIHT coding. Fourth, some expected bits are disregarded from your encoder result by rearranging the code procedure. Finally, the quantization is beginning from the middle-point in line with the figures. Experiments demonstrate these developments raise PSNR by up to 5 dB at very low rates, along with the typical improvement at 0.2 - one bpp is about 0.5 dB for the standard test images used. Computation complexity is also, decreased.

Yet another innovative scheme to enhance the robustness of SPIHT based color picture coder for transmitting over noisy channels is suggested [7]. Within this structure, the SPIHT bit streams are re-arranged according to their spatial (square block) representation without loss in coding efficiency. A group of blocks, called slice are carried independently. The first erroneous block within the piece is detected by examining error checking problems while decoding the image. Till a viable solution is found whether any transmission problem is detected, a collection of bit skipping and recurrent decoding procedure is performed in the part of the bit-stream. The simulation results demonstrate that vital quality improvement is reached through this system. Another effort to improve the grade of picture is put by Tung, Chen [8] to enhance the progressive image transmission (PIT) of SPIHT. The unique strategy about the progressive image transmission is that SPIHT regards the bit channels acquired from every truncation as a transmission in every stage; in every truncation, SPIHT not only improve the substantial coefficients from this truncation but additionally re-refine the significant coefficients extracted from the previous phases. The approach introduced within this document is that, in certain transmission phases, the refined and redefined bit streams will never be sent immediately and will soon be replaced by the bit streams based on the significant coefficients of the truncation. These purified bit streams will probably be sent late. According to the results, this approach gets the better image-quality in every PIT phase than the original SPIHT.

An effective source and channel programming for progressive image broadcast over noisy channels [9] is proposed. It was shown that with a small number of additional redundancies, we are able to incorporate error-detection into arithmetic coding. This system is utilized to provide error detection and also to improve the channel decoder functionality by means of a combined source channel decoding structure. Moreover, au Unequal Problem Protection (UEP) process which employs error detection coding only into a bit, influenced by error distribution is introduced. Yet another algorithm for error resilience commonly referred as Color SPIHT (CSPIHT) is created [10] to encode and quantize wavelet coefficients and have exceptional speed distortion feature within the sound free environments. Yet, in presence of noise it's very delicate towards the bit problems. It was observed that parts have different amount of vulnerability of mistakes. The error in a number of the bits (critical pieces) causes the serious degradation while mistakes in other bits (non-critical bits) have minimal effect within the reconstructed images. Within this document, unequal error protection (UEP) scheme is proposed, in which within each bit plane, the bits are re-organized according to their susceptibility of errors and then critical bits are protected asymmetrically using RCPC codes.

The defense is decreased for higher bit-planes, by changing the puncturing rate. The simulation outcomes demonstrate a marked improvement of 5-15 dB within the characteristic of duplicated images, in comparison with the identical error protection (EEP) and unguarded CSPIHT bitstream. Lately yet another technique for error resilience is proposed by Xin and Pearlman Li [11], in which a novel data representation known as the progressive importance map for error -resilient SPC (significant map coding) is proposed. It buildings the value guide (sig-map) into two components: a high level summation sig-map and also a low-level supporting sig-map (comp-sig-map). This kind of structured representation of the sig-map enables us to enhance its error-resilient property at the cost of only a minimal compromise in compression effectiveness. Simulation results have revealed the prog-sig-map may reach highly-competitive rate distortion efficiency for binary symmetric routes while maintaining low computational complexity.

A variation of SPIHT, called no list SPIHT (NLS) [12] which functions without linked lists and has predetermined memory requirements is proposed for reducing the complexity. Here instead of lists a state table with nibble per coefficient keeps track of encoded information and set partitions. Image information is stored in one dimensional recursive zig zag variety for computational effectiveness and ease.

Yet another algorithm suggested by Oliver, Malumbres [13] changes sorting process of wavelet coefficients, replacement for the first string table construction with a single dimensional array, alter significant judgment foundation of wavelet coefficients. The outcomes of studies suggest storage space was preserved too and the intricacy of the criteria was reduced.

Yet another formula is suggested for wavelet based image compression by using zero tree theory in the wavelet decomposed image [14]. The algorithm has a large edge over previously developed wavelet based image compression algorithms as it utilizes intra and inter band correlation simultaneously. Besides the advancement in code performance, the algorithm also uses significantly lower storage for calculations and coding thus reducing the complexity of the formula.
The striking feature is move independent coding that makes it appropriate for use to error protection schemes and makes it less susceptible to data reduction because of noisy communication channel. The formula codes each of the color bands independently thereby enabling differential coding for the color information.

A document suggested by Zhang, and Hu [15] deals with the implementation of SPIHT algorithm using DSP processor. As a way to ease the execution and improve the codec's operation, some relative issues are discussed, such as the optimization of application construction to hasten the wavelet decomposition. SPIHT's large memory requirement is actually a major drawback for hardware implementation so in this paper the original SPIHT algorithm is altered by presenting two new concepts amount of problem pieces and absolute zero-tree. As A Result, the memory cost is dramatically reduced. A fresh technique is introduced to handle the coding process by number of error bits. Experimental results reveal the implementation meets frequent demand of real -time video coding and is demonstrated to be a useful and efficient DSP solution.

When it comes to storage requirement, a listless block sapling established partitioning algorithm was proposed [16] when a listless implementation of wavelet based block tree code (WBTC) algorithm of changing root block sizes is implemented. WBTC criteria enhances the picture compression efficiency of SPIHT at lower rates by efficiently coding both inter and intra scale correlation using block trees. It makes good use of three bought auxiliary databases, although WBTC decreases the storage requirement by using prevent trees compared to SPIHT. This characteristic makes WBTC unwanted for hardware implementation; since it requires lots of storage management when the list nodes grow exponentially on every pass. The projected listless implementation of WBTC formula uses specific markers rather than lists. The proposed algorithm is joined with DCT and discrete wavelet transform (DWT) to show its superiority over DCT and DWT based set programmers, including JPEG 2000 at lower prices. The efficiency on most of the standard test images is practically identical to WBTC, and outperforms SPIHT by a wide margin particularly at lower bit rates.

In medical imaging Wang [17] suggested an algorithm to realize high compression ration and therefore high PSNR. First, within the larger bit-plane, this formula only quantizes the wavelet coefficients within the bottom frequency sub band. Then it quantizes other ones by standard scalar. Test results demonstrate the proposed scheme improves the performance of wavelet image coders. In particular, it'll improve coding gain within the low bit rate image coding.

Another algorithm suggested by Zhu and Lawson [18], introduced two techniques. One would be to make use of a new type of tree, to hold as several wavelet coefficients as possible during initialization. The other is to omit the predictable code symbols for the importance indicator of the coefficient sets or individual coefficients. While the second favors fairly large bit rate image code, the first development raises the compression proportion of low bit rate image code.

The enactment of the SPIHT is re designed to include both improvements. The computation complexity is not increased on utilizing these developments. Simulation results reveal substantial performance increase of the Developments.

The SPIHT algorithm has drawn great attention lately as a method for picture coding. Not only does this offer objective and subjective performance, it's also simple and efficient. An enhanced lossless image compression which relies on SPIHT is launched [19]. The most important modification within this algorithm is the addition of a straightforward modification to the group of type a using a new evaluation to the brink. The tests show that this improvement raises the operation of lossless image coding for a great many standard test images.

Yet another algorithm for high-performance programs like medical and satellite imaging is offered by [20] in which a brand new lossless hybrid algorithm based on simple selective scan order with Bit Plane Slicing technique is offered for lossless Image compression of limited bits/pixel images, for example medical images, satellite images and additional still images common on the planet. Effective coding is reached by modified Huffman code and run length.

This strategy is combined with efficient selective scan order for entire picture in one pass-through. The brand new hybrid algorithm achieves good compression speed, compared to the present techniques of coding with various test images.

VI. Conclusion

This document presents different changes done to original SPIHT introduced by Said and Pearlman in 1996. It's observed that the SPIHT algorithm is an extremely efficient and widely employed technique since it offers many advantages as it's a really simple and fully embedded codec with progressive image transmission and powerful error correction methods. Additionally it may be coupled with DCT and DWT for higher compression efficiency. Although having several advantages, it still needs lots of developments to be performed in it to be able to increase speed which lesser execution period, redundancy, high quality(high peak signal-to noise ratio), error resilience, lesser complexity, decrease in storage requirement and high compression ratio. SPIHT may even be applied for lossless image compression for greater image quality I.e large PSNR without much drop-off in compression ratio. Therefore numerous enhancements to SPIHT are done based on the requirement. Major improvements are finished lately in the areas of error resilience speed and memory necessity.

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Global Journal of Computer Science and Technology
Graphics & Vision
Volume 13 Issue 9 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Probabilistic Color Image Classifier based on Volumetric Robust Features

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Abstract- Need of more sophisticated methods to handle color images becomes higher due to the usage, size and volume of images. To retrieve and index the color images there must be a proper and efficient indexing and classification method to reduce the processing time, false indexing and increase the efficiency of classification and grouping. We propose a new probabilistic model for the classification of color images using volumetric robust features which represents the color and intensity values of an region. The image has been split into number of images using box methods to generate integral image. The generated integral image is used to compute the interest point and the interest point represent the volumetric feature of an integral image. With the set of interest points computed for a source image, we compute the probability value of other set of interest points trained for each class to come up with the higher probability to identify the class of the input image. The proposed method has higher efficiency and evaluated with 2000 images as data set where 70 % has been used for training and 30% as test set.

Index Terms: *robust features, image classification, probabilistic classifier.*

GJCST-F Classification: *I.4.6*

PROBABILISTIC COLOR IMAGE CLASSIFIER BASED ON VOLUMETRIC ROBUST FEATURES

Strictly as per the compliance and regulations of:

Probabilistic Color Image Classifier based on Volumetric Robust Features

V.Padmanabhan [α] & Dr. M.Prabakaran [σ]

Abstract- Need of more sophisticated methods to handle color images becomes higher due to the usage, size and volume of images. To retrieve and index the color images there must be a proper and efficient indexing and classification method to reduce the processing time, false indexing and increase the efficiency of classification and grouping. We propose a new probabilistic model for the classification of color images using volumetric robust features which represents the color and intensity values of an region. The image has been split into number of images using box methods to generate integral image. The generated integral image is used to compute the interest point and the interest point represent the volumetric feature of an integral image. With the set of interest points computed for a source image, we compute the probability value of other set of interest points trained for each class to come up with the higher probability to identify the class of the input image. The proposed method has higher efficiency and evaluated with 2000 images as data set where 70 % has been used for training and 30% as test set.

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I. Introduction

Image information systems are becoming increasingly important with the advancements in broadband networks, high-powered workstations etc. Large collections of images are becoming available to the public, from photo collection to web pages, or even video databases. Since visual media requires large amounts of memory and computing power for processing and storage, there is a need to efficiently index and retrieve visual information from image database. In recent years, image classification has become an interesting research field in application.

A number of image features based on color and texture attributes have been reported in literature. Although quantifying their discrimination ability to classification problem has not been so easy. Among the many possible features for classification purpose, extracted from an image. We focus on robust features like color distribution, density features, region features. The reason why we use three different features is the color distribution represent the distribution of color values throughout the image and region feature represent the features spread on a particular region where the density feature represent the feature density on each region.

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The image classification depends on variety of feature where the classification accuracy sit on the type of feature we used. The features of the image are extracted to compute some value which is called feature vector to represent the image in huge space. The classification is performed by computing any form of relevancy with set of feature vectors in the literature. There are many features has been used in the literature to compute the distance for classification.

The probabilistic classifier is one where there are more number of classes with large data set and basically the color images has more values and features. Classifying the color images are not an easy task, the probabilistic classifier computes the probability of input image which tells the relationship of image towards a class in probability manner. In most cases the probability based classifier has produced efficient results with less time complexity.

Efficient indexing and retrieval of large number of color images, classification plays an important and challenging role. The main focus of this research work is devoted to finding suitable representation for images and classification generally requires comparison of images depending on the certain useful features.

II. Background

There are various methods have been discussed and we explore few of the methods for understanding and relate to our problem.

Efficient HIK SVM Learning for Image Classification [5], presents contributions concerning HIK SVM for image classification. First, we propose intersection coordinate descent (ICD), a deterministic and scalable HIK SVM solver. ICD is much faster than, and has similar accuracies to, general purpose SVM solvers and other fast HIK SVM training methods. We also extend ICD to the efficient training of a broader family of kernels. Second, we show an important empirical observation that ICD is not sensitive to the C parameter in SVM, and we provide some theoretical analyses to explain this observation. ICD achieves high accuracies in many problems, using its default parameters. This is an attractive property for practitioners, because many image processing tasks are too large to choose SVM parameters using cross-validation.

Improving Color Constancy Using Indoor–Outdoor Image Classification [6], designed different strategies for the selection and the tuning of the most appropriate algorithm (or combination of algorithms) for each class. We also considered the adoption of an uncertainty class which corresponds to the images where the indoor/outdoor classifier is not confident enough. The illuminant estimation algorithms considered here are derived from the framework recently proposed by Van de Weijer and Gevers. We present a procedure to automatically tune the algorithms' parameters.

Iris image classification based on color information [7], we propose a novel color feature for iris classification, named as iris color Texton using RGB, HSI and lαβ color spaces. Extensive experiments are performed on three databases. The proposed iris color Texton shows advantages in iris image classification based on color information.

Novel color HWML descriptors for scene and object image classification [8], proposed initially a new three dimensional Local Binary Patterns (3D-LBP) descriptor is proposed for color image local feature extraction. Second, three novel color HWML (HOG of Wavelet of Multiplanar LBP) descriptors are derived by computing the histogram of the orientation gradients of the Haar wavelet transformation of the original image and the 3D-LBP images. Third, the Enhanced Fisher Model (EFM) is applied for discriminatory feature extraction and the nearest neighbor classification rule is used for image classification. Finally, the Caltech 256 object categories database and the MIT scene dataset are used to show the feasibility of the proposed new methods.

Color Local Texture Features for Color Face Recognition [9], proposed color local texture features are able to exploit the discriminative information derived from spatio chromatic texture patterns of different spectral channels within a certain local face region. Furthermore, in order to maximize a complementary effect taken by using color and texture information, the opponent color texture features that capture the texture patterns of spatial interactions between spectral channels are also incorporated into the generation of CLGW and CLBP. In addition, to perform the final classification, multiple color local texture features (each corresponding to the associated color band) are combined within a feature-level fusion framework.

The most of the related methods have classification errors and to overcome the demerits we propose a new probabilistic approach using volumetric estimations.

III. Proposed Method

The proposed method has three phases namely sub image generation, interest point computation, and probabilistic image classifier. At the first stage an image is converted to set of small images, at the second stage the images intensity and color features are extracted to compute interest point and at the final stage the probability value is computed for each class for the set of interest points computed based on which the image is assigned with a class.

IV. Integral Image Generation

In order to improve matching accuracy and faster processing, we compute the integral images. The integral images are the small set of images generated using box filters which splits images into many number of sub image set. The input image is selected and number of sub images is created based on the parameters m and n. Here m and n specifies the width and height of the integral image to be generated. The value of m and n is a multiple of width and height of the image. For example for a image with size 300×300, the value of m and n will be 3×5 or 5×3 and so on.

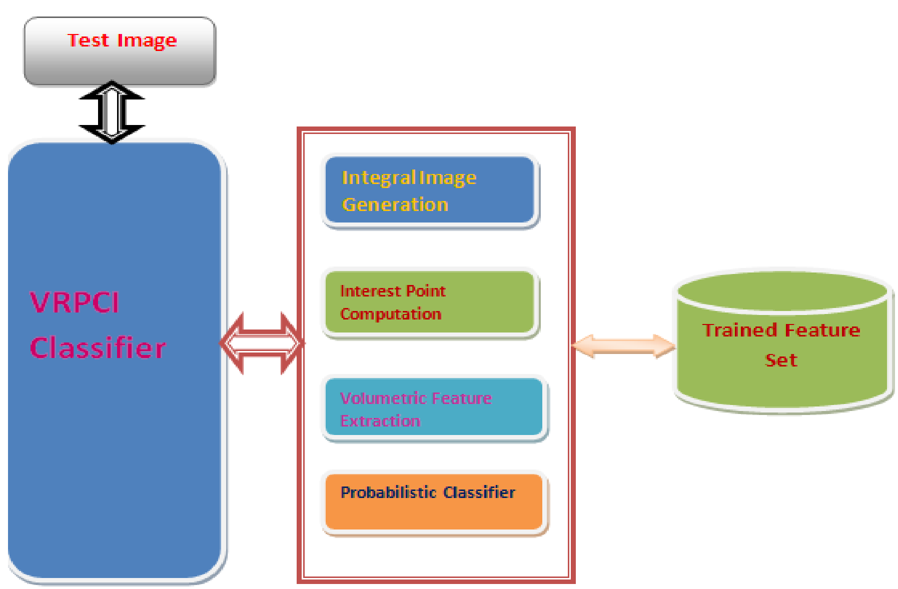

Figure1 : Proposed system architecture.

V. Interest Point Computation

The interest points are computed from generated integral image using pixel adjacency graph. For each pixel from the integral image we generate the pixel adjacency graph with the size from 3×3 to n×n to minimize the number of interest points. The overlapping interest points are dropped from execution and to reduce the execution time of the process. The interest points are computed with 64 features of the region identified. A point from the integral image will be selected based on the feature distribution around the pixel. From the constructed adjacency graph we select the pixel which has more features surrounded and will select the pixel to represent the region. The interest points are used to represent the region of an image even at different scaling and transformation or shifting.

Algorithm:

Step1: Start
Step2 : Read integral image Iimg.
Step3 : For each window w
Identify most dominating pixel $d_{i.}$
$D_{i=}$ Ô(w(Iimg)).
Compute interest point Ip.
Ip= R×(w×(Iimg/w))+ G×(w×(Iimg/w))+ B×(w×(Iimg/w)).
Add to the list IpList = ΣIp.
End
Step4 : Increase window size ws.
Step5 : Compute interest point nIp.
Step6 : If nIp£Ip
Remove Ip from list IpList.
Step7 : Stop.

VI. Volumetric Estimation

The volumetric measure of the image is computed based on the feature density measures i.e. how much the feature at a particular point is dense to represent the image region. For each integral image and interest points identified the selected pixel position is identified and we identify other pixel positions which are having similar values in that region and finds out the edges. Using the edge details we compute the volume using the width and height values.

VII. Probabilistic Classifier

With the computed set of interest points IpList, we compute the probability value for each class trained. The classifier is trained with different class of images with interest points and volume features. The computed interest point is classified with the classes available based on the probability value computed.

Algorithm:

Step1 : Start
Step2 : Read interest points IpList.
Step3 : Initialize probability set Ps.
Step4 : For each class available
For each interest points set Ips for each image Img_i
For each interest point $Ip_{i\ from}$ Ips
Compute total matches Ipm = $\Sigma Ip_i \times Ip_t$
End
End
Compute probability Pb_i = size of Ipm/size of Ip_i(Ips).
End.
Step5 : Select the class with more probability.
Step6 : Assign label with the class.
Step7 : Stop.

VIII. Results and Discussion

The proposed probabilistic volumetric robust feature based classifier has produced efficient results than other classifier. We have evaluated the proposed algorithm with different methodologies discussed earlier.

Color Space	OAA	DAG	SVM	PVRC
RGB	79	68	83	96
HSV	74	63	84	97
HVC	81	65	82	96.5

Table1 : shows the accuracy of classification with different algorithms.

IX. Conclusion

We proposed a new probabilistic model to classify the color images using volumetric robust features, which uses intensity and color values to generate the interest points using which the probability value is computed. The computed probability value is used to classify the images. The proposed method has produced better results than other classifier with low time and space complexity.

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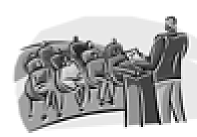

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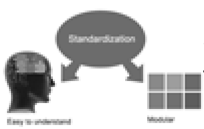
The FARSC can go through standards of OARS. You can also play vital role if you have any suggestions so that proper amendment can take place to improve the same for the benefit of entire research community.

As FARSC, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders, Auto-Responders, Email Delivery Route tracing, etc.



The FARSC will be eligible for a free application of standardization of their researches. Standardization of research will be subject to acceptability within stipulated norms as the next step after publishing in a journal. We shall depute a team of specialized research professionals who will render their services for elevating your researches to next higher level, which is worldwide open standardization.

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The FARSC is eligible to earn from sales proceeds of his/her researches/reference/review Books or literature, while publishing with Global Journals. The FARSC can decide whether he/she would like to publish his/her research in a closed manner. In this case, whenever readers purchase that individual research paper for reading, maximum 60% of its profit earned as royalty by Global Journals, will be credited to his/her bank account. The entire entitled amount will be credited to his/her bank account exceeding limit of minimum fixed balance. There is no minimum time limit for collection. The FARSC member can decide its price and we can help in making the right decision.

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The MARSC member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.

Once you are designated as MARSC, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

Auxiliary Memberships

Institutional Fellow of Open Association of Research Society (USA)-OARS (USA)

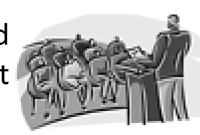
Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.
The author fees of such paper may be waived off up to 40%.



The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

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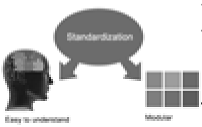

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.

The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

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- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
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- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

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The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

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(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

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- Two Column with Equal Column with of 3.38 and Gaping of .2
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- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
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You can use your own standard format also.
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1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript’s Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

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Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

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Complete support for both authors and co-author is provided.

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Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications.

Research letters: The letters are small and concise comments on previously published matters.

5. STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

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.

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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.

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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.

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

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1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish 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.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

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.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

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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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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ISSN 9754350