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Hybrid Face Recognition using Image Feature Extractions: A Review

Venkata Naresh Mandhala[1], Debnath Bhattacharyya[2] and Tai-hoon Kim[3*]

[1]*Vignan's Foundation for Science, Technology and Research University, Vadlamudi, Guntur, AP, India*
[2]*Department of Computer Application, RCC Institute of Information Technology, Canal South Road, Beliaghata, Kolkata - 700015, India*
[3]*Department of Convergence Security, Sungshin Women's University, 249-1, Dongseon-dong 3-ga, Seoul, 136-742, Korea*
[1]*mvnaresh.mca@gmail.com*, [2]*debnathb@gmail.com*, [3]*taihoonn@daum.net*

Abstract

Face recognition is an image processing technique that recognizes the face of a person in the system. Face recognizing system may comprise the circuit board, software for detecting face with programmatic assurance. Face recognition developed in neural networks is the major application development in present days. This process can be used in security and biometric applications. For providing more security considerations proposed technique was Hybrid Face Recognition with Radial Basis Function, that uses two algorithms like PCA and LDA for face feature extraction and dimensionally fusion methods for associated to PCA and LDA. We will plan to extend our existing approach for feature extraction with different stages. In this we propose four stages for recognizing image extraction in facial schema. In this process the recognized image is determined by the corresponding output value present within threshold description. Our experimental shows efficient security considerations on facial feature extraction process.

Keywords: *Back Propagation, Euclidean Distance, Face recognition, Histogram Equalization, Neural network, Normalization, Preprocessing, Principle Component Analysis*

1. Introduction

Image processing is a form of signal processing for which the input is an image such as video/photo frame, and then apply processing formats of the image feature extraction may either in image or some set of characteristics/parameters present image. Image processing technique can be used in different formats like image compression, biometric, security considerations from different domains. Most of the image processing techniques testing the image as two dimensional way and then apply standard signal processing techniques to that image [2]. Consider the use of image processing technique in biometric applications. Face Recognition is one of the major aspects in neural networks. Identification of the person is one of the critical tasks in verifying results for retrieving relevant information of human. In those times the task of recognition human faces is quite complex task in present day's because the human face contain a full of information then working with all those events is a critical task for time consuming and less efficiency of the image results. For doing this complex task earlier more number of algorithms and techniques were proposed to develop face recognition.

* Corresponding Author

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Principal Component Analysis/Linear Discriminant Analysis approaches and for recognition back propagation neural networks are used for detecting face recognition, it is the new approach to recognize the faces in less training time and less training patterns [1]. First we use Principal Component Analysis for lower dimensionality of a space for retrieving face space and then to extract these features on high dimensional face space we perform LDA to maximize the discriminatory power for detecting face space regions in image extraction [3]. Principal Component based Analysis technique normally contains two phases: Training and Classification phases, in training phase Eigen-space established from training samples in image extraction process and then training face images are mapped with Eigen space values present in the image extraction [1]. In classification phase of the image extraction process input face image is projected with Eigen space points and then classify into appropriate methods to image extraction, this process can be applicable only low dimensional data processing. To develop these features in high dimensional image a standard Linear Discriminant Analysis has processed. LDA performed to maximize the discriminatory power; it is used not only in classification it is also used for dimensionality reduction. By using above considerations for detecting faces in face recognition system contains following architecture with sufficient stages for image extraction process.

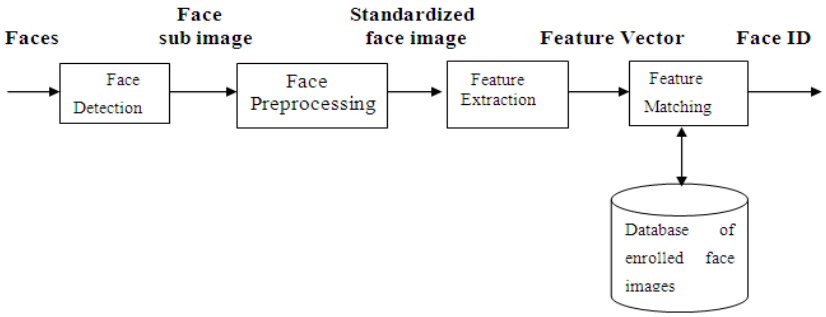


Figure 1. Face Recognition System

Face Detection: For extracting image to track face in multiple frames for reduce computational time and preserve the identity of a face (human) between frames. It includes shape templates, neural networks and active appearance models.

Face Preprocessing: It is normalizing the coarse face detection for robust feature extraction can be achieved. It includes translation, rotation, scaling operations and light normalization correction.

Feature Extraction: The feature extraction is to extract a set of interpersonal discriminating geometrical/photometrical features of the face. It includes following methods: PCA, LDA, and LDP [14, 13].

Feature Matching: It is an actual recognition process, the feature extraction is matched to classes of facial images enrolled in data base [1]. The matching algorithms fairly found the nearest neighbor to advanced schemas like neural networks.

To extract the above features efficiently, we propose a new face recognition method Radial Based Functional Approach. This approach is developed based on PCA, LDA, and Radial Basis Functions is proposed for classification. This approach contains four phases as follows: 1) Normalization2) Feature Extraction using PCA and LDA 3) Feature Fusion using PCA 4) Classification using Neural Networks Radial Basis Functions. Compared to conventional

classifiers neural network classifiers give an efficient data extraction features based on image processing techniques [16]. In the above phases the combination of PCA and LDA gives an efficient result for improving capability of the sampled images. Using neural classifier is used to increase the classification accuracy.

2. Neural Networks

A neural network is an information processing system that has been developed as generalizations of mathematical model matching human cognition [10, 12]. They are exposed with large number of highly connected processing units that together to perform specific task. A neural network is a parallel distributed processor that has a natural prosperity of the stored experimental knowledge acquired by inter-connection synaptic weights. Each neural has an internal thread state called Activation function/Threshold process [14].

Neural classification generally assumes following steps for classifying data in image *i.e.*, Pre-processing for analyzing documents, Training for selection of some feature extractions depending on patterns, based on decision of the feature extraction patterns, finally access the accuracy of the classification procedures [18]. Based on the connection accepted by the neuron present in the network efficiency neuron networks contain following methods:

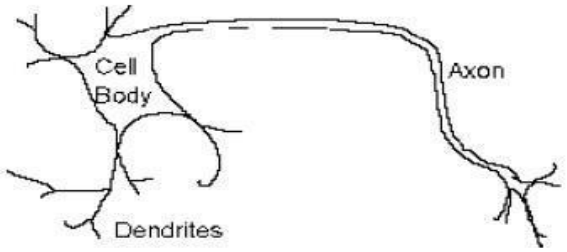
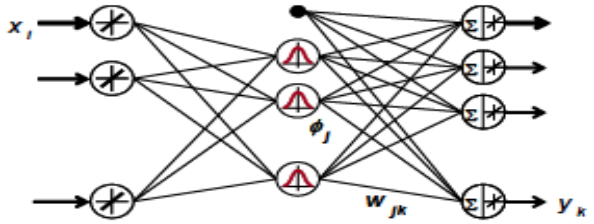


Figure 2. Neural Network in Biological Event Generation

Supervised & Unsupervised Learning: In this learning process of the neural networks, each neuron is an adaptive element [4, 16]. Nature of the input/output task present in the neural networks there are two techniques are introduced for service provided in neural networks; they are supervised and unsupervised techniques for accessing services of the neural networks. Supervised learning process provides data of the network to train, but in unsupervised learning technique doesn't know the details of the data in neural network for response about input data.

Topology of Neural Networks: It is not a simple task for interconnection present in the neural network processes. Because for example consider the topology of the human brain, in that impossible to describe the all the domains present in the human brain present access in the network simulation process [8, 7]. This model achieves only input, hidden process, and output of the all the layers present in the neural networks based in their neurons [15].

Radial Basis Function Networks: Radial Basis Function achieving and viewing the details of the design of the curve fitting problem in high dimensional space of the neural networks. Both supervised and unsupervised techniques were developed for learning the specific feature of the neural networks but they are not applicable for the efficient learning service in high dimensional data space applications [15, 22].



Input Layer **RBFs** **Output Layer**

Figure 3. Architecture of a RBF Network

The design of the Radial Basis Functional Networks is basic form that consists three basic layers; Input Layer, it is a collection of source nodes neural networks [6]. Hidden layers that are applicable for accessing high dimensional data process, Output layer, it gives response of the activation patterns.

3. Background Work

For detecting face recognition in biometric applications is one of the major task in present day's. Traditionally more number of methods was developed for detecting face recognition as follows:

Eigen faces Method: In this schema decomposes images into a small set of characteristic features called 'Eigen Faces' which is based on the principal component of the initial set of face images [12, 9]. Recognition is performed into sub space spanned and then classifying the face by comparing its position face space. It gives an efficient way to find this lower dimensional space. In this method we have to implement PCA applications for face recognition process in Biometric Techniques.

Eigenfaces are the Eigenvectors which are representative of each of the dimensions of this face space and they can be considered as various face features. Any face can be expressed [7], as linear combinations of the singular vectors of the set of faces, and these singular vectors are eigenvectors of the covariance matrices.

Fisher Faces Method: This schema is based on NWFE method that improves LDA by focusing on sample near the eventual decision boundary location. It is the distance function to evaluate the closeness between samples. The main ideas of NWFE put different weights on every sample to [6], compute the "weighted means" and define new nonparametric between-class and within-class scatter matrices. The matrix formation is given by equation 1.

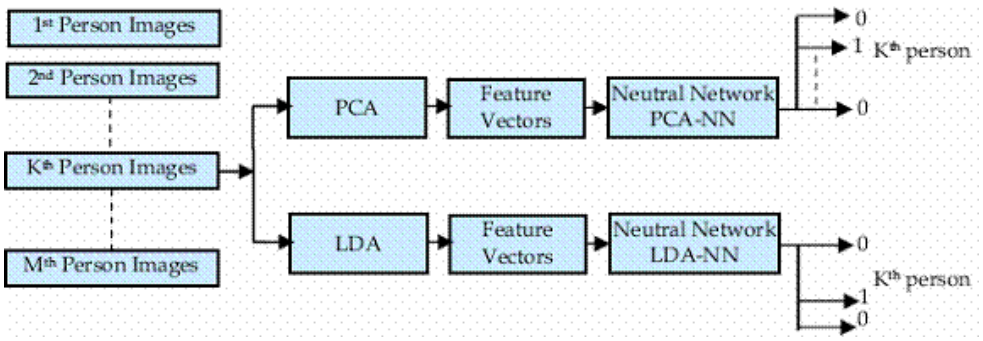


Figure 4. PCA & LDA using Neural Networks

Where Ni is the training sample size of class I, x_k is the k^{th} sample class present in the image repository *Mj*(*xi k*) denotes the weighted mean corresponding to *xi k* for class j, and dist(x, y) is the distance measured from x to y [18, 11]. The closer *xi k* and *Mj*(*xi k*) are, the larger the weight λ (*i*,*j*) *k* is. The sum of λ (*i*,*j*) *k* for class i is one. In this method we have to implement the LDA development histogram techniques for recognizing face detection.

$$S^{NW} = \sum_{j=1}^{l} Pi \sum_{i=1}^{l} \sum_{k=1}^{Ni} \frac{\lambda^{(i,j)}}{N_i} * (X^i - Mj(X^j)(X^j - Mj(X^j))T$$

$$Mj(xik) = Nj\_l = 1w(i,j)kl\ xjl \quad \text{----------} \quad (1)$$

4. Our Work

The experimental results show different types of data bases indicate our proposed work achieves good recognition results in face recognition applications.

Contributions of our proposed work:

1) Resolution with Quality of image extraction features.
2) Orientation process of image retrieval
3) Image Currency with Physiologic changes.

The above contributions are solved efficiently in Radial Basis function based on neural networks. The basic idea of Radial Basis Function Networks derives theory of the function approximation. It introduces a set of N base functions. Each function depends on the Euclidean distance between pixel notations present in neural networks.

As mention in the above discussion PCA&LDA are the efficient face recognition techniques in lower data dimensional applications. But those methods are not applicable for high dimensional data processes for detecting face recognition. So in this section we propose to extend PCA& LDA with Radial Basis Function's two feature neural network for face recognition. Our proposed model consists four phases for detecting facial recognition as follows:

4.1. Face Preprocessing (or) Normalization

The main idea behind normalization is that, after preprocessing an image f^1(a,b) and itss intensity value can be achieves f^1_p(a,b) local mean zero equation 2 and unit area variant W is as follows:

$$E(f^1_p(a,b))=0 \text{ and } W(f^1_p(a,b))=1, \text{ where } (a,b)€W.$$

$$f1p(a,b) = \frac{f1(a,b) - E(f1(a,b))}{Var(f1(a,b))}, (a,b)€W \text{------ (2)}$$

$$\text{and } Var = \sqrt{\sum f1(a,b) - E(f1(a,b))}\ /N,$$

Where N is the number of pixels presentation process in normal image process for face recognition and E(f^1(a,b)) and Var(f^1(a,b)) are the corresponding mean and local variance of *f*(a,b)then we present f^1_p(a,b) in equation 3 for finding pixel identification in local variance and mean of the relevant image extraction process.

$$f1\mathrm{p}(\mathrm{a},\mathrm{b}) = \frac{f1(\mathrm{a},\mathrm{b}) - \mathrm{E}(f1(\mathrm{a},\mathrm{b}))}{Var(f1(\mathrm{a},\mathrm{b}))}, f(a,b) \in W \text{------ (3)}$$

Using this equation in order to avoid overflow process in pixel formation when small constant value can be added to all the variance values present in image extraction and then calculate the intensity level of the each pixel described by the corresponding each image value *f(a,b)* which is under normal illumination [4, 16].

We consider above discussion we assume that a human face can be consider as a combination of sequences of small and flat facets.

Figure 6 shows the local mean map of the image represents [4], low frequency contents with local variance values. Figure 6 shows the recognition rates based on different databases. For each database, with an increase of the block size, the recognition rate will rapidly increase until the block size reaches a critical value. Then, the recognition rate will decrease slowly. The critical or optimal filter size varies for different databases; each database has distinct characteristics in terms of the lighting conditions.

4.2. Feature Extraction using PCA & LDA

This work is motivated is motivated individual recognition of emotions giant patterns in recognition rate with influence of the individual walking styles. The contribution of this work is to extract the relevant features from kinematics parameters and find the individual as well as the person dependent recognition rate was identified by observing single stride with neighbor pixels in image formation [20, 18].

(a)

(b)

Figure 5. (a) Samples of Cropped Faces used in our Experiments. The Azimuth Angles of the Lighting of Images from Left to Right Column are: 0, 0, 20, 35, 70, 50 and70 Degrees Respectively. The Corresponding Elevation Angles are: 20, 90, 40, 65, 35,40and 45, Degrees Respectively. (a) Original Images (b) Image Processed using Normalization Technique

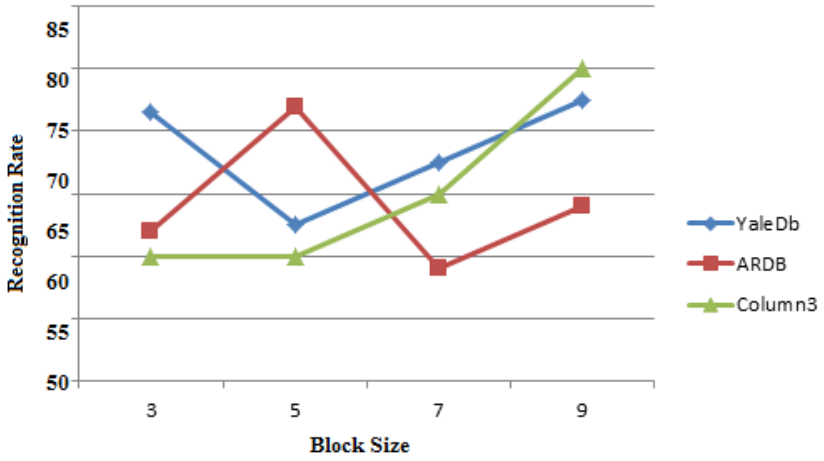


Figure 6. Face Recognition with Different Block Sizes

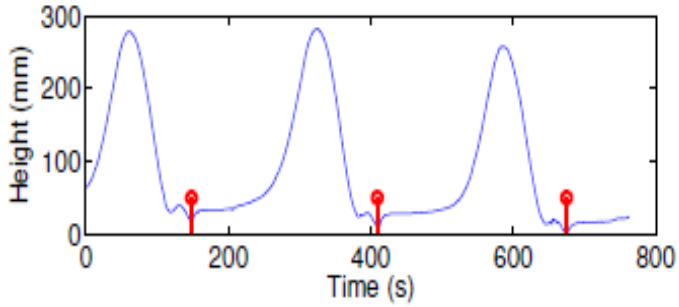


Figure 7. Periodic Characteristics of Marker Affixed to the Heel are an Example of the 105 Recorded Trajectories

For transforming the above features of the image extraction PCA and LDA transformations were proposed original data sets into orthogonal set of Principal Components.

$$(1/N\ N\ X\ n=1\ xk_{in},norm\ xT\ k_{in},norm)\ ui = \lambda i\ ui\ (1)\ \text{with}\ i = 1, ...,M$$

Principal components Ui with highest Eigen values **λi** represent vectors with maximum variance present in data set of the individual data set variation process. Original data is mapped on up to a maximum of M principal components. In contrast to algorithms based on the PCA and LDA consider class membership [18], for dimension reduction. The key idea behind LDA is to separate class means of projected directions achieving small variance levels present in the original mean of the image representation. By using these aspects present in both PCA and LDA invariants of the applicable orientation, we extract the feature of the relevant images with calculation of scatter matrix is as follows: the mean $\mathbf{m}_j$ for samples $\mathbf{x}_j\mathbf{k}_{in,i}$ [19], of each class j, and the number of samples nj for each class, the between-class scatter matrix SB is given by equation 4.

$$SB \coloneqq \sum_{j=1}^{c} nj(mj - m)(mj - m)^T \text{ ------ (4)}$$

Maximizing the minimal values present in the proper invariants present in the sequential formation of the scatter matrix of the individual assurance of the image pixel notation.

Results for all classifiers are shown in Table 1. Recognition based solely on velocity, [18], [19], stride length and cadence (vts) reaches 84% averaged over all walkers for 1NN. Mean accuracy increases to 91 % for classification based on the complete feature vector, including 15 kinematic parameters (all).

4.3. Feature Fusion using PCA

A good object representation or object descriptor is one of the key issues in object based image analysis. To effectively fuse color and texture as a unified descriptor at object level, this paper presents a novel method for feature fusion. Color histogram and the uniform local binary patterns are extracted from arbitrary-shaped image-objects, and kernel principal component analysis (kernel PCA) is employed to find nonlinear relationships of the extracted color and texture features.

The maximum likelihood approach is used to estimate the intrinsic dimensionality, which is then used as a criterion for automatic selection of optimal feature set from the fused feature.

Table 1. Mean Accuracy of the Distinctive State Present In Original Image Pixel Notation

Feature	INN	BayesNew	SVM
vts	84	86	84
All	85	91	76
PCA	88	83	74
LDA	87	92	89

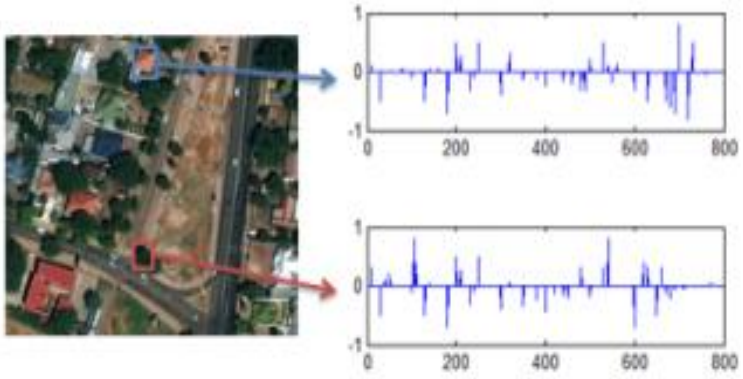


Figure 8. Distribution of Feature Fusion Process based on Weights of Images

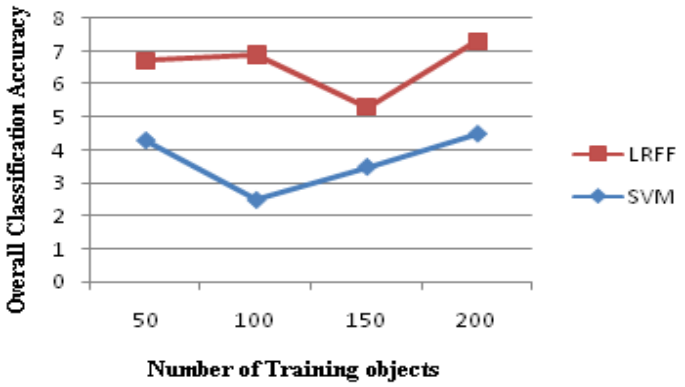


Figure 9. Fusion Set of Feature Extraction based on Training Samples

The proposed method is evaluated using SVM as the benchmark classifier and is applied to object-based vegetation species classification using high spatial resolution aerial imagery. To analyze the influence of the feature extraction of the training data set classification accuracy with different types of training samples.

4.4. Classification using RBF

Artificial Neural Networks are used to describe the many kinds of problems such as classification, pattern recognition, signal processing, feature extraction. In depended Inc- Net networks are constructed for each class for a given problem. Each of them receives input vector x and 1 if index of i-th sub-network is equal to desired class number, otherwise 0. The output of i-th network defines how much a given case belongs to i-th class. Winner takes all strategy is used to decide the final class for a case. Figure on the right presents the structure of Inc Net network for classification [21]. Note that each of the sub-networks learns separately (which helps in parallelization of the algorithm) and its final structure tries to match the complexity for i-th class, not for all classes (structure of each sub-network is usually different).

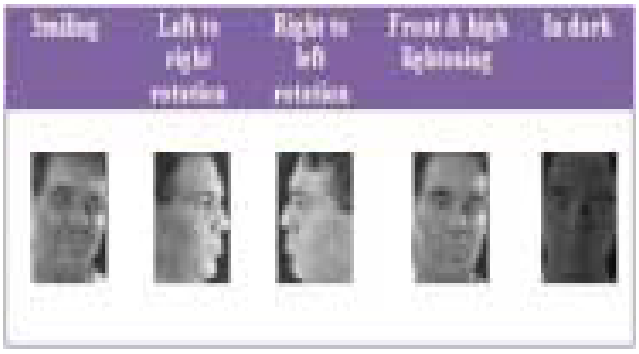


Figure 8. Fused Images of Class-1 for Testing (which are not used in training)

It is possible to learn and build a model for extraction of the individual performance of the automatic generation of the individual assignment of a given person It will give the overall performance of the automatic generation of the each person recognition state with training and testing sets for learning the application movements [17].

Table 2. Overall Study of the Fusion Images

Class	Total number Of testing images	Number of testing images from one particular class	Number of testing images from other 5 different classes	Number of testing images from other 5 different classes	False rejection rate
Class-1	10	5	5	86%	14%
Class-2	10	5	5	79%	23%
Calss-3	10	5	5	81%	26%
Class-4	10	5	5	85%	45%
Class-5	10	5	5	89%	56%

Radial Basis Function (RBF) neural networks are found to be very attractive for many engineering problems because (1) they are universal approximates, (2) they have a very compact topology and (3) their learning speed is very fast because of their locally tuned neurons [16, 18]. An important property of RBF neural networks is that they form a unifying link between many different research fields such as function approximation, regularization, noisy interpolation and pattern recognition [19]. Therefore, RBF neural networks serve as an excellent candidate for pattern classification where attempts have been carried out to make the learning process in this type of classification faster than normally required for the multilayer feed forward neural networks.

5. Conclusion

Face recognition can be developed in neural networks is the major application development in present days. Identification of the person is one of the critical tasks in verifying results for retrieving relevant information of human. In those times the task of recognition human faces is quite complex task in present day's because the human face contain a full of information then working with all those events is a critical task for time consuming and less efficiency of the image results. This process can be used in security and biometric applications. For providing more security considerations traditionally proposed technique was Hybrid Face Recognition with Radial Basis Function, that uses two algorithms like PCA and LDA for face feature extraction and dimensionally fusion methods for associated to PCA and LDA. We will plan to extend our existing approach for feature extraction with different stages; in this we propose four stages for recognizing image extraction in facial schema. Our experimental results show efficient face recognition process in extracting features of images.

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Authors

Venkata Naresh Mandhala received his M.Tech in Computer Science and Engineering from JNTU Hyderabad in 2012. He is a research student of VFSTR University. His research interests include Image Processing, Data Mining, and Cloud Computing.

Debnath Bhattacharyya, Ph.D. (Tech, Computer Science and Engineering) from University of Calcutta, and M.Tech. (Computer Science and Engineering) from West Bengal University of Technology, Kolkata. Currently, he is associated as a Professor with Computer Application Department at RCCIIT, Kolkata. He has 18 years of experience in Teaching, and Research. His research interests include Bio-Informatics, Image Processing and Pattern Recognition. He has published 145 Research Papers in International Journals and Conferences and 4 Text Books for Computer Science.

Prof. Tai-hoon Kim, M.S., Ph. D (Electricity, Electronics and Computer Engineering), currently, Professor of Sungshin Women's University, Seoul, Korea. His research interests include Multimedia security, security for IT Products, systems, development processes, operational environments, etc. He has 20 Years of experience in Teaching & Research. He has already got distinctive Academic Records in international levels. He has published more than 250 Research papers in International & National Journals and Conferences.