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A PATH FOR HORIZING YOUR INNOVATIVE WORK

PERSON IDENTIFICATION ACROSS PLASTIC SURGERY

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Abstract: Variation in pose, expression, illumination, occlusion and aging are the major problem in face recognition and various algorithms have been proposed to handle these challenges. Except this new problem in face recognition is plastic surgery which changes facial features to large extend. Plastic surgery procedures provide a proficient and enduring way to enhance the facial appearance by correcting feature anomalies and treating facial skin to get a younger look. Apart from cosmetic reasons, plastic surgery procedures are beneficial for patients suffering from several kinds of disorders caused due to excessive structural growth of facial features or skin tissues. The security and privacy problem has been overcome. The proposed method deals better for overcoming such problems. Matching post-surgery images with pre-surgery images becomes an arduous task for automatic face recognition algorithms. In this system, Local binary pattern is used to extracts feature from face image. Euclidean distance is used for comparing pre and post surgical facial images.

Keywords: Face Recognition; Plastic Surgery; Local Binary Pattern; Euclidean distance

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INTRODUCTION

Recently, technology became available to allow verification of "true" individual identity. This technology is based in a field called "biometrics". Biometric access control are automated methods of verifying or recognizing the identity of a living person on the basis of some physiological characteristics, such as fingerprints or facial features, or some aspects of the person's behaviour, like his/her handwriting style or keystroke patterns. Since biometric systems identify a person by biological characteristics, they are difficult to forge. Among the various biometric ID methods, the physiological methods (fingerprint, face, DNA) are more stable than methods in behavioural category (keystroke, voice print). The reason is that physiological features are often non-alterable except by severe injury. The behavioural patterns, on the other hand, may fluctuate due to stress, fatigue, or illness. However, behavioural IDs have the advantage of being no intrusiveness. People are more comfortable signing their names or speaking to a microphone than placing their eyes before a scanner or giving a drop of blood for DNA sequencing. Face recognition is one of the few biometric methods that possess the merits of both high accuracy and low intrusiveness. Also, it provides information about Age, gender, personal identity (physical structure), Mood and emotional state (facial expression) and Interest / attentional focus (direction of gaze). However, even after decades of research, face is still an active topic because of the variability observed in face due to illumination [1], pose, expression and occlusion [2]. A new challenge to face recognition is facial plastic surgery [4]. These surgeries alters the facial features to such an extent that human being often struggle to identify a person face after surgery. The Fig. 1 shows an example of the effect of plastic surgery on facial appearances.

Fig.1 The effect of plastic surgery on facial appearances

The plastic surgery is experienced world-wide and is driven by factors such as the availability of advanced technology, affordable cost and the speed with which these procedures are performed. Facial plastic surgery is generally used for correcting feature defects or improving the appearance, for example, removing birth marks, moles, scars and correcting disfiguring defects [3]. These surgical procedures prove beneficial for patients suffering from structural or

functional impairment of facial features but these procedures can also be misused by individuals who are trying to conceal their identity with the intent to commit fraud or evade law enforcement. These surgical procedures may allow anti-social elements to move freely around without any fear of being identified by any face recognition system. Plastic surgery, results being long lasting or even permanent, provide an easy and robust way to evade law and security mechanism [4]. Sometimes, facial plastic surgery may unintentionally cause rejection of genuine users.

A. Face recognition system

A facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. Facial recognition systems at a very high level work by recognizing a human face from scene and extract it. The system then measures nodal points on the face, distance between eyes, shape of the cheekbones and other distinguishable features.

B. Plastic Surgery

The acceptance of cosmetic surgery in society has saturated modern culture through television programs, news articles and advertisements for elective procedures that promise the fountain of youth and happiness. This increased media fascination has generated a greater public awareness for cosmetic procedures [4] that propagates an ideal beauty standard that is not attainable by natural .The overabundance of elective surgical messages has led to a pervasive message that the body can be “easily” modified to conform to a permanent youthful image or conform to unrealistic beauty standards. The result is the normalization of certain body images, unrealistic expectations in regard to plastic surgery, as well as unethical practices within cosmetic surgery marketing.

C. Types of Facial Plastic Surgery

When an individual undergoes plastic surgery, the facial features are reconstructed either globally or locally [3]. Therefore, in general, plastic surgery can be classified into two distinct categories. First is Disease correcting local plastic surgery for correcting defects, anomalies, or improving skin texture. This local surgery is used for correcting jaw and teeth structure, nose structure, chin, forehead and eyelids etc. Local plastic surgery is also aimed at reshaping and restructuring facial features to improve the aesthetics. Examples of this surgery are Rhinoplasty, Blepharoplasty, Brow lift, Lip augmentation etc. Second is Global surgery which is used to reconstruct complete facial structure. This include Skin resurfacing, Rhytidectomy, Liposhaving etc.

D. Facial Rcognization

Plastic surgery procedures provide a proficient and enduring way to enhance the facial appearance by correcting feature anomalies and treating facial skin to get a younger look. Apart from cosmetic reasons, plastic surgery procedures are beneficial for patients suffering from several kinds of disorders of facial features or skin tissues.

RELATED WORK

E. Component-Based Recognization System

A probabilistic approach using part-based matching has been proposed in for expression invariant and occlusion tolerant recognition of frontal faces. The global approaches and a component-based approach [8] [9] to face recognition and evaluate their robustness against pose changes have presented. The global method consists of a straightforward face detector which extracts the face from an input image and propagates it to a set of SVM classifiers that perform the face recognition.

F. Part-Based Face Recognition

We introduces a subscribes to part-based face recognition and proposes for its robust implementation a novel approach driven by boosting and transduction. Current face recognition biometric systems [7] are particularly ineffective when temporal changes, involuntary or not occur. While faces can be partially occluded and/or disguised some of their parts remain unchanged and can still be properly detected and authenticated. Part-based recognition makes biometric processing and recognition easier because it does not seek for face invariance. Instead it employs flexible geometric modelling to compensate for image variability, pose changes and limited occlusion and temporal changes.

G. Face Recognition (FR) With Feature Selection

Face recognition (FR) has emerged as one of the most extensively studied research topics that spans multiple disciplines such as pattern recognition, signal processing and computer vision. This is due to its numerous important applications in identity authentication, security access control, intelligent human-computer interaction, and automatic indexing of image and video databases. Feature extraction methods commonly represent the face images with a large set of features in which features do not contribute equally to the face recognition task. Feature selection (FS) in pattern recognition involves the derivation of the feature subset match [6] from the raw input data to reduce the amount of data used for classification and simultaneously provide enhanced discriminatory power. The selection of an appropriate set of features often exploits the design criteria such as redundancy minimization and decorrelation,

and minimization of the reconstruction error. Existing methods have the following drawbacks: It is not sufficient for improving the performance with single gallery evaluations, Offspring's are exactly similar to parents, Crossover is not performed and offspring's are generated randomly.

METHODALOGY

This work is aimed to develop a technique for recognition of facial images that have previously undergone some feature modifications through plastic surgery. This method mainly uses the approach of linear binary pattern for feature extraction and Euclidian distance for classification. The block diagram of this method is shown in Fig. 2. Both shape and texture feature is extracted from face region with the help of local binary pattern and then dimension reduction is done with the help of PCA. The flowchart contains the following steps.

- Data Collection
- Pre-processing
- Feature Extraction
- Classification

H. Data Collection

The As the plastic surgery face database is not available, data required for face recognition across plastic surgery is collected from different sources on internet. These images have noise and irregularities. So some pre-processing like image contrast maximization, filtering is done. Using these images, the plastic surgery face database is created. This plastic surgery face database contains one pre- and post-surgery face image with frontal pose, proper illumination, and neutral expression. The database consists of different types of facial plastic surgery cases such as rhinoplasty (nose surgery), blepharoplasty (eyelid surgery), brow lift, skin peeling, and rhytidectomy (face lift). Face image from this database is used as an input to the proposed face recognition system.

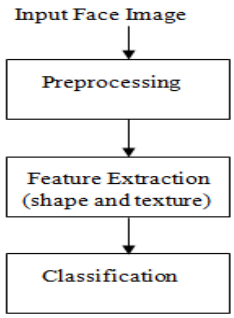

Fig. 2 The block diagram of proposed method

I. Pre-processing

The feature and information of face image should not be altered by local changes due to noise and illumination error. Hence to satisfy the environmental conditions, pre-processing of the raw data is highly important.

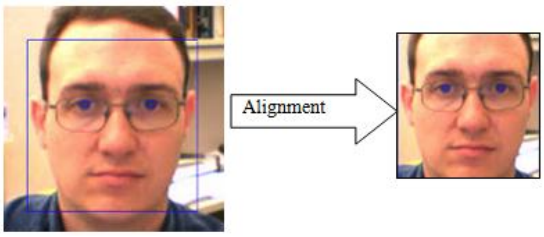

Fig. 3 Alignment process

Image capturing is a random process. The resolution of various image capturing devices may not be the same. This results in different resolution of the captured images. For accurate comparison of the features and to reduce the computational effort needed for processing, all the images should be scaled to a uniform size. So, first step of pre-processing is normalization in which face images are geometrically normalized and size of each image is uniform. Further alignment is done in which we achieve more accurate localization of face. The result of alignment process is shown in Fig. 3.

J. Feature Extraction

Another phase in face recognition is feature extraction. This is phase where the system does the localizing of the characteristics of face component (i.e. eyes, mouth, nose etc) in an image. In other words, feature extraction is a step in face recognition where the system locates certain points on the face such as corner and centre of the eyes, tip of the nose, mouth, etc. it analyze spatial geometry of differentiate feature of a face. The result of this analyzing is a set of template generated for each face. The template consists of reduced set of data that represent the uniqueness of the face image. This proposed method uses the LBP for extraction of feature from face region.

In this, first extraction of shape free patch is done and then the features are extracted from the shape free patch with the help of local binary pattern operators. The sixty eight shape landmark points for the plastic surgery face database is manually selected for training purpose. These landmarks points are shown in table I and Fig. 4 shows the landmark points location on face image. The shape modeling is done on the hand annotated shape landmark points which models the face shape variation in relation with the mean shape from the training set. In order

to avoid shape variation in texture modeling, each face image is warped to the mean shape. This is called as shape free patch.

TABLE I

LANDMARK POINTS ON FACE

Points On Face	Location
1-15	Face Outer
16-21	Right Eyebrow
22-27	Left Eyebrow
28-32	Left Eye
33-37	Right Eye
38-48,68	Nose
49-67	Lips

Fig. 4 Landmark points location on face image

Local binary patterns [5] were introduced by Ojala as a fine scale texture descriptor. In its simplest form, an LBP description of a pixel is created by thresholding the values of the 3 * 3 neighborhood of the pixel against the central pixel and interpreting the result as a binary number. The process is illustrated in Fig. 5.

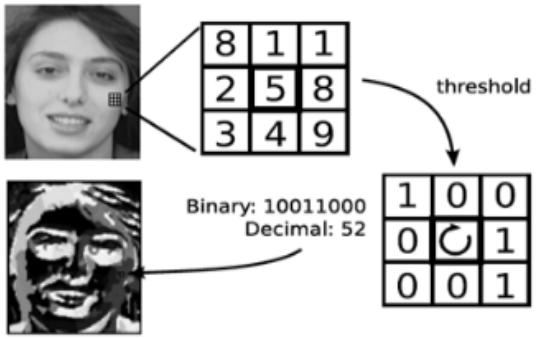

Fig. 5 The LBP operator thresholds each pixel against its neighboring pixels and interprets the result as a binary number. In the bottom image each gray-level value corresponds to a different local binary pattern.

K. Classification

Classification will be executed on the base of defined features i.e. it required some features such as density, texture or shape feature for classification of object. There are various classification techniques available, but I use Euclidean distance [10]. It is used as the classifier to identify which training set image belongs to the given test image. Classification is performed by comparing C from each training set image with the test image $Ctest$ using Euclidean distance, εi

$$\varepsilon i2 = (|| Ctest - Ci ||)2$$

Where, Ci is a shape texture parameter of the ith face image in training set. Test image is classified as belonging to image i when minimum of εi is below some chosen threshold value θ. Threshold value, $\Theta = 1/2 \max(|| Cj - Ci ||)$ where i and j are images from same class.

II. CONCLUSIONS

This paper presents an approach for recognition of surgically alter human face. This paper proposes a system which extracts features from face using local binary pattern operator. This clearly extract the shape and texture features which represents a face image in more meaningful way than any other feature extractor. In this paper we reviewed the different face recognition algorithms and their accuracy to plastic surgery face recognition. Future work will consist of experimentation and more concrete results.

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