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Global Security Using Human Face Understanding under Vision Ubiquitous Architecture System

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***Abstract*—**Different methods containing biometric algorithms are presented for the representation of eigenfaces detection including face recognition, are identification and verification. Our theme of this research is to manage the critical processing stages (accuracy, speed, security and monitoring) of face activities with the flexibility of searching and edit the secure authorized database. In this paper we implement different techniques such as eigenfaces vector reduction by using texture and shape vector phenomenon for complexity removal, while density matching score with Face Boundary Fixation (FBF) extracted the most likelihood characteristics in this media processing contents. We examine the development and performance efficiency of the database by applying our creative algorithms in both recognition and detection phenomenon. Our results show the performance accuracy and security gain with better achievement than a number of previous approaches in all the above processes in an encouraging mode.

***Keywords*—**Ubiquitous architecture, verification, Identification, recognition

I. Introduction

GLOBAL Security of User Computer Interaction (GSUCI) research is designed and developed for the security based-system that allow efficient and natural phenomenon for both communication and interaction at any conceivable environment. GSUCI along with ubiquitous vision system circled around W5H phenomenon which is being exposed by considering the identification, activity detection (input), recognition, time limitation according to appropriate place, accuracy (output) and emotion control are discussed in our research. Simultaneously, human behavior monitoring is not only verified by everyday experience but also the validity of comprehensive information play side-by-side role in real-time communication environment. While, a comprehensive set of effective access control between vision ubiquitous architecture with secure database lead towards strong and ever-build communication. Further, ubiquitous computing along with wireless network fetches secure information of human computer interaction by the allocation of different video cameras position.

In this paper we present identification applications which represented the feature vectors of fixed frontal, by applying the critical boundary algorithm to identify unknown face. While in verification application, the numerical implementations meet the need of validity of the claimed identity to consider the output matching score with likelihood ratio phenomenon. Successful implementation of face verification move towards the face recognition section which evaluates different techniques to get the most matching scores eigenfaces. Finally, management query information of particular input (eigenface) is authenticate, schedule, monitor and serve as an output. Therefore, our goal is to convey viewer's attention towards different matters to preserve the global security and reliability of our system.

According to comparison of our architecture with other researchers, pattern matching methods deal with huge number of dimensions feature vector with their redundant characteristics. So the recognition is not accurate and hardly to make stable. Due to this condition, some low-dimensional feature vector is required to give surety of different eigenfaces. Also view capturing phenomenon consists of different techniques, in which frontal, half-face and ¾ views for recognition are most running ideas. It shows their advantageous improvement but their complication and insecure information gathering, let our system to introduce Frontal face boundary fixation phenomenon with numerous modification based on view system. In paper [1], the performance of varying lighting conditions is for away from ideal condition and unusual for practical implementation in real application. So the proposed uniform light normalization process is needed to act boldly in all conditions. While ASM[2] technique emphasis on a particular part of face shows more simple and quick data processing but accuracy move towards decline in huge amount of eigenfaces. So implementation of average difference of most local features analysis is required to achieve positive enhancement with secure management.

The paper is organized as follows. In the second section we describe the features of identification evaluation based on boundary fixation images along with monitoring-based security system in verification process. In the third and fourth sections, we explain the human-face recognition method and the results obtained from these methods. Finally, in the fifth section, we give our conclusions and suggest new direction for future research.

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II. IDENTIFICATION AND VERIFICATION METHODS

The main issue of the technologies discussed here is to identify an unknown face by performing operations on the system and extract the features of most resembled face. Simultaneously, this proved the claimed identity of the face by the system. Processing flow of system face recognition is generally fulfill the task which is described in Fig. 1

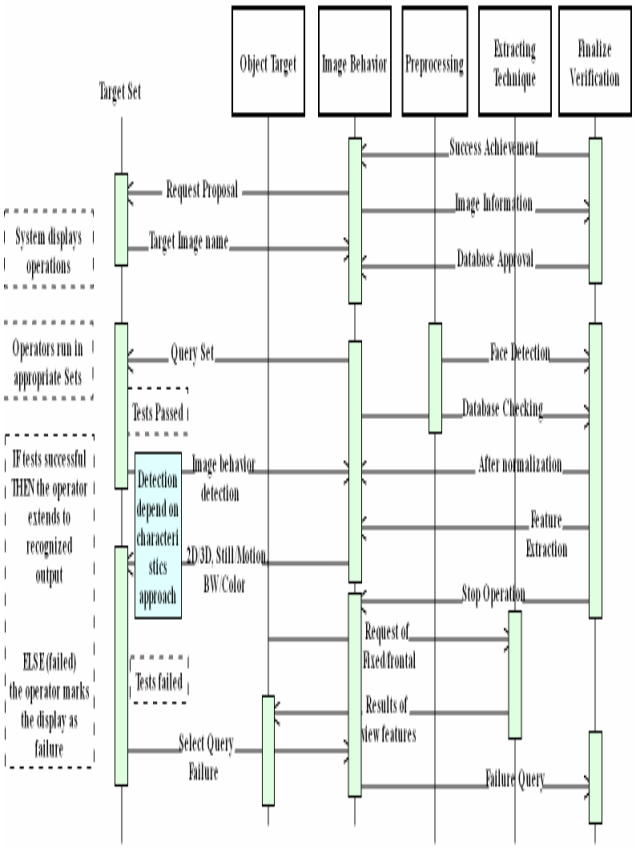

Fig. 1 Flow diagram of system-based face recognition process

The testing phenomenon is based on target set containing the query operation to run a set of design principles. The design principles executes their evaluation by fixing the most recent target object (Fixed/ Frontal/ textual) which stored the image behavior characteristics such as dimensions, background behavior, color and motion information. Image information of recognition objects normalize all extracted features which moves towards the fulfillment of query approach.

A. Methodology of identification evaluation

Identification evaluation of frontal face images is considered which performs the view and orientation characteristics to run on a fixed frontal face image for recognition.This method using Principal Component Analysis (PCA) performing functions on features vectors to represent different person properties (position and face different features) for multiple facial images. Considering the searching phenomenon of eigenfaces, we have to reduce the dimensionality of facial patterns to scratch and distinguish reliability from different faces.

Suppose, we consider a set of known faces having "$D_{(max)}$" as the weight of matrix implementation of each face parameter with N-dimensional vectors, using some average vector "μ". So the covariance matrix "$C_{(max)}$" is found as

$$C_{(max)} = \frac{1}{D_{(max)}} \sum_{j=1}^{J} (Vs_{(j)} - \mu)(Vt_{(j)} - \mu)$$

$$\left(\mu = \frac{1}{M} \sum_{n=1}^{M} \mu^{(n)} \right) \quad (1)$$

where "$Vs_{(j)}$" is the shape vector of specific face while "$Vt_{(j)}$" is the texture vector followed by the average vector "μ" having eigenimages ($\mu^{(n)}$). Each face "$Vt_{(e)}$ refers to the corresponding eigenvectors "Ψ_i" containing I eigenvalues of every eigenfaces "$w_{(i)}$" with the mean of specific face.

$$Vt_{(e)} = \sum_{i=1}^{I} \Psi_i \, w_{(i)} + \Delta Vt \quad (2)$$

While to minimize the mean absolute error (MAE), we have to consider dimensions (X, Y) movement which reducing the feature vector.

$$Xvs_{(j)} = \sum_{x=1}^{X} (Vs_{(j)} - \mu)_x \mu_x + Vt_{(c)} \quad (3)$$

$$Xvt_{(j)} = \sum_{x=1}^{X} (Vt_{(j)} - \mu)_x \mu_x + Vt_{(c)} \quad (4)$$

Same calculations are implemented in Y-dimension. Eq. (3) and (4) defines all approximation performed across X-dimensions related with shape and texture vectors.

$$Dxy_{(MAE)} = \frac{1}{D_{(max)}} \sum_{j=1}^{J} \| (V_{s_j} - \sum_{x=1}^{X} (V_{s_{(j)}} - \mu)_x \mu_x - \psi_i) \cdot$$

$$+ (Vt_{(j)} - \sum_{x=1}^{X} (Vt_{(j)} - \mu)_x \mu_x - \psi_i \|^2 \quad (5)$$

These eigenvectors obtained from the N-dimensions of every eigenfaces.

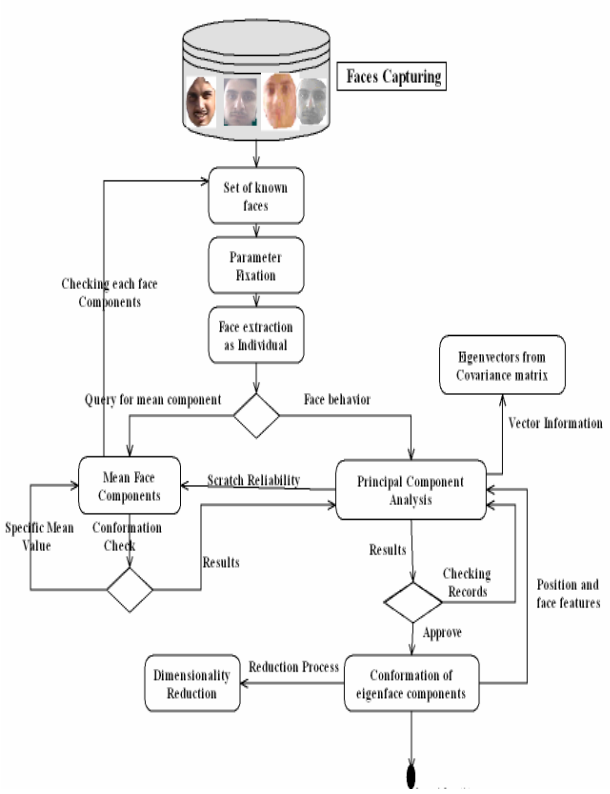

Fig. 2 Flow diagram of identity of face features with dimensionality reduction

Fig 2 shows the flow extraction of eigenfaces from a set of different eigenfaces using dimensionality reduction to minimize computational complexity.

B. *Verification Evaluation*

Considering the verification phenomenon, an algorithm is presented to identify the output density ($D_{(curr)}$) value of appropriate query which compared against the probability density ($D_{(prob)}$) present in the database.

Two possibilities are possible in this subsequent analysis: Either the value of output density ($D_{(curr)}$) compared their ratio with probability density which reaches to the highest matching score ($D_{(mat)}$), so ($D_{(curr)} : D_{(pro)} >= D_{(mat)}$) or the comparison ratio never reaches its maximum matching due to error occur during transmission. ($D_{(curr)} : D_{(pro)} < D_{(mat)}$).

If the output matches:

$$D_{(curr)} = \frac{1}{|P_{(pro)}|} \sum_{i=1}^{P} \frac{(\partial_s - \partial_e)_i}{\Delta \partial_e}$$

where considering $|P_{(pro)}|$, i=1,…., P with "∂_s" is the query signal response and "∂_e" containing error probability in this query signal with its mean property ($\Delta\partial_e$).

Otherwise

$$D_{(curr)} = \frac{1}{|P_{(pro)}|} \sum_{i=1}^{P} \frac{(\partial_s - \partial_e)_i}{\sqrt{\frac{\Delta \partial_s^2 + \Delta \partial_e^2}{2}}}$$

Therefore, their final conclusion of decision-making module of acceptance or rejection depends upon the matching score generated in matching phenomenon.

To achieve matching score results, we apply Conformation Likelihood Ratio ($\gamma_{(CLR)}$) to enhance security, accuracy and verification phenomenon.

$$\gamma_{(CLR)} = \frac{\left(\frac{1}{\partial_s 2\pi}\right)^{n/2} . \lambda e^{-\frac{1}{2}\sum (D_{(curr)})_i / \theta}}{\left(\frac{1}{\partial_n 2\pi}\right)^{n/2} \lambda e^{-\frac{1}{2}\sum (D_{(curr)})_i / \theta}}$$

where λ is the weighting factor dealing with both density functions and θ is acting as variance of each query.

III. HUMAN FACE RECOGNITION

Face recognition technique regarding with real-time pattern phenomenon create a natural and useful interaction between intensity (database) and ubiquitous view. Techniques are used to manage the features characteristics of human face and their linkage in management system.

A. *Characteristics features of human-face*

Sequential implementation is needed to standardize the features extraction in face recognition process.

Face Boundary Fixation (FBF) process is introduced to extracted human face in every condition (view moment criteria) automatically from the natural background. It exposes the manufacturing control of curvature and length operation, while also deal with the features of black/white lines at the edges.

FBF is defined as

$$\Phi_{(boun)} = \frac{1}{N} \sum_{i=1}^{N} \frac{\left(S_{(i)} - \alpha(S_{(i-1)} - S_{(i+1)})\right)^2}{\left(S_{(i)} - S_{(i-1)}\right)} + |\varepsilon_d(x,y)|^2$$

where "$S_{(i)}$" is equal to every pixel in the FBF and "α" is the total area regarded with the face. $\varepsilon_d(x,y)$ is the magnitude of edge in both x,y coordinates.

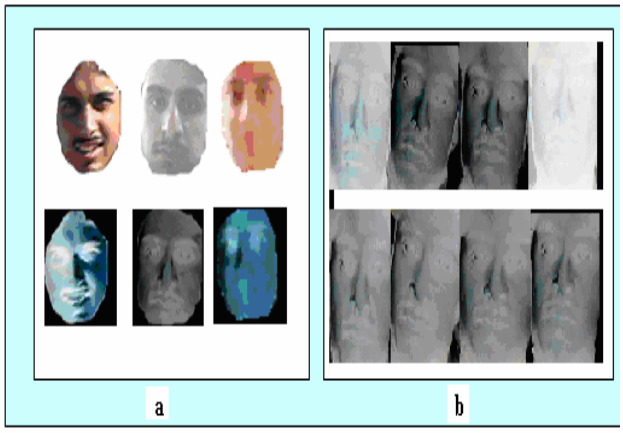

Fig. 3 Results of different features of eigenfaces using FBF proposal system. (a) FBF phenomenon (b) Light normalization

Due to this above operation, the image of the particular eigenfaces can easily be eliminated from the invariance properties (environmental behavior) by subtracting the overall pixel ($P_{(i)}$) behavior from the FBF ($\Phi_{(boun)}$) phenomenon. To find face extraction:-

$$\beta_{(ext)} = \sum_{i=0}^{N} I_{(p_{(i)} - p_{(i-1)})} - \Phi_{(boun)}$$

Similarly, light normalization has been controlled by considering the average intensity of x and y direction to smoothened [3] every row and column of pixels by using best-fitting curve method.

Finally, normalization is considered which depends upon the matching frequency, their size, intensity of the pixels and their difference between two appropriate data sets.

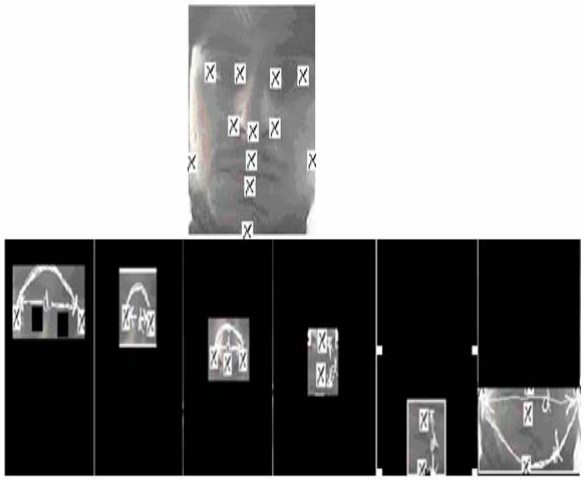

Fig. 4 Results of average difference of local features analysis of face recognition

Therefore, finding the similarity ($\Omega_{(sim)}$) and difference ($\Omega_{(diff)}$) of two views, we analyze the intensity of pixels and frequency, $\Phi_{(nor)} = I(\sum \Omega_{i(sim)} | \sum_{i=0}^{N} \Omega_{i(diff)})$ to pickup the best matching score eigenface.

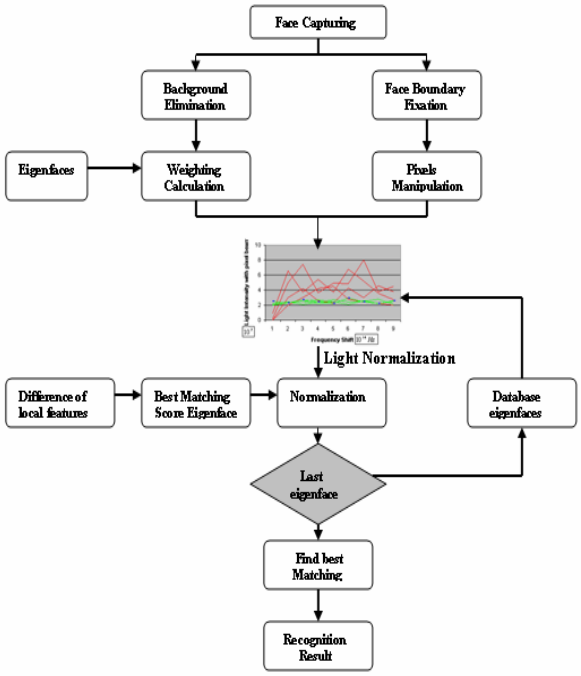

Fig. 5 Flowdiagram of the overall features of face recognition

IV. OVERALL PERFORMANCE

To calculate the performance efficiency regarding with ubiquitous view security, we considered the matching score of eigenfaces values according to storage ability of the database.

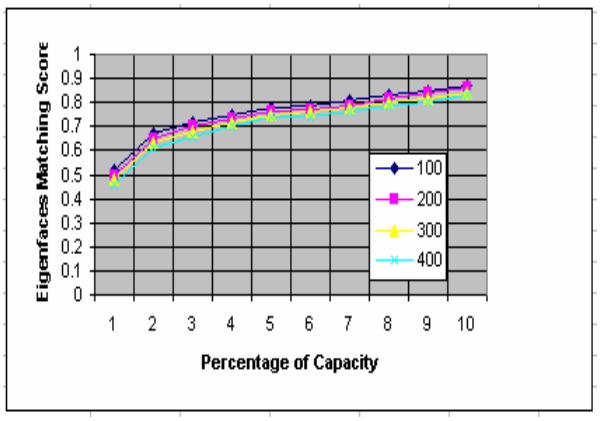

Fig. 6 Accuracy Measurement in Matching Score Value regarded with eigenfaces storage in database

Fig 6 shows the average matching score value with the fluctuation in the storage size by considering the identity features. It shows more accuracy in performance by examine in small scale (first 10 results) because curve movement is closer to each other.

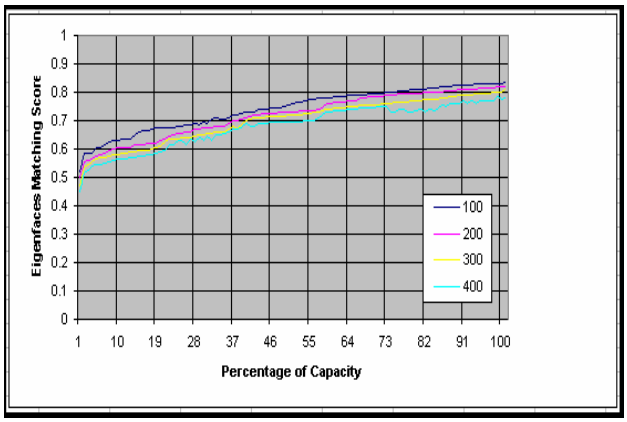

Fig. 7 Matching Score Value containing large-scale view having size 100,200,300,400

While in fig 7, we examine a large scale view (first 100 results) in which the curve moment shows that if the size of the comparison stage increase, the performance decrease. So the comparison performance measure by changing their size capability.

Simultaneously, we considered the error rate calculation regarding with number of eigenfaces. Experimental results show that the downfall of error rate proportion with the increase of eigenfaces because large eigenvalues provided more useful information as shown in Fig. 2 and 3.

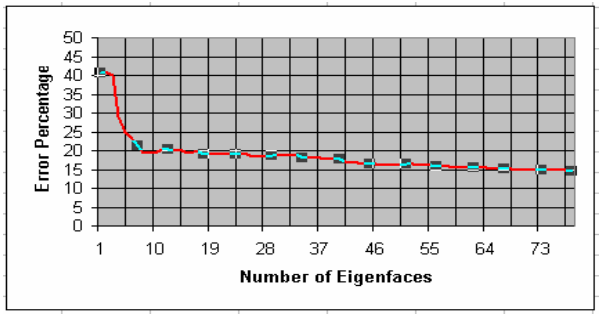

Fig. 8 Error Percentage Vs Number of eigenfaces

Fig. 8 clearly shows an inverse proportional relationship between percentage of error with size of eigenfaces.

V. CONCLUSION

We have presented a vision ubiquitous architecture system that provide different areas of human recognition in real-time with less constrained environment. Also, security-based monitoring system with face behavior activities is capable of detecting in different lighting conditions, different background and single/multiple faces in a single frame (according to webcam properties). Using the vector (shape, texture) reduction with density control of eigenfaces initializes a set of active streamline in the face region. Then, they are linked to recognition factor which acting as media processing to extract their reliable features and conform their eigenvalues to perform humanlike decision-making scenario. Our results contain the research platform which provides development with practical approach and experimentation in new implementation areas of vision ubiquitous system.

In the future, face recognition technique holds a large scale of storage (database) and also produce different other features to reduce the processing activities with upgrading of security. The proposed system can be used for safety and security in daily life activities such as an airport, shopping malls, stations and all other authenticated access locations.

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