A Study on Nature - Inspired Approach of Face Recognition

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Abstract: *A number of algorithms have been developed for face recognition including ACO (Ant Colony Optimization) which is really a efficient optimization algorithm for finding the best option from a number of available ones. Face Recognition includes feature extraction, feature selection, identification of image. Feature selection in research area evolved a no. of methods eg.PCA, LDA, DCT etc. And selection also have no. of evolved methods likewise ABC, ACO, GA etc. This paper presents an review and detail analysis of a new approach using mathematical filter (mixed) approach for feature extraction, and simple Feature selection using combined equation for optimization .Finally, identification is done by Ant Colony Optimization. The analysis reports good results in recognition efficiency and time cost factor reduction. It will be useful for new researchers exploring its use in their research problems.*

Keywords: Mixed Filter, Mathematical Equation, ACO , Time-Cost Reduction

1. Introduction

It is the human face that is most telling. A face remains the most widely used way of identifying or authenticating a person. A photo of it is on most of the identifications documents that we carry in our purses and wallets. A lot of information can be provided from a person's face. While humans have always had the innate ability to recognize and distinguish between faces, computers only recently gained the same ability. The history of developing facial recognition software started in the mid 1960s, when scientist began working on using computers to recognize human faces. Since, then facial recognition software has progressed significantly .The proposed work is the enhancement of the existing face identification algorithm. At the initial stage, the featured dataset is generated for each image in the database. To obtain the feature extraction the mathematical equations is defined in this work. A mixed filter equation will perform the feature selection. Once the optimized featured dataset is generated, the second level will perform the recognition. To perform this recognition, the Ant Colony Optimization (ACO) is defined in this work. The presented works has improved the recognition rate as well as improve the efficiency and reduce the time-cost.

A facial recognition system is a computer application for 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 facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems.

2. Why Face Detection is Difficult?

- **Pose:** Variation due to the relative camera-Face pose (frontal, 45 degree, profile, upside down), and some Face features such as an eye or the nose may become partially or wholly occluded.
- **Presence or absence of structural components:** Face features such as beards, mustaches, and glasses may or may not be present, and there is a great deal of variability amongst these components including shape, color, and size.
- **Image orientation:** Face images directly vary for different rotations about the camera's optical axis.
- **Imaging conditions:** When the image is formed, factors such as lighting (spectra, source distribution and intensity) and camera characteristics (sensor response, lenses) affect the appearance of a Face.
- **Flexibility Factor of Recognition Implementation:** Incase we have to enhance some qualities of algorithm, it becomes a tedious task & specifically in area of database improvement & discarding any obsolete functioning.

3. Proposed Work

Face Recognition consist of 3 steps of procedure:

Facial Feature extraction, Feature Selection, Identification (Matching)

Facial Feature Extraction It further divides the process into two fronts-Database front, User test front

At the Database Front, feature are extracted using mathematic equation of filter (mixed)

All the data is saved in the database. We can say it as training of Dataset.

At the User Test Front, Features extracted and saved in current process and matched with the database of selected (optimized set) set of features.

Feature Selection is done using a optimization algorithm having equations that produces a set of features from previously created database of feature set.

The data is saved for matching process.

Image Identification Finally the input image feature set is matched with the stored optimized set of features.

Identification is done using mixed algorithm of ACO and Euclidean distance is finally used to find out the match.

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ACO (Ant Colony Optimization) Assumptions: Ant colony is said to be the probabilistic technique, which is used for solving the computational problems. They help in finding good solution to the problems. This is a Meta heuristic approach, which provides solution to the hard problem in the reasonable time. The reason why we use this technique is basically the foraging behavior of ants. Well now have a brief description about the working of the ants on basis of which this technique is based. The basic idea to be focused in this technique is that they chose any path and they think that path is optimum but when they actually find the optimum path then they replace old with the new one. Ants are almost blind but they still find out the shortest distance between their food and home without any visual sense. Ants follow one instinct which make them survive in any environment i.e. sociality. They cooperate with each other, communicate and divide their work they have ability to find way build nest and locating food supply. Thus this technique is adapted on the working behaviors' of ant.

- **Nodes/ food source= represent selected features.**
- **Ants = pixels of image (replaced)**

Figure1: Assumption of ACO

Step1: This is the initialization step in which we will determine what is the population of ants which would be equal to the number of features. We will set the intensity of *pheromone trial* associated with any of the path among the features. That means that we will read the distance among features in the given image and determine the threshold value. In this we will also define the maximum numbers of iterations are allowed i.e. number of nodes and paths can be traversed.
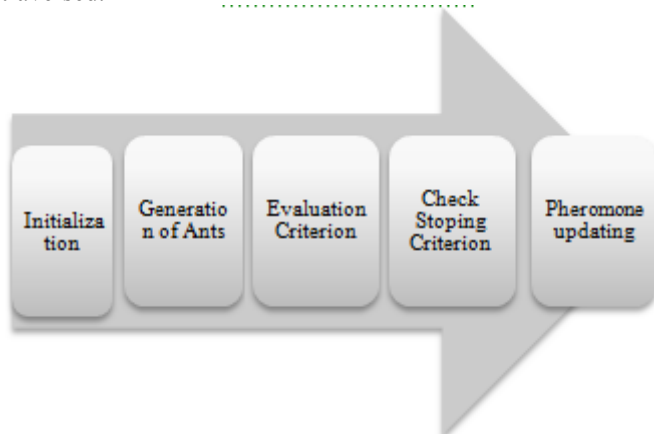

Figure 2: Process of ACO

Step 2: This step contains generation of ant. In this we will place one ant on each selected feature. We can assign any ant to feature. This ant should visit all features and build the solution completely.

Step 3: In this step we will talk about the evaluation criteria. In this step we will make use of the Euclidean Distance among the features. Then we will compare the distance obtained with the stored image distance. In this we can assume that if the distance among the features meets the

requirement with more than 40% deviation for all paths then we will exit.

Step 4: In this step we will check the stopping criteria i.e. if ants have visited all features. Nodes/paths i.e. it reaches the maximum number of iteration allowed then we would exit otherwise we will continue.

Step 5: In this step we do the process of pheromone updating i.e. pheromone intensity for the features, which are selected in step3, is updated. By doing this we will mark the path as verified and node as visited.

Considering these 3 steps of recognition, if first and second step algorithm is made a little relaxed in time factor and complexity factor, its cost will be reduced proportionally .Hence we use mathematical equation inspite of algorithms of extraction and selection. In selection also, we use a mixed set of code based on equations for optimization algorithms.

Simple mathematical Equation use & mixed ACO algorithm-

DataBase-A number of available face databases is there to implement the experiments e.g YALE, ORL etc. The study gives good results in case of time factor, efficiency factor. Database must contain flexible images like male female, all age groups, and other mixture of variants.

Extraction Equations-These equations could be enhanced accordingly to the requirement which is not facilitated if we apply a fix algorithm or methodology. This is the main advantage of this approach.

Selection Equations-A optimized set of features is produced as a result .That makes easy the process of matching and identification.

Identification/Recognition-Use of ACO with euclidean distance calculations makes the work successful for recognition.

4. Conclusion

Face Recognition is one of most used and the challenging biometric recognition and authentication system. One of the major challenges while performing the face recognition is the person's facial expression and the movement. And one other drawback is its limitation of disability of not acquiring the changes and modifications according to the demand. In this present work, a fast and effective approach is presented to perform this recognition, two layered feature extraction and selection approach is defined in this work. At first, the complete face is sub divided in different facial components. A mixed filter equation is applied to perform the feature selection. At the final stage, the ACO is applied to perform the recognition. The presented model is applied on authenticated dataset. The obtained results show the high accuracy level from the system. Other approaches used the recognition algorithms likewise ABC,ACO,BFO etc. for recognition and feature selection optimization , but here we use a simple approach of mixed filter equation for selection of features which is faster than other algorithms .We majorly concentrate on the time and cost factor of approach which

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gives a positive results.

The proposed work is about to detect the Face from the still image and to recognize it we can future enhance this work in different cases. Firstly we can include the concept of multiple person image. Second, the area to include the moving image. i.e. to capture the image from the webcam and to perform the recognition. hirdly, a more advancement in the database could be suggested to save the new images for future reference in the database .

5. Future Work

Although many face recognition techniques have been proposed and have shown significant promise, robust face recognition is still difficult. There are at least three major challenges: illumination, pose, and recognition in outdoor imagery. Some basic problems remain to be solved; for example, pose discrimination is not difficult but accurate pose estimation is hard. In addition to these problems, there are other even more difficult ones, such as recognition of a person from images acquired years apart. We can improvise this work with the inclusion of handling of these problems. We don't add the concept handling of moving or video images it could be enhanced in this area too i.e. to capture the image from the webcam and to perform the recognition. Another major enhancement suggested about the flexibility if a recognition system to acquire the changes as per the requirement of Image quality, image resolution and any sudden change in the image with the instant modifications & manipulations required in the fixed database .Because database should be dynamic acquiring new images instantly. Hence, more advancement in the database could be suggested to save the new images for future reference in the database.

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