ABSTRACT

Face recognition systems are usually used for crime prevention, video surveillance, person verification and similar security activities. Given the requirement for determining people's identity, the best technology for supplying this information has to be identified. There are many different identification technologies available, many of which have been in widespread commercial use for years. An attempt is made to identify unravel classical problems of human face identification technologies on each stage such as image enhancement, segmentation, feature extraction and recognition and solution is also produced for these identified problems.

The biometric techniques like fingerprint, iris are used to identify or authenticate individuals where interaction with each individual is essential which leads to inconvenient and unwanted delay in the entire process of verification/recognition. The face recognition is a non-intrusive technique, natural, higher percentage of compatibility, and easy to apply. As a result, biometric face recognition technology has received significant attention in the past several years due to its potential for a wide variety of applications in both law enforcement and non-law enforcement.

Hence, this research mainly focuses on recognizing the face by bringing new dimensions of exiting methods in each stage of face recognition technique with the best class of accuracy.

Face recognition is achieved in four stages which are image enhancement, complex background elimination and segmentation, optimized feature extraction and face recognition. With these goals in mind, the complete study has been carried out in terms of problems in the existing methods and these problems are eliminated by introducing improved background elimination and segmentation algorithm, modified
optimum feature extraction algorithm and introducing a new class of face recognition algorithm. Accordingly, problem definition on each stage is formulated as follows:

The process of face recognition is very critical to identify the face in images if images are corrupted by noises. The digital images are most frequently affected by Impulse noise. This is because noise gets introduced into the data via any electrical system used for storage, acquisition, transmission, and/or processing.

Therefore, the most successful method, Enhanced Switching Median Filter (ESMF), is used to remove the noise to enhance the image. It preserves important details of the image like edge information if the image is affected either by low noise density or high noise density.

Second stage of face recognition is complex background removal and segmentation. Most of the existing segmentation algorithms have been used to segment the face image with simple background only. There are limitations and difficulties found in the existing segmentation algorithms such as images with complex background, images with similar contrast of foreground and background, reduced size of segmented image, ill defined object boundaries, highlighting smaller salient regions better than larger ones, and highlighting background instead of object of interest. To overcome these limitations and difficulties faced by the existing algorithms, an improved algorithm- Segmentation using Saliency Color Mapping Technique (SSCMT) –is proposed to overcome these limitations and difficulties faced by the existing algorithms.

Further, most of the existing datasets contains only simple front view face images, rotated left/right/up or down, different lightening conditions and as such there is no face saliency dataset with ground truth. Therefore, an artificial dataset is created from the internet, called Random Samplings (RS) dataset with manual ground truth.
The statistics metrics are calculated to test the performance of the proposed segmentation algorithm (SSCMT algorithm) with available non face Microsoft Research Asia Salient Object Database (MSRA SOD), applied on artificially created RS dataset and also applied on non saliency Informatics and Mathematical Modeling (IMM) face dataset.

The third stage of face recognition is the optimum features extraction using hybrid approach which includes both holistic feature such as face and local features such as eyes, nose and mouth. Certain factors influence the performance of Genetic Algorithm (GA) such as search space, fitness function, diversity, problem difficulty, and selection pressure. Besides these difficulties, the problem of finding a good initial population is also a major one. As such, the Genetic Algorithm uses random initial population to obtain the optimum result. As many researchers have suggested that a small population size could lead the algorithm to poor solutions and that a large population size could make the algorithm expend more computation time in finding solutions. In order to avoid such difficulty, the conventional Genetic Algorithm is modified by incorporating k-Mean algorithm, known as K-Mean Genetic Algorithm (KMGA) to obtain a good initial population consisting of good chromosomes for a faster search mechanism and good convergence.

Most of the research works have worked on local features, being exclusive of a holistic approach. So far, no system exists which includes both features. But, the proposed method works both holistically and also on local features. The Neural Network is the simplified model of the biological nervous system, due to which several well defined architectures of Neural Network have been developed. Further, the factors affecting the performance of the Neural Network are number of training, number of neurons. In order to increase the performance of network by minimizing all
these factors, a modified new algorithm, ‘Back Propagation Neural Network-Hippoamy algorithm’ (BPNNH), is proposed, which is based on the concept of architecture re-usability for face image recognition. This entire system is based on hybrid approach of Gray Level Co-occurrence Matrix (GLCM’s) statistical features of both holistic and local features of face image to produce high precision and high recognition rate.

The proposed algorithm is experimentally tested on IMM frontal face database which consists of 240 sample images of 40 different persons and these samples are used to extract statistical features of gray level co-occurrence matrix. These statistical features are used for recognition of a face.

Hence, this research work is named as ‘Face Recognition using Saliency Segmentation with KMGA-BPNN Hippoamy Algorithm’, which when applied on face image datasets, de-noises them more efficiently to produce good quality image, eliminates the complex background along with preserving important details of the image, segments the object of interest with high accuracy and finally recognizes the face with high recognition rate.