A Project Report

on

FACE RECOGNITION SYSTEM

COMPUTER SCIENCE ENGINEERING

Under The Guidence of :-
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CANDIDATE'S DECLARATION

I/We hereby certify that the work which is being presented in the project, entitled **"CAPS…."** in partial fulfillment of the requirements for the award of the submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of month, Year to Month and Year, under the guidence of Tarun kumar Assisant professor Department of Computer Science and Engineering/Computer Application and Information and Science, of School of Computing Science and Engineering , Galgotias University, Greater Noida

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Tarun kuma
Assistant professor

CERTIFICATE

The Final Project Viva-Voce examination of ANURAG NAYAN:19SCSE1010638 and AMAN KUMAR:19SCSE1010633 has been held on _____ and his/her work is recommended for the award of Bachelor of Technology in “COMPUTER SCIENCE AND ENGINNERING” in the academic during 2019-2023.

Signature of Guide

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Abstract

The face is one of the easiest ways to distinguish the individual identity of each other. Face recognition is a personal identification system that uses personal characteristics of a person to identify the person's identity. Human face recognition procedure basically consists of two phases, namely face detection, where this process takes place very rapidly in humans, except under conditions where the object is located at a short distance away, the next is the introduction, which recognize a face as individuals. Stage is then replicated and developed as a model for facial image recognition (face recognition) is one of the much-studied biometrics technology and developed by experts. There are two kinds of methods that are currently popular in developed face recognition pattern namely, Eigenface method and Fisherface method. Facial image recognition Eigenface method is based on the reduction of facedimensional space using Principal Component Analysis (PCA) for facial features. The main purpose of the use of PCA on face recognition using Eigen faces was formed (face space) by finding the eigenvector corresponding to the largest eigenvalue of the face image. The area of this project face detection system with face recognition is Image processing. The software requirements for this project is matlab software.

Keywords: face detection, Eigen face, PCA, matlab ,openaCV,python

Extension: There are vast number of applications from this face detection project, this project can be extended that the various parts in the face can be detect which are in various directions and shapes.

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CHAPTER-1

Introduction

Face recognition is the task of identifying an already detected object as a known or unknown face.Often the problem of face recognition is confused with the problem of face detectionFace Recognition on the other hand is to decide if the "face" is someone known, or unknown, using for this purpose a database of faces in order to validate this input face.

1.1 FACE RECOGNIZATION:

DIFFERENT APPROACHES OF FACE RECOGNITION: There are two predominant approaches to the face recognition problem: Geometric (feature based) and photometric (view based). As researcher interest in face recognition continued, many different algorithms were developed, three of which have been well studied in face recognition literature.

Popular recognition algorithms include:

1. Principal Component Analysis using Eigenfaces, (PCA)
2. Linear Discriminate Analysis,
3. Elastic Bunch Graph Matching using the Fisherface algorithm,

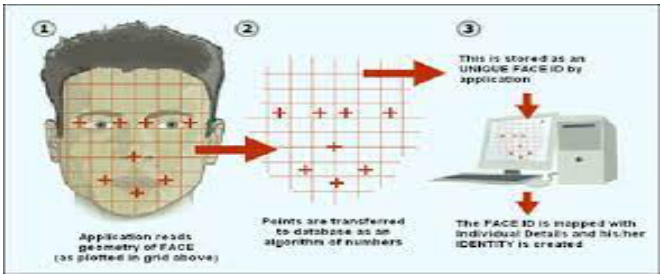


Fig 1: geometrical facial recognition

1.2 FACE DETECTION

Face detection involves separating image windows into two classes; one containing faces (tarning the background (clutter). It is difficult because although commonalities exist between faces, they can vary considerably in terms of age, skin colour and facial expression. The problem is further complicated by differing lighting conditions, image qualities and geometries, as well as the possibility of partial occlusion and disguise. An ideal face detector would therefore be able to detect the presence of any face under any set of lighting conditions, upon any background. The face detection task can be broken down into two steps. The first step is a classification task that takes some arbitrary image as input and outputs a binary value of yes or no, indicating whether there are any faces present in the image. The second step is the face localization task that aims to take an image as input and output the location of any face or faces within that image as some bounding box with (x, y, width, height).

The face detection system can be divided into the following steps:-

a) **Pre-Processing**: To reduce the variability in the faces, the images are processed before they are fed into the network.
b) **Classification**: Neural networks are implemented to classify the images as faces or nonfaces by training on these examples.
c) **Localization**: The trained neural network is then used to search for faces in an image and if present localize them in a bounding box.

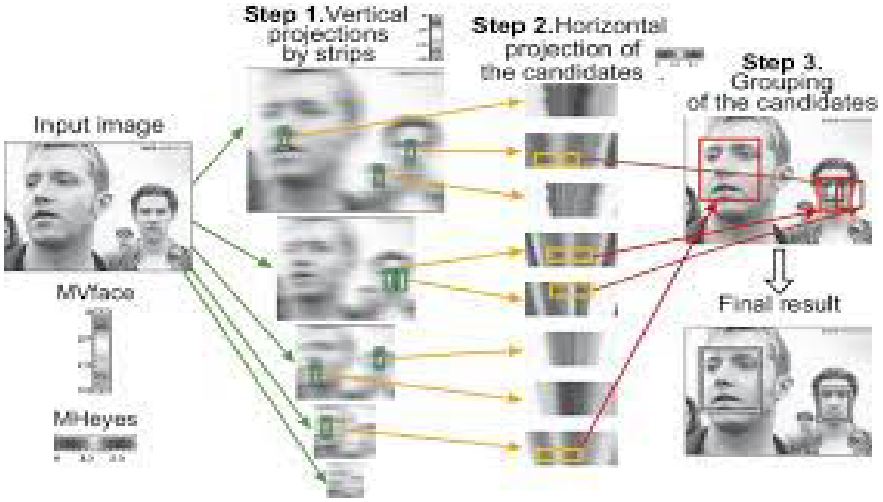


Fig 2:- Face detection algorithm

Chapter 2

LITERATURE SURVEY

Face detection is a computer technology that determines the location and size of human face in arbitrary (digital) image. The facial features are detected and any other objects like trees, buildings and bodies etc are ignored from the digital image. It can be regarded as a ‗specific' case of object-class detection, where the task is finding the location and sizes of all objects in an image that belong to a given class. Face detection, can be regarded as a more ‗general' case of face localization. In face localization, the task is to find the locations and sizes of a known number of faces (usually one). Basically there are two types of approaches to detect facial part in the given image i.e. feature base and image base approach.Feature base approach tries to extract features of the image and match it against the knowledge of the face features. While image base approach tries to get best match between training and testing images.

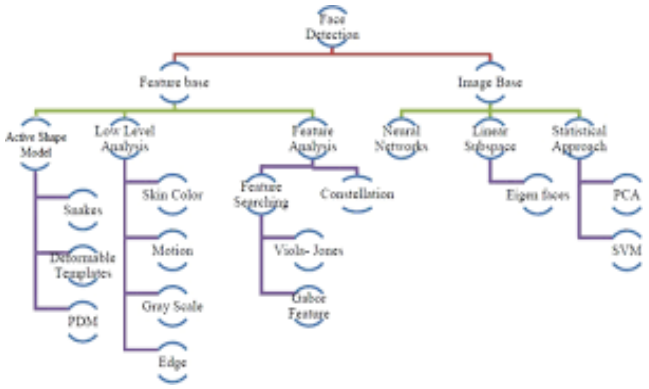


Fig 3:-detection meathod

2.1 FEATURE BASE APPROCH:

Active Shape ModelActive shape models focus on complex non-rigid features like actual physical and higher level appearance of features Means that Active Shape Models (ASMs) are aimed at automatically locating landmark points that define the shape of any statistically modeled object in an image. When of facial features such as the eyes, lips, nose, mouth and eyebrows. The training stage of an ASM involves the building of a statistical.

a) facial model from a training set containing images with manually annotated landmarks. ASMs is classified into three groups i.e. snakes, PDM, Deformable templates

b) 1.1)Snakes:The first type uses a generic active contour called snakes, first introduced by Kass et al. in 1987 Snakes are used to identify head boundaries [8,9,10,11,12]. In order to achieve the task, a snake is first initialized at the proximity around a head boundary. It then locks onto nearby edges and subsequently assume the shape of the head. The evolution of a snake is achieved by minimizing an energy function, Esnake (analogy with physical systems), denoted asEsnake = Einternal + EExternal WhereEinternal and EExternal are internal and external energy functions.Internal energy is the part that depends on the intrinsic properties of the snake and defines its natural evolution.

2.1.1 Deformable Templates:

Deformable templates were then introduced by Yuille et al. to take into account the a priori of facial features and to better the performance of snakes. Locating a facial feature boundary is not an easy task because the local evidence of facial edges is difficult to organize into a sensible global entity using generic contours

2.1.2 PDM (Point Distribution Model):

Independently of computerized image analysis, and before ASMs were developed, researchersdeveloped statistical models of shape . The idea is that once you represent shapes asvectors, you can apply standard statistical methods to them just like any other multivariateobject. These models learn allowable constellations of shape points from training examplesand use principal components to build what is called a Point Distribution Model.

2.2) LOW LEVEL ANALYSIS:

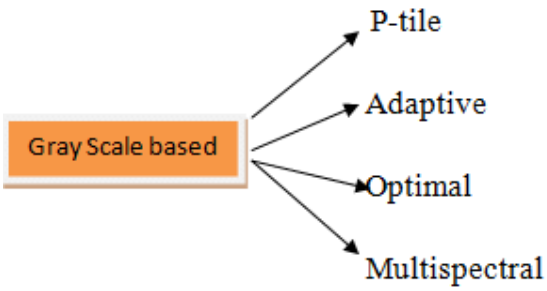
Based on low level visual features like color, intensity, edges, motion etc.Skin Color BaseColor is avital feature of human faces. Using skin-color as a feature for tracking a face has several advantages. Color processing is much faster than processing other facial features. Under certain lighting conditions, color is orientation invariant

2.3) MOTION BASE:

When useof video sequence is available, motion informationcan be used to locate moving objects. Movingsilhouettes like face and body parts can be extractedby simply thresholding accumulated framedifferences . Besides face regions, facial featurescan be located by frame differences

2.3.1 Gray Scale Base:

Gray information within a face canalso be treat as important features. Facial features such as eyebrows, pupils, and lips appear generallydarker than their surrounding facial regions. Various recent feature extraction algorithms searchfor local gray minima within segmented facial regions.



Chapter 3

DIGITAL IMAGE PROCESSING

1.1 DIGITAL IMAGE PROCESSING

Interest in digital image processing methods stems from two principal application areas:
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1. Improvement of pictorial information for human interpretation
2. Processing of scene data for autonomous machine perception

Image:
An image refers a 2D light intensity function f(x, y), where(x, y) denotes spatial coordinates and the value of f at any point (x, y) is proportional to the brightness or gray levels of the image at that point. A digital image is an image f(x, y) that has been discretized both in spatial coordinates and brightness. The elements of such a digital array are called image elements or pixels.

A simple image model: To be suitable for computer processing, an image f(x, y) must be digitalized both spatially and in amplitude. Digitization of the spatial coordinates (x, y) is called image sampling. Amplitude digitization is called gray-level quantization.

Types of image processing
• Low level processing
• Medium level processing
• High level processing

1.2 FUNDAMENTAL STEPS IN IMAGE PROCESSING:-

Fundamental steps in image processing are
1. Image acquisition: to acquire a digital image
2. Image pre-processing: to improve the image in ways that increases the chances for success of the other processes.

3. Image segmentation: to partitions an input image into its constituent parts of objects.
4. Image segmentation: to convert the input data to a from suitable for computer processing.
5. Image description: to extract the features that result in some quantitative information of interest of features that are basic for differentiating one class of objects from another.
6. Image recognition: to assign a label to an object based on the information provided by its description

Chapter – 4

MATLAB

The name MATLAB stands for MATrix LABoratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems.

4.2 MATLAB's POWER OF COMPUTAIONAL MATHMATICS

Dealing with Matrices and Arrays
• 2-D and 3-D Plotting and graphics
• Linear Algebra
• Algebraic Equations
• Non-linear Functions
• Statistics

4.3 FEATURES OF MATLAB

• It also provides an interactive environment for iterative exploration, design and problem solving.
• It provides vast library of mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration and solving ordinary differential equations.
• It provides built-in graphics for visualizing data and tools for creating custom plots.
• MATLAB's programming interface gives development tools for improving code quality, maintainability, and maximizing performance.

4.4 USES OF MATLAB

• signal processing and Communications
• image and video Processing
• control systems
• test and measurement
• computational finance
• computational biology

Chapter -5

FACE DETECTION

The problem of face recognition is all about face detection. This is a fact that seems quite bizarre to new researchers in this area. However, before face recognition is possible, one must be able to reliably find a face and its landmarks. This is essentially a segmentation problem and in practical systems, most of the effort goes into solving this task. In fact the actual recognition based on features extracted from these facial landmarks is only a minor last step.

5.1 FACE DETECTION IN IMAGES

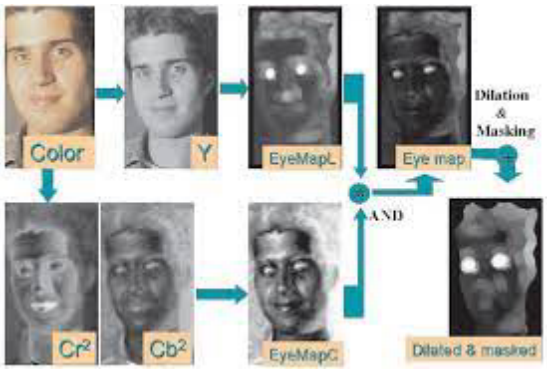


Fig 4:- A successful face detection in an image with a frontal view of a human face

5.2 REAL-TIME FACE DETECTION

Real-time face detection involves detection of a face from a series of frames from a videocapturing device. While the hardware requirements for such a system are far more stringent, from a computer vision stand point, real-time face detection is actually a far

simpler process thandetecting a face in a static image.

5.3 FACE DETECTION PROCESS

It is process of identifying different parts of human faces like eyes, nose, mouth, etc… this process can be achieved by using MATLAB codeIn this project the author will attempt to detect faces in still images by using image invariants. To do this it would be useful to study the greyscale intensity distribution of an average human face. The following 'average human face' was constructed from a sample of 30 frontal view human faces, of which 12 were from females and 18 from males. A suitably scaled colormap has been used to highlight grey-scale intensity differences.

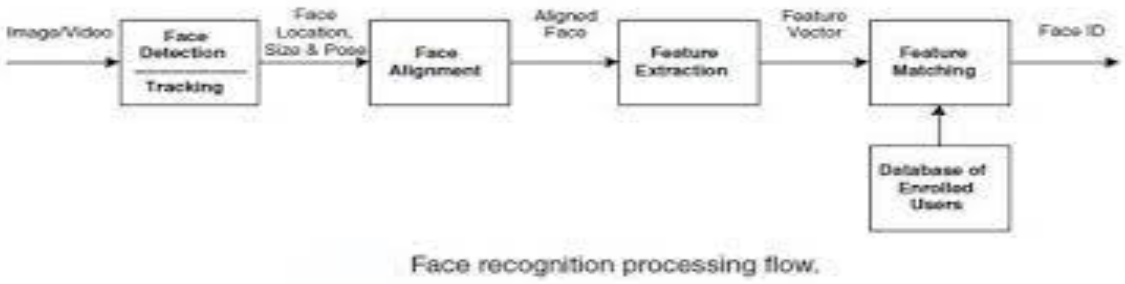
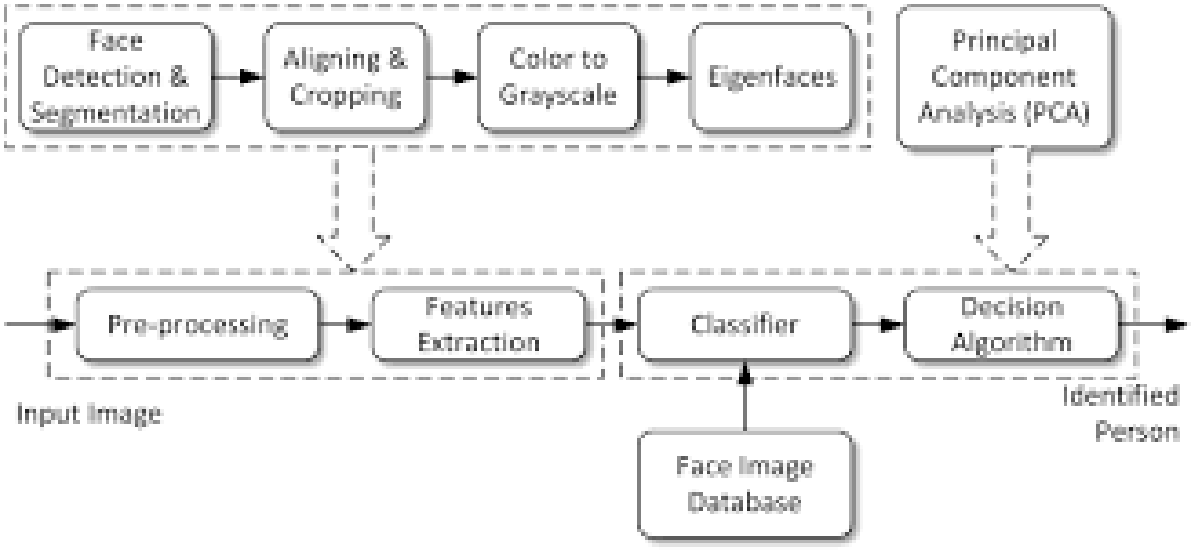


Fig 5:- face detection process

5.4 FACE DETECTION ALGORITHM



Chapter 6

FACE RECOGNITION

Over the last few decades many techniques have been proposed for face recognition. Many of the techniques proposed during the early stages of computer vision cannot be considered successful, but almost all of the recent approaches to the face recognition problem have been creditable. According to the research by Brunelli and Poggio (1993) all approaches to human face recognition can be divided into two strategies:
(1) Geometrical features and
(2) Template matching.

6.1 FACE RECOGNITION USING GEOMETRICAL FEATURES

This technique involves computation of a set of geometrical features such as nose width and length, mouth position and chin shape, etc. from the picture of the face we want to recognize. This set of features is then matched with the features of known individuals. A suitable metric such as Euclidean distance (finding the closest vector) can be used to find the closest match.

6.1.1 Face recognition using template matching

This is similar the template matching technique used in face detection, except here we are not trying to classify an image as a 'face' or 'non-face' but are trying to recognize a face.

6.2 PROBLEM SCOP AND SYSTEM SPECIFICATION

The following problem scope for this project was arrived at after reviewing the literature on face detection and face recognition, and determining possible real-world situations where such systems would be of use. The following system(s) requirements were identified

1 A system to detect frontal view faces in static images
2 A system to recognize a given frontal view face
3 Only expressionless, frontal view faces will be presented to the face detection&recognition
4 4 All implemented systems must display a high degree of lighting invariency.
5 All systems must posses near real-time performance.
6 Both fully automated and manual face detection must be supported
7 Frontal view face recognition will be realised using only a single known image
8 Automated face detection and recognition systems should be combined into a fully

automated face detection and recognition system. The face recognition sub-system must display a slight degree of invariency to scaling and rotation errors in the segmented image extracted by the face detection sub-system.

6.3 BRIEF OUT LINE OF THE IMPLEMENTED SYSTEM

Fully automated face detection of frontal view faces is implemented using a deformable template algorithm relying on the image invariants of human faces. This was chosen because a similar neural-network based face detection model would have needed far too much training data to be implemented and would have used a great deal of computing time. The main difficulties in implementing a deformable template based technique were the creation of the bright and dark intensity sensitive templates and designing an efficient implementation of the detection algorithm.

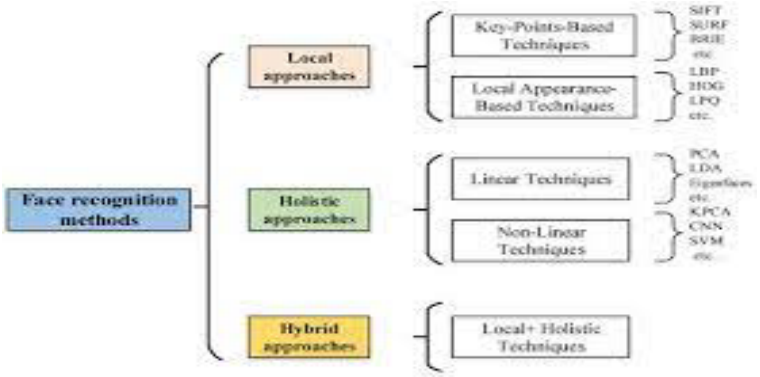


Fig 6:- face recognition system

6.4 FACE RECOGNITION DIFFICULTIES

1. Identify similar faces (inter-class similarity)
2. Accommodate intra-class variability due to
   2.1 head pose
   2.2 illumination conditions
   2.3 expressions
   2.4 facial accessories
   2.5 aging effects
3. Cartoon faces

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