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Face Recognition Technology

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Abstract : *Face recognition technology is a advance biometric technology, which is based on the identification and verification of facial features of a person and any other devices. People are collecting the face images, and the recognition equipment automatically processes the images. This paper introduces the related researches of face recognition from different perspectives. This paper describes the development stages and the related technologies of face recognition technology. We introduce the research of face recognition technology for real conditions, and we are introducing the general evaluation standards and the general databases of face recognition technology. We give a forward and high looking viewof face recognition technology. Face recognition technology has become the future development direction, scope and has many high potential application prospects.*

Keywords - *Face recognition, image processing, neural network, artificial intelligence.*

I. INTRODUCTION

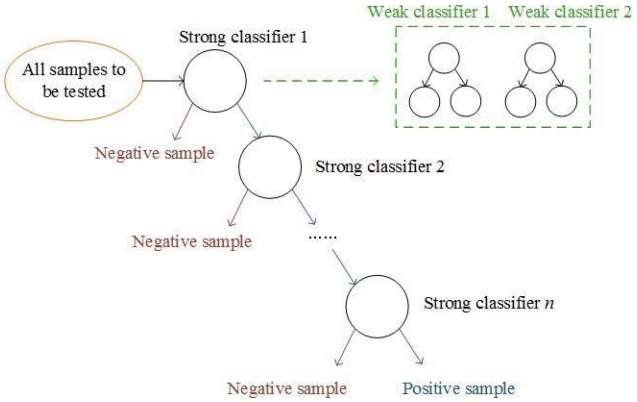
Face recognition is a subdivision problem of visual pattern recognition technology. Humans are recognizing visual patterns all the time, and we obtain visual information through our eyes, skin, nose, hair. This important information is recognized by the brain as meaningful good concepts. For a computer, whether it is a picture or a video, it is a matrix method of many high pixels. The intelligent machine should find out that what type of concept a certain part of the data represents in the database. This is a very hard classification problem in visual model recognition technology. For face recognition technology, it is more needed to distinguish who the face belongs to in the part of the data with the face recognition.

1.1 The Development stage of face Recognition and related technology

Principal component analysis is the most widely used data dimensionality reduction algorithm. In face recognition technology algorithms, principle component analysis implements different feature face extraction. In year 1991, Turk and Pent land of MIT Media Laboratory introduced the principal component analyses into face recognition technology. Principle component analysis is usually used to preprocess the data set before other analyses. In the facial recognition data with more dimensions, it can be remove large information and large noise, retain the more important characteristics of data, greatly reduce the dimensions, improve the processing accuracy of data, and save a lot of time and cost. Therefore, this algorithm is usually used for the dimensionality reduction and the multidimensional data visualization in face recognition.

The original boosting algorithm was proposed by Schapire. It is used for face detection technology. Boosting algorithm can improve the speed of any given learning algorithm. The main idea is to integrate various classifiers into a very stronger final classifier through some simple rules so that the overall performance is higher.
There are two problems for face recognition technology in the boosting algorithm. One is how to adjust the training set in face recognition, and the other is how to combine the weak classifier to form a very strong classifier. Ada Boost has improved these problems, and it has been proved to be an effective and practical boosting algorithm in face recognition technology. Ada Boost uses the weighted training data instead of randomly selected training samples to focus on the relatively difficult training data samples. Ada Boost uses the weighted voting mechanism instead of the average voting mechanism which makes the weak classifier with good classification effect have larger weight.

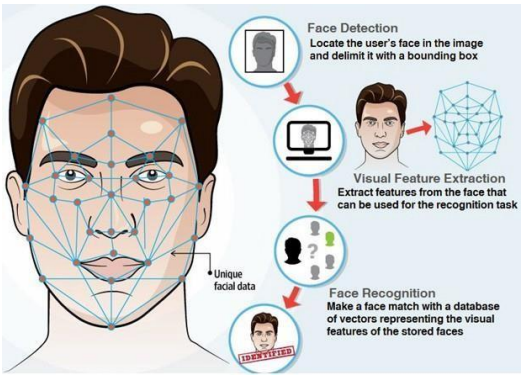
Fig 1. Ada Boost cascading structure.



1.2 Deep learning
Deep learning is a branch of machine learning. Deep learning can find out the features needed for classification automatically in the training process without feature extraction steps. That is to force network learning to obtain more effective features for distinguishing different face. The field of face recognition technology has been completely transformed by deep learning technology. Face recognition technology is the problem of identifying and verifying people and also animal in a photograph by their face.
It is a task that is better performed by humans, even under varying light and when faces are changed by age or obstructed with accessories, cloth and facial hair. Nevertheless, it is remained a challenging computer vision problemfor number of decades until recently.
Deep learning methods are able to very large datasets of faces and learn rich and compact representations of face recognition and allowing modern models to first perform as well and later to outperform the face recognition capabilities of humans and other devices. In this research paper, you will discover the problem of face recognition technology and how deep learning methods can achieve superhuman a very high performance [11].
After reading this research paper you will know .

1. Face recognition technology is a broad problem of identifying or verifying people in photographs and videos.
2. Face recognition technology is a process comprised of detection, alignment, feature extraction, and arecognition task
3. Deep learning methods first approached then exceeded human performance for face recognition technologytasks.

Fig 2. Face recognition based on deep learning



II. FACE RECOGNITION BASED ON REAL CONDITION

At present time, the face recognition technology has been quite understanding the condition of controllable illumination and small intra class change. However, the good performance of face recognition in non-ideal condition is still needed be improved. The problem is the non-ideal condition that face recognition should solve the problem of variable illumination, posture and expression. The researchers proposed a method based on different features, which is used the features of the face image that did not vary with the change of lighting conditions to process, that is, to find the light heartless features. At present time, the representative method is the quotient image. In addition, a 3D linear subspace can be used to represent the face image with light change without considering shadow.

In the case of face biometrics, a 2D or 3D sensor capturing a face. It then transforming it into high digital data by applying an algorithm before compare the image captured to those held in a database.

These automated systems of face recognition technology can be used to identify or check an individual's identity in just a few seconds based on their facial features like spacing of the eyes, bridge of the nose, the contour of the lips, chin, ears, etc. They can also do this in the middle of a large crowd areas and within dynamic and unstable environments. Owners of the Android mobile and iPhone X have already been introduced to face recognition technology [2].

III. DESIGN METHODOLOGY

3.1 Face Recognition detection

Figure 3 shows the flowchart of the face recognition steps. To do face recognition, there must be an input to be detectedthe face and verified. Hence, an image sensor or typically a camera has to be set up for recording or capturing images. The camera should be good compatible with the software used. The next step is the input image. The input can be images and recorded video or real-time video. After the input is provided, faces in the images or videos are to be detected. When the classifier is trained, it can be utilized to start to recognition work. It can be used in either video or image to recognize one or more person. Different set of python scripts are provided to run the various type of face recognition. The python script will import the classifier that is trained in previous step in order to carry out the face recognition technology for the person from the camera or from an image [4].

Fig 3. flow chart of face recognition

In face detection, HAAR feature based cascade classifier is used and the classifier used is HAAR Cascade for frontal face. A Cascade is basically a classifier which is used to detect the object for which it has been trained for, from the source. The haar Cascade is performed by superimposing the positive image over a set of negative images. The training is generally done on a server and on differents stages. Very good results are obtained by using very high quality images and increasing the amount of stages for which the classifier is trained.

Tensor flow is the very nice framework that is being used in the system classifier section. Classifier is trained and used in the recognition process. The training process takes a long time to achieve a good classifier. The very longer the time of the training runs, the good the classifier is. In the proposed face recognition system, the training period taken is 5 days. If the training is allowed to run very longer, the some loss can be reduced further and hence the accuracy can be increased.

3.2 Accuracy

The accuracy of the system will be tested face recognition of five peoples with numbers times at different location, mainly to test how light intensity affects the accuracy of the system. The accuracy is verified using a confusion matrix. The calculation is based on (2).

((TP + TN) / Total) x 100% (2)

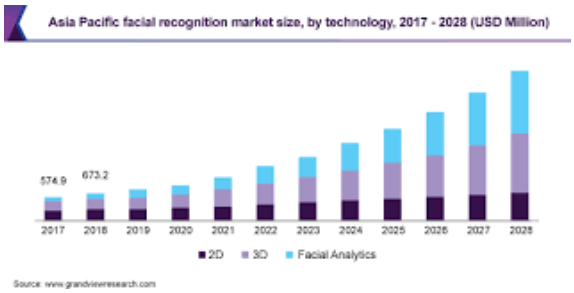
TN is true negative while TP is true positive.

IV. FUTURE OF FACE RECOGNITION

Face recognition technology has been widely used in security and financial fields because of its convenience. With the rapid development of science and technology, the application of faces will be more developed, and the application scenarios will be more diverse. However, face recognition will easily cause technical, legal, and ethical problems. Due to the automating features of face recognition technology, similar related information may be processed or decided through automation, lacking transparency and not very easy to supervise, and even in the event of some errors or discrimination. Itis very difficultto trace back. For example, the face recognition information is used to achieve non-recognition purposes such as judging an individual's sexual orientation, race, or religion. Face recognition solutions are expected to be present in 1.5 billion devices by 2030. Powered by AI, facial recognition software in mobile phones is already being used by companies like Android and Master card to authenticate payments and other high-end authentication tasks. Such uses will going to be increase as we move into 2050 and beyond.

Around the house, security systems are also turning to face recognition to both improve security in and around the house and also to improve access and create a very good experience. Especially when deployed in smart house or buildings developments. How future scope of face recognition used like? The system can be deployed for verification and attendance tracking at different governments offices and corporates. For access control verification and identification of authentic users it can also be installed in bank locker and vault. For identification of criminals the system can also be used by police, military force also. Very powerful special microcontrollers and processors, good images with better cameras and on chip processing and edge computing for very intelligence in and close to the camera, 3D face recognition, and very accurate face recognition algorithms thanks to the network algorithms are just some of the evolutions.

Fig 4. Future scope of face recognition market trend.



V. CONCLUSION

In this paper, a face recognition and identification system is designed and developed using deep learning approach. The overall procedure of developing this face recognition system from training the data using CNN approach to face recognition is described. It is verified that with the large number of face images being trained into a classifier can achieve accuracy of 91.7% in recognized image and 86.7% in real-time video. There are some factors that are effect the speed of the system. When the light intensity is insufficient, the accuracy is relatively low compared to higher light intensity. Other than that, classifier is the main element in the recognition process. The longer the classifier is trained, the better the classifier is performed. The images that are used to train the classifier must be in variety of conditions in order to generate a robust classifier. The discovery of science and technology in the face recognition technology has made good achievements, but there is still improvement in practical application. In the future, there may be a special camera for face recognition, which can improve the image quality and solve the problems of image filtering, image reconstruction.

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