Journal For Innovative Development in Pharmaceutical and Technical Science (JIDPTS)
Volume:2, Issue:12, December:2019

(J I D P T S)
ISSN(O):2581-6934

# Cloud Face Recognition Identification using Eigen Face Technique

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**Abstract :** The face is probably the least demanding approaches to separate the individual personality of one another. Face acknowledgment in cloud is an individual ID framework that utilizations individual attributes of an individual to distinguish the individual's character. Human face acknowledgment method fundamentally comprises of two stages, specifically face location, where this procedure happens quickly in people, aside from under conditions where the article is situated at a short separation away, the following is the presentation, which perceive a face as people. Stage is then imitated and created as a model for facial image acknowledgment (face acknowledgment) is one of the much-examined biometrics innovation and created by specialists. There are two sorts of techniques that are as of now prominent in created face acknowledgment design in cloud to be specific, Eigen face strategy and Fisher face technique. Facial image acknowledgment Eigen face strategy depends on the decrease of facedimensional space utilizing Principal Component Analysis (PCA) for facial highlights. The principle reason for the utilization of PCA on face acknowledgment utilizing Eigen faces was shaped (face space) by finding the eigenvector comparing to the biggest eigenvalue of the face image. The territory of this undertaking face location framework with face acknowledgment is Image processing in cloud. The product necessities for this venture is MATLAB programming**.**

**Keywords:** Face detection, Eigen face, PCA, MATLAB, cloud

## I. Introduction

CloudFace recognition is the errand of distinguishing a previously recognized item as a known or obscure face. Frequently the issue of face recognition is mistaken for the issue of face detection. Face Recognition then again is to choose if the "face" is somebody known, or obscure, utilizing for this reason a database of faces so as to approve this info face.

### 1.1 Cloud Face Recognition: Different Approaches of Face Recognition:

There are two overwhelming ways to deal with the face recognition issue: Geometric (include based) and photometric (see based). As specialist enthusiasm for face recognition proceeded, a wide range of calculations were created, three of which have been all around considered in face recognition writing. Recognition calculations can be partitioned into two primary methodologies:

**1. Geometric:** Depends on geometrical connection between facial milestones, or as it were the spatial setup of facial highlights. That implies that the fundamental geometrical highlights of the face, for example, the eyes, nose and mouth are first found and afterward faces are ordered based on different geometrical separations and edges between highlights.

**2. Photometric stereo:**Used to recoup the state of an article from various images taken under various lighting conditions. The state of the recuperated item is characterized by a slope map, which is comprised of a variety of surface typical. Prominent recognition calculations include:

1. Principal Component Analysis using Eigen faces, (PCA)
2. Linear Discriminate Analysis,
3. Elastic Bunch Graph Matching using the Fisher face algorithm

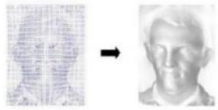

Figure 2 -Photometric stereo image.

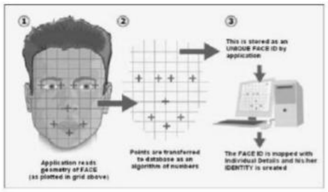

**Fig: Geometric face recognition**

**1. 2 FaceExposure:**

Face exposure 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 color 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).

**1. Pre-Processing:** To reduce the variability in the faces, the images are processed before they are fed into the network. All positive examples that is the face images are obtained by cropping images with frontal faces to include only the front view. All the cropped images are then corrected for lighting through standard algorithms.

**2. Classification:** Neural networks are implemented to classify the images as faces or nonfaces by training on these examples. We use both our implementation of the neural network and the Matlab neural network toolbox for this task. Different network configurations are experimented with to optimize the results.

**3. Localization:** The trained neural network is then used to search for faces in an image and if present localize them in a bounding box. Various Feature of Face on which the work has done on: - Position Scale Orientation Illumination

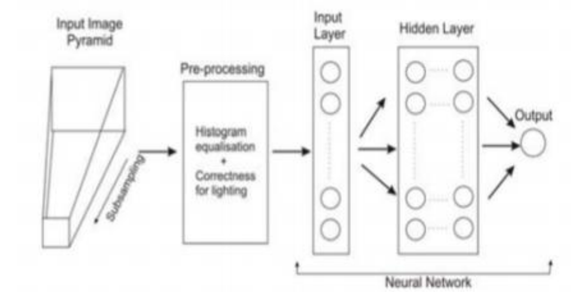


**Fig: Face detection algorithm**

## II. 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

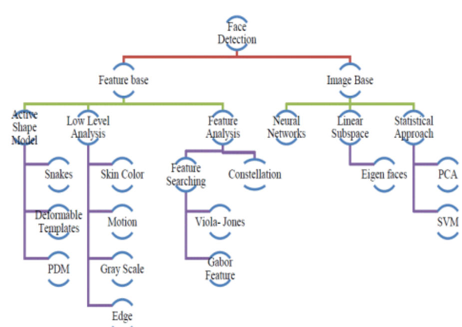


**Fig: Detection Methods**



ISSN:-2581-6934 |Available at : www.jidps.com | pp :(15-20)

## II. FACE DETECTION IN CLOUD

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. There are two types of face detection problems:

1) Face detection in images and

2) Real-time face detection

**Face detection in images**

Most face detection systems attempt to extract a fraction of the whole face, thereby eliminating most of the background and other areas of an individual's head such as hair that are not necessary for the face recognition task. With static images, this is often done by running an across the image. The face detection system then judges if a face is present inside the window. Unfortunately, with static images there is a very large search space of possible locations of a face in an image

Most face detection systems use an example based learning approach to decide whether or not a face is present in the window at that given instant. A neural network or some other classifier is trained using supervised learning with 'face' and 'non_face' examples, thereby enabling it to classify an image (window in face detection system) as a 'face' or 'non-face'. Unfortunately, while it is relatively easy to find face examples, how would one find a representative sample of images which represent non-faces. Therefore, face detection systems using example based learning need thousands of 'face' and 'non_face' images for effective training.

There is another technique for determining whether there is a face inside the face detection system's window - using Template Matching. The difference between a fixed target pattern (face) and the window is computed and thresholder. If the window contains a pattern which is close to the target pattern(face) then the window is judged as containing a face. An implementation of template matching called Correlation Templates uses a whole bank of fixed sized templates to detect facial features in an image. By using several templates of different (fixed) sizes, faces of different scales (sizes) are detected. The other implementation of template matching is using a deformable template.

Instead of using several fixed size templates, we use a deformable template (which is non-rigid) and there by change the size of the template hoping to detect a face in an image. A face detection scheme that is related to template matching is image invariants. Here the fact that the local ordinal structure of brightness distribution of a face remains largely unchanged under different illumination conditions is used to construct a spatial template of the face which closely corresponds to facial features. In other words, the average grey-scale intensities in human faces are used as a basis for face detection. For example, almost always an individual’s eye region is darker than his forehead or nose. Therefore, an image will match the template if it satisfies the 'darker than' and 'brighter than' relationships

**Real-Time Face Detection**

Real-time face detection involves detection of a face from a series of frames from a video capturing 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 than detecting a face in a static image. This is because unlike most of our surrounding environment, people are continually moving. We walk around, blink, fidget, wave our hands about, etc.

Since in real-time face detection, the system is presented with a series of frames in which to detect a face, by using spatio-temperal filtering (finding the difference between subsequent frames), the area of the frame that has changed can be identified and the individual detected. Furthermore, as seen in Figure exact face locations can be easily identified by using a few simple rules, such as,

1)the head is the small blob above a larger blob -the body

2)head motion must be reasonably slow and contiguous -heads won't jump around erratically Real-time face detection has therefore become a relatively simple problem and is possible even in unstructured and uncontrolled environments using these very simple image processing techniques and reasoning rules.



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## III. 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 code. In 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 color map has been used to highlight grey-scale intensity differences.

The grey-scale differences, which are invariant across all the sample faces are strikingly apparent. The eye-eyebrow area seems to always contain dark intensity (low) gray-levels while nose forehead and cheeks contain bright intensity (high) grey-levels. After a great deal of experimentation, the researcher found that the following areas of the human face were suitable for a face detection system based on image invariants and a deformable template.

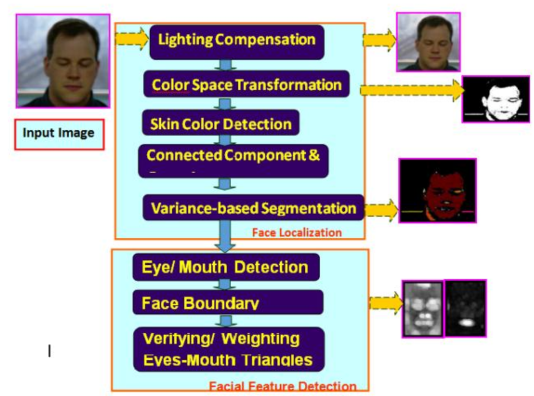


**Fig: Face Detection algorithm**

## IV. Face Recognition in Cloud

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. All approaches to human face recognition can be divided into two strategies:

(1) Geometrical features and

(2) Template matching.

### 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. Most pioneering work in face recognition was done using geometric features although did relatively recent work in this area.

The advantage of using geometrical features as a basis for face recognition is that recognition is possible even at very low resolutions and with noisy images (images with many disorderly pixel intensities). Although the face cannot be viewed in detail its overall geometrical configuration can be extracted for face recognition. The technique's main disadvantage is that automated extraction of the facial geometrical features is very hard. Automated geometrical feature extraction based recognition is also very sensitive to the scaling and rotation of a face in the image plane

### 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. Whole face, eyes, nose and mouth regions which could be used in a template matching strategy.The basis of the template matching strategy is to extract whole facial regions (matrix of pixels) and compare these with the stored images of known individuals. Once again Euclidean distance can be used to find the closest match. The simple technique of comparing grey-scale intensity values for face recognition was used.

However, there are far more sophisticated methods of template matching for face recognition. These involve extensive preprocessing and transformation of the extracted grey-level intensity values. For example, Principal Component Analysis, sometimes known as the eigenfaces approach, to pre-process the gray-levels and Elastic Graphs encoded using Gabor filters to pre-process the extracted regions. An investigation of geometrical features versus template matching for face recognition came to the conclusion that although a feature based strategy may offer higher recognition speed and


ISSN:-2581-6934 |Available at : www.jidps.com | pp :(15-20)

smaller memory requirements, template based techniques offer superior recognition accuracy.

## V. 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. A manual face detection system was realized by measuring the facial proportions of the average face, calculated from 30 test subjects. To detect a face, a human operator would identify the locations of the subject's eyes in an image and using the proportions of the average face, the system would segment an area from the image A template matching based technique was implemented for face recognition. This was because of its increased recognition accuracy when compared to geometrical features based techniques and the fact that an automated geometrical features based technique would have required complex feature detection pre-processing.

Of the many possible template matching techniques, Principal Component Analysis was chosen because it has proved to be a highly robust in pattern recognition tasks and because it is relatively simple to implement.

The author would also like to have implemented a technique based on Elastic Graphs but could not find sufficient literature about the model to implement such a system during the limited time available for this project.

Using Principal Component Analysis, the segmented frontal view face image is transformed from what is sometimes called 'image space' to 'face space'. All faces in the face database are transformed into face space. Then face recognition is achieved by transforming any given test image into face space and comparing it with the training set vectors. The closest matching training set vector should belong to the same individual as the test image.Principal Component Analysis is of special interest because the transformation to face space is based on the variation of human faces (in the training set). The values of the 'face space' vector correspond to the amount certain 'variations' are present in the test image

Face recognition and detection system is a pattern recognition approach for personal identification purposes in addition to other biometric approaches such as fingerprint recognition, signature, retina and so forth. Face is the most common biometric used by human’s applications ranges from static, mug-shot verification in a cluttered background.

## Conclusion

The computational models, which were implemented in this project, were chosen after extensive research in cloud, and the successful testing results confirm that the choices made by the researcher were reliable. The Cloud 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.

However, if some sort of further processing in cloud face processing, such as an eye detection technique, was implemented to further normalize 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 in cloud 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 in cloud 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



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need a very high degree of accuracy.The real-time automated pose invariant Cloud based face detection and recognition system proposed would be ideal for crowd surveillance applications. If such a system were widely implemented its potential for locating and tracking suspects for law enforcement agencies is immense.

The implemented fully automated face detection and recognition system (with an eye detection system) in cloud could be used for simple surveillance applications such as ATM user security, while the implemented manual face detection and automated recognition system is ideal of mugshot matching. Since controlled conditions are present when mugshots are gathered, the frontal view face recognition scheme should display a recognition accuracy far better than the results, which were obtained in this study, which was conducted under adverse conditions.

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