

Face Recognition System

Ebrahim Said, Mona Nasr

Department of Information Systems, Faculty of Computers and Artificial Intelligence, Helwan University
ebrahemhesham1299@gmail.com, m.nasr@helwan.edu.eg

ABSTRACT

One of the modern technological techniques in practical application will be discussed in this paper in broad manner will be discussed on a large scale. This technique, which is considered a means of technological security to keep personal data away from the hands of snoopers and spies, this technology has occupied the minds of developers in recent years who have ensured its development continuously is a facial recognition technology.

Keywords – Face Recognition, Artificial Neural Network, Facial Expression recognition, Recognition Algorithms

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I. INTRODUCTION

The concept “**recognition**” can be defined as an attempt to identify of something or someone was familiar to us before, acknowledgement of when you say something or someone, I know it before but I can't remember who is or where the last time I saw it/him or how it/he/she came across me but I think I have seen it/him/her before ,this attempt to identify what you think that you have seen in real life before but you don't remember anything about his /her or its identity is called "Attempt to Recognition" and when you have already remember his/it's or her identity this called "recognition " which we can present as that moment you remember or success in remember your memories about this thing.

As matter of fact the more popular the thing or somebody was familiar the more the others can identify which can be described as an easy task to recognize him.

the technological evolution and the massive discoveries as well as the inventions (we should mention here the great brains and creative talented as well) have the biggest effect on our access to this point of what is described as "The Humanitarian machines " or in deeper manner the "mindful machines", These fully deaf machines nowadays can even make what it can defined as an impossible to accomplish if it's depending only on the human being elementary. Learning machines how they should behave in best manner possible to the extent that they can analyzing and thinking the same way of thinking as the human is indeed a matter similar as fiction. the awareness is a concept relating to every what is humane and to grant this humane feature to the machines sometimes considered Miracle.

Humans have a wonderful ability to identify faces in a rapid and simple with no efforts to be mentioned.

It improves frequently over multiple years of childhood and resulting in the intelligence to recognize thousands of faces throughout our lifetime. This skill is gradually empowered robust.

This skill is gradually empowered robust and provide us the ability to accurately identify others nevertheless of the changes in appearance, like aging, hairstyle, facial hair, and emotions. It is also unaffected by the face way and brighten conditions.

Developing a computational model of face recognition is quite complicated, because faces are complex. Multi dimensional, and meaningful visual stimuli. Consequently, we focused our research for the sake of developing a sort of early pattern recognition ability that does not depend upon having full three-dimensional models or detailed geometry.

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Facial recognition is fast becoming popular as well with its seamless authentication experience and improving accuracy, it may even replace fingerprinting in near future. It does not depend on physical contact with individuals for authentication and therefore can be used in cultures where physical contact is undesirable. It can also be used in scenarios such as cross-border travel when large numbers of authentications must be done rapidly. While facial-recognition technology is still susceptible to morphing, it is rapidly improving, especially with the advent of 3D facial recognition. However, in cultures where women cover their faces with a niqab or veil, face recognition may be difficult to use. For this reason, many Middle Eastern countries have adopted iris capture and matching technologies in immigration control.

Our purpose was to promote a computational model of face recognition which is rapid, reasonably simple, and precise in constrained environments such as an office or a house hold even though face recognition is a high-level visional problem, there is quite a bit of structure decreed on the task.

We occupy advance of some of this structure by suggesting a scheme for recognition which is based on an information theory approach, seeking to encode the most closely info in a group of faces

which will better differentiate them from one another.

The process converts face images into a small set of characteristic feature images, called eigen faces", which are the prime components of the initial exercising set of face images. Recognition is performed by projecting a new image into the space spanned by the eigenfaces ("face space") eigenfaces ("face space") and then sorting the face by confronting its posture in face space with the positions of known individuals. Automatically learning itself and later be recognized new faces is practical within this framework Recognition under reasonably varying cases is achieved by training on a finite number of characteristic visions (e.g., a "straight on" view, a 45' view, and a profile view). This tactic has usefulness over other face recognition schemes in its speed and simplicity, learning capacity, and relative insensitivity to small or gradual changes in the face image. which are the prime components of the initial exercising set of face images. Recognition is performed by projecting a new image into the space spanned by the eigenfaces ("face space") eigenfaces ("face space") and then sorting the face by confronting its posture in face space with the positions of known individuals. Automatically learning itself and later be recognized new faces is practical within this framework Recognition under reasonably varying cases is achieved by training on a finite number of characteristic visions (e.g., a "straight on" view, a 45' view, and a profile view). This tactic has usefulness over other face recognition schemes in its speed and simplicity, learning capacity, and relative insensitivity to small or gradual changes in the face image.

II. WORKING METHODS OF FACE RECOGNITION

The face recognition technique often focuses on identifying separate physical elements in people such as the eye, nose, or mouth, for example, and the size of the head. The technique of facial recognition is often focused on identifying separate physical elements in people such as the eye, nose or mouth, for example, the size of the head, the shape of the face can also be determined by its size and the amount of space it occupies from the body and also its size is proportional to the sizes of the rest of the facial organs such as the mouth, eye and nose.

Beginning with Bledsoe's and Kaneda's early systems number of automated or semi-automated face recognition strategies have shaped and classified faces depended on normalized distances and ratios among feature points. Recently this general approach has been continued and improved by the recent work of Yuille et al. Such approaches have proven difficult to stretch to various views and have often been quite fragile. Moreover, Research in

human strategies of facial recognition, has shown that individual lineaments and their immediate relationships include an insufficient exemplification to account for the performance of adult human face identification. Nevertheless, this approach to face recognition still the most common one in the computer vision.

Recent advances in automated face analysis, pattern recognition and machine learning have made it possible to develop automatic face recognition systems to address these applications.

According to one point of view Only, recognizing face is natural Procedure to do, because of people can often do it by low efforts without much concern. On the other hand, implementation of this process in area of computer vision still a difficult problem. Participates In a biometric technology, automated face recognition has a plenty of desirable properties. They were built based on the important feature. The numerous biometric methods can be distinguished into physiological (fingerprint, DNA, face) and behavioral (keystroke, voice print) categories.

Face recognition uses the features of the face that do not change significantly with age or through surgery. These include the eyebrow ridge, cheekbones, edges of the mouth, distance between the eyes, width of the nose, and shape of the jaw line and chin.

The physiological and mental appearances are more stable and non changeable, unless by serious injury. Behavioral patterns are more sensitive to human overall condition, such as stress, illness or fatigue.

The brief analysis of the face detection techniques using effective statistical learning methods seems to be crucial as practical and robust solutions.

Face detection performance is a key issue, so mechanisms for dealing with non frontal face detection are discussed. Subspace designing and learning based proportion decreasing methods are essential to a lot of nowadays face recognition techniques. finding out these subspaces so as to extract influential features and put up powerful classifiers hold up another challenge in this area. Face recognition has characteristic of both high accuracy and low intrusive, so it has drawn the attention of the researches in various fields from psychology, image processing to computer vision.

III. STEPS OF ACQUIRING FACIAL RECOGNITION

The first level in face detection is the obtained image that is regardless of standard scale and position. It often hardness a progress filtering procedure to differentiate locations that represent faces and filters them with exact and accurate classifiers. It is remarkable that all translations, scramble up and rotational variations must be dealt in the face detection phase. For example, regarding to facial expressions and hairstyle changes or smiling and

frowning face still regarded important variations during pattern recognition stage.

In the next step, anthropometric data set based system expects the estimated location of the major face features such as eyes, nose and mouth. Of course, whole transaction is reduplicate to expect the sub features, related to major features, and ensured with collocation statistic to refuse any misallocated features.

Dedicated anchor points are produced as the result of geometric merge in the face image and then it begins the real operation of recognition. It is executed by detecting local representation of the facial shape at every point of the anchor points. The representation scheme based on approach. So that dealing with such complexity and find out the true invariant for recognition, researchers have developed several and various recognition algorithms.

There are several borders for current face recognition technology (FERET). In was provided early benchmark of face recognition technologies. While under prefect cases, performance is superb, under terms of variable lightening, expression, resolution, distance or senility, performance cut down significantly. It is the fact that face recognition systems are still not very powerful regarding to deviations and variations from ideal face image.

Another problem is a dynamic way of keeping and access granting to facial code (or facial template) stored as a set of features and extracted from image or video

Considering almost elements have been presented over of the complex process of face recognition, a few limitations and imperfections can be seen. They need illustration or exchange by new algorithms, procedures or even technologies.

We have discussed face recognition processing, including major components such as face detection, tracking, alignment and feature extraction, and it points out the technical challenges of building a face recognition system. We focus on the importance of the most successful solutions available so far.

The aim to search deeper in this subject is could be described as an invitation to take part in the further development of this technology (face recognition), Which can be considered that the continuous development in it can lead to greater and more effective results in various other fields such as the field of crime science in addition to more safety in electronic devices and prevent access to personal information on them easily

Despite the reality, there is persistent performance improvement concerning various face recognition technology areas, and it is deserved to note that current applications also require new requirements for its further development.

IV CLASSICAL FACE RECOGNITION ALGORITHMS

Facial-recognition systems and algorithms fall into two main categories: two-dimensional (2D) and three dimensional (3D). Currently, 2D systems outperform 3D, but this is expected to change soon.

There has been a speedy development of the authoritative face recognition algorithms in the last decade. The traditional face recognition algorithms can be classified into two categories: holistic features and local feature approaches. The holistic group can be also split into linear and nonlinear projection methods. Many software programs and applications have indicated good results of the linear projection appearance based methods such as principal component analysis (PCA), independent component analysis (ICA), linear discriminate analysis (LDA) Two-Dimensional PCA and linear regression classifier (LRC). However, due to large variations in illumination conditions, facial expression and other factors, these methods may fail to adequately represent the faces. The major cause of that are the face patterns exist on a complex nonlinear and non convex divergent in the high dimensional space. So that to act with such cases, nonlinear extensions have been suggested like kernel PCA (KPCA), kernel LDA (KLDA) or locally linear embedding (LLE). The most common nonlinear methods which using the kernel techniques, where the generic idea consist from mapping the info of input face images into a higher-dimensional space in which the divergent of the faces is linear and simplified. So the traditional linear methods can be utilized.

Despite of PCA, LDA and LRC are believed as linear subspace learning algorithms, it is important to take in your mind that PCA and LDA methods focus on the global structure of the Euclidean space, whereas LRC approach focuses on local structure of the divergent.

These methods so that to be applicated needed to present face onto a linear subspace spanned by the eigenface images. The distance from face space is the orthogonal distance to the plane, whereas the distance in face space is the distance along the plane from the mean image. These both distances can be turned into Mahala Nobis distances and given probabilistic interpretations. Following these, there have been developed: KPCA, kernel ICA and generalized linear discriminant analysis.

V.FACE RECOGNITION SYSTEM METHODOLOGY

Despite powerful theoretical foundation of kernel based methods, the practical application of these methods in face recognition have problems, however, does not define a practical considerable improvement compared with linear methods.

In another category, local manifestation advantages have certain qualities over holistic features. These

methods are more stable to local changes such as expression, obstruction and misalignment

The popular representative method named local binary patterns (LBPs). The popular representative method named local binary patterns (LBPs). The contiguous changes nearly the central pixel in a rapid but effective way are described by LBP. It is invariant density processing and supports small illumination variations.

Many LBP variants have been discussed to empower and make better use of the original LBP such as histogram of Gabor phase patterns and local Gabor binary pattern histogram sequence.

In general, the LBP is utilized to model the neighboring relationship jointly in spatial, frequency and orientation domains.

It allows to explore efficiently discriminant and strong information in the pattern. Extra improvement of the mentioned subspace approaches represents discriminant common vectors (DCVs) approach. The DCV method collects the likenesses amongst the elements in the same class and lands their dissimilarities. Thus, each class can be performed by some major popular vector calculated from the within scatter matrix to explore this technique, you need to test a strange face, the corresponding feature vector is computed and connected to the class with the most similar nearest common vector. Sometimes, kernel discriminative common vectors or improved discriminative common vectors and support vector machine (SVM) are inserted in the face recognition task. In a similar way to the LLE method, neighborhood preserving projection (NPP) and orthogonal NPP (ONPP) are introduced in. These approaches preserve the local structure between samples. To reflect the intrinsic geometry of the local neighborhoods, they use data-driven weights by solving a least squares problem. ONPP forces the mapping to be orthogonal and then solves an ordinary eigenvalue problem. NPP requires solving a generalized eigenvalue problem, regarding to imposing a condition of orthogonality on the projected data. However, it is still not easy to determine how to pick out the neighborhood size and how to specify best values for other hyper-parameters; for them, sparsity preserving projections and LPPs are also utilized for face recognition.

VI. ARTIFICIAL NEURAL NETWORKS IN FACE RECOGNITION

Artificial Neural Networks in face recognition in artificial neural networks are applied to conclude a solution to nonlinear dilemma. To recognize human faces, a non-convergent messy neural network is suggested in.

A radial basis function neural network integrated with a non-negative matrix factorization to recognize faces is presented in. Moreover, for face and speech investigations, utilize a momentum back propagation

neural network. Non-negative sparse coding method to learning facial features using different distance metrics and normalized cross correlation for face recognition is applied in. It has elements of both neural networks and statistical approaches and replenishes methods for recognizing face images with partial distortion and occlusion. It is unfortunate that, this processing tactic in face reorganization systems, similar to other statistical-based methods, is inexact to model classes specified only a single or a small number of training samples.

VII. EIGENFACES FOR RECOGNITION

A lot of the previous discussion about the subject on automated face recognition has not pay attention to the case of just what ARE THE aspects of the face allusions, are significant for identification, assuming that predefined measurements were suitable and enough. This directed our attentions to an information theory approach of coding and decoding face images may do provide insight into the information Content of face images, emphasizing the significant local and global "features". Such features may or may not be straight linkage to our intuitive notion of face features such as the eyes, nose, lips, and hair. using the language of information theory, we want to extract the pertinent information of a face image, encode it as efficiently as possible, and compare one face encoding with a database of models encoded similarly.

An uncomplicated approach to deduce the information contained in an image of a face is to somehow capture the diversity in a collection of face images, regardless of any judgement of features, and employing this information to encode and compare solo face images. In mathematical terms, we wish to find the principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face images. These eigenvectors can be thought of as a set of features which together characterize the variation between face images and every image's place share in more or less to each eigenvector, for the reason of that we can display the eigenvector as a sort of ghostly face which we call an eigenface.

Each face image in the training set can be represented exactly in terms of a linear combination of the eigenfaces. Some of expected resulted eigen faces is equal to the number of face images in the training set. However the faces can also be approximated using only the "best" eigenfaces - those that have the largest eigenvalues, and which therefore account for the most variance within the set of face images. The best M' eigenfaces span an M' -dimensional subspace ~ "face space" ~ of all possible images. As sinusoids of varying frequency and phase are the basis functions of a Fourier decomposition (and are in fact

eigenfunctions of linear systems), the eigenfaces are the basis vectors of the eigenface decomposition. The idea of developing eigenfaces was motivated by a technique developed by Sirovich and Kirby [10] for efficiently announced pictures of faces using principal component analysis. They discussed that a collection of face images can be something like to be reconstructed it by conserving a little collection of heaviness for each face and a few combinations of standard pictures. It occurred to us that if a plenty of face images can be reconstructed by weighted sum of a small set of characteristic images, then an efficient way to learn and recognize faces might be a good indication way to build the characteristic features from known faceimages and to recognize specific faces by comparing the feature weights needed to (approximately)reconstruct them with the weights associated with the known individuals. The following steps summarize the recognition process:

- 1- Initialization: gain the experimental set of facial images and then determine the calculation of the eigenfaces, which specify the face space.
- 2- When a new face image is inserted, determine the amount of a set of weights dependent on the input image and the M eigenfaces by computerizing the entered image onto each of the eigenfaces.
- 3- decide on whether the image is a face at all (whether known or unknown) by examining to see if the image is appropriately close to "face space" or not
- 4- If it is a face, sort the weight pattern as either a known human or as unknown.
- 5- (Optional) If the same unfamiliar, unknown face is seen many times, put in your account its characteristic weight pattern and blending it into the known faces (i.e., learn to recognize it).

VIII. FACIAL EXPRESSION RECOGNITION

Facial expression is one of various styles and modes of nonverbal communication. The message value of various modes can be vary based on context and may be congruent or diverse with each other. Recently, many researchers merged facial expression analysis with many other modes as an example nodding , prosody, and speaking.

Cohn et al. investigated the link between facial reactions and sonic prosody for depression he found recognition the depressional faces That They achieved the same accuracy rate at 79% by using facial actions and vocal prosody respectively. Gunes and Piccardi has combined facial actions and body gestures for 9 expression recognition. They found that recognition from merged face and body modalities behaves better than that from the face or the body structural alone.

For facial feature extraction in following frame-by-frame face detection, a combination of appearance

(e.g., wrinkles) and geometric features (e.g., feature points) is extracted from the face videos .

. A reference template with neutral emotions is utilized for feature comparison. For body feature extraction and tracking, they disclosed and tracked upper side of face, heads, width of shoulders and hands by using mean shift method from the body videos

IX-SKIN COLOR IN FACE ANALYSIS

Color is a popular elementary used in machine visualization applications. As a cue, it provides various advantages: more familiar to use and easier to understand and maintain. Implementations can be made computationally rapid and efficient, thus providing a low-level cue. Under balanced and regular lightening, color cue still be considered robust against geometrical changes. Its ability to differentiate the target objects from the background based on the color contrast among targets and background. In some scenes, the color itself is enough for object detection.

The main obstacle in employing color in machine vision applications is that the cameras could distinguish changes of layer colors from color shifts created by varying illumination spectra. Thus, color is sensitive to modifications in illumination which are popular under absolute environments. The changes can be due to varying light level, for example, shadowing, altering light color due to changes in spectral power allocation (like daylight and fluorescent light source), or both. Cameras and their defaults options and settings may output different appearances which are different from the perception of human vision system.

The characteristics of the face modality form a very complicated problem in sometimes as for facial image analysis.

The face is a dynamic not static and non rigid object which is harden to handle. Its structural view differs due to differences in position of face, expressions, brightness intensity in the surrounding environment and other factors such as age and make-up. As a result, for that, most of the facial analysis tasks generally involve complex and multi objective computations due to the complexity of facial patterns. Therefore, one may want to make some extra signs, such as color or motion, so that assisting and accelerating the analysis. These additional cues also offer an indication of the reliability of the face analysis results: the more the cues support the analysis, the more one can be confident about the results. For instance, with the appearance-based face detection an exhaustive scan (at different locations and scales) of the images is conducted when searching the faces. However, when the color cue is available, one can reduce the search regions by pre-processing the images and selecting only the skin-like areas. Also, in face detection, it has been

discussed greatly that color does play a virtual role under degraded conditions by facilitating low-level facial image analysis such as better estimations of the boundaries, shapes and sizes of facial features

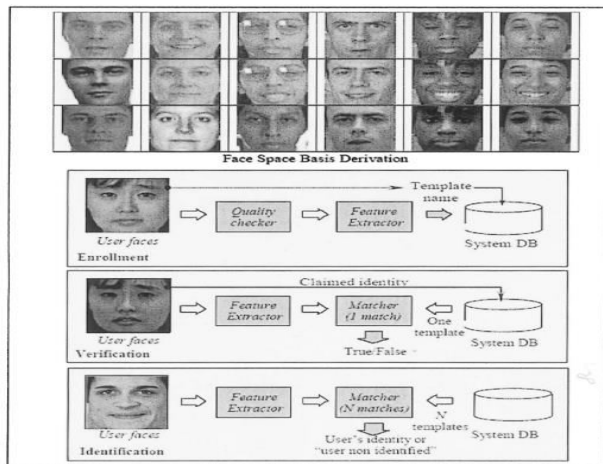


Fig no.1 FACE RECOGNITION SYSTEM METHODOLOGY AND ALGORITHMS [12]

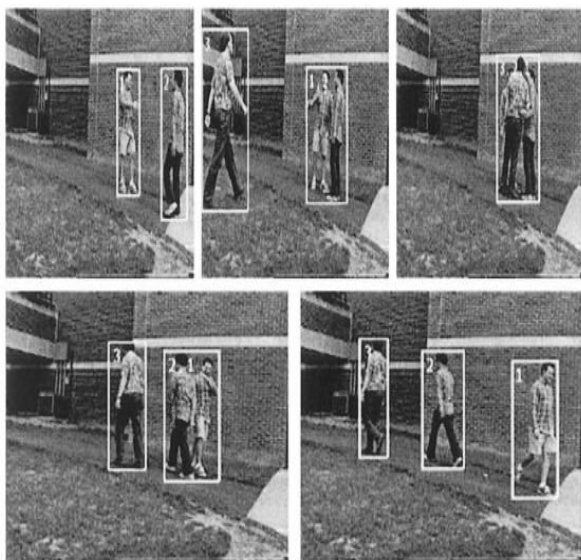


Fig no.2 Tracking people Through grouping behavior [12]

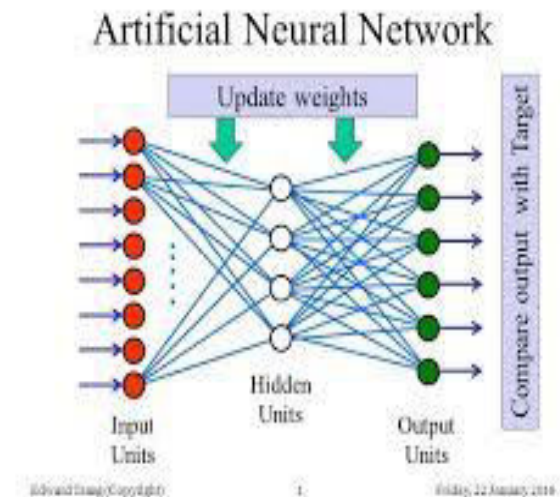


Fig no. 3A Diagram for Artificial Neural Network [12]



Fig no.4 Examples of facial analysis operations for different faces of different ages [12]

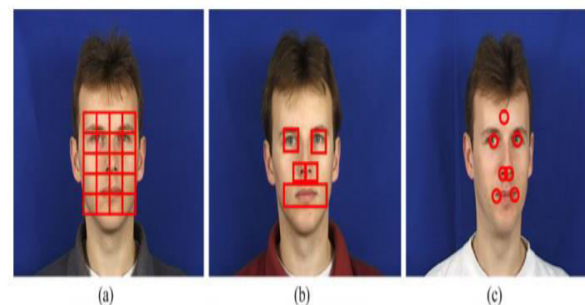


Fig no. 5 Divide the face into units to facilitate its identification in terms of the pattern of geometric shapes that limit each unit of it [12]



Fig no. 6 Different shapes of faces during different reactions and feelings [12]

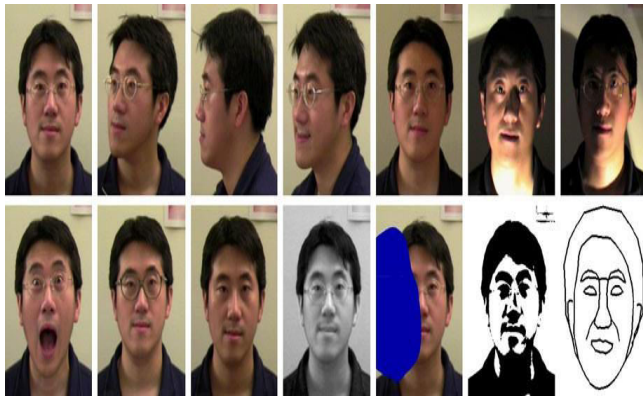


Fig no 7 Facial recognition using different rays and different imaging modes [12]

CONCLUSION

We conclude the topic by mentioning that facial recognition techniques are still in a state of continuous development and despite all the difficulties that it faces as a modern technology has not been applied before, except during the last decade, the continuous development in this field opens new horizons for us and new ideas for making superb devices and equipment capable of preserving and identifying People have to face through their faces, which opens up to us through the techniques of artificial intelligence the ideas of making a complete robot that can live with a family of robots and be more familiar with them and differentiate between them.

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