Analysis of the impact of the use of Artificial Intelligence as a service for the detection of unprotected facial passers-by.

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Abstract– ***The world is facing unprecedented challenges due to the COVID-19 pandemic, this situation has slowed development progress in many countries. The pandemic has had a very strong impact on human capital: many lives, education, basic well-being, and future productivity were taken. Many countries have become increasingly concerned with the pandemic, which necessitates research in new information technologies. This includes artificial intelligence research. One new idea we present in this paper helps to fight the epidemic. Very little research has been conducted on mask detection. This is because masks provide protection against COVID-19, and people with masks struggle to function normally without protection. However, recent advances in CNNs have made it possible to extract deep features from faces.***

Key words— Artificial Intelligence, face detection, face protection, Deep Learning, COVID-19.

I. INTRODUCTION

Artificial Intelligence became popular thanks to recent advancements in computer algorithms, data storage capacity and the volume of data processed. In 1956, the term AI was first used.

Artificial intelligence is a sub-field of computer science concerned with the creation of tools that mimic human intelligence. It aims to create computers capable of learning, reasoning and self-correction. Many concepts related to AI are transversal and applicable to multiple fields. Machines "learn" by using algorithms. They can then make decisions and even live among us in our homes, cars and health care systems. This has already become a reality, and it will only continue to expand.

A lot of the 1950s' research focused on issues related to problem solving, including using symbolic methods in its approach. Some research from the 1960s saw the US military experimenting with computers being trained to mimic basic human reasoning. In the 1970s, DARPA completed projects for street mapping. At the same time, names like Siri, Alexa, and Cortana were becoming widespread. In 2003, DARPA created the first intelligent personal assistants— named R1 and R2— through the development of artificial intelligence.

Machines can process data quickly and don't need to rest or eat. They can learn new information by interacting with many different situations. People have to interact with multiple situations and sources of data over time to progress in their learning. Sensory data from machines are compared to the massive amounts of Big Data they have access to.

In the literature, research that gives great weight to the advantages of AI applications in the field of health and medical sciences in general is common; however, there are few analyzes referring to the forecast of its possible impacts on ethical, cultural, social and technological aspects in general or with respect to certain sectors of the population with diverse characteristics. Valuing the points of view of national application of AI techniques in the field of health and raising some of the core problems on which their immediate development depends are two objectives of the next lines

II. THEORETICAL FRAMEWORK

For understand this research, it's necessary to know some key concepts:

A. Artificial Intelligence:

It is a discipline based on technologies that try to simulate certain unique characteristics that human beings possess, such as problem solving based on continuous learning. Artificial intelligence is one of the trending topics worldwide due to its application in various solutions from different areas that facilitate interaction between the user and the company, for example.

B. NLP:

NLP involves helping computers understand, interpret and manipulate human language. It involves natural language processing— or borrowing elements from both computer science and computational linguistics. Its main goal is to bridge the gap between human communication and computer understanding.

C. Machine Learning:

A machine can learn without being explicitly programmed to do so. This type of artificial intelligence is referred to as machine learning. One of the key areas of artificial intelligence that involves this process is pattern identification. Once a pattern has been identified, machines can make predictions based on the data they have processed.

Statistics is crucial to the development of automatic learning. It involves the creation of algorithms that automatically analyze large volumes of data to find the best possible solution to a given problem.

D. Deep Learning:

Deep learning is a method of learning that involves understanding the world through experience and understanding concepts based on their hierarchical order. As computers learn from their experiences, they are able to gather information without requiring a human computer operator to specify it in advance. This is because computers can understand complicated concepts by combining simpler ones into various layered graphs.

E. Protector facial:

A face shield, also called a face shield, face shield, or face shield, is a device designed to provide facial fit and an efficient physical barrier to airborne particles, including aerosols and small particle droplets. Likewise, a face protector is known as the maximum and complete protection of the face, because it covers up to the chin.

Face shields provide support in protecting the eyes and preventing people from unnecessarily touching any part of the face, a fundamental measure used by different governments to prevent the spread and contagion of coronavirus in open spaces. Currently, by provisions of the Government and the Ministry of Health, masks and face shields are mandatory due to the covid-19 pandemic.

F. Mascarilla:

Masks are individual protection equipment (PPE) where their function is based on protection from exposure to polluting elements through the respiratory tract.

These kits are made of filtering material and have a nasal adapter and rubber bands or face straps. In addition, there are some masks that sometimes also have exhalation valves. Likewise, they are indicated for the worker's respiratory protection against particles and liquid aerosols, such as: biological agents, dust, cytostatic and other drugs that are harmful to health. Likewise, this equipment doesn't offer any protection against gases or chemical vapors.

III. Review Methodology

The systematic literature review is a study helpful in mapping and critically evaluating the results of primary studies on a research topic. Figure 1 shows how it's conducted, which adheres to guidelines set by B. Kitchenham for Systematic Review of the Literature. The purpose of this review is to summarize the content of previous research, identify any gaps between past and current research, produce a coherent report synthesis of the research article, and create a research framework. Additionally, this review method prepares the research questions, search sources and strategy, selection criteria, study selection, quality assessment, data extraction and data synthesis.

Fig. 1. Description of a flow of an SLR.

A. Investigation questions:

The main objective of the SLR is to clarify and evaluate the empirical evidence when developing a systematic review of the literature, the research questions play a prominent role in deciding the search strategy, extraction and analysis of data. The research questions identified for this study, as well as its motivation or objective, are shown below (RQ):

RQ1. In which areas is artificial intelligence being applied?
RQ2. What are the purposes of using artificial intelligence for the detection of bystanders without facial protection?
RQ3. What is the impact of using artificial intelligence to detect passers-by without a mask and/or facial protection?
RQ4. In which countries is artificial intelligence used the most for facial detection?

Table 1 shows the research objectives of this study through the correspondence between each research question and motivation:

TABLE I
INVESTIGATION OBJECTIVES

INVESTIGATION QUESTIONS	**Motivations**
RQ1: *In which areas is artificial intelligence being applied?*	Identify areas where artificial intelligence is being used.
RQ2: *What are the purposes of using artificial intelligence for the detection of bystanders without facial protection?*	Identify the purposes of using artificial intelligence for the detection of bystanders without facial protection.
RQ3: *What is the impact of using artificial intelligence to detect passers-by without a mask and/or facial protection?*	Identify the impact of using artificial intelligence to detect the lack of use of masks and/or face shields in passers-by.
RQ4: *In which countries is artificial intelligence used the most for facial detection?*	Identify in which countries the use of artificial intelligence regarding facial detection is more frequent.

B. Source and search strategies:

Referred search sources include prominent bibliographic databases of scientific articles such as: Taylor & Francis Online, Google Scholar, ProQuest, and Science Direct.

The search strategy includes conducting a search using keywords that are relevant to our study. The search has been focused based on research questions and commonly used terms related to machine learning and software effort estimation.

The search procedure has been carried out using search threads written as (artificial intelligence) AND (facial recognition or COVID), which the set of AI represents the keywords related to the machine learning methods, that is, Bi represents the keywords found in relation to the dependent variables, i.e. Bi {facial recognition, COVID}.

Said search procedure allowed the formulation of different generic search equations for each of the search sources. The main generic search equations, in addition to their sources and corresponding base number of results, are shown below in Table 2.

TABLE II.
CONSOLIDATED MATRIX OF THE NUMBER OF RESULTS BY SOURCE

Source	Generic search equation	N° Resultados Base
Taylor & Francis Online	[ALL: ARTIFICIAL INTELLIGENCE] OR [ALL: FACIAL RECOGNITION] AND [ALL: COVID] AND [[ALL: METHOD] OR [ALL: METHODOLOGY] OR [ALL: MODEL]]	3,006
ProQuest	(Artificial intelligence OR facial recognition) AND covid AND (methodology OR method OR model)	3,141
Science Direct	(Artificial Intelligence OR facial recognition) AND covid AND (methodology OR method OR model)	1,796
Google Scholar	Artificial intelligence OR facial recognition AND Covid AND (method OR methodology OR model)	17,800
	Total	**25,743**

C. Selection criteria:

Exclusion criteria (CE) have been defined to evaluate the quality of the available literature under a high precision index. The exclusion criteria established for this study are mentioned below.

CE1: Articles are not less than 1-year-old.
CE2: The articles are written in languages other than English or Spanish.
CE3: The articles do not contain the exact phrase "face mask detection".
CE4: Full access to articles.
CE5: The articles do not mention a methodology or model or method.
CE6: The articles did not propose tools to apply artificial intelligence in facial detection against covid-19.
CE7: The articles are repeated.

D. Selection of studies:

After adjudicating the exclusion criteria, a total of 21 relevant studies were selected. CE 1 and 2 formed the first study filter; CE 3 and 4, the second filter; CE 5 and 6 the third filter; and finally, the CE 7 the fourth filter. The number of results after applying each CE in the corresponding filter are detailed in Figure 3 and Table 4.

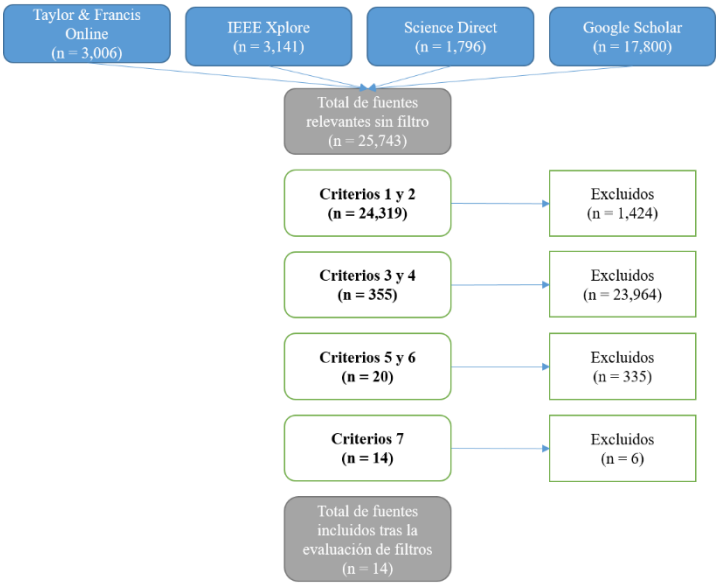

Fig. 2. Consolidation of the number of results when applying exclusion criteria

TABLE III
CONSOLIDATED MATRIX OF THE NUMBER OF RESULTS WHEN APPLYING EXCLUSION CRITERIA

Source	First Studies	Filtro 1: CE1 y CE2	Filtro 2: CE3 y CE4	Filtro 3: CE5 y CE6	Filtro 4: CE7	Estudios Finales
IEEE Xplore	3 141	3 136	24	6	6	6
Taylor & Francis Online	3 006	2 990	175	5	1	1
Google Scholar	17 800	16 400	94	12	7	7
Science Direct	1 796	1 793	62	2	0	0
Total	**25 743**	**24 319**	**355**	**20**	**14**	**14**

E. Quality assessment:

In this step, quality criteria (QA) were formulated and applied, as follows:

QA1: Is the document well organized?

QA2: Does the topic belong to the fields of computing, information systems or management?

QA3: Are the research objectives clearly specified in the document?

QA4: Does the article belong to a book, publication or conference?

QA5: Are the results of the experiments performed clearly identified and reported?

QA6: Is the full text of the document available?

QA7: In general, is the document considered useful?

The review of the quality criteria was carried out after the exclusion criteria where it helped to filter the selected items for the selection of the most relevant for the present investigation. The 18 articles met the seven quality assessment criteria.

F. Data extraction:

The data extraction procedure has been developed taking into consideration three important properties of the data, raised in the research objectives. These properties have been inspected by the available literature and selected studies. The three properties taken into account for the extraction are: impact of artificial intelligence on facial detection in passers-by/ models/ methods and areas with the most use.

G. Data syntesis:

The data synthesis process incorporates gathering the data and concluding the answers according to the research questions posed previously. The data synthesis has been carried out by analyzing the selected studies using multivariate regression techniques for the meta-analysis, as well as the following descriptive statistical measures: count, sums, averages, median, mode, percentages.

IV. Results and Discussion

Below are the answers to the questions posed above:

RQ1: In which areas is artificial intelligence being applied?

Currently, artificial intelligence is applied in a large number of fields, where its use includes medical diagnosis, stock trading, law, robotic control, remote sensing, scientific discovery, and toys.

If we talk about which sectors are working with artificial intelligence, we have:

- Hospital
- Financial sector
- Videogames industry
- Transport sector
- Industry
- Media

There are many areas where AI is present, either to a greater or lesser extent. Some of these areas are briefly discussed below:

- Treatment of natural languages: This field can include applications where translations between languages are developed, human-machine interfaces that allow interrogating a database or giving orders to an operating system, etc., so that communication is more user-friendly.
- Expert systems: This area includes those systems where the experience of qualified personnel is incorporated into these systems to obtain deductions close to reality.
- Robotics: Navigation and control of mobile robots, control of robotic arms, assembly of parts in industrial areas, etc.
- Perception problems: vision and speech, recognition of objects and speech, detection of defective parts through vision, support in medical diagnosis, etc.
- Learning: Behavior modeling for its subsequent implementation in computers.

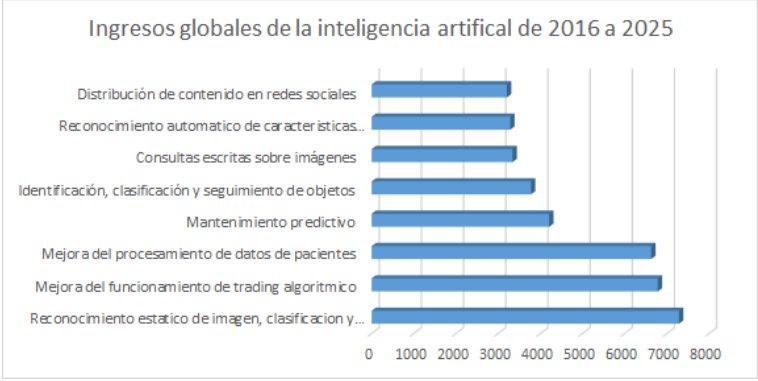

Fig. 3. Map of the application of Artificial Intelligence in Europe. Statista.

TABLE IV.
ARTIFICIAL INTELLIGENCE APLICATIONS

Technology	Articles	Total	Percentage
Social networks	[8][9][10][14]	4	29%
Automatic recognition	[8][9][13] [14]	4	29%
Predictive Maintenance	[7][8][11]	4	21%
Data processing	[10][11]	2	14%

RQ2: What is the objective of using Artificial Intelligence for the detection of passers-by without facial protection?

Through this systematic review of the literature, the main objective was found to be solutions for high-risk groups facing COVID-19 and to be able to stop its spread.

We're striving for the highest possible results, so we'll look for ways to work with complementary methods of Artificial Intelligence. Registries indicate that keeping patients COVID-

19 involved is important because it helps them identify the pattern of cardiovascular complications. This also makes it easy to identify cardiac complications and predict responses to different treatment modalities.

By using deep convolutional neural networks, classification algorithms and facial recognition software, the proposed way to identify faces with or without masks is a dataset.

This data set includes multiple faces with different types of facial coverings. Additionally, it includes images of faces with no covering. Both the face with the covering and the face without the covering are included in the data set. The method is tested on this data to verify its accuracy.

Machine learning models need a lot of data to help them learn, but mask datasets are small and hard to access features. So people use data augmentation as a strategy to increase the diversity of available data. By doing this, they don't have to collect new data. In order to create more generalized results from our experiments, we use data augmentation techniques such as padding, flipping and cropping.

In order to accurately identify the face mask, both models tuned and optimized for the task. However, they all performed well above 90% with little to no tweaking.

TABLE V.
OBJECTIVE OF USING AI IN FACIAL DETECTION

Architectures and/or programming languages most	Articles	Total	Percentage
Pattern identification	[1][3] [7] [11]	4	29%
Classification algorithms	[1][2] [4] [6] [10]	5	36%
Data augmentation	[2][3] [5] [11] [12]	5	36%
Transfer learning	[4][5] [9]	3	21%

According with the results of the systematic review of the literature, it is determined which were the techniques most used by the authors within the titles of their articles, leading the identification of patterns.

RQ3: What is the software and/or programming languages most used by artificial intelligence to detect passers-by without a mask and/or facial protection?

Table 6 lists the main software that has been used for facial detection. The statistical results of the approaches show that digital exclusion (35.00%), inefficient and failed systems (25.00%) and privacy problems (20.00%) are the main drawbacks generated by the application of information technologies in the promotion of tourist destinations.

TABLE VI.
MAIN SOFTWARE MOST USED PROGRAMMING LANGUAGES

Most used architectures and/or programming languages	Articles	Total	Percentage
Phyton	[6]	1	7%
MobileNet/MobileNetV2	[7][9][3][8][11]	5	36%
OpenCV	[11]	1	7%
Convutional Neural Network (CNN)	[6][8][10]	3	21%
Support Vector Machine (SVM)/K-Nearest Neighbors (K-NN)	[3] [6] [8]	3	21%
TensorFlow	[9] [11]	2	14%

RQ4: In which countries is artificial intelligence used the most for facial detection?

Facial recognition systems analyze the faces of people captured by surveillance cameras and make it possible to detect people who for some reason are in a database of, generally, security companies and state agencies.

Table 7 shows the countries in which it has been possible to model, implement or make use of facial detection using artificial intelligence.

TABLE VII.
PRINCIPAL COUNTRIES WHICH MOST USES HAVE ON ARTIFICIAL INTELLIGENCE FOR FACIAL DETECTION

Principal countries which most use on Artificial Intelligence for facial detection	Articles	Total	Percentage
Bangladesh	[6]	1	7%
Filipinas	[7]	1	7%
Marruecos	[8]	1	7%
China	[9]	1	7%
Arabia Saudita	[10]	1	7%
Ecuador	[11]	1	7%

V. CONCLUSIONS

This paper discusses the conceptual frameworks and platforms introduced in AI-based techniques research that deal with COVID-19 related issues. This includes facial recognition and radiology and geographic issues. Also, the risks of dealing with COVID-19 were looked into in this paper.

We also show a method to correctly choose the right models for measuring or predicting the parameters we want by combining many different types of data sets.

Artificial intelligence and medical professionals can work together thanks to the existence of these platforms. They enable AIs to analyze many data sets, which can help doctors to train intelligent machines or create algorithms that optimize data analyzed. This is because they provide a workspace for AI experts to work side by side with doctors. Moreover, this speeds up virus analysis by improving precision and speed.

The current limitations of AI methods against COVID-19 haven't been fully discovered yet. In order to combat this disease, new strategies need to be utilized consistently. People

should still conduct real scientific experiments even though many of the variables have not been figured out. This is because new strategies need to be found in order to counter the complexities of this magnitude.

Defeating COVID-19 requires a comprehensive plan that includes tools, approaches and methods for ending the threat. This goal must be achieved by building an army of platforms, methods and weapons that converge on the same objective.

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