



## Face Detection and Recognition Methods- A Survey

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**Abstract**—A human face is central constituent of communal interaction. It is the main basis by that people recognizes every single supplementary and the focus across a conversation. As the skill to recognize every single supplementary is one of human's core skill, then a usual question to ask is whether a computer might replicate this ability. The need to craft mechanisms that are as human as probable sparks the scrutiny on face recognition. Face credit is one of the countless frank skills that are needed in order to craft a man - like machine. For most protection authentication requests whereas nearly each nature or situation needs a key, card, or password for admission can be substituted or more enhanced by face recognition. Employing face credit will considerably raise the ease of use and implementation as well as finished elegance of use. If face credit is utilized parallel alongside continuing admission methods, next the protection level might be considerably increased. This paper surveys present Face Detection and Credit Methods.

**Index Terms**— Biometrics, Face Recognition, Face Detection, Machine Learning

### I. INTRODUCTION

“Biometrics encompass of technologies that prop automatic identification or verification of individuality instituted on behavioral or physical properties”. Biometrics validates originality by computing exceptional individual characteristics. The most main spans of biometrics involve fingerprints, eyes and facial characteristics, hand geometry, retina, voice and touch. They have been consigned to infrequent use in films and in a slight elevated - protection manipulation or martial equipments [6]. Nowadays, Biometrics is rising its demands in countless outlooks of span and confidential life. For example, in the computer industry the most average confidential identification numbers (PIN) and passwords are being substituted by Biometrics. Even nevertheless these are yet the most area verification and identification methods. But they concern alongside forgery, theft that development a tremendously real menace to elevated protection settings that are nowadays arcing to biometric technologies to alleviate this potentially hazardous threat. Biometrics is obtaining popularity in the protection of restricted spans, both firm and household.

The past of face trust dates back to the 1960's afterward a semi - automated method was utilized to difference facial properties. Main the key properties in the snapshot were marked by hand; key properties encompassed eyes, ears, nose and mouth. Subsequent the distances and ratios amid these marks and a area reference point were computed and these benefits were subsequent contrasted to reference data of supplementary faces. In the main 1970's Goldstein, Harmon and Lesk crafted a face trust arrangement retaining 21 particular markers e.g. color of hair and thick knee's of lips etc. This method was less computerized than the preceding method because countless of the computations had to be made completely by hand [7].

The consecutive pace in face trust was made by Fisher and Elshlagerb in the main 1970's. They measured the key properties in a face retaining templates of the properties of the disparate servings of the face. Subsequent all the pieces were plotted on to a finished template. Even nevertheless this method was supplementary computerized than the preceding it proved to be too inconclusive as the properties utilized did not encompass plenty distinctive data to embody a face.

Fingerprints, DNA scrutiny, geometry of hand, iris screening and to a slight extent confidential signatures are all biometric identifiers. But the one that does not inhibit or stay alongside admission is face recognition. Humans understand others by their face and voice and subsequently are probable to be supplementary cozy alongside a arrangement that uses face and voice recognition.

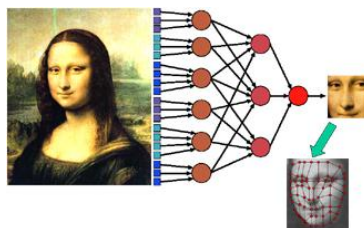


Figure 1 - Example of face recognition

This makes face trust ultimate for elevated traffic spans that are open to the finished span for e.g. railway stations ,airports, ATM's, transportation and all kinds of businesses. Face trust gives a fact of who was there. As the

facts record is stored in a database hence strangers can be noticed automatically and understood persons can be checked quickly

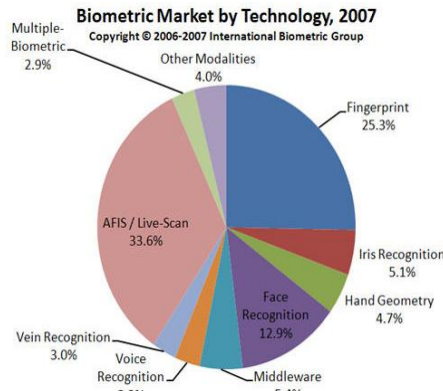


Figure 2 - Biometric Market Technology

However, to contest effectually alongside alternative biometric technologies, benefits of face biometric resolutions are to be reduced. A main competitor that matches the face biometric arrangement in words of accuracy and presentation is the non - automated fingerprint identification arrangements (non - AFIS). A reluctance to lower benefits might hamper the adoption of face trust biometrics.

The aim of this consenting is to craft a observation instituted biometric authentication arrangement for PCs. Nowadays, to notice admission entitlements most PCs use a password instituted authentication system. The reason for crafting a vision instituted authentication arrangement is because the password instituted arrangement -

- Less safeguard – Anybody could go in anybody else’s password
- Remembering passwords – This could come to be a setback after a user is accessing a number of disparate systems
- Tedious – A user has to go in his/her passwords every single period the workstation needs to be locked.

Because of the improvements completed in picture processing methods, chiefly in the spans of face detection and face credit, coupled alongside the low price of digital imaging hardware, make a vision established authentication arrangement quite useful.

## II. APPLICATION OF BIOMETRIC SYSTEM

- **Forensics** - The use of biometric in the regulation implementation and forensic is supplementary understood and from long era, it is utilized usually for convict’s identification. In particular, the AFIS (automatic fingerprint identification system) has been utilized for this purpose. Lately the facial - scan vision (mug shots) is being additionally utilized for identification of suspects. One extra appeal is the verification of persons of residence arrest and an appealing resolution for this setback is voice - scan. The normal appeal are -
- **Identification of convicts** - accumulating the facts in the scene of offense (e.g., fingerprints) it is probable to difference alongside data of suspects or make a find in the database of criminals.
- **Surveillance** - one can monitor the tremendously busy locations retaining cameras such as stadiums, meetings, airports, etc. Looking in the crowd for suspect instituted on the face trust biometric retaining a pictures (e.g., mug shots) database of wanted persons or criminals. The attention has increased melodramatically in biometric surveillance, exceptionally for air excursion applications. Currently countless cameras are utilized for monitoring crowds at airports for noticing terrorists.
- **Corrections** - This remarks to the treatment of offenders (criminals) across a arrangement of penal imprisonment, enhancement, probation, and examination or the authorized arrangement by that these are accomplished. Is this case a biometric arrangement can circumvent the possible of emitting the wrong prisoner unintentionally or to safeguard that people departing the skills are honestly visitors and not inmates.
- **Probation and residence arrest** - biometric can additionally be utilized for post - discharge strategies (conditional released) to safeguard the fulfillment of the probation, parole and residence custody words.
- **Government** - There are countless demands of the biometry in the manipulation sector. An AFIS is the central arrangement utilized for discovering duplicates enrolls in benefits arrangements, electronic electing for polls innate or nationwide both, driver's license discharge, etc.
- **Commercial** - Banking and business services embody a large progress spans for biometric vision, alongside countless placements presently working and pilot consenting is uttered oftentimes.

## III. BIOMETRICS TECHNIQUES

Biometric vision is utilized to understand people considering the world. There are countless technologies that embodies the earth of biometrics. Iris Scanning, Hand Geometry, Facial Trust and Voice Trust are four of the most normally utilized arrangements to understand people retaining biometric knowledge [8].

- Iris Scanning - Iris scanning is one of the most oftentimes utilized methods of biometric identification. An iris scan arrangement checks alongside a puny camera every single solitary iris of the individual's eyes. Small, exceptional features in the structural (stromal) chart of the iris (around 400 and counting) brand an individual's identity.
- Both of the eyes right and left differ from one extra in constitution and exceptional details. This method is tremendously facile and normally needs an individual rigid a insufficient inches away from a scanner. The scanner reads the iris data, analyzes these features and identifies the person.
- Facial Trust - Facial Trust is obtaining popularity but yet there are bugs to be worked out. Facial Trust relies on chart identification. A sensor gathers the data considering your facial constituents such as your eyes, your nose, their size and form, pigmentation, etc. Subsequent a mechanism that extracts the data of your features computes the data and analyzes it. Later you go for a face scan, the arrangement identifies your features and matches the features alongside your facial pattern. Currently it is tough to come to be a clear picture of a advancing person or in the distant distance.
- Hand Geometry - These are supplementary worth - competent forms of biometrics, hand geometry mechanisms, or 'hand scanners,' have stayed consented as they were manufactured in the main 1980's. This form of biometrics identifies users by the form of their hands. The hand scanners elucidate the varied properties of hand such as form, length, and supplementary features of the hand and input the data into a database. As scanning your hand the arrangement just matches your handprint to your identity. It is not as competent as supplementary kinds of biometric vision, these are trusted most reliable afterward utilized in conjunction alongside an ID Card.

#### **IV. FACE RECOGNITION**

Face credit should be capable of recognizing new instances of faces that the computer has been trained or programmed to recognize. Given the prior vision of a set of recognized face, and a digitized scene that encompasses one or extra faces to examine, the face credit arrangement endeavors to find the locale and orientation, remove, enhance, and in the end understand the removed face(s).

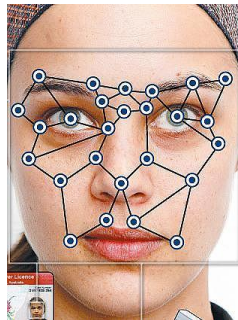


Figure 3 - A Facial Recognition Process with face vectors

For example, given a scene of crowdie road whereas the subject of attention is erect in the middle, and encircled alongside number of objects such as cars, shops, people etc. The face credit arrangement attempts to find the subject in the scene and remove it. The removed picture is pre - processed to enhance the picture quality. The credit arrangement next attempts to match the removed face to a recognized face endowed in the database.

There are two vital agents in face credit arrangement - the training face set and the examination face set. The training face set is a set of recognized faces utilized to teach the credit system. Reliant on the kind of face credit algorithm, the arrangement attempts to remove features, or attempts to recall the features. As alongside each credit arrangement, the quality of the training faces has a colossal alter on the credit accuracy and robustness. This result exists in the human credit arrangement as well. If a human is not able to discern an object clearly, the skill to know the object is critically hindered. The training faces are normally a set of photographs. To safeguard quality, these photographs are normally seized below manipulated environment.

The subsequent agent is the examination face set. These faces assist as the input to the face credit arrangement for the intention of testing. The basis could be a digital camera feeding the arrangement in real period, or plainly a set of photographs from archived database. Examination faces could vary from the training faces. The number of difference, and the skill of the credit arrangement to tolerate these contrasts, dictates the credit accuracy. A robust arrangement will be able to generalise from a set of examples.

#### **V. NECESSITY OF FACE RECOGNITION**

A human face is central constituent of communal interaction. It is the main basis by that people recognizes every single supplementary and the focus across a conversation. As the skill to recognize every single supplementary is one of human's core skill, then a usual question to ask is whether a computer might replicate this ability. The need to craft mechanisms that are as human as probable sparks the scrutiny on face recognition. Face credit is one of the countless frank skills that are needed in order to craft a man - like machine.

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admission methods, next the protection level might be considerably increased. For example, face credit might be utilized in a building's main entrance to substitute the card entry system. This will stop fraud access. User authentication at ATM mechanisms is exceedingly susceptible to fraud because due to the ease of card falsification. Face credit will disallow such fraudulence. The extensively installed center of ATM mechanisms makes them strategically advantageous to find wanted convicts across the nation. Potentially, even convicts will demand to admission an ATM machine.

In the span of human - computer contact (HCI), automatic logon is made probable if a workstation is installed alongside a camera that detects its user. On affirmative identification, the user is automatically logged on and his/her nature is automatically loaded. The computer will next be perceived as a far approachable piece of hardware.

In regulation implementation, face credit is extremely functional to match mug shots seized from lineup, or supplementary way of buy, opposing the database of recognized convicts to notice their presence. This task is extremely labour intensive if gave by a person. These requests are clearly well beyond the state - of - the - fine art for present creation face credit arrangements, except perhaps whereas merely a tiny number of faces demand be recognized. Though, the appalling skill of people to know faces is an attendance facts that a sufficiently elevated level of presentation is physically possible. Indeed the higher check of presentation could well be larger than that attained by human beings, who clearly have merely a manipulated number of steps in the algorithm utilized, as neural switching speeds are rather slow

### **Applications of Face Recognition**

Affective face credit should no mistrust is a extremely functional technology. It can be requested in a expansive scope of real globe applications. Its huge possible should be extremely functional from protection point of view. The encounter includes tighter protection implementation and larger ease of custom on the user end. A insufficient main spans whereas face credit can be requested are debated next.

- **Secure Access to Entrances, Protected Property -**

- Currently, the most accepted way of admission are magnetic/smart card, key admission, , and/or pin number authentication. The provider trusts that merely the authorised person holds those ways of access. Though, after the way of admission falls into unwanted labor, there is no method to halt the protection wreck if the provider is yet in the dark.
- Performing face credit in parallel alongside these way of admission provides higher levels of trust. Unrecognised people will be repudiated access. This ensures the person grasping the standard way of admission is the person alongside authorised access. That is why there is a protection guard booth on main locale entrances. Being able to truly discern the person demanding admission is a critical factor in conceding access. Face credit is exceptionally functional after allocating a protection worker on 24 hourly basis is not probable, e.g. building/door entrances, ATM mechanisms, protection deposit boxes, vaults.

- **Surveillance Statistics/Audit**

- Currently, a surveillance arrangement plainly records snapshots from the surveillance camera at fixed intervals. This arrangement does not furnish each statistical data, and is usefully unusable unless one spends a outstanding deal of period looking at the video. Requesting face credit knowledge to merely those snapshots should expose a finished scope of statistical data and give a possible audit trail. Even the simplest data such as the number of people bypassing across the span at precise periods of the date is useful. A maximum operative movement audit trail should furnish data on movement outlines or customs, and might be utilized to notice unauthorised workers in a safeguarded area. Finished surveillance like road surveillance is functional in the event of offense.
- Another functional request is to recognize convicts and suspects. Possessing such a arrangement in transport hub like airport and train station can be utilized to notice wanted convicts and to stop the convicts from departing the span or state.

- **Authenticating Users of Computer Networks**

- The most usually utilized method of authenticating a computer user is via username and password. Countless firms have discovered that passwords can be estimated, stolen or forgotten. They can frequently be cracked employing instruments that are freely obtainable on the internet. Several passwords each user is not feasible, as this is inconvenient for the user, tough to recall, and period consuming for administrators. Face credit can whichever deed as an alternative to the password arrangement, or add an supplementary layer of protection to the continuing arrangement.

- **Time and Attendance**

- Many firms impose a punch card strategy on employees. This needs the operative to insert a card into a period stamping contraption (the established method). The target is to record the period of becoming into work, departing work, and the attendance of this particular employee. This method is bulky and sluggishly losing its popularity. A prosperous face credit provides the identical functionality lacking the hassle of a punch - card, and the recorded date and period can be fed into the workers association arrangement directly. This is additionally functional for protection intentions across emergency situations such as a fire alarm. The catalog of people and/or the number of people inside the constructing can be ambitious at a glance.

## VI. RELATED WORK

**Karthigayani, et al.,2011.** In the Research Paper the recent technology of image processing forms the basic principles of project entitled “A Novel Approach for Occlusion Detection in Face Wearing Detector for Face Detection and Age estimation using AdaBoost and Decision Tree with C5.0 algorithm Using Morph Dataset” has been developed to overcome the inconveniences faced by the organizations in recognizing the exact person . To maintain a high recognition rate in a wide range of resolution levels and it outperforms the other alternative methods. In this paper a new model is used to detect the occluded faces from no occluded faces using AdaBoost Classifier, Linear Discriminated analysis and Decision Tree C5 .0 methods. The proposed method involves AdaBoost classifiers for whole faces and individual face part classifier is trained on non-occluded classifiers. The whole face classifier is used to classify the facial part with occluded face and to apply the decision tree with C5.0 algorithm is used for integrate the occluded part. They plan to work on the MORPH dataset for this purpose. In the experiments we observed that the difficulty of face verification algorithms saturated when the age gap is larger.

**Erdem, et al., 2011.** In the Research Paper presents a hybrid method for face detection in color images. The well known Haar feature-based face detector developed by Viola and Jones (VJ), that has been designed for gray-scale images is combined with a skin-color filter, which provides complementary information in color images. The image is first passed through a Haar-Feature based face detector, which is adjusted such that it is operating at a point on its ROC curve that has a low number of missed faces but a high number of false detections. Then, using the proposed skin color post-filtering method many of these false detections can be eliminated easily. They also use a color compensation algorithm to reduce the effects of lighting. Our experimental results on the Bao color face database show that the proposed method is superior to the original VJ algorithm and also to other skin color based pre-filtering methods in the literature in terms of precision. They plan to do experiments on more extensive color face databases. They also plan to improve the skin-color based face detection algorithm to further decrease the number of false negatives.

**Ruiz-Sarmiento, et.al 2011.** One of the cornerstones of ambient intelligence technology is the need of sensory systems to reliably notice the presence of people. Several approaches for detecting humans within a non-controlled scenario can be found in the literature but they exhibit, not enough effectiveness, i.e. a high rate of false positive or true negative detections. This becomes a drawback for the development of a variety of ambient intelligence applications which depend on such sensory capability. In this paper we propose the use of a TOF camera for noticing human presence by detecting their faces. Apart from a typical intensity image, this camera also provides a range image of the scene. The proposed methodology first detects faces from the intensity image (by using the Viola-Jones algorithm) and then analyzes those detections in the range image to discard false positives. Experimental evaluations of the proposed process have yielded excellent results in non-controlled scenarios, eliminating most of false positive detections. In this work we have presented a robust human face detector for TOF cameras that highly reduces the number of false detections, while keeping a very low level of false negative cases. The obtained results demonstrate the interest in using not just intensity images, but also range data to achieve the robustness level demanded applications. Though nowadays these TOF cameras are still very expensive, they believe that the emergence of these sensors to interface to next generation of interactive games will put them in the market at a very cheap price. In the future they plan to investigate the use of the proposed method in a service robot aimed to provide Aml capabilities.

**Zhang, et al.2010** In the Research Paper the authors have proposed an Active Testing framework in which one can perform fast face detection and localization in images. In order to and faces, they use a coarse tone method, while sampling sub windows which maximize information gain. This allows us to quickly and the face pose by focusing on regions of interest, and pruning large image regions. They show through a series of experiments, that Face detection has been one of the most studied topics in the computer vision literature. In this technical report, we survey the recent advances in face detection for the past decade. The seminal Viola-Jones face detector is first reviewed. They then survey the various techniques according to how they extract features and what learning algorithms are adopted. It is our hope that by reviewing the many existing algorithms, They will see even better algorithms developed to solve this fundamental computer vision problem. The Haar features used in the work by Viola and Jones are very simple and effective for frontal face detection, but they are less ideal for faces at arbitrary poses. Complex features may increase the computational complexity, though they can be used in the form of a post-filter and still be efficient, which may significantly improve the detector’s performance. Regarding learning, the boosting learning scheme is great if all the features can be pre-specified. However, other learning algorithms such as SVM or convolution neural networks can often perform equally well, with built-in mechanisms for new feature generation.

**Froba, et al.2004.** In the Research Paper Illumination variation is a big problem in object recognition which usually requires a costly compensation prior to classification. It would be desirable to have an image to image transform which uncovers only the structure of an object for an efficient matching. In this context the contribution of our work is twofold. First we introduce illumination invariant Local Structure Features for object detection. For an efficient computation we propose a Modified Census Transform which enhances the original work. They show some shortcomings and how to get over them with the modified version. Secondly they introduce a efficient four-stage classifier for rapid detection. Each single stage classifier is a linear classifier which consists of a set of feature lookup-tables. They show that the first stage which evaluates only 20 features filters out more than 99%of all background positions. Thus the classifier structure is much simpler than previous described multi-stage approaches, while having similar capabilities. Together with a coarse-to-fine grid search introduced in our former work this leads to an efficient real-time detector with high detection rates and very few false positives. The system is able to analyze a video stream of spatial resolution 384×288at frame rate (0.06sec/frame) on a Pentium2GHz computer.

**Zhenhua Chai, 2014** In the proposal, different kinds of ordinal measures are derived from magnitude, phase, real and imaginary components of Gabor images, respectively, and then are jointly encoded as visual primitives in local regions. The statistical distributions of these visual primitives in face image blocks are concatenated into a feature vector and linear discriminant analysis is further used to obtain a compact and discriminative feature representation. Finally, a two-stage cascade learning method and a greedy block selection method are used to train a strong classifier for face recognition. Extensive experiments on publicly available face image databases such as FERET, AR and large scale FRGC v2.0 demonstrate state-of-the-art face recognition performance of GOMLoad.

## VII. CONCLUSION & FUTURE WORK

As continual scrutiny is being led in the span of Biometrics, one of the most useful requests below forceful progress is in the assembly of a face credit system. A comprehensive description of biometric credit established on the most accepted human biometric traits is provided. A outstanding emphasis was allocated on the face characteristics, chiefly on the state of the fine art of the component-based face recognition. As the setback of knowing faces below gross variations stays mainly unsolved, a demonstration arrangement as facts of believed that such arrangements are nowadays becoming useful have been developed. A arrangement capable of reliable credit, alongside decreased constraints in regards to the facial locale and expression of the face and the illumination variation and background of the picture has been implemented. We have requested and difference continuing face credit algorithms that are extensively utilized and subject of attention

### Future work

Different aspects of human physiology are utilized to authenticate a person's identity. The science of ascertaining the individuality alongside respect to disparate characteristics traits of human being is shouted biometrics. The characteristic traits can be mainly categorized into two groups i.e. physiological and behavioral. Measurement of physical features for confidential identification is an period aged exercise that dates back to the Egyptians era. But it was not till 19th century that the discover of biometrics was extensively utilized for confidential identification and protection connected issues. With the advancement in knowledge, biometric authentication has been extensively utilized for admission association, regulation implementation, protection system. A person can be recognized on the basis of disparate physiological and behavioral traits like fingerprints, faces, iris, hand geometry, gait, ear outline, voice credit, keystroke outline and thermal signature

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