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Recognizing Pre and Post Surgery Faces Using Multi Objective Particle Swam Optimization

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Abstract---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 Existing, multi-objective evolutionary granular algorithm is used to match face images before and after plastic surgery. The problem faced by using existing system is it fails to maintain diversity in a population which in terms decreases quality of solution. To overcome from these problems the proposed method uses PSO for premature and population diversity.

Keywords--- Plastic Surgery, Face Recognition, Face granules, feature selection, feature Extraction.

I. Introduction

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. 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. 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. Face recognition has been an intensely researched field of computer vision for the past couple of decades.

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 [1] 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 [2] are reconstructed either globally or locally. Therefore, in general plastic surgery can be classified into two distinct categories.

- Disease correcting local plastic surgery (Local surgery): This is a kind of surgery in which an individual undergoes local plastic surgery for correcting defects, anomalies, or improving skin texture. Local plastic surgery techniques can be applied for possibly three different purposes:
  1) to correct by-birth anomalies, 2) to cure the defects that are result of some accident and 3) to correct the anomalies that have developed over the years.

• Plastic surgery for reconstructing complete facial structure (Global surgery): Apart from local surgery, plastic surgery can be performed to completely change the facial structure which is known as full face lift. In this type of surgery the appearance, texture and facial features of an individual are reconstructed to resemble normal human face but are usually not the same as the original face. Furthermore, global plastic surgery may also be used to entirely change the face appearance, skin texture and other facial geometries making it arduous for any face recognition system to recognize faces before and after surgery.

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.

II. Relatedwork

A. 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 [3-12] 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.

B. 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 [6] 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 modeling to compensate for image variability, pose changes and limited occlusion and temporal changes.

C. 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 [8] 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.

III. Methodalogy

In proposed research when an individual undergoes plastic surgery facial features are reconstructed either globally or locally. In general this process changes the appearance investigate different aspects related to plastic surgery and face recognition. The premature coverage and Population diversity problem can be overcome by applying PSO (Particle swarm optimization). Dimensionality reduction techniques offer solutions that both significantly improve the computation time and yield reasonably accurate clustering results in high dimensional data analysis. In these proposed research we take the post surgery images and finding the original images using PSO algorithm.

A. Face Image Granulation

Let F be the detected frontal face image of size n × m. Face granules are generated pertaining to two levels of granularity. The first level provides global information at multiple resolutions. This is analogous to a human mind processing holistic information for face recognition at varying resolutions. Inner and outer facial information are extracted at the second level. Local facial features play an important role in face recognition by human mind.

1) First Level of Granularity

In the first level, face granules are generated by applying the Gaussian and Laplacian operators. The Gaussian operator generates a sequence of low pass filtered images by iteratively convolving each of the constituent images with a 2D Gaussian kernel. Let the granules generated by Gaussian and Laplacian operators be represented by F_{Gri} , where i represents the granule number.

2) Second Level of Granularity

To accommodate the observations of Campbell horizontal and vertical granules are generated by dividing the face image F into different regions.

Fig, 1 Horizontal face granules from the second level of granularity

Fig. 2 Vertical face granules from the second level of granularity

In the above figure $F_{Gr7}$to F_{Gr15} denote the horizontal granules and $F_{Gr16}$to F_{Gr24} denotes the vertical granules.The second level of granularity provides resilience to variations in inner and outer facial regions. It utilizes the relation between horizontal and vertical granules to address the variations in chin, forehead, ears, and cheeks caused due to plastic surgery procedures.

B. Feature Extraction

1) Extended Uniform Circular Local Binary Patterns (EUCLBP)

Extended Uniform Circular Local Binary Pattern (EUCLBP/LBP) is a texture based descriptor that encodes exact gray-level differences along with difference of sign between neighboring pixels. For each local patch, the LBP descriptor is computed based on the 8 neighboring pixels uniformly sampled on a circle (radius=2) centered at the current pixel. The concatenation of descriptors from each local patch constitutes the image signature. Two LBP descriptors are matched using the weighted χ^2 distance.

2) Scale Invariant Feature Transform (SIFT)

SIFT is a scale and rotation invariant descriptor that generates a compact representation of an image based on the magnitude, orientation, and spatial vicinity of image gradients. SIFT, is a sparse [7] descriptor that is computed around the detected interest points. However, SIFT can also be used in a dense manner where the descriptor is computed around pre-defined interest points. SIFT descriptors computed at the sampled regions are then concatenated to form the image signature. Similar to EUCLBP, weighted χ^2 distance is used to compare two SIFT descriptors.

3) Particle Swarm Optimization (PSO)

Particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. PSO optimizes [9] a problem by having a population of candidate solutions, here dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity. Each particle's movement is influenced by its local best known position and is also guided toward the best known positions in the search-space, which are updated as better positions are found by other particles. This is expected to move the swarm toward the best solutions. PSO has also been applied to multi-objective problems, in which the objective function comparison takes pare to dominance into account when moving the PSO particles and non-dominated solutions are stored so as to approximate, pare to front.

IV. Result And Disscussion

A.Performance Comparison of Genetic and PSO Algorithm

Line Chart

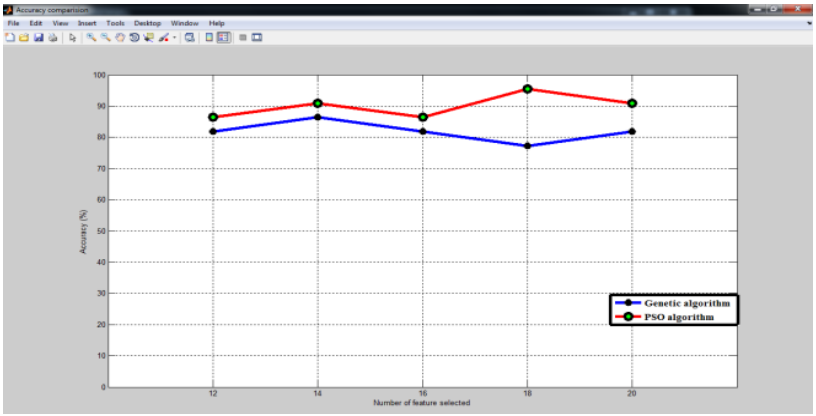

Fig. 3Comparison of Genetic and PSO Algorithm Chart

Multi-objective evolutionary approach for selecting feature extractor using participle spam optimization (PSO) provides the advantage of choosing better performing feature extractor for each face granule than Genetic algorithm.

Bar Chart

The following graph shows the Accuracy comparison for Genetic algorithm and PSO algorithm.

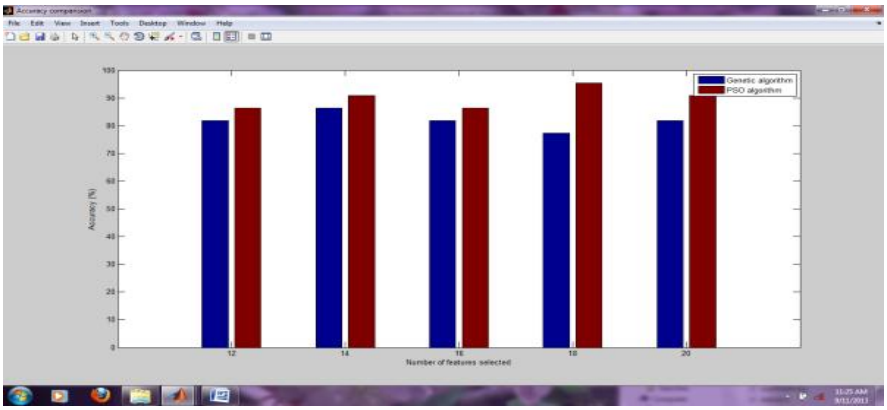

Fig.4 Comparison graph for GA and PSO

Thus the above graph depicts that the proposed Multi-objective PSO algorithm gives out better accuracy than existing Genetic algorithm**.** Figure 8 shows bar chart uses 12 images for the first set of comparisons and increasing the images at each level by 2 can get best accuracy in the successive iterations.

V. Conclusion

In this research we present an efficient face recognition algorithm with plastic surgery, first we collect the input images from before and after plastic surgery, perform the face recognition algorithm for both image. First algorithm GA original images are taken as input and found the face recognition with surgical images .After that perform novel multi-objective PSO algorithm called MOPSO has been presented. This research presents a multi-objective evolutionary granular algorithm that operates on several granules extracted from a face image. PSO optimization algorithm selects the first level of granularity processes the image with Gaussian in with gray levels images are found and second level of granularity tessellates the image into horizontal and vertical face granules of varying size and information content. Particle swarm optimization algorithm finds the best particles based on two level mentioned above and move particle i to j if the best recognition result are found than the existing recognition results .PSO is used for feature selection in input images and weighted function is added to selection of each and every feature granule in image.

Feature selection algorithm switching between the two basic extractors that is SIFT and EUCLBP/LBP and helps in encoding discriminatory information for each face granule. The proposed PSO algorithm utilizes the observation that human mind recognizes faces by analyzing the relation among non-disjoint spatial features extracted at different granularity levels. Experiments under different matching show that the proposed algorithm outperforms existing algorithms including a commercial system when matching surgically altered face images. Finally measure the performance of the system PSO and GA algorithm with accuracy measure. Based on the results, we believe that more research is required in order to design an optimal face recognition algorithm that can also account for the challenges due to plastic surgery. It is our assertion that the results of this work would inspire further research in this important area. One possible future research direction would be to use thermal-infrared imagery and compute the thermal differences between pre and post surgery images. However, such an approach first requires creating a large face database that contains pre and post operative thermal infrared images.

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