Image Based Facial Recognition

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ABSTRACT

The foundations for biometrics or identification systems were laid long ago. Today these developments have contributed to the identification of people, access to private sites and all places that need security and order with the help of computerized computers that perform biometric facial recognition, exclusively based on images of human faces for their function. With the extraction of facial midst characteristics of each person provides information used for the detection of the face.

This communication also addresses the different processes, stages and methods of feature extraction operated by facial recognition systems.

Including the positive and negative aspects of the implementation of these, the advantages and disadvantages, people's criteria in this respect.

KEYWORDS: Algorithms, automation, biometric tasks, methods, computers, biometrics system, recognition techniques

INTRODUCTION

Facial recognition has developed rapidly. Since Alphonse Bertillon in 1883 laid the foundations of the facial recognition system, since they used as a basis a number of anthropometric measurements such as: the distance from the eyes, the symmetry or the different facial features of an individual. This system is a trend in the forensic field and has also reached the point of having an opinion in a court of law since it can accuse or prove innocence when dealing with people with criminal records (Guerrero, 2012).
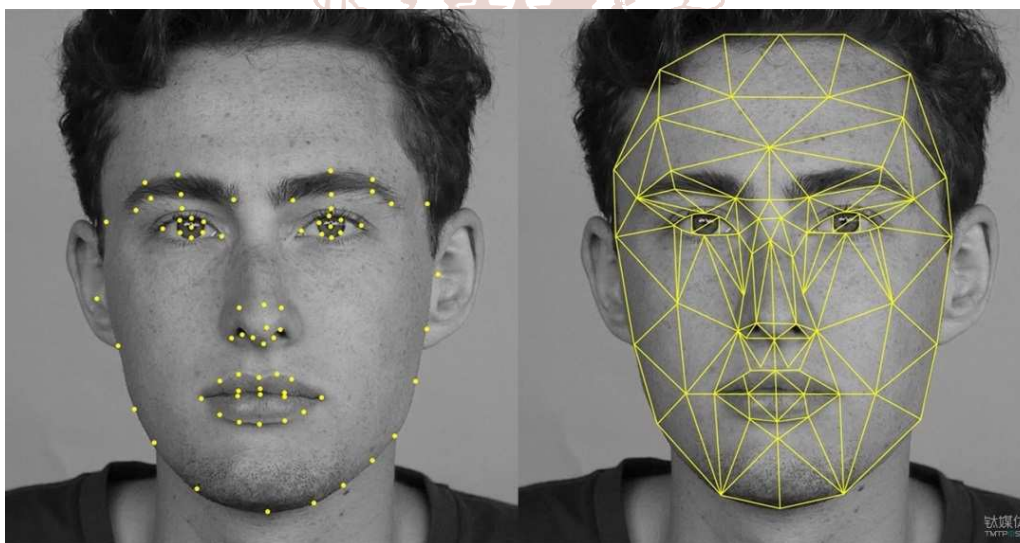

Figure 1 Facial Recognition Source: (www.liberaldictionary.com)

Facial recognition is a much more powerful version of the technology that uses your cell phone or computer to identify your friends in your photos. Using it to recognize people and validate their identities can speed up access control to corporate and government buildings. Some systems have the ability to identify known or suspected criminals and companies can analyze the faces of their customers to adapt marketing strategies. But there are also serious privacy issues, as this technology can be used to track individuals throughout their communities and even around the world. (Chrome, 2017)

It can be said that facial recognition is a very important tool in the environment as it allows to identify through certain characteristics of an individual, although sometimes it is beneficial to facial recognition, it should not be forgotten that the misuse of facial recognition greatly affects the development of the individual.

Facial recognition has an approximate market of US$ 3 billion, which is estimated to grow to US$ 6 billion in 2021. In addition, surveillance is one of the fundamental factors for growth, meaning that governments are the main income generators. So you can see that the FBI has a database with images of more than half of the U.S. population, so that just entering certain characteristics of the inhabitant will automatically have the image of the person, there is also the fear of several people, so they can use the information to commit criminal acts. (Chrome, 2017)

HOW FACIAL RECOGNITION WORKS
The advances start from the study of biometrics, and this added to the technology, results in the taking of measurements and the analysis of biological data such as DNA, handprint, iris and voice (biometric tasks). This is how facial recognition systems are born, which make their identification decisions with the help of the personal characteristics (photographs and videos) of each person, and translate them into a digital image that can be recognized or verified in an automated way by a computer.

"Biometrics is designed so that you you don't have to do anything. The device simply recognizes you."
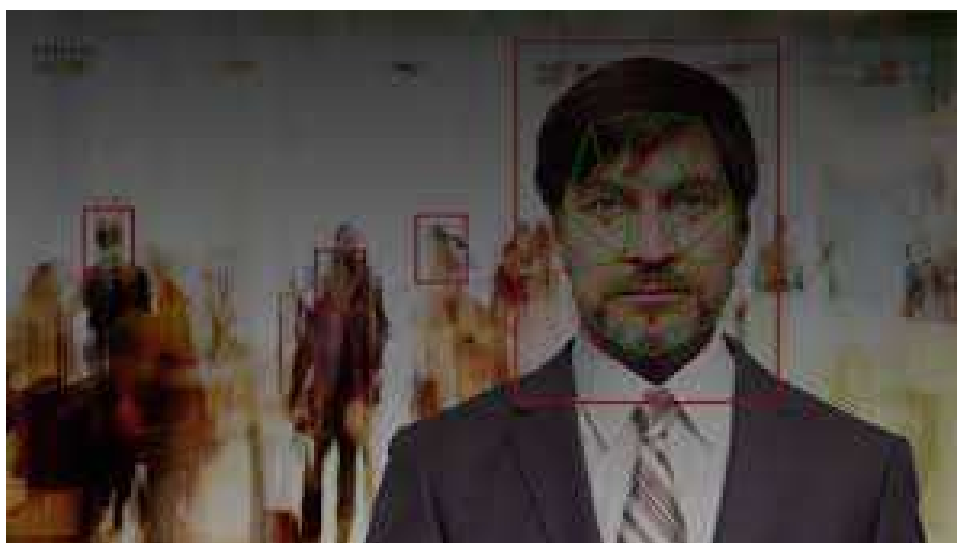

Figure 2 Facial Recognition Source: (ALPHABET, 2017)

On the other hand, the recognition process uses algorithms (analyzes hundreds of faces and uses a facial mapping that captures 100 facial expressions) for image processing, all images are 50 x 50 pixels wide and high, and a directionality of 2500 pixels, so its computational cost increases.

Taking into account the techniques for the extraction of characteristics, some of the existing components were analysed:
PCA (Principal Component Analysis)
LDA (Linear Discriminant Analysis)
LPP (Locality Preserving Projections)
DCT (Discrete Cosine Transform)

In PCA, it is a dimensional reduction algorithm that allows finding the vectors that best represent the distribution and classification of a group of images. The aim of this consists of representing an image in terms of an optimal coordinate system by reducing the number of anal components that the image will have.

Meanwhile, LDA performs when the measurements made on independent variables for each observation are continuous amounts. The objective is to project a data set in a smaller space with class separability to avoid over-equipment and also to reduce computational costs. When dealing with categorical independent variables, the equivalent technique is discriminant correspondence analysis.

In the LPI, you mount graphs that include neighborhood information as the data set. The representation of graphs is generated by the algorithm can be seen as a discrete linear approximation to a naturally occurring collector geometry.

In the DCT it provides a finite sequence transformation of data as the sum of cosine functions oscillating at different frequencies.

In the DCT, the characteristics of the image are obtained and then used to classify them, as is done with PCA, so the basis of the DCT is independent of the images.
Stages of Facial Recognition

By including the facial recognition systems, five stages are rescued:
1. Face detection.
2. Conditioning.
3. Normalization.
4. Extradition of characteristics.
5. Recognition. (Carrero & et al., 2010)

The detection, locates the facial region (if it exists) and the segmentation of it from the rest of the scene. The conditioning locates the components and the scale at which we find the face, by means of geometric transformations. Following the process, normalization consists of normalizing the images in the pre-processing stage so that the effects are attenuated of the changes in illumination, i.e. to equalize in size, intensity of a given range among others and thus to scale and cut out with a rectangle or ellipse.

The determination of characteristics provides the necessary information to differentiate the different faces of people according to their geometrical variations. Finally the recognition gives the facial pattern extracted from the characteristics and is compared with the database. If there is a 90% similarity, it gives the identity of the face, or if not, it indicates that it is an unknown face. (Carrero & et al., 2010)
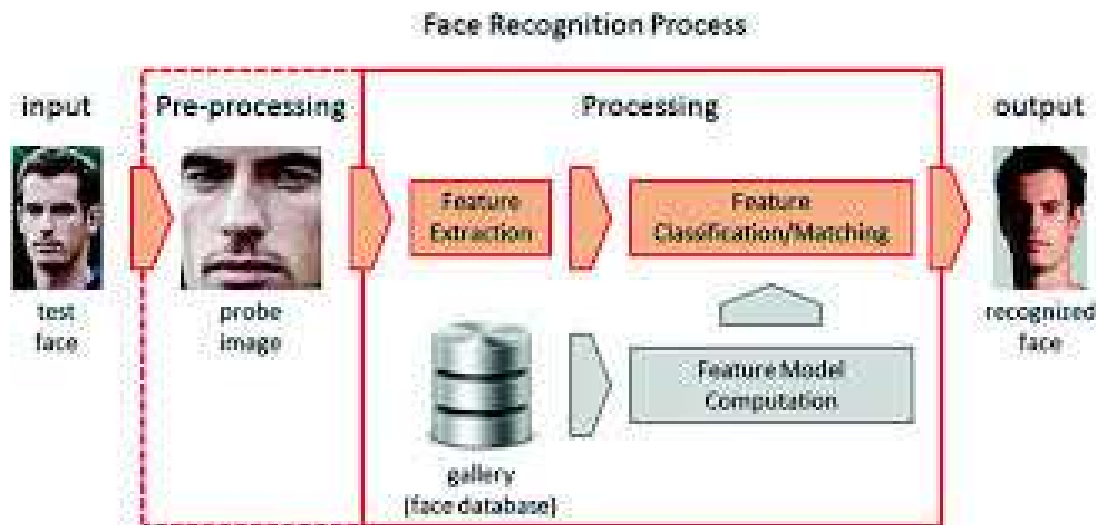

Figure 3 Process of Facial Recognition Source: (Carrero & et al., 2010)

There are also other strategies to detect faces, such as the position of the eyes, in other cases the symmetry or the different facial features of each person. Or classifiers based on neural networks.

In other cases, when the standardization process is reached, eye, nose or other parts information is used with biometric information or only a scale is made of the image. The recognition systems that perform these operations mentioned above are known as location systems.

It's not always easy to determine which regions have the face you start by taking out the characteristics, so you use any of the recognition techniques mentioned above. Usually a certain operation produces characteristic vectors of reduced dimensions which must be checked against the previously recompiled database of persons. If the person is identified by any recognition method, such as a code or access cards or other systems are known as an authentication or identity verification system.

In this process the vector of test characteristics is compared with the database, if it presents an equal measure the individual is identified but if not it is another person, Mahalanobis, cosine of the angle between vectors, Fuzzy systems, correlation coefficient among others. From all the distances, the small ones are chosen and compared with the initially selected data in order to determine if the person is in the database or is an intruder. What is remarkable is that

several authors put into practice various techniques to carry out the extraction of characteristics and reduce the dimension ability of the problem.

In this way, a facial recognition system based on images is obtained. The first experiments with this technology date back to the 1960s, although, at that time, research to begin with its development was kept secret but unfortunately lacked reliability, for some reasons such as: the lack of unified criteria, or the possibility of failure, when taking the measures manually would not be so viable.

These advances are applied in many places. Among the most important are:
Quantity verification e.g. at ATMs, building access, etc.
Surveillance, security and monitoring of people.
Improvement of the human-machine interaction for example: computer that recognizes who is using it.
Identification of offenders in police files.

The goals of facial recognition are:
Face Verification or Authentication: Compare one image of the face with another image of the face we want to know the identity of. The system will confirm or reject the identity of the face.

Facial identification or recognition: compares the image of an unknown face with all images of known faces in the database to determine its identity.

Table 1 Advantages and Disadvantages of Face Recognition

Advantages	Disadvantages
Useful in the forensic field	They interrupt privacy
Access control in private places	Lighting (interior / exterior)
No physical contact required, etc.	Occlusion from sunglasses, etc.

Facial recognition is one of the not so new systems, being biometrics a fundamental part of it. People react to this paradigm since its effectiveness is less than 85%. They also argue that fingerprint detection systems are more effective and compromise less the privacy of people circulating in any public space. The debate is long and it will be up to governments to decide which carries more weight: people's privacy or their security.

Since then, facial recognition systems are found everywhere, such as in public places, shopping malls, in other occasions it appears in social networks when photos are uploaded at that moment leaving biometric data of the face.

METHODOLOGY
The methodology of this article was developed through research in books, websites, blogs and other research sources. Documents in this area have been read, analyzed and summarized.

From the beginning, the study of biometrics was fundamental to the creation of facial recognition systems. Subsequently, the steps listed below have been carried out, while continuously reviewing and even analyzing the research. The steps followed have been:
➢ Definition of the title of the research
➢ Description of the all the topics that have relation with the title.
➢ Classification of, analysis and interpretation of documents.
➢ Description of each literary content

Going through the stages of pre-processing, visualization, segmentation, feature extraction, and facial recognition using the different techniques that have been indicated and described above in a way that is clear and understandable to the reader.

RESULTS
In the study of facial recognition through images it was determined that this is very important , so a survey was made to 50 people in the city of Jizzakh, which were randomly selected to know the benefits of facial recognition, which contribute to research.
Do you consider it important in facial recognition?

Table 2 Importance of Facial Recognition

ALTERNATIVES	ANSWERS	PERCENTAGE
YES	45	80%
NOT	5	20%
TOTAL	50	100%

Of the 100% of the people surveyed, 90% responded that facial recognition helps to solve criminal cases in the country, while 10% of the respondents answered no, so that

it can be interpreted that facial recognition is of great importance at present since it allows to recognize a person simply by giving some characteristics of some individual. Do you think facial recognition is important today?

10% of the people mentioned that there is data protection for facial recognition, and 90% of the people mentioned that there is no subject, so the study will contribute a great deal to society to make the subject known.

DISCUSSION
In this document, different techniques for the extraction of facial characteristics corresponding to movements and deformations were shown. It is difficult to compare facial expression recognition systems because of the way the results are presented and the different databases used. A disadvantage of most of the methods shown is that they were tested on frontal view images taken under controlled conditions which represents difficulty when performing a real human-machine interface application

CONCLUSIONS
With the study it was possible to determine that there is no specific technique of facial recognition that meets all the expectations of the case, and it was possible to know that it helps in the fight against crime, since in the investigation it can be seen that 90% of the respondents affirm the mentioned, so that the fight against terrorism, in the blink of an eye facial recognition changes people's idea of privacy.

In addition, it was established that facial recognition is a computerized system that automatically identifies a person based on whether a digital image, or a video source is contained in a stored database. Thus you can see that the advantage is that it allows people to respond to the faces they see rather than having to break them down into parts Current recognition rates for research papers using a single feature extraction technique are around 90%. Industry implementations using the Ministry of internal affairs of Uzbekistan database for testing have an approximate performance of 99.99% with a false acceptance rate of only 0.001%. These values should be taken into account when any future implementation is desired.

It was also found that the most commonly used techniques in the research are PCA and any of its variations CPCA or KPCA and artificial neural networks RN. Within the latter technique, researchers mainly use SVM vector support machines, RBF radial base functions and in some cases MLP multilayer perception. It was also found that DSPs are one of the preferred hardware for real time implementations and that there is a diversity of works based on the C6000 architecture from Texas Instruments. No real time implementations of applications based on 3D models of the head were found, this may be an area of research for future work.

No matter which side you're on, one thing is clear: facial recognition technology is here to stay. While it brings many benefits, there are obvious issues.

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

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

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

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

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

[7] 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.

[8] 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).