Cross Pose Facial Recognition Method for Tracking any Person's Location an Approach

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ABSTRACT

In today's world, there are number of existing methods for facial recognition. These methods are based on frontal view face data. There are few methods which are based on non-frontal view face recognition method. In most of the face recognition algorithm, "Feature space" approach is used. In this approach, different feature vectors are extracted from face. These distances are compared to determine matches. In this paper, it is proposed that how any person can be located in a campus or in a city using a cross pose face recognition method. This paper is focusing on three parts 1) generation of multi-view images 2) comparison of images 3) showing the actual location of a person.

Keywords: Feature Space, Face Recognition, Cross Pose method.

I. INTRODUCTION

Image processing concept plays an important role in aspects of all science and technology field. Face recognition is one of the biggest challenges for today's scientist in real applications. A facial recognition system is a system which identifies and verifies a person automatically from a digital image or a video frame from a video source. One of the methods to do this is by comparing selected facial features from the image and a facial database. Face recognition is one of the most pertinent applications of image analysis. It is really a true challenge for the developer to build an automated system which can recognize faces same like a human being. "Face geometry" was the first way to recognize people. There are number of algorithms which can be used for identifying the faces. Recognition algorithm can be divided into two main approaches those are Geometric and Photometric. Geometric is a process which keeps a track on distinguishing features. Photometric is process that arranges the data into statistical form. This process converts an image into values, then it compares those values with predefined templates to eliminate variations[1].

In recent years, Biometric based techniques were widely used to identify individuals. Face recognition is having number of practical applications in the area of biometrics, smart cards, law enforcement, information security, access control and surveillance system [2]. Face recognition method can also be used for security purpose. Instead of remembering any password or PIN number, a user can feed the image of face, which can be identified by the system and the access will be granted. A good face recognition algorithm along with proper preprocessing of image can remove the noise and compensate the slight variations in scale orientation. An automated human facial expression recognition system can benefit multiple research fields. Face recognition system performs three steps

a) **DETECTION**(it finds the area of face or extracts a face from an image or a video frame).

b) **SEGMENTATION**(it analyze the distances between different points on face i.e. eyes, nose jaws etc.).

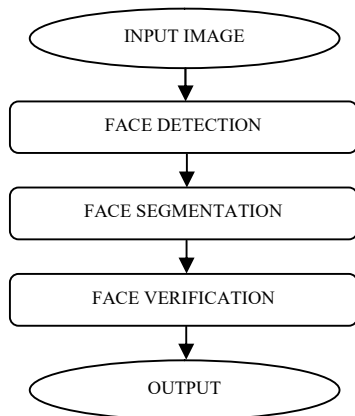c) **RECOGNITION/VERIFICATION**(it compares the statistical data with database).

INPUT IMAGE

↓

FACE DETECTION

↓

FACE SEGMENTATION

↓

FACE VERIFICATION

↓

OUTPUT

fig 1: Face Recognition System

In spite of number of methods for face recognition, there are few challenges in face recognition method as

1) **POSE VARIATIONS**: The existing system recognizes based on frontal images which can be considered as the ideal image to detect he person. The performance of face detection algorithm drops when there are large pose variations.

2) **FEATURE OCCLUSION**: Beards, hats, glasses or moustache may cause a problem for face identification. These elements may introduce high variability.

3) **FACIAL EXPRESSION**: Due to different facial expressions, the features of face varies, which also arises problem for face identification.

4) **IMAGING CONDITIONS**: Different weather conditions and the quality of a camera may also affect the quality of an image, affecting the appearance of a face.[3]

II. RELATED WORK

In the beginning of the 1970's, face recognition was treated as a 2D pattern recognition problem [4].The distances between important points were used to recognize known faces, e.g. measuring the distance between the eyes or other important points or measuring different angles of facial components. The following methods are used in face recognition process.

1. Holistic Matching Methods
2. Feature-Based (structural) Methods
3. Hybrid Methods

1. **HOLISTIC MATCHING METHODS:** In holistic approach, the complete face region is taken into account as input data into face catching system. One of the best example of holistic methods are Eigenfaces[5], Principal Component Analysis, Linear Discriminant Analysis [6] and Independent Component Analysis etc.

2. **FEATURE-BASED (STRUCTURAL) METHODS:** In this method, local features such as eyes, nose and mouth are extracted and their locations and local statistics are feed into a structural classifier. A big challenge for feature extraction methods is feature "restoration".[7]

3. **HYBRID METHODS:** Hybrid Face Recognition Systems uses a combination of both Holistic and Feature Extraction methods. Generally 3D Images are used in hybrid methods. The image of a person's face is caught in 3D, allowing the system to note the curves of the eye sockets or the shapes of the chin or forehead. The 3D system usually proceeds through different terms as: Detection, Position, Measurement, Representation and Matching.

➢ **DETECTION**: Capturing a face either by scanning a photograph or photographing a person's face in real time.

➢ **POSITION**: Determining the location, size and angle of the head.

➢ **MEASUREMENT**: Assigning measurements to each curve of the face to make a template with specific focus on the outside of the eye, the inside of the eye and the angle of the nose.

➢ **REPRESENTATION**: Converting the template into a code - a numerical representation of the face.

➢ **MATCHING**: Comparing the received data with faces in the existing database. In this case, the 3D image is to be compared with an existing 3D image.[8]

Geometric approach is another way for face recognition. The first historical way to recognize people was based on face geometry. There are lots of geometric features based on the points. Geometric features may be generated by segments, perimeters and areas of some figures formed by the points. The feature set are described in detail "Human and machine recognition of faces: a survey"[9], which helps in comparing the recognition result. It includes 15 segments between the points and the mean values of 15 symmetrical segment pairs.[10]

III. PROPOSED METHODOLOGY

The proposed system can track a person's location. This can be done by using image processing, cross pose

multi-view image generation and pattern matching concept.

In this process a 2D image of a person is given as an input, by using partial least square method, this 2D image is converted into multi-view image i.e. cross pose image in different angles(0º, 30º, 45º, 60º & 90º degrees), which will give an idea of 3D image. In the proposed system, there is a single database which is connected with several cameras and this database will store the images extracted from the videos captured by the cameras. This database is having four attributes (image, date, time &camera_id). The multi-view images generated from input image are compared with database. By using geometric and photometric approach the images are compared, wherever the images are matched, the corresponding row is fetched.

The numbers of fetched rows are stored in separate file. This separate file is having three attributes(date, time & camera_id). The records of this file is arranged in descending order, giving the higher priority to date and then to time. After sorting, the first row is fetched and the address corresponding to that camera_id is displayed on the output screen. The proposed system is explained with the help of following flowchart,
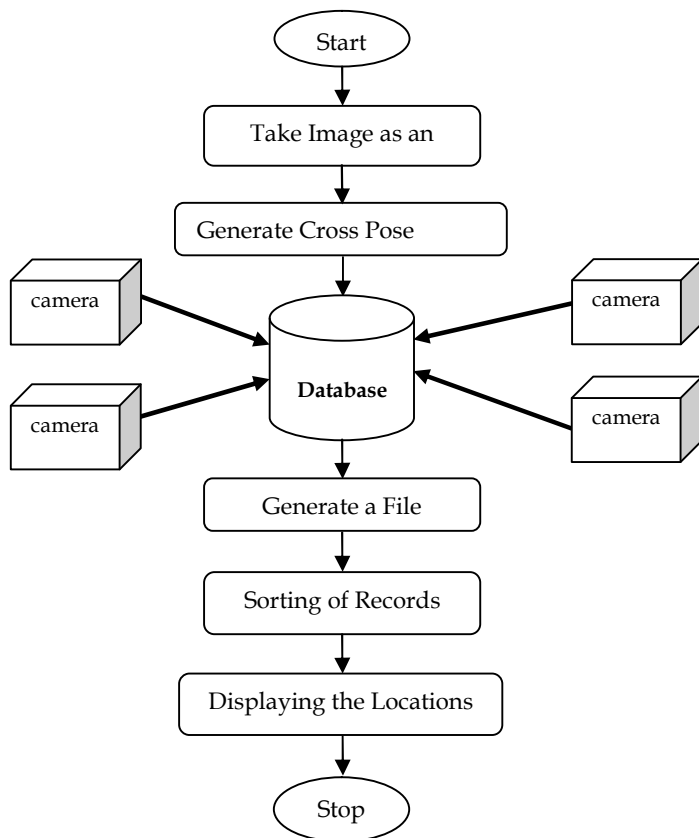

fig2: Flowchart

IV. STEP-BY-STEP DESCRIPTION OF OPERATION

a) **INPUT**: A 2D image of a person is given as an input as shown in fig 3. This image must be a person to be located. Enter the name of the person as an input so that the name can be displayed on the output screen.

fig 3: Input Image[11]

b) **PREPROCESSING**: This step will remove all the noise present in the input image.

fig 4: Preprocessed Image[11]

c) **GENERATE CROSS POSE IMAGES**: A 2D images is converted into multi-view images using partial least square method. It will generate multi-view images of facial expressions from the available 3D data. The data in this experiment includes images at five different angles(0°,30°, 45°, 60° & 90° degrees).

fig 5: Multi-View Image[11]

d) **CAMERA INTERFACING**: In this system, a high storing capacity database is required, which will store the images extracted from videos captured by different cameras. These cameras are placed at different locations having unique id. All the cameras are connected with a single database. This database is having separate subparts, which will store the images extracted from videos of each camera.

e) **FACE RECOGNITION**: The output of Partial least square method (cross pose images) of input is

compared with the database. Wherever the images are matched, its date, time and camera_ id are stored in different variables of same file. There are number of algorithms for identifying the faces. This may be done by analyzing the relative positive, size and shape of eyes, nose, cheekbones and jaws. This can be achieved either by using Eigenfaces or by Line Edge Map technique.

f) **GENERATION OF FILE**: In this step, the system will generate a file, which includes information in a tabular form as below.

Sr.	Date	Time	Camera_id
1.	12/04/2013	13:00	3
2.	13/05/2014	02:00	4
3.	14/05/2011	17:00	1
4.	16/07/2013	18:00	2

table 1: File showing details about an input image

g) **SORTING OF RECORDS**: The number of readings stored in a file in the previous step are sorted in descending order giving the first priority to "date" and then "time" as shown below.

Sr.	Date	Time	Camera_id
1.	13/05/2014	02:00	4
2.	12/04/2013	13:00	3
3.	16/07/2012	18:00	2
4.	14/05/2011	17:00	1

table 2: Records in sorted order

h) **FINAL OUTPUT** (displaying the location): After generating the sorted list, the first row is fetched from the file and the address corresponding to the camera_id present at that row is displayed on the screen as shown below.

MESSAGE

Name: Ms. Subject
Last seen
Date: 13/05/2017
Time: 02:00
Camera_id: 4
Location: 3rd floor
Computer Technology
Department KITS, Ramtek.

fig 6: Message Displaying Location

V. CONCLUSION AND FUTURE SCOPE

In the field of image analysis and computer vision, face recognition is really a challenging problem. Face recognition has received a great deal of attention because of its many applications in various domains. The analysis of face from non-frontal view is largely unexplored research. This paper includes an introductory survey from face recognition technology and cross pose generation method. A proposed system can track a location of any individual simply by using 2D image. A system can generate multi-view images or cross pose images which can give a 3D effect of an input image.

Recognizing a face accurately in all poses is still a great challenge which can be implemented in future. In future the system can be extended all over the country that requires large database which belongs to the concept of Bigdata.

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