

## **The facial recognition as a citizen security measure for the elderly**

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### **Abstract**

Insecurity is one of the most disturbing problems for citizens and governments. In Peru, in recent years it has been occupying the second problem that most afflicts the population. The objective of the study is to publicize about facial recognition as an alternative measure that contributes to the safety of older adults, and it is also intended to give a more in-depth study about the positive or negative impact on the implementation of facial recognition systems to deal with cases of disappearance / loss due to spatial disorientation in the elderly. Likewise, it is intended to make known that, with the use of technological advances such as artificial intelligence, video surveillance with biometric recognition (physical characteristics / behaviors) and specialized software.

**Keywords:** Facial recognition, Safety of the elderly, Biometrics.

### **1. Introduction**

Biometric technology has been contributing a lot to the field of social security, and in a more particular way facial recognition, where to this day it has been applied as a measure of identification or verification of people's identities. An outstanding example is the country of Japan, which for years had implemented video surveillance cameras in order to identify criminals, terrorists, missing persons and which are currently being implemented in supermarkets, ATMs, access control, among others. Facial recognition consists of the identification of people through the use of algorithms, where the facial characteristics of an individual captured by a camera and a database with images of faces are compared.

The research aims to present concepts about biometrics, facial recognition, its application, its impact, safety in the care of the elderly and how facial recognition will help families in the care of the elderly.

With a more in-depth study on the subject, we can see, how technological advances and even more so facial recognition technology, have been one of the effective alternatives to address complex problems such as citizen insecurity and disappearances (loss) in adults greater.

## **2. System facial recognition**

To talk about facial recognition we must first understand certain basic concepts such as, for example, what is biometrics? What biometric features are there? and What are the processes handled by biometrics ?, among others.

To answer these questions we quote Jean-Marc Royer (2007) who makes reference that: "biometrics consists of measuring one of the characteristics of the human body in order to identify an individual". With reference to (Cortés Osorio, Medina Aguirre, & Muriel Escobar, 2010), they mention in their research that biometrics comes from: "bio (life) and metería (measurement), that is, it consists of techniques that measure and identify physical characteristics or patterns of behavior that allow the identification of human beings ". Finally (Serratos, 2014) defines biometrics as: "science that analyzes the distances and positions between the parts of the body to be able to identify or classify people" (p.5), this same author mentions that there are the following biometric features:

- a) Of the head: face, ear, facial thermogram, iris, retina.
- b) Hand and fingers: hand and finger geometry, fingerprint, handprint, hand veins.
- c) Of the behavior: talkative (voice), signature, way of walking, way of typing.
- d) Of the whole body: smell, DNA.

And according to (Ruiz Marín, Rodríguez Uribe, & Olivares Morales, 2009) the main identification techniques are:

- a) Identification by voice whose advantage is low cost, but its performance is also low.
- b) Identification by fingerprints, the advantage of this technique is that it is widely used, stable and high-performance. The other technique is through the iris, its advantage is multiple, and its disadvantage is that it is expensive.
- c) Identification by hand this technique is unstable, and therefore little applied.
- d) Face identification The advantage of this technique is that it is comfortable and imperceptible and its drawback is that this technique is very sensitive.

With regard to security, biometrics has been used for a long time, and the biometric systems most used to contribute to security are: facial recognition, voice recognition, fingerprints, signatures, retina and iris. Thanks to biometric security, systems capable of identifying people are implemented, these can be criminals, disappeared, homicides; with the purpose of addressing citizen insecurity that is increasingly difficult to control. (Cáceres Mariño, 2018)

(Ortega Garcia, Alonzo fernandez, & Coomonte Belmonte, 2008), refer that the general structure of a biometric system is common functional, which is made up of several phases

and that its way of proceeding will depend on patterns, characteristics or signals to be recognized. Figure 1 shows the architectural stages of the biometric system.

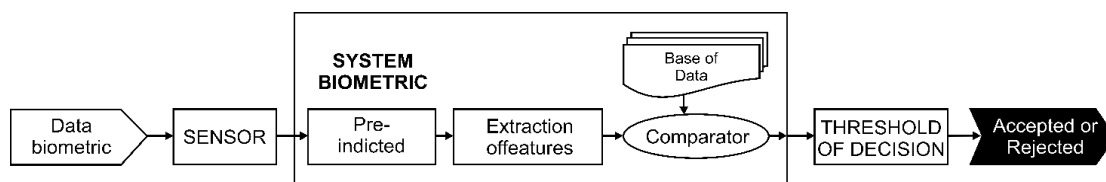


Figure 1: Stages of the Biometric System Architecture

Note: (Ortega García, Alonzo Fernández, & Coomonte Belmonte, 2008)

Once we have understood the previous basic concepts, from now on we can talk about the facial recognition system, this technology comes from 1960, when Woodrow Wilson Bledsoe, developed a system capable of classifying photographs of faces made by hand, This device allowed people to enter coordinates vertical and horizontal in a grid using pencils that emitted electromagnetic pulses. In this system, the coordinates of the characteristics of a face were registered manually, in the same way the eyes, mouth, hair were registered and then this information was inserted into a database and later recovered when finding similarities (SPOT, 2019).

According to (Eslava, 2013) facial recognition is divided into five main stages: “The first is the acquisition of data by means of a device that provides a photograph containing a face to be analyzed. The second comprises the detection and localization of the face. The third is the preprocessing stage where the data is prepared by normalizing, aligning and scaling the image. Once the data is prepared, the fourth feature extraction stage is carried out to obtain the relevant information from the image and finally, the recognition stage where the recognition algorithms are applied and a decision is extracted regarding the base of data and input image”.

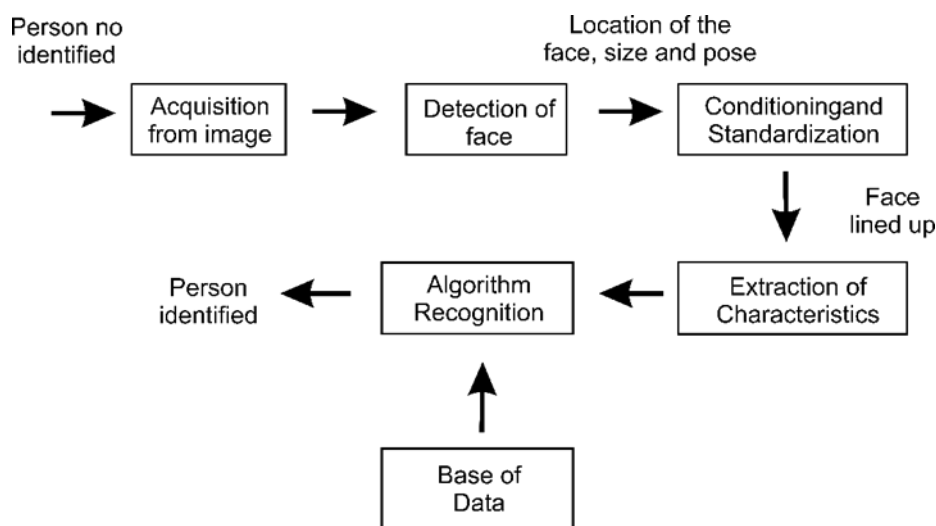


Figure 1: Stages of Facial Recognition

Note. González et al., (2019)

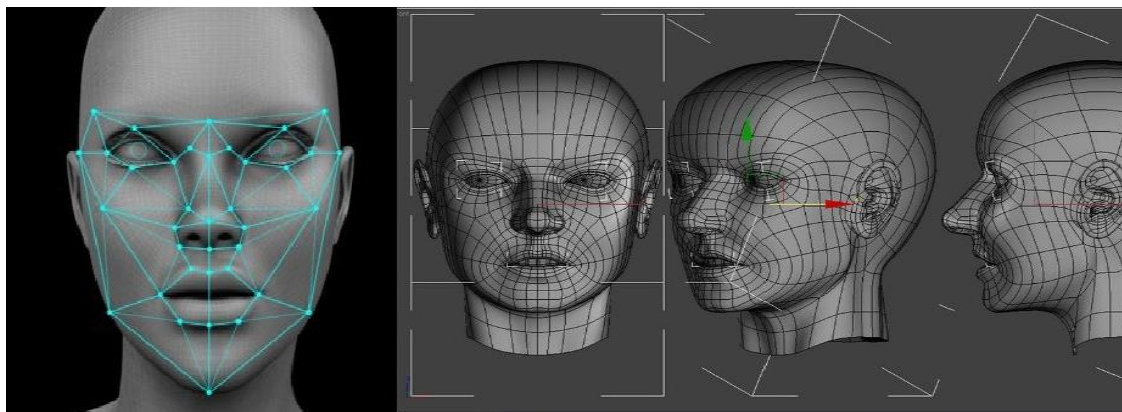
Likewise, facial recognition is classified into three categories:

Based in 2D images: "Where they extract traits or local characteristic marks of the faces and are placed in a classifier. By geometry, these methods use edges, lines, and curves to differentiate and recognize faces. Some characteristics are lost by the pose or lighting ". (Filio, 2021)

Based in 3D images: "They are represented in two ways, by range images or 2.5 and 3D images (polygonal meshes) ". (Filio, 2021)

Hybrids or multimodal (2D + 3D): "It is the combination of 2D and 3D images. its accuracy is 91.4% and it already has better performance ". (Filio, 2021)

In Figure 3, it shows the difference between the 2D and 3D categories. Figure 3. 2D and 3D images.



The most used algorithms in facial recognition systems are (Mateo, 2020):

Eigenfaces: It is an algorithm used to detect faces by computer from an input image.

Fisherfaces: Whose main characteristic of this algorithm is that it evaluates faces based on variables.

LPBH: "This algorithm identifies textures of an image and describes them by regions, thus applying a histogram, with which he will work with the algorithm ". (Esparza Franco, 2015)

These algorithms mentioned, when used alone, do not achieve the desired efficiency, but when combined or complemented with algorithms such as:

PCA: "This algorithm looks for dominance based on data that is best represented in least squares processes. Its main advantage is to reduce the dimensions of a data set and its disadvantage is that the observed data is assumed to be a linear combination of a certain base ". (Solís, (2017)

Viola-Jones: "Detect faces in real time, it is based on the comparison between the luminous intensities of rectangular regions of the images called Haar-Like that it calculates using an

integral image. These classifiers are grouped in a cascade using an AdaBoost learning algorithm to achieve high detection performance ”. (González et al., (2019)

Then the eigenfaces, fisherfaces and LPBH algorithms combined with PCA and Viola-Jones obtain favorable results in facial identification.

### 2.1. System application facial recognition

The application of the facial recognition system occurs in the following sectors:

Financial sector, Immigration, social services, care health, access control, time and attendance, computer security, telecommunications, police and crime. The following table explains these mentioned sectors with examples.

Table 1

Facial Recognition Application

Sectors	Example
Financial services	ATMs, banking transitions
Immigration border control	Airports, issuance of passports and visas
Social services	Social programs
Health care	Security Measures for Medical Records Privacy
Physical access control	Institutional, governmental and residential.
Time and attendance	Time punched card replacement
Computer security	Login, network access, e-commerce, encryption
Telecommunications	Unlocking mobile phones
Law enforcement	Criminal investigation, national identification, penitentiary institutions, follow-up of suspects, access control

Note. Adequate from Sánchez, (2020) and Costa, (2020)**3. Impact of facial recognition**

Facial recognition has brought many advantages to date, especially within the field of security since it has been applied more in police investigations and disappearance of people where through the use of this technology it allows to provide a solution to the cases raised in these scopes. The application of facial recognition and artificial intelligence can be used to verify the identity of a person, identify a person in a group. It is also intended to apply facial recognition technology to extract information about a person, such as their personality or their mood. (Pérez, 2021)

This technology It is widely accepted if it is applied in the police and criminal fields, since a large part of the citizens agree on the use of facial recognition in cases of catching terrorists,

criminals, kidnappers or to locate missing persons. The problem occurs when the use of facial recognition violates our privacy with the inappropriate use of our information, as a result of this problem, regulations that protect data were presented, this is the RPGD and the Spanish organic law for the protection of data and guarantee of digital rights (LOPDGDD) who protect biometric data for being sensitive data.

China is the country that leads in the use of facial recognition and that is increasingly being questioned due to its use and application. It is followed by India who focused on the application of this technology mainly to deal with human trafficking. The US applies facial recognition in the police field.

In Peru, this facial recognition technology is being implemented little by little. In 2014, the biometric recognition system was applied by the RENIEC, its use is for the recognition of the citizen or the verification of their identity and that this system is essentially for civil use and is complementary to the AFIS (fingerprint system), said Chaves Espíritu Gerente Information Technology Department of RENIEC (LZD, 2015). In 2019 with the arrival of the company FacePhi in order to provide its services to the BCP (Banco de Crédito del Perú) with SelphID technology, which consists of opening an account without the need to go to the bank's branches (FacePhi, 2019). Likewise, the municipalities of Miraflores, San Martín de Porres and La Victoria had been implementing facial recognition in their video surveillance cameras.

#### **4. Trends facial recognition – 2020**

"A study conducted in June 2019 estimated that, by the year 2024, the global facial recognition market would generate \$ 7 billion of revenue, supported by a compound annual growth rate (CAGR) of 16% during the period 2019-2024" thus It was referred to by Thales Group, (Group, 2020) a company dedicated to the development of information systems.

Facial recognition with artificial intelligence and blockchain represent a major digital challenge for governments and organizations.

Next, we will know what the trends in facial recognition are:

Learning to learn through learning: Deep learning, according to Peter Corke, a robotics expert, is a "network of artificial neurons that mimic the functioning of the human brain. The possibilities offered by this technology will increase as we discover the secrets of our brain. Through the understanding of the algorithm that the human brain is based ... reverse engineering will allow us to bring the potential of the human brain to artificial networks".

Security, trade and health: These three are the main applications of 2020 and it is estimated that by 2024, the facial recognition market will generate revenues of up to 7 billion dollars, with an annual growth rate of 16%.

Security: has greater activity with purposes of fighting terrorism, crime and economic competition.

Health: With facial recognition and deep learning it has been possible for a patient to use a medicine with greater precision, enables stopping diseases, for example DiGeorge syndrome, being able to provide better pain management.

Trade: This it was a less expected area for the application of facial recognition. But in 2018, the KYC process (Know your customer) was released where customer behavior is analyzed when buying, and after this analysis, implement or improve purchasing processes, as you can see, it makes a combination between the experience of the customer. customer and marketing

User mapping: China applies facial recognition in banks (to identify VIP users or clients), airports and the police (Sunglasses program), India (Aadhaar Project) and Africa, Gabon, Cameroon and Burkina Faso decided to apply IT For biometric identity, in 2017 in Russia programs were installed to collect faces, voices, irises, fingerprints.

The general data protection regulation (GDPR) provides a rigorous framework for the protection of our data against the use and application of facial recognition and against the breach of this regulation there are drastic sanctions.

The Rebels: In Russia an algorithm was created that creates a makeup that deceives facial recognition software, this was created in order to prevent facial recognition cameras from capturing the face of Grigory Bakinov in order to protect your information, However, the creator of the algorithm did not launch his product on the market since criminals could use his product to evade justice.

## **5. Security in the care of the elderly**

The INEI refers to the fact that the aging of the population has varied significantly since 1950, since in this year the proportion of older adults represented 5.7% compared to the current year 2021, the proportion of older adults represents 12.7%. The integration of households with an older adult member are the following:

“By the end of 2020, 39.1% of Peruvian households have at least one person over 60 years of age. In Lima, the proportion of households with some older adult member reaches 41.4%. Urban households with an older adult registered 35.2%. While in rural areas, 44.2% of households have a person from this age group”. (INEI, 2021) (p. 2).

As the years go by and sometimes due to neurodegenerative diseases (Alzheimer's, Parkinson's, diabetes mellitus, schizophrenia, among others) that older adults over 65 years of age suffer, they suffer from disorientation problems in time and space, which It makes them more vulnerable to having a greater risk of getting lost even in places close to their homes.

This problem worries to family members, which leads them to take very drastic and sometimes inhumane measures since they tend to lock up older adults in order to prevent them from leaving home and getting lost.

This type of acts causes the elderly to suffer a lot and sometimes causes the elderly to flee their homes, resulting in disappearances, accidents and even death.

Front To this problem, the Peruvian state implemented the Comprehensive Center for the Care of the Elderly (CAIAM), this becomes a municipal space for the provision of comprehensive and multidisciplinary basic services, for the well-being, promotion and social participation of the elderly. Its purpose is to facilitate and encourage active participation, combat and prevent health problems (physical and psychological) through the development of workshops, recreational activities that contribute to the maintenance of mental functions. All this to guarantee the health, safety and integrity of the elderly. (MIMP). In the same way, programs such as pension 65, whose purpose is “to provide social protection to adults over 65 years of age, who live in vulnerable situations, giving them a monetary grant that allows them to increase their well-being; and improve their mechanisms for access to public services provided by the State ”. (“El Peruano” newspaper, 2021), make periodic home visits to the elderly in order to corroborate the good care of the elderly.

## **6. How this technology will help families in caring for the elderly**

Biometric technology has been used for a long time in society, and over the years, new horizons are also opening, mainly facial recognition, since it has been used in both the public and private sectors of many countries in the world. world.

The facial recognition system contributes to the identification of people who are in a database, such is the case of countries such as China, the United States, and India that apply this technology in order to identify criminals or missing persons who are in a database. of data.

So if this technology is applied to identify vulnerable older adults, their disappearance can be prevented, since they will be registered in a database, and when the system identifies the person wandering, it will send alert signals so that later, the shift staff can intervene and thus avoid the risk of the elderly being lost. Therefore, guarantee the tranquility of the family and the safety of the vulnerable older adult.

## **7. Conclusions**

Facial recognition is a technology that has many advantages in security, but it has also been seen that it has its not so good side since this technology can sometimes be used in order to collect private and sensitive personal information causing discrimination, such as the In the case of China, they use it to select VIP clients or to prevent people with low social status from entering shopping centers, causing discrimination.

Facial recognition is a technology that allows to face different problems that have to do with security such as; crime and cases of disappearance of persons.

Older adults over 65 years of age tend to suffer from spatial disorientation, which makes them more vulnerable to a higher risk of loss, this has led families to sometimes take inhumane measures to prevent the disappearance of older adults.



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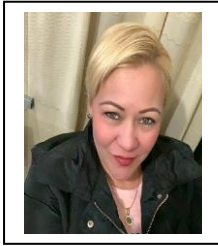
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