International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 4, June 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Face Recognition and Increased Reality System for Mobile Devices

Sirojiddin Tavboev[1], Tavboev Islom[2]

[1]Vice Rector, [2]Teacher,
[1,2]Jizzakh Polytechnic Institute, Jizzakh, Uzbekistan

ABSTRACT
The objective of this article is to explain the problems of using the facial recognition functions in current mobile devices, as well as to give a possible solution based on a client-server design.

KEYWORDS: *Facial recognition, reality, mobile phones, client-server*

How to cite this paper: Sirojiddin Tavboev | Tavboev Islom "Face Recognition and Increased Reality System for Mobile Devices" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-4, June 2020, pp.1313-1316, URL: www.ijtsrd.com/papers/ijtsrd31384.pdf

IJTSRD31384

INTRODUCTION

In recent years, the development of new computer hardware and software for security systems has experienced a great boost, such is the case of fingerprint, voice, iris and facial recognition systems. Among these, facial recognition stands out as the most promising.

The identification of facial features has received a strong boost from advances in multimedia video technology, leading to an increase in cameras in workplaces, homes and mobile devices at low cost. Facial recognition can be applied in access control to public and private buildings, ATMs, research laboratories, as a secret access key for the use of personal computers or latest generation mobile terminals as well as to serve as a person's business card.

The process of facial identification is basically divided into two tasks: detection and recognition]. The first task, detection, involves the location of one or more faces within an image, either a still image or a video sequence. The second task, recognition, consists of the comparison of the face detected in the previous step with other faces previously stored in a database. These processes, detection and recognition, should not be totally independent because depending on the way a face is detected it may be practically impossible to recognize it with faces from a database detected differently, hence facial recognition systems are strongly conditioned by the position and orientation of the subject's face in relation to the camera and the lighting conditions at the time of detection.

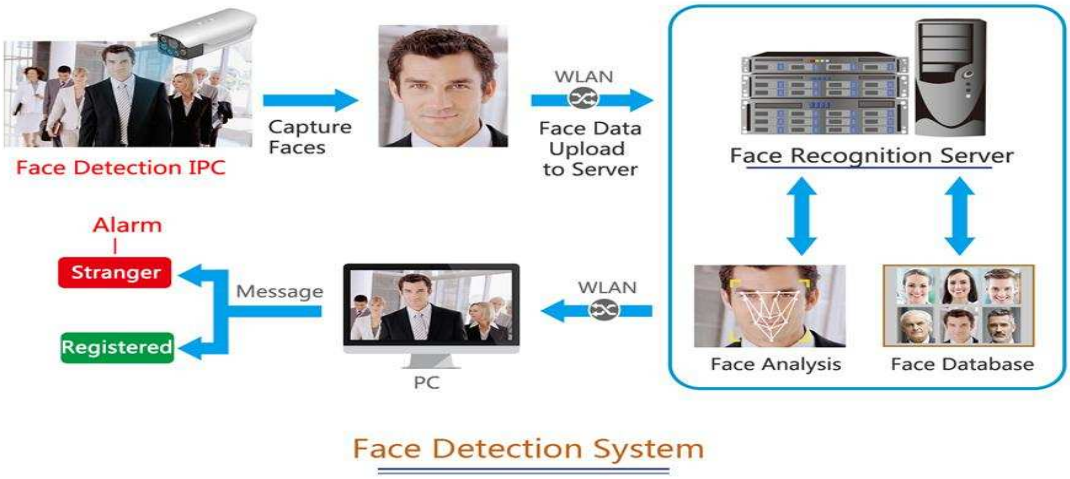
MOTIVATION

Depending on the facial recognition algorithm we use, this task can place a very high load on the device that performs it, consuming practically all the system's available resources and leaving it unusable during the processing time.
It is therefore necessary to find a solution to this problem for those devices that do not have such computing power and require running this type of multimedia applications.

ANALYSIS

After a thorough analysis of different recognition methods and how to perform this task on devices with low computing power, it has been thought that the best option is to make a task division of the whole procedure. Thus, the system will be divided into 2 main pillars:

- A detection device
- A recognition server



Picture 1. System design. Source: https://beward.en.alibaba.com/.

Today, every mobile device has a network connection, whether Wifi or wired, so implementing a client-server based model may be an acceptable solution.

The detection device is responsible for capturing the image or video containing the person whose face you want to recognize. This device has a camera, integrated or external. Once the image has been captured, it detects the faces of the person or persons it is focusing on. The region is extracted and sent through the connection available at that time to the recognition server. In short:

- Capture the image
- Detecting faces
- Send the selected region to the server and wait for a response

On the other hand, the recognition server is running in passive mode waiting to receive connections from devices running the client software and interacting with them to meet the appropriate needs. The tasks of the reconnaissance server are:

- Pre-process the image you received from the customer
- Performing recognition and obtaining extra information
- Improve classifier features
- Responding to the customer

As you can see, client tasks are light tasks that you can perform without consuming excessive system resources.
Face detection is the process of finding a face in pictures or videos. The face detection algorithm is based on a function that searches for rectangular regions within an image, regions containing objects that with a high probability resemble others in a training set, by returning the rectangular region of the image where they have been found. The function scans the image several times and at different scales to find similar objects of different sizes. Therefore, in order to detect faces, only the set of faces with the desired characteristics has to be passed to the function so that the detected faces look like these.

Picture 2. Face detection. Source: www.nodirbek.uz

The object detector used in this article was initially proposed by Paul Viola and improved by Rainer Lienhart. First, a cascade classifier (i.e. a cascade of pulsed magnetic classifiers working with haar-like characteristics [5]) is trained with a few hundred test images of a particular object (e.g. a face, a car, etc.), called positive images that are scaled to the same size; and negative images (arbitrary images of the same size).

After the classifier has been trained, it can be applied to a region of interest (the same size as that used during training) from an input image. The classifier returns a "1" if the region contains the object, and "0" otherwise. To search for the object in the entire image, the search window is moved through the image and each location is checked using the classifier. The classifier is designed so that it can be easily resized to be able to find the objects of interest in different sizes, which is much more efficient than resizing the image itself. Therefore, to find the object of an unknown size in the image, the scanning procedure must be repeated several times with different scales.

The word "cascade" in the classifier's name means that the resulting classifier consists of several simpler classifiers (or steps) that are applied one after the other to a region of interest until either the candidate is rejected or all steps are satisfactory. The word "driven" means that the classifiers at all stages of the cascade are complex and are built on the basic classifiers using one of four different drive techniques (weighted voting). Basic classifiers are classifiers in decision trees with at least 2 leaves.

FACIAL RECOGNITION

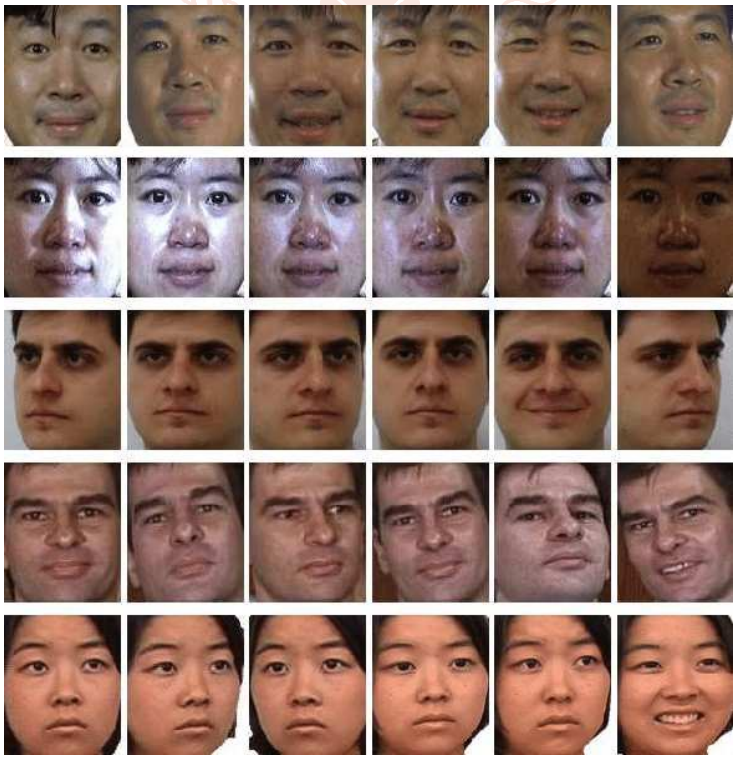
Facial recognition is a very active area of research specializing in how to recognize faces in images or videos. Face recognition is the process of matching the detected face to one of the many faces known to the file system.

There are a multitude of algorithms available to carry out facial recognition, among which the following stand out [2]:

- Eigenfaces or Principal Component Analysis (PCA) method
- Fisherfaces or Linear Discriminant Analysis method
- Kernel Methods
- Methods of 3D facial recognition
- Gabor Wavelets' method
- Markov's Hidden Models
- Active Appearance Models

For this development, the Eigenfaces method has been used because it is one of the simplest to implement.
The process of facial recognition using decomposition into principal values (PCA) and Eigenfaces, without going into too much detail, consists of the following steps:

- Store a set of training images of different people. You can have subsets of images for each person that contain different positions, lighting conditions, etc.
- Create a matrix consisting of the new input image and those already stored in the database. Through a mathematical process, the eigenvectors are calculated using the covariance matrix.
- Once the characteristic vectors are obtained, the distances between the vector representing the original image and the rest are compared.
- Established a threshold of discernment a priori, if the lower value of the previous step is less than this threshold, the image of the input side is considered as known, if it is higher, it is considered unknown.



Picture 3. Example of a face database. Font FERET. Source: www.researchgate.net

DEVELOPMENT

The implementation of the above process has been carried out using the free machine vision library OpenCV. It is totally multiplatform, with versions for Linux, Mac OS X and Windows, and contains more than 500 functions that cover a wide range of areas in the vision process, such as object recognition, facial recognition, camera calibration, stereo vision and robotic vision.

Two applications have been obtained from the development:

- Server application: multiplatform, programmed in C language using OpenCV, multithreaded so that it can attend to requests from multiple clients simultaneously.
- Client application: multiplatform, programmed in JAVA, also using OpenCV to facilitate access to the camera,

RESULTS

After the research, requirements study and development phases, a system has been obtained that complies 100% with the initial expectations and ideas of the project.

On the one hand, a server software has been developed for Linux systems that is continuously listening on a TCP port while waiting for clients and that, in addition, is in charge of performing all the calculations to determine the identity of a face. On the other hand, a real-time image capture client software has been developed that is in charge of extracting the region of the desired face and communicating with the server to process it.

CONCLUSION

Recalling the initial objectives of the article "finding ways to integrate facial recognition into devices with low computing power", it can be concluded that these objectives have been satisfactorily met: a robust and fast client-server facial recognition system has been developed.

In the results section you can see how the facial recognition in the cases with which it has been experimented has been correct, obtaining success rates close to 100% and with response times, both on the client side and the server side, more than acceptable.

However, the system is susceptible to improvements such as the strong dependence on lighting conditions, which are assumed to be constant for the development of the program, and on the orientation and position of the subject's face, both in the detection and the recognition process.

REFERENCES

[1] Carrero, A. (2018). Biometrics and Federal Databases: Could You Be In It?, 51 J. Marshall L. Rev. 589 (2018). *The John Marshall Law Review*, *51*(3), 4.

[2] FERET database. [Online]. http://es.wikipedia.org/wiki/Base_de_datos_FERET.

[3] G.H, Zahorjan, J Forman, "The challenges of mobile computing," IEEE, vol. 27, no. 4, pp. 38-47, 1994.

[4] Gates, K. A. (2011). *Our biometric future: Facial recognition technology and the culture of surveillance* (Vol. 2). NYU Press.

[5] Matthew AT and Alex PP, Face recognition using eigenfaces.: Proc. IEEE Conf. Computer Vision and Pattern Recognition, 1991.

[6] Milligan, C. S. (1999). Facial recognition technology, video surveillance, and privacy. *S. Cal. Interdisc. LJ*, *9*, 295.

[7] Monroe, D. A. (2009). *U.S. Patent No. 7,634,662*. Washington, DC: U.S. Patent and Trademark Office.

[8] OpenCV. [Online]. http://es.wikipedia.org/wiki/OpenCV.

[9] Paul V. and Michael J. (2001) How face detection works. [Online]. http://www.cognotics.com/opencv/servo_2007_series/part_2/sidebar.html.

[10] R. and Maydt, J. Lienhart, An extended set of Haar-like features for rapid object detection.: ICIP02, 2002.

[11] R. and Poggio, T Brunelli, Face recognition: features versus templates. IEEE Trans. PAM1, 1993, vol. 15.

[12] R. Chellappa, P.J. Phillips, A. Rosenfeld W. Zhao, Face Recognition: A literature survey.: ACM Computing Surveys, 2003, vol. 35.

[13] Тавбоев, С. А., & Искандарова, З. А. (2019). ОБРАБОТКА ИЗОБРАЖЕНИЙ С ИСПОЛЬЗОВАНИЕМ ТЕОРИИ НЕЧЕТКИХ МНОЖЕСТВ. *Фундаментальные и прикладные исследования в современном мире*, (27), 42-45.

[14] Тавбоев, С. А., & Тавбоев, И. И. (2019). МЕТОДЫ ЦИФРОВОЙ ОБРАБОТКИ ИЗОБРАЖЕНИЙ С ИСПОЛЬЗОВАНИЕМ АППАРАТА НЕЧЕТКИХ МНОЖЕСТВ. In *Научный форум: Инновационная наука* (pp. 65-68).

[15] Тавбоев, С. А., Савурбаев, А., & Салиев, Э. А. (2016). Формирование методов и задач компьютерного зрения с использованием аппарата нечетких множеств. *Молодой ученый*, (7-2), 23-26.

[16] Тавбоев, С. А., Савурбоев, А., Туракулов, О. Х., & Исроилов, И. Н. (2016). АРХИТЕКТУРА СИСТЕМЫ ЦИФРОВОЙ ОБРАБОТКИ ИЗОБРАЖЕНИЙ СРЕДСТВАМИ ТЕОРИИ НЕЧЕТКИХ МНОЖЕСТВ. *Ученый XXI века*, (2-5).

[17] www.researchgate.net

[18] www.nodirbek.uz