Face detection system

Using Android Studio

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report titled "face detection system **" is the work of Sonu , AMAN Kaushik ,Aryan Jain and SAURABH JAYBHAYE .who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported here does not form part of any other project / research work on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.**

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LIST OF ABBREVIATIONS

S. No.	Abbreviations Used	Explanation
1	U.M.L	unified modeling language
2	ID	Identification
3	Are	area
4	App	Application
5	ER diagram	Entity relations hip diagram

LIST OF FIGURES

ABSTRACT

Face recognition is a well-known biometric method that used in many applications for authentication and identification. The original face recognition scheme takes face image, extract its features and store it as a vector in the database. The saved vector is then compared with the input image by comparing features to recognize it. Many methods had been proposed before to achieve that and to increase the level of identification accuracy. This paper proposes a new method by using a meta-heuristic algorithm Genetic and Chemical Reaction Optimization algorithms, both are implemented in parallel using multicore platform. The aim is to increase accuracy of image matching with less error rate and increase performance of the system in terms of speedup.

1. Introduction: -

1.1. Introduction: -

Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars.

Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process.

1.2. Motivation for the work: -

Face recognition has always been a very challenging task for the researches. Although we can find many other identification and verification techniques, the main motivation for face recognition is because it is considered a passive, no intrusive system to verify and identify people. About Introduction to the project including techniques: -

1.3. Problem Statement: -

Probably, they need to ask help from some protecting force like police, etc. in addition, their functioning is restricted to a particular city or town, so our app is the only solution for this drawback.

1.4. Objective of the work: -

The objective of our work is to design the software that human face from crowd or group of people.

1.5. Summary: -

Many published works mention numerous applications in which face recognition technology is already utilised including entry to secured high-risk spaces such as border crossings as well as access to restricted resources. On the other hand, there are other application areas in which face recognition has not yet been used.

Automated surveillance, where the objective is to recognise and track people.

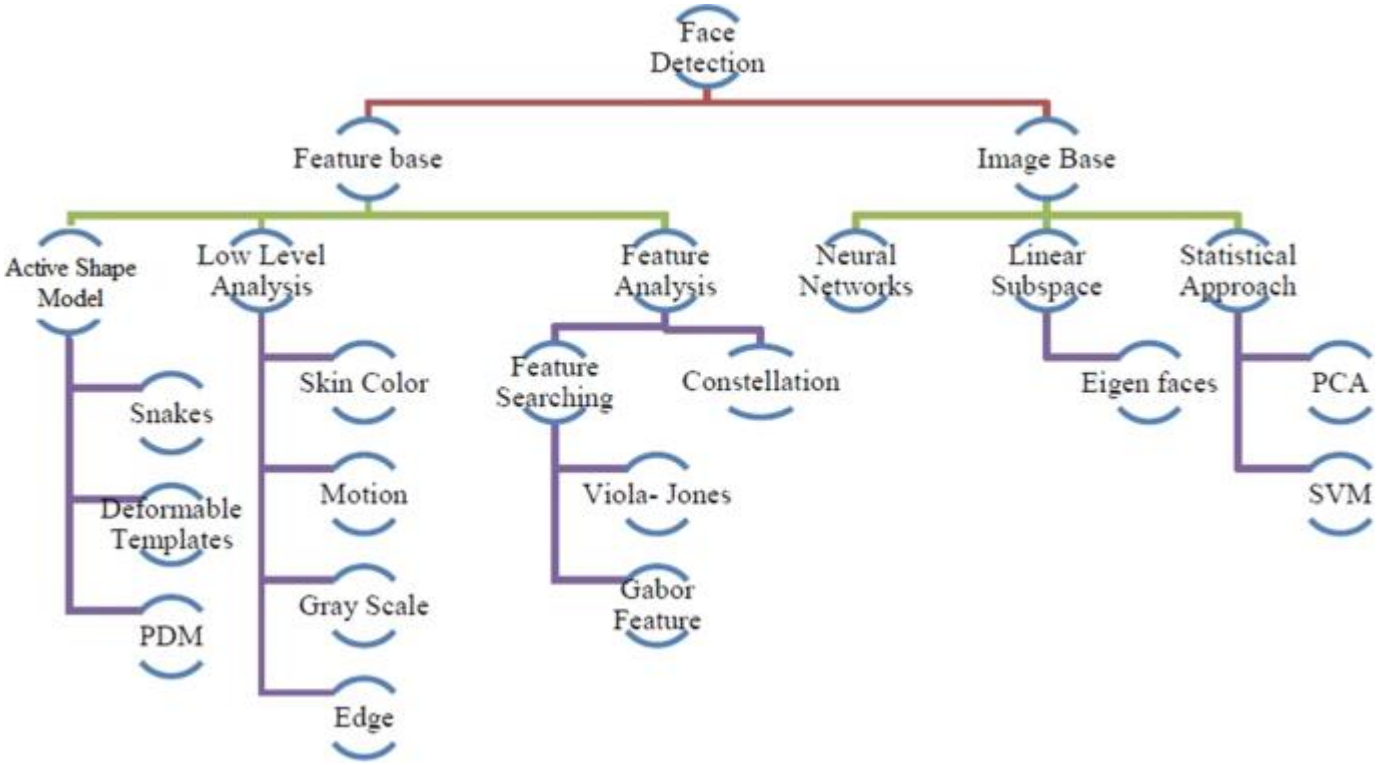
Monitoring closed circuit television (CCTV), the facial recognition capability can be embedded into existing CCTV networks, to look for lost children or other missing persons or tracking known or suspected criminals.

Image database investigations, searching image databases of licensed drivers, benefit recipients and finding people in large news photograph and video collections as well as searching in the Facebook social networking web site.

Multimedia environments with adaptive human computer interfaces (part of ubiquitous or context aware systems, behaviour monitoring at childcare or centres for old people, recognising customers and assessing their needs).

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.



FEATURE BASE APPROCH:

Active Shape Model Active 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 modelled 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 as Esnake = Einternal + External Where Einternal and External 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. The typical natural evolution in snakes is shrinking or expanding. The external energy counteracts the internal energy and enables the contours to deviate from the natural evolution and eventually assume the shape of nearby features—the head boundary at a state of equilibria. Two main consideration for forming snakes i.e. selection of energy terms and energy minimization. Elastic energy is used commonly as internal energy. Internal energy is vary with the distance between control points on the snake, through which we get contour an elastic-band characteristic that causes it to shrink or expand. On other side external energy relay on image features. Energy minimization process is done by optimization techniques such as the steepest gradient descent. Which needs highest computations. Huang and Chen and Lam and Yan both employ fast iteration methods by greedy algorithms. Snakes have some demerits like contour often becomes trapped onto false image features and another one is that snakes are not suitable in extracting non Convex features.

Edge Base:

Face detection based on edges was introduced by Sakai et al. This work was based on analysing line drawings of the faces from photographs, aiming to locate facial features. Than later Craw et al. proposed a hierarchical framework based on Sakai et al.‘s work to trace a human head outline. Then after remarkable works were carried out by many researchers in this specific area. Method suggested by Anila and Deva Rajan was very simple and fast. They proposed frame work which consist three stepsie. initially the images are enhanced by applying median filter for noise removal and histogram equalization for contrast adjustment. In the second step the edge image is constructed from the enhanced image by applying sobel operator. Then a novel edge tracking algorithm is applied to extract the sub windows from the enhanced image based on edges. Further they used Back propagation Neural Network (BPN) algorithm to classify the sub-window as either face or non-face.

FEATURE ANALYSIS :

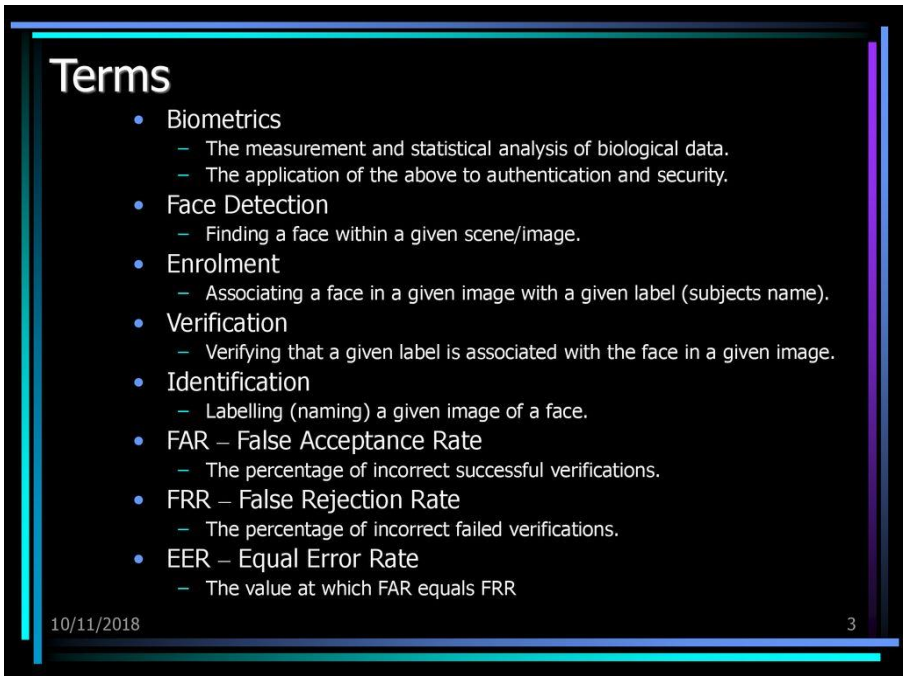
These algorithms aim to find structural features that exist even when the pose, viewpoint, or lighting conditions vary, and then use these to locate faces. These methods are designed mainly for

Support Vector Machine (SVM):

SVMs were first introduced Osuna et al. for face detection. SVMs work as a new paradigm to train polynomial function, neural networks, or radial basis function (RBF) classifiers. SVMs works on induction principle, called structural risk minimization, which targets to minimize an upper bound on the expected generalization error. An SVM classifier is a linear classifier where the separating hyper plane is chosen to minimize the expected classification error of the unseen test patterns .In Osunaet al. developed an efficient method to train an SVM for large scale problems, and applied it to face detection. Based on two test sets of 10,000,000 test patterns of 19 X 19 pixels, their system has slightly lower error rates and runs approximately30 times faster than the system by Sung and Poggio . SVMs have also been used to detect faces and pedestrians in the wavelet domain.

LINEAR SUB SPACE METHOD:-

2.6 **Eigen faces Method**: An early example of employing eigen vectors in face recognition was done by Kohonen in which a simple neural network is demonstrated to perform face recognition for aligned and normalized face images. Kirby and Sirovich suggested that images of faces can be linearly encoded using a modest number of basis images. The idea is arguably proposed first by Pearson in 1901 and then byHOTELLING in 1933 .Given a collection of n by m pixel training. Images represented as a vector of size m X n, basis vectors spanning an optimal subspace are determined such that the mean square error between the projection of the training images onto this subspace and the original images is minimized. They call the set of optimal basis vectors Eigen pictures since these are simply the eigen vectors of the covariance matrix computed from the vectorized face images in the training set. Experiments with a set of 100 images show that a face image of 91 X 50 pixels can be effectively encoded using only50 Eigen pictures.

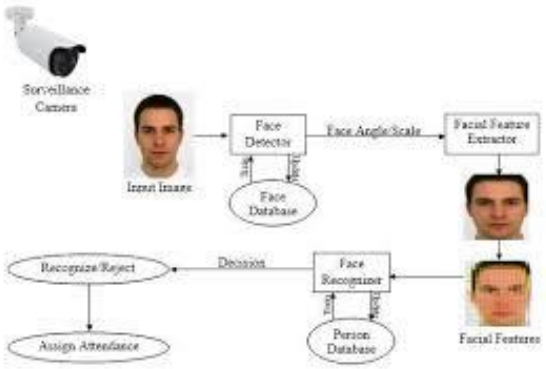


IMPROVING FACE DETECTION USING RECONSTRUCTIN:-

Reconstruction cannot be used as a means of face detection in images in near real-time since it would involve resizing the face detection window area and large matrix multiplication, both of which are computationally expensive. However, reconstruction can be used to verify whether potential face locations identified by the deformable template algorithm actually contain a face. If the reconstructed image differs greatly from the face detection window then the window probably does not contain a face. Instead of just identifying a single potential face location, the face detection algorithm can be modified to output many high 'faceness' locations which can be verified using reconstruction. This is especially useful because occasionally the best 'faceness' location found by the deformable template algorithm may not contain the ideal frontal view face pixel area. O

potential face locations that have been identified by the face detection system (the best face locations it found on its search) are checked whether they contain a face. If the threshold level (maximum difference between reconstruction and original for the original to be a face) is set correctly this will be an efficient way to detect a face. The deformable template algorithm is fast and can reduce the search space of potential face locations to a handful of positions. These are then checked using reconstruction. The number of locations found by the face detection system can be changed by getting it to output, not just the best face locations it has found so far but any location, which has a 'faceness' value, which for example is, at least 0.9 times the best heuristic

value that has been found so far. Then there will be many more potential face locations to be checked using reconstruction. This and similar speed versus accuracy trade-off decisions have to be made keeping in mind the platform on which the system is implemented. Similarly, instead of using reconstruction to check the face detection system's output, the output's correlation with the average face can be checked. The segmented areas with a high correlation probably contains a face. Once again a threshold value will have to be established to classify faces from non-faces. Similar to reconstruction, resizing the segmented area and calculating its correlation with the average face is far too expensive to be used alone for face detection but is suitable for verifying the output of the face detection system.



MATLAB

INTRODUCTION:-

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. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. Specific applications are collected in packages referred to as toolbox. There are tool boxes for signal processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering.

MATLAB's POWER OF COMPUTAIONAL MATHMATICS MATLAB

Is used in every facet of computational mathematics. Following are some commonly used mathematical calculations where it is used most commonly:

- Dealing with Matrices and Arrays
- 2-D and 3-D Plotting and graphics
- Linear Algebra
- Algebraic Equations
- Non-linear Functions
- Statistics
- Data Analysis
- Calculus and Differential Equations Numerical Calculations
- Integration
- Transforms

UNDERTANDING THE MATLAB ENVIRONMENT MATLAB development IDE can be launched from the icon created on the desktop. The main working window in MATLAB is called the desktop. When MATLAB is started, the desktop appears in its default layout.

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

CONCLUSION AND FUTURE SCOPE:-

CONCLUSION The facial expression recognition system presented in this research work contributes a resilient face recognition model based on the mapping of behavioural characteristics with the physiological biometric characteristics. The physiological characteristics of the human face with relevance to various expressions such as happiness, sadness, fear, anger, surprise and disgust are associated with geometrical structures which restored as base matching template for the recognition system. The behavioural aspect of this system relates the attitude behind different expressions as property base. The property bases are alienated as exposed and hidden category in genetic algorithmic genes. The gene training set evaluates the expressional uniqueness of individual faces and provide a resilient expressional recognition model in the field of biometric security. The design of a novel asymmetric cryptosystem based on biometrics having features like hierarchical group security eliminates the use of passwords and smart cards as opposed to earlier cryptosystems. It requires a special hardware support like all other biometrics system. This research work promises a new direction of research in the field of asymmetric biometric cryptosystems which is highly desirable in order to get rid of passwords and smart cards completely. Experimental analysis and study show that the hierarchical security structures are effective in geometric shape identification for physiological traits. 140 The facial expression based face recognition system is made efficient with genetic algorithm invariants of the facial surface resulting to a recognition rate of 95.4%. The illustration of this model is given in this research work to build expressional representations using the concept of hierarchy based embedding approach. The facial representation model is deployed in laptop for biometric authentication process. The impact of the embedding space choice on the metric (distortion) concludes that spaces with spherical geometry are more favorable for representation of facial surfaces.

SCOPE FOR FUTURE WORK The use of spherical canonical images allows us to perform matching in the spherical harmonic transform domain, which does not require preliminary alignment of the images. The errors introduced by embedding into an expressional space with some predefined geometry are avoided. In this facial expression recognition setup, end-to-end processing comprises the face surface acquisition and reconstruction, smoothening, sub sampling to approximately 2500 points. Facial surface cropping measurement of large positions of distances between all the points using a parallelized parametric version is utilized. The general experimental evaluation of the face expressional system guarantees better face recognition rates. Having examined techniques to cope with expression variation, in future it may be investigated in more depth about the face classification problem and optimal fusion of color and depth information. Further study can be laid down in the direction of allele of gene matching to the geometric factors of the facial expressions. The genetic property evolution framework for facial expressional system can be studied to suit the requirement of different security models such as criminal detection, governmental confidential security breaches etc.

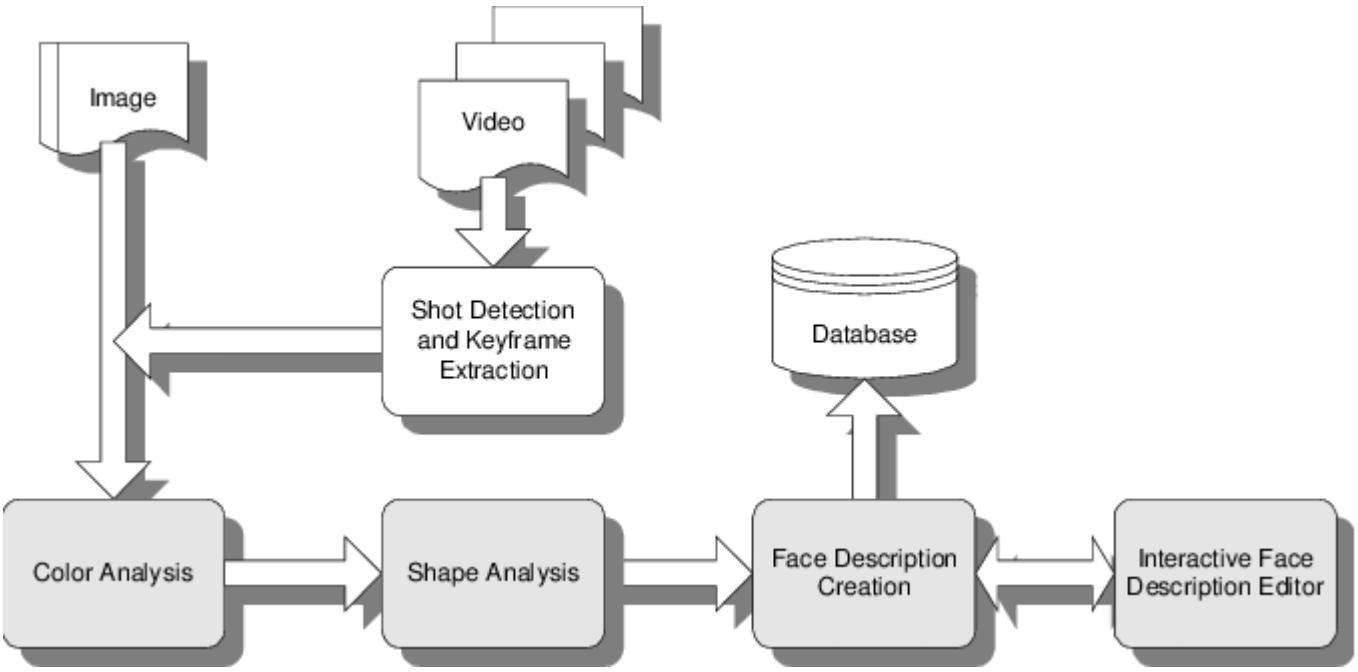


Image
Video
Shot Detection and Keyframe Extraction
Database
Color Analysis
Shape Analysis
Face Description Creation
Interactive Face Description Editor

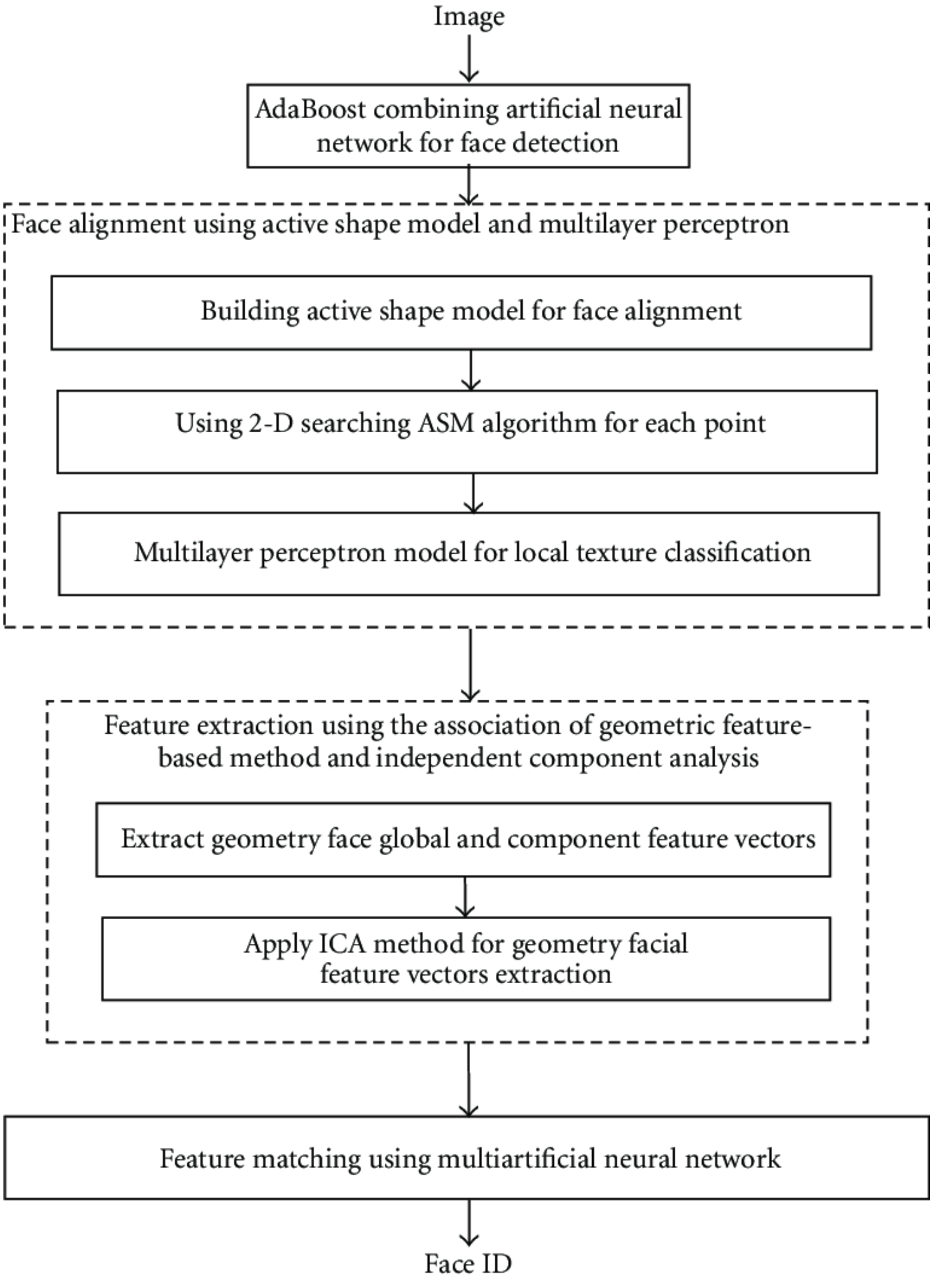


Image
AdaBoost combining artificial neural network for face detection
Face alignment using active shape model and multilayer perceptron
Building active shape model for face alignment
Using 2-D searching ASM algorithm for each point
Multilayer perceptron model for local texture classification
Feature extraction using the association of geometric feature-based method and independent component analysis
Extract geometry face global and component feature vectors
Apply ICA method for geometry facial feature vectors extraction
Feature matching using multiartificial neural network
Face ID

DATABASE

The most commonly used databases for face recognition systems under different conditions are Pointing Head Pose Image Database (PHPID) [126], Labeled Faces in Wild (LFW) [127], FERET [15,16], ORL, and Yale. The last are used for face recognition systems under different conditions, which provide information for supervised and unsupervised learning. Supervised learning is based on two training modules: image unrestricted training setting and image restricted training setting. For the first model, only "same" or "not same" binary labels are used in the training splits. For the second model, the identities of the person in each pair are provided in the training splits.

- LFW (Labeled Faces in the Wild) database was created in October 2007. It contains 13,333 images of 5749 subjects, with 1680 subjects with at least two images and the rest with a single image. These face images were taken on the Internet, pre-processed, and localized by the Viola–Jones detector with a resolution of 250 × 250 pixels. Most of them are in color, although there are also some in grayscale and presented in JPG format and organized by folders.
- FERET (Face Recognition Technology) database was created in 15 sessions in a semi-controlled environment between August 1993 and July 1996. It contains 1564 sets of images, with a total of 14,126 images. The duplicate series belong to subjects already present in the series of individual images, which were generally captured one day apart. Some images taken from the same subject vary overtime for a few years and can be used to treat facial changes that appear over time. The images have a depth of 24 bits, RGB, so they are color images, with a resolution of 512 × 768 pixels.
- AR face database was created by Aleix Martínez and Robert Benavente in the computer vision center (CVC) of the Autonomous University of Barcelona in June 1998. It contains more than 4000 images of 126 subjects, including 70 men and 56 women. They were taken at the CVC under a controlled environment. The images were taken frontally to the subjects, with different facial expressions and three different lighting conditions, as well as several accessories: scarves, glasses, or sunglasses. Two imaging sessions were performed with the same subjects, 14 days apart. These images are a resolution of 576 × 768 pixels and a depth of 24 bits, under the RGB RAW format.
- ORL Database of Faces was performed between April 1992 and April 1994 at the AT & T laboratory in Cambridge. It consists of a total of 10 images per subject, out of a total of 40 images. For some subjects, the images were taken at different times, with varying illumination and facial expressions: eyes open/closed,

smiling/without a smile, as well as with or without glasses. The images were taken under a black homogeneous background, in a vertical position and frontally to the subject, with some small rotation. These are images with a resolution of 92 × 112 pixels in grayscale.

- Extended Yale Face B database contains 16,128 images of 640 × 480 grayscale of 28 individuals under 9 poses and 64 different lighting conditions. It also includes a set of images made with the face of individuals only.

- Pointing Head Pose Image Database (PHPID) is one of the most widely used for face recognition. It contains 2790 monocular face images of 15 persons with tilt angles from −90° to +90° and variations of pan. Every person has two series of 93 different poses (93 images). The face images were taken under different skin color and with or without glasS.

6.1 Conclusion: -

The computational models, which were implemented in this project, were chosen after extensive research, and the successful testing results confirm that the choices made by the researcher were reliable. The system with manual face detection and automatic face recognition did not have a recognition accuracy over 90%, due to the limited number of eigen faces that were used for the PCA transform. This system was tested under very robust conditions in this experimental study and it is envisaged that real-world performance will be far more accurate. The fully automated frontal view face detection system displayed virtually perfect accuracy and in the researcher's opinion further work need not be conducted in this area. The fully automated face detection and recognition system was not robust enough to achieve a high recognition accuracy. The only reason for this was the face recognition subsystem did not display even a slight degree of invariance to scale, rotation or shift errors of the segmented face image. This was one of the system requirements identified in section 2.3. However, if some sort of further processing, such as an eye detection technique, was implemented to further normalise the segmented face image, performance will increase to levels comparable to the manual face detection and recognition system. Implementing an eye detection technique would be a minor extension to the implemented system and would not require a great deal of additional Research.

All other implemented systems displayed commendable results and reflect well on the deformable template and Principal Component Analysis strategies. The most suitable real-world applications for face detection and recognition systems are for mugshot matching and surveillance. There are better techniques such as iris or retina recognition and face recognition using the thermal spectrum for user access and user verification applications since these need a very high degree of accuracy. The real-time automated pose invariant face detection and recognition system proposed in chapter seven would be ideal for crowd surveillance applications. If such a system were widely implemented it’s potential for locating and tracking suspects for law enforcement agencies is immense.

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