# Children Abnormal GAIT Classification Using Extreme Learning Machine

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***Abstract*-Analyzing human gait has earned considerable interest in recent computer vision researches, as it has immense use in deducing the physical well-being of people. Detection of unusual movement patterns can be performed using Support Vector Machines classification with T-Test pre-normalization. Support Vector Machine classifiers are powerful tools, specifically designed to solve large-scale classification problems. Almost all recent works broadly uses SVM method for gait analysis because of its remarkable learning ability. But when dealing with time complexity there exists a limitation with the SVM. As the computation cost for the SVM is high, the recently developed Extreme Learning Machine (ELM) is being used for the gait classification as a better option in this paper . ELM avoids problems like local minima, improper learning rate and over fitting commonly faced by previous iterative learning methods and completes the training very fast. The multi category classification performance of ELM with T-Test is evaluated with the Virginia gait dataset. The results indicate that ELM produces better classification accuracies with reduced training time and implementation complexity when compared to SVM.**

*Keypoints*-Extreme learning machine, Gait analysis, SVM classification.

## I. Introduction

Human gait is the way locomotion is achieved using human limbs. Different gaits are characterized by differences in limb movement patterns, overall velocity, forces, kinetic and potential energy cycles, and changes in the contact with the surface (ground, floor, etc). Early diagnosis of gait disease and rehabilitation assessment is possible with gait analysis.Most doctors diagnose gait diseases based on their own judgments by comparing many curves created by certain gait analysis system and it is inexact in many cases. In recent years, doctors gain a more objective and exact disease assessment by means of machine learning technology and this has gained much utilization of gait analysis [1].Artificial neural network (ANN) has strong non-linear learning ability, with which it is able to distinguish normal gait and diseased gait [2]. But, the ANN often gets into a local minimum and overstrains training samples which may reduce the accuracy of classifier. Also many ANN techniques are not suitable for gait analysis, as they demand high volume of data for training and it is very much time consuming in case of acquiring huge gait database. Also, this way of implementation will result in increase in the system complexity; greater computational burden and longer training time. Support Vector Machine (SVM) is widely applied in pattern recognition because of its remarkable learning ability. Begg [3] applied SVM for the gait classification of the children and the also for the elderly. Kamruzzaman [4] used SVM to distinguish the gait of children with cerebral palsy. As like the case in ANN, SVM also faces some difficulties, especially the time compatibility. Hence in order to overcome these difficulties, we propose a new training algorithm called the Extreme Learning Machine (ELM) for gait analysis in this paper . The performance of the ELM algorithm is tested using the Virginia gait dataset. For the Virginia data set, the results indicate that ELM can perform direct classification for these multi category microarray problems in a fast and efficient manner. ELM produces higher classification accuracies than those obtained by SVM with a more compact network and shorter training time in case of the Virginia data set .

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## II. Related Work

The study of human gait has created much interest in many application areas. As a result many researches emerged in recent years and of which, a few studies related to Gait classification are noted herewith.A.Bobick et.al.,[5] projected a view-based approach to the representation and recognition of human movement. The basis of the representation is a temporal template-a static vector-image where the vector value at each point is a function of the motion properties at the corresponding spatial location in an image sequence. Using aerobics exercises as a test domain, the representational power of a simple, two component versions of the templates is explored: The first value is a binary value indicating the presence of motion and the second value is a function of the regency of motion in a sequence. Then the author develops a recognition method matching temporal templates against stored instances of views of known actions. The method automatically performs temporal segmentation, is invariant to linear changes in speed, and runs in real-time on standard platforms. Ross Cutler et.al.,[6] described new techniques to detect and analyze periodic motion as seen from both a static and a moving camera. By tracking objects of interest, we compute an object's self-similarity as it evolves in time. For periodic motion, the self-similarity measure is also periodic and we

apply Time-Frequency analysis to detect and characterize the periodic motion. The periodicity is also analyzed robustly using the 2D lattice structures inherent in similarity matrices.Sheng-Wu Xiong et.al.,[7] proposed in their paper that fuzzy support vector machines based on fuzzy c-means clustering. They apply the fuzzy c-means clustering technique to each class of the training set. During the clustering with a suitable fuzziness parameter q, the more important samples, such as support vectors, become the cluster centers respectively. G.-B. Huang et.al.,[8] explained in their paper about the recently developed Extreme Learning Machine (ELM). ELM is used for direct multi category classification problems in the cancer diagnosis area. ELM avoids problems like local minima; improper learning rate and over fitting commonly faced by iterative learning methods and completes the training very fast. The authors have evaluated the multi-category classification performance of ELM on three benchmark microarray datasets for cancer diagnosis, namely, the GCM dataset, the Lung dataset and the Lymphoma dataset. The results indicate that ELM produces comparable or better classification accuracies with reduced training time and implementation complexity compared to artificial neural networks methods like conventional back-propagation ANN, Linder's SANN, and Support Vector Machine methods like SVM-OVO and Ramaswamy's SVM-OVA. ELM also achieves better accuracies for classification of individual categories.C.-K. Siew et.al.,[9] gives an idea on ELM. In this paper they presented Extreme Learning Machine (ELM) for Single-hidden Layer Feed-forward Neural-networks (SLFNs) which randomly chooses hidden nodes and analytically determines the output weights of SLFNs. The ELM avoids problems like local minima, improper learning rate and over fitting commonly faced by iterative learning methods and completes the training very fast. The author have evaluated the multi-category classification performance of ELM on five different data sets related to bioinformatics namely, the Breast Cancer Wisconsin data set, the Pima Diabetes data set, the Heart-Statlog data set, the Hepatitis data set and the Hypothyroid data set. A detailed analysis of different activation functions with varying number of neurons is also carried out which concludes that Algebraic Sigmoid function outperforms all other activation functions on these data sets. The evaluation results indicate that ELM produces better classification accuracy with reduced training time and implementation complexity compared to earlier implemented models.Ju Han et al., [16] proposed a new spatio-temporal gait representation, called the Gait Energy Image (GEI), for individual recognition by gait. Unlike other gait representations which consider gait as a sequence of templates (poses), GEI represents human motion sequence in a single image while preserving temporal information. To overcome the limitation of training templates, we propose a simple model for simulating distortion in synthetic templates and a statistical gait feature fusion approach for human recognition by gait. Experimental results show that 1) GEI is an effective and efficient gait representation and 2) the proposed recognition approach achieves highly competitive performance with respect to the published major gait recognition approaches. This paper presents a systematic and comprehensive gait recognition approach, which can work just as fine as other complex published techniques in terms of effectiveness of performance while providing all the advantages associated with the computational efficiency for real-world applications.

Davrondzhon Gafurov [17] presented an overview of biometric gait recognition is given. Depending on the way the gait data is captured, biometric gait verification and identification is categorized into three classes (MV-based, WS-based and FS-based). The primary advantage of MV based gait biometric is in being captured from the distance. The main advantage of WS-based and FS-based gait biometric is in providing unobtrusive user authentication and identification. In a multi- modal biometric system, gait helps to increase the accuracy of the system too. However, there are many factors that can negatively influence the accuracy of a gait recognition system. An investigation of these factors is very important towards developing robust systems. With respect to gait security, studies also indicated that gait biometric is robust against minimal effort impersonation attacks. However, impostors who know their closest person in the database or the gender of the users in the database can be a threat to a gait authentication system. Multi-modal biometric systems combine evidences from several biometric modalities to establish more reliable and accurate identification.

## III. Methodology

The block diagram of the proposed system is as shown in Figure 5.1. After suitable preprocessing, the Salient Gait Features are extracted and statistical based feature selection is performed using the extracted features. These selected salient gait features are then subjected to normalization and ranking methodologies followed by a classification algorithm. The ranking and normalization methodologies dealt in this chapter are Principle Component Analysis (PCA) and T-Test. The two classification algorithms discussed here are Support Vector

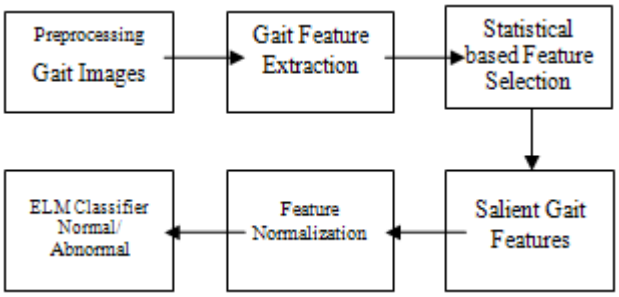


Figure1.Block Diagram of Gait Analysis using ELM

The two ranking methodology dealt in this paper are Principle Component Analysis (PCA) and T-Test. The two classification algorithm is Support Vector Machine (SVM) and Extreme Learning Machine (ELM).

1) *Short introduction of SVM*

SVM is usually used for classification problems introduced by Vapnik [10]. For binary classification, an SVM is used to find an optimal separating hyper plane (OSH) which generates a maximum margin between the two categories of data. To construct an OSH, SVM maps data into a higher dimensional feature space. SVM performs this nonlinear mapping by using a kernel function. Then, SVM constructs a linear OSH between the two categories of data in the higher feature space. Data vectors which are nearer to the OSH in the higher feature space are called support vectors (SVs) and will contain all the information required for classification. The theory of SVM can be briefed as follows [10].Consider training set $D = \{(x_j, y_i)\}_{i=1}^{L}$ with each input in x ∈ $R^n$ and an associated output $y_i \in \{-1, +1\}$. Initially,each input x is mapped into a higher dimension feature space F, by z=φ (x) via a nonlinear mapping φ: $R^n \rightarrow F$. When the data are linearly non-separable in F, there exists a vector w ∈ F and a scalar b which defines the separating hyper plane as:

$$y_i(w'.z_i + b) \geq 1 - \xi_i, \forall i \qquad (1)$$

where ξ( ≥0) are called slack variable. The hyper plane that optimally separates the data in *F* is the one that

$$minimise \frac{1}{2}.w'.w + C.$$

$$subject\ to\ y_i(w'.z_i + b) \geq 1 - \xi_i, \xi_i \geq 0, \forall i \qquad (2)$$

where *C* is called as the regularization parameter that determines the tradeoff between the maximum margin and the minimum classification error. By constructing a Lagrangian, the optimal hyper plane according to the equation (2) may be shown as the solution of

$$maximize\ W(\alpha) = \sum_{i=1}^{L} \alpha_i - \frac{1}{2}\sum_{i=1}^{L}\sum_{j=1}^{L} \alpha_i \alpha_j y_i y_j K(x_i, x_j)$$

$$subject\ to\ \sum_{i=1}^{L} y_i\, \alpha_i = 0, 0 \leq \alpha_i \leq C, \forall i \qquad (3)$$

where $\alpha_1, \ldots, \alpha_L$ are the nonnegative Lagrangian multipliers. The data points $x_i$ that correspond to $\alpha_i > 0$ are SVs. The weight vector *w* is then given by

$$w = \sum_{ieSVs} \alpha_i y_i z_i \qquad (4)$$

For any test vector $x \in R^n$ , the classification output is then given by

$$y = sign(w.z + b) = sign(\sum_{ieSVs} \alpha_i y_i K(x_i, x) + b) \qquad (5)$$

To construct an SVM classifier, a suitable kernel function and its parameters need to be chosen. So far, no analytical or empirical studies have been established to prove the superiority of one kernel over another. Hence, in this study, the following three kernel functions have been applied to build the SVM classifiers:

1) Linear kernel function, $K(x,z) = \langle x,z \rangle$ ;

2) Polynomial kernel function $K(x, z) = (\langle x, z \rangle + 1)^d$ is the degree of polynomial;

3) Radial basis function, $K(x,z) = \exp\left\{-\frac{\|x-z\|^2}{2\sigma^2}\right\}$, $\sigma$ is the width of the function.

2) *Introduction of FCM algorithm*

FCM algorithm proposed by Dunn [11] and extended by Bezdek [12] is one of the most well-known methods in cluster analysis. FCM partitions a set of *s*-dimensional vectors $X=\{X_1, X_2, \ldots, X_n\}$ into *c* clusters, where $X_j = (X_{j1}, X_{j2}, \ldots, X_{js})'$ represents the *j*th sample for *j=1,….,n.* The *i*th cluster is supposed to have a center vector $v_i = (v_{i1}, \ldots, v_{is})$ and FCM aims to determine the cluster centers $v_i$ , where $1 \leq i \leq c$. For the $j^{th}$ sample $X_j$ and the *i*th cluster center $v_i$ , there is a membership degree $u_{ij} (\in [0,1])$ indicating in which degree the sample $X_j$ belongs to the cluster center vector $v_i$ , which results in a fuzzy partition matrix $U=(u_{ij})_{nXc}$ . The objective function *J* is defined as follows:

$$J(U, v_1, \ldots, v_c, X) = \sum_{i=1}^{c}\sum_{j=1}^{n} u_{ij}^m d_{ij}^2 \qquad (6)$$

$$d_{ij} = (\sum_{k=1}^{5}(v_{ik} - x_{jk})^2)^{\frac{1}{2}} \qquad (7)$$

$$v_i = \sum_{j=1}^{n} u_{ij}^m X_j / \sum_{j=1}^{n} u_{ij}^m \qquad (8)$$

$$u_{ij} = (\sum_{k=1}^{c} (d_{ij} / d_{kj})^{\frac{2}{(m-1)}})^{-1}, m \neq 1 \qquad (9)$$

subject to $\sum_{i=1}^{c} u_{ij} = 1, \forall j = 1, \ldots, n$, where $m$ (usually set to be 2) in (11) and (12) is used to adjust the weight effect of membership values.
The FCM algorithm [13] may be described as follows:

1) Choose an integer c and a threshold value ε . Initialize the fuzzy partition matrix $U$ by $c \times n$ random numbers in the interval [0,1] ;
2) Compute $v_i (i = 1, \ldots, c)$ according to equation (8);
3) Compute all $d_{ij}$ and $u_{ij}$ according to (7) and (9) respectively. Thus update the fuzzy partition matrix $U$ by the new computed $u_{ij}$ .

4) Compute the objective function $J$. If the difference between two adjacent $J$ *values* is less than the given threshold ε , then stop. Otherwise go to step 2.

3) *SVM algorithm*

SV plays a decisive role in SVM, but non-SVs are usually inoperative. In F-SVM, the treatment is not the same for each sample. Training samples that are affirmatively not SVs are not involved in SVM, and only the samples that have a weak relationship with each cluster are chosen to be trained in SVM. By using this method, the classification accuracy can be increased and the training time may considerably be reduced[7],[14].The selection of training data is executed by the FCM which may cluster samples non-compulsively. The membership degree $u_i$ in FCM indicates with what degree a sample belongs to the cluster center vector $v_i$. If there exists one $u_{i_0} (i_0 \in \{1, \ldots, c\})$ which is bigger than a threshold λ (80% in this study), it is clearly that the sample is far from OSH and its probability to be a SV is small. So, this sample is not involved in SVM. The block diagram of F-SVM is shown in Figure 2

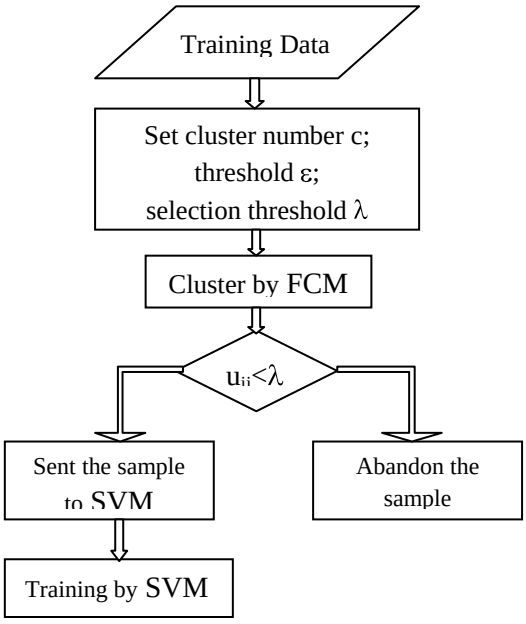


Figure 2 block diagram of the F-SVM.

The process of F-SVM is described as follows:

1) Choose a cluster number $c$ (2 in this study) and a threshold value ε for FCM. Choose a selection threshold λ (80% in this paper).
2) Cluster the training samples by applying FCM and calculate the membership degree $u_{ij}$ according to equation (9). If $u_{ij} < \lambda$, $\forall i \in \{1,\ldots,c\}$, sent the sample to SVM. Otherwise, abandon it.
3) Classify the selected training sample set using SVM. Calculate each classification output according to (7).

## IV. Extreme Learning Machine

A new learning algorithm called the Extreme Learning Machine (ELM) is a Single-hidden Layer Feed forward neural Networks (SLFNs) supervised batch learning. The output of an SLFN with ~N hidden nodes (additive or the RBF nodes) can be represented by

$$f_{\tilde{N}}(X) = \sum_{i=1}^{\tilde{N}} \beta_i G(a_i, b_i, X), \quad X \in R^n, \quad a_i \in R^n, \qquad (10)$$

where ai and bi are the learning parameters of hidden nodes and $\beta_i$ is the weight connecting the ith hidden node to the output node. $G(a_i,b_i,X)$ is the output of the ith hidden node with respect to the input x. For the additive hidden node with the activation function $g(x):R \rightarrow R$ (e.g., sigmoid or threshold), $G(a_i,b_i,X)$ is given by

$$G(ai, bi, X) = g(a_i . X + b_i), b_i \in R \qquad (11)$$

Where ai is the weight vector connecting the input layer to the ith hidden node and bi is the bias of the ith hidden node. ai .x denotes the inner product of vectors ai and x in R. For a RBF hidden node with an activation function $g(x):R \rightarrow R$(e.g., Gaussian), $G(a_i,b_i,X)$ is given by

$$G(ai, bi, X) = g\left(b_i \left|\left| x - a_i \right|\right|\right), b_i \in R^+ \qquad (12)$$

where ai and bi are the center and impact factor of the ith RBF node. Here $R^+$ indicates the set of all positive real values. The RBF network is a special case of SLFN with the RBF nodes in its hidden layer. Each RBF node has its own centroid and impact factor and its output is given by a radially symmetric function of the distance between the input and the center.The learning algorithms use a finite number of input-output samples for training. Here, we consider N arbitrary distinct samples $(x_i,t_i) \in R^n \times R^m$, where $x_i$ is an n x 1 input vector and $t_i$ is an m x 1 target vector. If an SLFN with $\tilde{N}$ hidden nodes can approximate these N samples with zero error, it then implies that there exist $\beta_i$, ai, and bi such that

$$f_{\tilde{N}}(X_j) = \sum_{i=1}^{\tilde{N}} \beta_i G(a_i, b_j, X_j) = t_j, \; j = 1, \ldots, N \qquad (13)$$

Equation () can be written compactly as

$$H\beta = T \qquad (14)$$

Where
$H(a_1, \ldots\ldots, a_{\tilde{N}}, b_1, \ldots\ldots, b_{\tilde{N}}, X_1, \ldots\ldots, X_{\tilde{N}}) =$

$$\begin{bmatrix} G(a_1, b_1, X_1) & \cdots & G(a_{\tilde{N}}, b_{\tilde{N}}, X_1) \\ \vdots & \ddots & \vdots \\ G(a_1, b_1, X_N) & \cdots & G(a_{\tilde{N}}, b_{\tilde{N}}, X_N) \end{bmatrix}_{N \times \tilde{N}} \quad (15)$$

$$\beta = \begin{bmatrix} \beta_1^T \\ \vdots \\ \beta_{\tilde{N}}^T \end{bmatrix}_{\tilde{N} \times m} \text{ and } T = \begin{bmatrix} t_1^T \\ \vdots \\ t_N^T \end{bmatrix}_{N \times m} \quad (16)$$

H is called the hidden layer output matrix of the network [15]; the i[th] column of H is the i[th] hidden node's output vector with respect to inputs $x_1$, $x_2$,…, $x_N$ and the j[th] row of H is the output vector of the hidden layer with respect to input $x_j$.In real applications, the number of hidden nodes, $\tilde{N}$, will always be less than the number of training samples, N, and, hence, the training error cannot be made exactly zero but can approach nearer to a nonzero training error . The hidden node parameters $a_i$ and $b_i$ (input weights and biases or centers and impact factors) of SLFNs need not be tuned during training and may simply be assigned with random values according to any continuous sampling distribution. Equation (5) then becomes a linear system and the output weights _ are estimated as

$$\tilde{\beta} = H \dagger T \quad (17)$$

Where $H \dagger$ the Moore-Penrose is generalized inverse [15] of the hidden layer output matrix H. The ELM algorithm which consists of only three steps, and can then be summarized as

**ELM Algorithm:** Given a training set $\aleph = \{(X_i, t_i) | X_i \in R^n, t_i \in R^m, i = 1, \ldots, N\}$ activation function g(x), and hidden node number $\tilde{N}$,

1) Assign random hidden nodes by randomly generating parameters $(a_i, b_i)$ according to any continuous sampling distribution, i=1,…., $\tilde{N}$
2) Calculate the hidden layer output matrix H.
3) Calculate the output weightβ: $\tilde{\beta} = H \dagger T$

The universal approximation capability of ELM has been analyzed in Huang et al. [16] using an incremental method and it has been shown that single SLFNs with randomly generated additive or RBF nodes with a wide range of activation functions can universally approximate any continuous target functions in any compact subset of the euclidean space $R^n$. $g(x) = \frac{1}{1+e^{-\lambda x}}$ is the sigmoidal function used as activation function in ELM

## V. Experimental Results

This study mainly deals with the Performance analysis of the t-test ELM classification method for gait classification as normality and abnormality. Several experiments are carried out to test the validity of t-test ELM. A comparative analysis of the results of our proposed method is also done with t-test SVM. The experimental data used in this study are obtained from the gait database in Virginia University. There are totally 158 gait samples present in the database. These samples belong to 68 children with normal gait and 88 children with abnormal gait. The ages of these children range from 2 years to 13 years. Four features of gait samples are selected for classification and they are stride length, cadence, leg length and age.

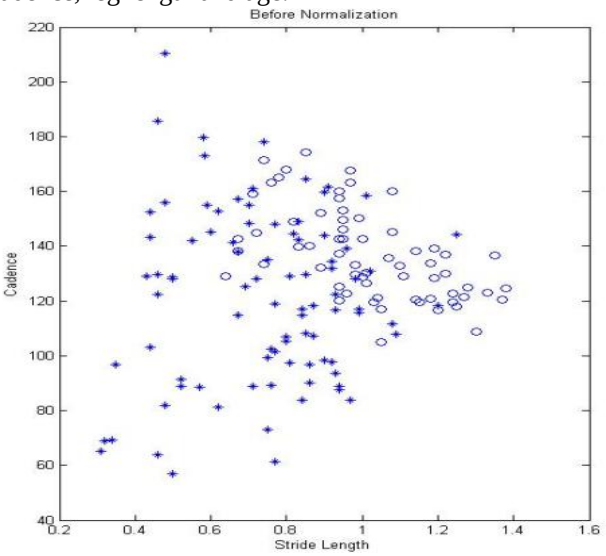


Figure 3: (a) Distribution of raw data before normalization.

In this study, the t-test is applied to normalize the gait samples. Figure 3.(a & b) shows the distribution of data before and after normalization. As shown in Figure3.b, the overlap of two sample sets is effectively reduced after normalization, which helps to improve the classification accuracy.

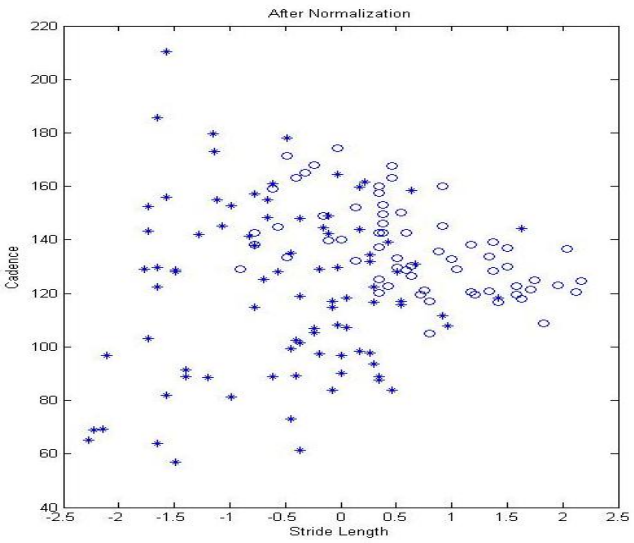


Figure 3: (b) Distribution of raw data after normalization.

The generalization capability of SVM enhances along with the increase of C (Regularization parameter). This is because the regularization parameter C may adjust the ratio of confidence interval and empirical risk. The generalization capability of SVM is weak when C is small, because a small C indicates that the punishment for empirical risk is small and the empirical risk is large. When C exceeds a certain value, the complexity of a classifier reaches the allowed maximum in the feature space. In this case, the SVM has almost no change of the empirical risk and generalization capability. The accuracy of using standard SVM, SVM with PCA and SVM with T-Test are measured and tabulated in Table1

When dealing with Classification Accuracy of ELM, it achieves better results. The accuracy achieved by ELM is 95 percent or more. This is consistent with our hypothesis that ELM performs better in the multi category classification applications where the number of classes is large.For all data sets, ELM takes much less total training time than does the SVM algorithm. As mentioned before, the SVM-algorithm has to build binary classifiers to distinguish between every two class combinations. For the data sets used with the number of categories classified decreasing, the difference between ELM and SVM is also decreasing. ELM takes significantly lower training time. For all data sets, it can be seen that the number of hidden nodes for ELM is always smaller than the number of support vectors for SVM, indicating a more compact network realized by ELM. The accuracy of ELM with PCA and T-Test are tabulated in Table1.

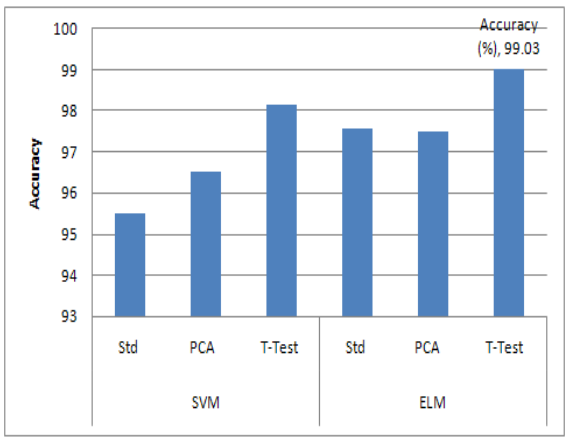


Figure 4. Comparison of SVM and ELM accuracy.

In reference with that ELM with PCA gives result with accuracy of 97.98% and when T-Test is used it gives the maximum accuracy of 99.21%. The increase in percentage of accuracy when using ELM is plotted in graph above.The performance of ELM can be estimated with the use of total training time. When the number of hidden nodes for ELM and support vectors of SVM is compared it can be seen that the number of hidden nodes for ELM is always smaller than in support vectors indicating a more compact network realized by ELM. For each network, there are five modules each consisting of 10 hidden nodes. This means that, for each experiment, up to 4,600 hidden nodes are needed for the training process of SANN, while, for ELM, the network needs less than 50 hidden nodes. Thus reducing the number of hidden nodes reduces the training time. The total training time for ELM and SVM is shown in Table 2. This shows that SVM

Table1.SVM and ELM accuracies

| Algorithm | | Accuracy (%) |
|---|---|---|
| SVM | Std | 95.51 |
| | PCA | 96.51 |
| | T-Test | 98.15 |
| ELM | Std | 97.56 |
| | PCA | 97.49 |
| | T-Test | 99.03 |

took around 410 seconds to train the dataset completely. For the same dataset ELM took only 125 seconds.

Table2. Total training time used by SVM and ELM

| Algorithm | Time(in sec) |
|---|---|
| SVM | 410 |
| ELM | 125 |

This result clearly shows that ELM takes a much smaller training time than SVM.

## VI. Conclusion

In this paper, a fast and efficient classification method called the ELM algorithm is used to classify the abnormal gait. ELM can perform the multi category classification directly, without any modification. Study results are consistent with our proposition that, when the number of categories for the classification task is large, the ELM algorithm achieves higher classification accuracy than the other algorithms with less training time and a smaller network structure. It can also be seen that ELM achieves better and more balanced classification for individual categories as well as very less training time comparative to SVM. In future some advanced neural network techniques can be used to train the ELM classifier which may enhance the classification accuracy further with reduced training time.

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# Health Information System Implementation: The Role Of Business Process Management On Successful Implementation

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***Abstract*-Integrated HIS provides significant improvements in efficiency across an environment of health care. However, there are also risk associated with implementation of integrated HIS but the actual implementation of integrated health information systems (HIS) is a challenging issue. Implementing integrated HIS are increasingly seen as the way to achieve quality and continuity in treatment, reducing clinical errors, and supporting health care professional in providing care. With the hurried growth in popularity of integrated HIS package, an increasing number of health care sectors are making the decision to implement an integrated HIS. The critical success factors for integrated HIS implementation include top management support, a clear business vision and issues specific to HIS such as implementation strategy and software configuration. However, some of the more important factors are the issues related to re-engineering business processes and the integration of various core processes to the HIS. This paper investigates the role and impact of business process management in successful integrated HIS implementation. The paper starts by defining business process management and the integrated HIS critical success factors. The impact of business process management on successful integrated HIS implementation is then assessed through looking at the experiences of several health care sectors. The paper concludes by documenting best practices for capitalizing on business process management for successful integrated HIS implementation.**

*Key Words:*Critical Success Factors (CSF), HIS, Business Process Management (BPM).

## I. INTRODUCTION

The recent push for healthcare reform has caused health departments to focus on ways to streamline their processes in order to deliver high quality care while at the same time reducing costs. Integrated Health Information Systems (HIS) software packages (synonyms are hospital information systems, health information management, clinical information systems, healthcare information systems, health information technology, and health application systems) seek to integrate the complete range of a health departments processes and functions in order to present a holistic view of the health care from a single information and IT architecture. I can say that the health departments increasingly recognize the value of sharing information among all stakeholders. Few health care sectors will dispute the value that HIS software can bring to their business. However, most health organizations are not putting in place the procedures tomanage the changes and customizations they need to make to HIS for establishing better services to their patients and staff. Most health sectors are too busy building and running the technical aspects of their HIS package to recognize the need, and long-term value of change and business process management. These values extend well beyond application development and in fact it provides the backbone for successful installations and operation of an HIS. Health care are becoming engrossed in building and running the technical aspects of their HIS to recognize the need and long-term value of change and business process management. Integrated HIS is the umbrella for integrating sets of health departments applications that allow them to manage almost all aspects of operations. The value of this holistic view extends well beyond application development and in fact provides the backbone forsuccessful installations and operation of an integrated HIS software package. Integrated HIS packages have made a tremendous contribution to the world of health care [12]. Indeed, the value that HIS packages can bring to health sectors is clear to many health organizations and few will dispute its potential. However, there are also hazards associated with implementation of integrated HIS. Their failure is high and may cause negative effects on staff and patients [1,2,11]. These software packages are huge and complex systems and warrant careful plan and execution to ensure successful implementation. In other words, integrated HIS implementation is much more than implementation of hardware or software systems; they affect how a health care conducts itself. The success of an integrated HIS implementation has often been attributed to two facts: the HIS package is configured and running and the whole project is (more or less) on time and within budget [6]. However, this is a narrow view of HIS implementation focusing on the hard aspects and reducing it to mere software or IT project. Many integrated software implementation failures have been due to the lack of focus on 'the soft issues', i.e. the business process and change management [5,14]. The role and impact of business process management (BPM) in successful integrated HIS implementation is crucial, and is the subject of our investigation here.

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## II. INTEGRATED HIS CRITICAL SUCCESS FACTORS

Due to the complex and integrated nature of HIS software package, the large investments involved (time and money), and the relatively high implementation failure rates [1,2,3]. It is imperative for health care sectors to study the experiences of others, and learn from their practices and success factors.A literature review was conducted to understand the critical success factors in successful integrated software implementation [17]. The review covered numerous published books and articles. The review concluded the identified CSFs fall under one of four main categories, namely: executive leadership, changing of the existing processes, deploying change management, and the IT infrastructure. These CSF categories are presented in Figure 1.

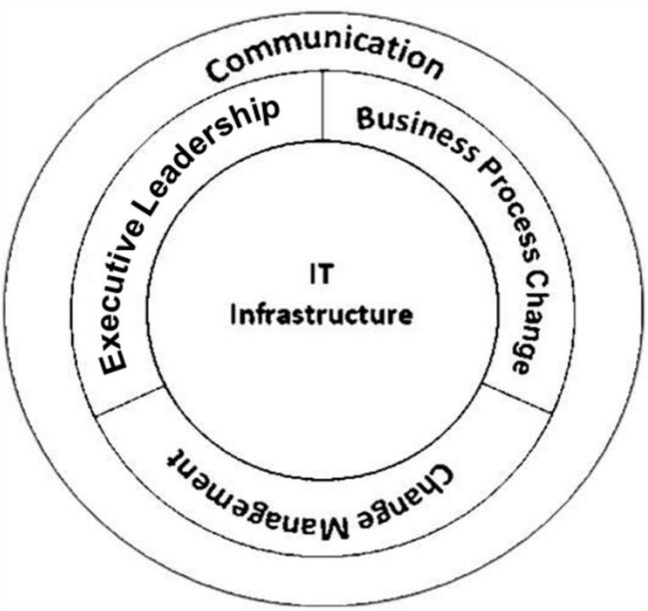


Figure 1: CSF Categories for successful integrated HIS

The following is a brief overview of each of these categories:

1). Executive Leadership: Executive must be a part of integrated HIS implementations. The leadership is a high level official who works for institutionalization of the project, is a talent and good communicator, and has political awareness and influential contacts. The IT literatures have clearly demonstrated that for IT protects to succeed executive support is critical. However, executive in many health care sectors still view the installation of an integrated HIS as primarily a technological challenge and assign its responsibility to the IT departments. This is seen as a risky act due to HIS's profound health care implications.

2). Business Process Change (BPC): Implementing an Integrated HIS package involves changing the existing business processes to the best business process standard. Integrated HIS was built on best practices that are followed in the health care sectors, and to successfully install HIS package, all the processes in a health departments must conform to the HIS package.

During the HIS preparation phase, health care sectors face a question as to whether to implement the HIS software "AS IS" or modify the product to the specific needs of their requirements. Indeed, it has been recommended by practitioners and expert people that a hospital has to change its processes to conform to the integrated HIS package. In fact, this need to change the hospital's business processes is seen as one of HIS's major benefits.

3). Change management: One of the main obstacles facing integrated HIS implementation is resistance to change. There will be resistance from users (for instance, from nurses, phlebotomists other paramedical staff, etc) who may feel that feeding information into the computerized system is additional work and not their primary responsibility or core competence. "Health care constantly evolving. Wave after wave of new technologies, insurance model, information systems, regulatory changes, and institutional arrangements buffet the system and the people in it. But people and institutions, for the most part, do not like change. It is painful, difficult and uncertain" [2]. To successfully implement integrated HIS package, the way health departments do business will need to change and the ways people do their jobs will need to change too. Its success is largely dependent on the commitment of health management, IT staff, and program staff to implementing integrated HIS that will change the way they do their jobs [9]. Thus, change management is essential for preparing a company for the introduction of a HIS , and its successful implementation. However, change management has to be structured within an overall Business Process Management methodology to achieve its goals.

4). IT Infrastructure: Implementing integrated HIS presents an immediate information architectural challenges that has organizational implications. Adequate hardware, communication, and networking infrastructure is required for HIS application. Integrated HIS can't be without sophisticated information technology infrastructure. Three primary attributions of success were identified from the descriptive statistics: willingness to change to new computer applications, effort, and persistence. In addition to the infrastructure, clearly, the software configuration has a critical influence on the implementation process and outcome [4].Clearly, three out of four of these main categories fall under the umbrella of Business Process Management (BPM). If anything, this strongly re-iterates the fact that integrated HIS is not merely software implementation or an IT project. Thus, to ensure successful HIS implementation and running, health care sectors must pay sufficient attention to BPM.

## III. BUSINESS PROCESS MANAGEMENT (BPM)

A business process is set of interrelated activities which have definable inputs and, when executed, result in an

output that adds value form a customer perspective. Business processes are quite simply the way work is done in any organization. They are cross-functional and go across the organizational functions, e.g. order fulfillment which spans all organizational functions from customer order to final delivery. BPM is a structured approach to understand, analyze, support, and continuously improve fundamental process such as manufacturing, marketing, communications and others major elements of a company's operations.

BPM is a wide and encompassing system that starts with top management understanding and involvement, focuses on process improvement across the supply chain, instills a structured approach to change management, and emphasizes people management and development.

## IV. BPM FOR SUCCESSFUL HIS IMPLEMENTATION

The importance and impact of BPM on integrated HIS success will be demonstrated in this section through assessing the experiences of six hospitals.

### *1) Case Study Hospitals*

The case studies analyzed in this paper are shown in Table 1.

### *2) Bpm Elements*

As noted earlier, BPM has several main pillars. The following are highlights to demonstrate their importance in successful integrated HIS implementation

#### *a. Executive Leadership*

The experience of all six hospitals highlight the importance of having executive leadership directly involved in planning and implementing an HIS. KFSHRC's executive was instrumental in overseeing its integrated HIS project and the entire board reviewed and approved the plans. At KFMC and Dallah hospital, the decision to implement an integrated HIS was also made at the board level and the senior management team input was very important when selecting a suitable vendor.Executive support and commitment does not end with initiation and facilitation, but must extend to the full implementation of an integrated HIS. KFSHRC, KFMC, SGHG, and Dallah hospital noted that HIS implementation is about people, not technology. The organization went through a major transformation, and the management of this change was carefully planned (from a strategic viewpoint) and meticulously implemented [10]. All the case studies analyzed have shown that the key to a smooth rollout is the effective change management from top. Intervention from management has been necessary to crucial for the adequate resourcing of the project, to taking fast and effective decisions, resolve conflicts and bring everybody to the same thinking, to promote company-wide acceptance of the project, and to build co-operation among the diverse groups in the organization, and in many times across national borders. Executive needs to constantly monitor the progress of the project and provide direction to the implementation teams

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Table1. Case Studies of successful integrated HIS

| Hospital | Major integrated HIS Results |
|---|---|
| King Faisal Specialist Hospital & Research Centre (KFSHRC) | Improving the quality of patient care.<br>Makes data retrieval faster<br>Makes management decision faster.<br>Provides better service to Patients.<br>More expansion and increase of activities in the same resource. |
| King Fahad Medical City (KFMC) | Comprehensive Performance Reports.<br>Powerful Search Facility for patient records.<br>Use efforts and time more effectively and productively.<br>Lower inventory holding.<br>Better decision. |
| Dallah Hospital | Reduce operation cost.<br>Access to timely and complete information<br>Cut the costs of operational systems, improved the reliability of customer service, and assured timely delivery and follow-up.<br>Data integration and standardization. |
| Al-Noor Specialist Hospital | Makes data retrieval faster.<br>Provides better service to Patients.<br>Improved inventory record accuracy<br>Enhanced data visibility.<br>Reduction in operation costs. |
| Dr. Abdul Rahman Al-Mishari Hospital | Comprehensive Performance Reports.<br>increased revenue and the decreased costs<br>Information can be accessed in real-time, meeting one of the prime objectives of the project. |
| Saudi German Hospitals Group (SGHG) | Improving the quality of patient care.<br>Well controlled inventory system.<br>Improved financial control.<br>Reduce administrative costs. |

*b. PROCESS MANAGEMENT AND IMPROVEMENT*

The two main areas in process management and improvement that directly affected integrated HIS success were business process change, performance measurement, and putting in place the appropriate process management structure.Business Process Change – Proper business processes, re-engineering and accurate definition of workflows incorporating global best practices will improve the effectiveness and efficiency of the hospital and in turn provide better patient care. The most common reason that hospitals walk away integrated HIS projects is that they discover that the software does not support one of their

important business processes. At that point there are two things they can do:

**a).** They can change the business process to accommodate the HIS software, which will mean deep changes in long-established ways of doing business (that often provide better services to patients and staff) and shake up important peoples' roles and responsibilities. Or they can modify the HIS software to fit the process, which will slow down the project, introduce risky bugs into the system and make upgrading the software to the integrated HIS vendor's next release excruciatingly difficult, because the customizations will need to be torn apart and rewritten to fit with the new version. Without exception, all six hospitals agreed that BPC is one of the main critical success factors for integrated HIS success. Rather than attempting to modify the software, KFSHRC, KFMC, Dr. Abdul Rahman Al-Mishari hospital, Al-Noor specialist hospital, Dallah hospital, and SGHG redesigned their business processes to be consistent with the software. This has proved to be critical to the project's success. The others undertook a mix of BPC and HIS software re-adjustment. Within this context, KFSHRC and KFMC have strongly emphasized on the criticality of structured project management approaches for integrated HIS success.

**b).** Performance Measurement – It has been said that you can not manage what you do not measure, and this is especially true in the case of integrated HIS implementation. Health sectors must be able to establish a clear and well defined performance measurement system to allow them to assess the development, and/or problems, that are occurring. KFSHRC, KFMC, and Dallah hospital noted that having a well established measurement system was crucial in their HIS project management initiative to allow for measuring and publicizing success stories for motivation, assessing progress, assigning and redirecting resources, and instilling an overall system of continuous improvement for the integrated HIS life cycle.

**c).** Process Management Structure - KFMC put someone "in charge" and centralized the management structure of the project in order to avoid duplication of effort. KFMC considered their project a success because of a centralized management structure. This has been implemented by KFSHRC, and Dallah hospital all saw this as an important factor in managing the HIS implementation efficiently. However, even those with no 'HIS Process Leader' still maintained this focus by appointing a 'champion'. The project leader for the HIS project was clearly a "champion" for the project, and that role was critical to marketing the project throughout the organization.

### *c. Change Management*

The main hurdle faced by all the organizations was resistance to change. There will be resistance from users (for instance, from nurses, phlebotomists other paramedical staff, etc) who may feel that feeding information into the computerized system is additional work and not their primary responsibility or core competence. Indeed, staff were reluctant to learn new techniques or the IT department was reluctant to change due to attachment to its product; this was one of the main hurdles faced during the integrated HIS implementations [15,16]. For users, the implementation of HIS means that their computer-related job tasks is completed in totally different computer environment. The complexity of these systems results in enormous learning curves and behavioral changes for user, implementers, and organizations. A variety of reactions by individuals, ranging from resisting to enthusiastically embracing HISs, are demonstrated, and unexpected difficulties often arise during all phases of implementation. Consequently, HIS users need to make sense of, and understand, their reactions to this technology, and their changing computer environment and computer-related job tasks. The attribution of HIS performance are important because they can either positively or negatively influence user's learning, confidence levels, effort, persistence, and use of these systems. Unfortunately, our understanding of individuals' reactions to HISs, and why they elect to use or avoid them, is limited [9].Four elements which can help reduce the resistance are tremendous executive support; training and education, placement of best people on implementation; and heavy involvement of people from the field. The main approaches to achieve the sought-after people involvement and commitment are an open environment, characterized by open communication and trust. Dr. Abdul Rahman Al-Mishari hospital, AL-Noor specialist hospital, KFSHRC, Dallah hospital, and KFMC agreed that effective communications should tell everyone in advance what is happening including the scope, objectives, and activities of the project, and admit that there will be change. Dallah hospital and KFMC saw an open and honest information policy helping the user to become acquainted with the new situation, to build up confidence in the project and its members, and finally to accept the project.Open communication and ethical behavior generate trust. KFMC highlighted the relationships of trust among the project members as a main success factor for HIS package. KFSHRC noted that trust can be built up with intensive communication, coaching, delegation of responsibility, personal care and attention, among other things.

### *d. People Management And Development*

People management is clearly a subset of change management. However, some specific issues have been shown to directly affect the success of integrated HIS implementation, and were mainly in the area of people development. The implementation of integrated HIS package requires a whole new set of skills and expertise that organizations must pay extra attention to where these skills will come from. Two main streams have emerged and all six organizations have used a mix of both:Training and re-skilling - Rigorous and continuous training and showing tangible benefits are the answers to overcome the initial resistance. Training is critical in an integrated HIS project. The most effective HIS possible will not improve health departments if their employees do not know how to use it.

Installing an integrated HIS package without adequate staff preparation could yield drastic consequences. In this respect, KFSHRC and KFMC noted that the costs of training and support are often under-estimated, and these costs may be many times greater than originally anticipated. At Al-Noor specialist hospital, Dr. Abdul Rahman Al-Mishari hospital, Dallah hospital, and SGHG one of the critical workforce requirements for the project was the ability to obtain and train analysts with both "business" and technology knowledge. However, retaining these professionals was a significant problem because of their market value. SGHG, KFMC and KFSHRC invested heavily in training and re-skilling their developers in integrated HIS package software design and methodology. Dr. Abdul Rahman Al-Mishari hospital considered their project a success because of investments in training and support required to overcome technical and procedural challenges in design and implementation.

**(b)** Using external consultants - With new technology,it is often critical to acquire external expertise, including vendor support, to facilitate successful implementation. Hundreds of companies provide integrated information systems services. Those services may include all or some combination of these offerings:

- Road Map
- Change management
- HIS package selection
- Business process planning or changing
- HIS implementation
- Training
- HIS maintenance and support

Quite simply, when they didn't have needed expertise internally, KFMC brought in the consultants they needed. They stressed that good consultants improve throughput time and quality. The success of a project depends strongly on the capabilities of the consultants because the consultant is the only one with in-depth knowledge of the integrated software

## V. BEST PRACTICES FOR CAPITALIZING ON BPM FOR SUCCESSFUL HIS

This study relieves that the best practices for capitalizing on business process management for successful HIS implementation, are the following:The success of a major project like an integrated HIS implementation hinges on the sustained commitment form executive. An overall commitment that is visible, well defined and felt is a sure way to ensure a successful outcome.

1..Implementing an integrated HIS is not a matter of changing software systems; rather it is a matter of repositioning the health care sector and transforming the business practices.

2..Training - whole departments must be retrained, jobs redefined, and procedures discarded or rebuilt from scratch.

3..Performance Measurement - Because the successful implementation of an integrated HIS is contingent upon an accurate assessment of the associated organizational changes, there is a need to investigate the organizational consequences of HIS software.

4..Selecting the right employees to participate in the implementation process and motivating them is critical for the implementation's success

## VI. CONCLUSION

Healthcare departments involve complex processes that span diverse groups and organizations. The implementation of Health Information System (HIS) to manage and automate the processes has increasingly played an important role in improving the efficiency of healthcare enterprises. However, most of the Health Information System (HIS) implementations are big failures considering the time taken or the desired results achieved. However, the benefits of implementing a fully integrated Health Information System (HIS) – better patient care, increased efficiency, lower costs, etc. – can be enormous. But the price tag can also be large, and the time-to-payback long. Overall, it can be concluded that integrated HIS is far form being an IT project, and is more of an integrated clinical development approach that changes the way health departments do business, and the way work is done. Consequently, to implement HIS successfully, health departments must treat it like a change management project and focus on an integrated approach of Business Process Management. This paper has investigated the role and impact of business process management in successful integrated HIS implementation.

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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.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

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.

**Structure**

All manuscripts submitted to Global Journals, ought to include:
Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.
*Abstract, used in Original Papers and Reviews:*
*Optimizing Abstract for Search Engines*
Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words
A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.
One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

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

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

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

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

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

*Acknowledgements: Please make these as concise as possible.*

References

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

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

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

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

Tables, Figures and Figure Legends

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

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

Preparation of Electronic Figures for Publication

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

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

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

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

**6. AFTER ACCEPTANCE**

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

**6.1 Proof Corrections**

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

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

(Free of charge) from the following website:

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

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

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

**6.2 Early View of Global Journals (Publication Prior to Print)**

The Global Journals are enclosed by our publishing's Early View service. Early View articles are complete full-text articles sent in advance of their publication. Early View articles are absolute and final. They have been completely reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after sending them. The nature of Early View articles means that they do not yet have volume, issue or page numbers, so Early View articles cannot be cited in the conventional way.

**6.3 Author Services**

Online production tracking is available for your article through Author Services. Author Services enables authors to track their article - once it has been accepted - through the production process to publication online and in print. Authors can check the status of their articles online and choose to receive automated e-mails at key stages of production. The authors will receive an e-mail with a unique link that enables them to register and have their article automatically added to the system. Please ensure that a complete e-mail address is provided when submitting the manuscript.

**6.4 Author Material Archive Policy**

Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

**6.5 Offprint and Extra Copies**

A PDF offprint of the online-published article will be provided free of charge to the related author, and may be distributed according to the Publisher's terms and conditions. Additional paper offprint may be ordered by emailing us at: editor@globaljournals.org .

## Informal Tips for writing a Computer Science Research Paper to increase readability and citation

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.

**Techniques for writing a good quality Computer Science Research Paper:**

**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.

## Administration Rules Listed Before Submitting Your Research Paper to Global Journals

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**Segment Draft and Final Research Paper:** You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

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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<br><br>Above 200 words | No specific data with ambiguous information<br><br>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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