

**SOME BENCHMARKS REGARDING THE ECONOMIC
IMPLICATIONS OF THE LATEST TECHNOLOGICAL
DISCOVERIES WITHIN FACE RECOGNITION**

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Abstract

In this paper we try to present some benchmarks about the economic implications of the latest technological discoveries recorded at the level of facial recognition. The facial recognition system is today considered to be the most natural of all biometric measurements, and this is for a good reason because we naturally recognize our faces not looking at our fingerprint or iris. These new technologies and the data they offer have come to be concentrated around several companies that act as Internet colossuses and have stock market capitalization values adjusted to inflation higher than any other company in history. All the forecasts and dreams about the evolution of the tech sector seem to be fulfilled sooner (as in the case of the quantum computer) or later (as in the case of the Solar X). Along with "artificial intelligence" (AI) and "blockchain", facial recognition is certainly a significant digital challenge for all companies and organizations in many sectors.

Keywords: *face recognition, tech-sector, economic development*

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1. Introduction

We must mention that this digital system has connected people from all over the world, registering a percentage of around 50% of the population on the Internet, although very unequal in terms of geographical location and income level. Initial optimism about the potential of the Internet and social media has rise concerns about people manipulation, first by constantly

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gathering information often beyond privacy limit, and then by actions based on this information collected online.

Viral demand for many algorithm-based services is a source of income for corporations, especially for those who offer free services. And we notice that these services offered as "free" are becoming more and more a must, because otherwise you can not compete with them. What is known is that, as Adam Smith wrote for the first time in his book "The Wealth of the Nations", there is no such thing as a free "dinner". So it is known that when a product is free you are the product.

Another aspect that should be considered when discussing the issue of internet and social media addiction is the individuals' dependency on technology, on the smartphone and on the communication platforms and apps. Even if there are some real benefits from having and using a social media account, we also must underline the potential negative aspects of social media, like online social media stalking, bullying and social media addiction (Fuciu M, 2019).

In recent years, hundreds of thousands of images are uploaded to the Internet every day, making it extremely difficult to find relevant images according to different users' request (Haomiao Liu et al, 2016).

This kind of applications has developed amazingly reaching impressive figures with products and applications designed to mediate on the one hand the interaction between people, but on the other hand, as any two-sided currency, have come with maximum intensification of dependence and data collection for various purposes, many of those announced, noble purposes, but not all. It is enough to remember the problems discovered and recognized by the Facebook, or en recent example with the problems announced and fined to "Youtube" by which they accumulates information of minors who accessed the platform. In the same sense of accumulation of information comes the new recognition technology that has increasing effects on life around the globe, from political to economic effects that have a great dynamic and becomes very important today.

To create less harmful technologies and ignite positive social change, AI engineers need to enlist ideas and expertise from a broad range of social science disciplines, including those embracing qualitative methods (Sloane and Moss 2019).

2. The revolution of the new technologies

The introduction of ICTs played a major role in reshaping the enterprise, determining the rise of a new economic entity, much more dynamic, flexible and adaptable. The place of the traditional enterprise was taken by the virtual one, based as fundamental elements on cooperation and networking. The ICTs implementation brought changes in the working process, transforming the tasks performed, the required skills and the working conditions. Nevertheless, the human capital became the primary dimension of the enterprise (Popecu D., 2019).

Airports across the country are prioritizing the introduction of newer technologies differently, achieving various results with each implementation. With various checkpoints and security measures to put in place, efficient passenger processing has proven, many times, difficult to achieve. Biometrics can be combined with these current self-service technologies to help meet the challenges of sustaining security while efficiently and quickly processing an increasing number of travellers (Patel, 2016).

It is current that some airlines have begun to embark on aircraft without requesting the boarding permit or even without that QR code containing our identification data. A relevant example is that of the giant American Airlines, which just a few months ago began using the facial recognition technology of passengers at the boarding gates. This is why some companies have the courage to use these new technologies and take the risks to reduce their customers' concern not to forget their flight permit at home or to empty the telephone battery on which this boarding permit is saved. . Here are examples of low cost companies that have implemented this technology and we can give the example of the low cost company JetBlue Airways Corporation (Sinead Baker, 2019).

In this sense, we can say that the trend is growing and can greatly help in speeding up the boarding procedure, which should be the basis for adopting the new facial recognition technology as widely as possible. At some airports this technology has already been introduced, but it works in parallel with the presence of a passport or identity card. From here, however, until the passport is replaced, it should be no more than a step, as governments are becoming more and more focused and discussing the implementation of new technologies at government level. And because we are talking about faces do not forget that "any currency has two faces", and if we identify so easily the arguments we should not forget to see the problems. And even if the advantages are obvious, the disadvantages do not delay to appear.

Both the government and businesses in China have embraced large-scale facial recognition quickly and even aggressively, either to help with public safety checks or to speed up payments from cash registers in supermarkets. The technology is beginning to attract more public attention at a geometric rate, especially as it continues to spread the cases of abuses that are increasingly common in the Chinese state. Chinese state closed-circuit video cameras have been used specifically against certain ethnic minority groups, but even to try to find suspects who might be involved in legitimate protests, and can then be prosecuted.

The Chinese have also paid the most attention and have put a lot of effort, especially financially, into a facial recognition system for the country's population, and it has become stronger than ever.

The facial recognition system that the Chinese have created is part of Skynet. According to the information provided, the system can scan the entire population of China in just one second. In the same idea the population of the entire planet can be scanned in about 2 seconds.

This system performs the monitoring and is carried out throughout the country. Through it, the use of surveillance cameras is encouraged, but their performances are also enhanced. The system came into being in 2005 and since then it has been continuously improved and is currently able to implement facial recognition technology in 16 regions of the country.

So far, China has installed no less than 170 million surveillance cameras and wants the number to reach 570 million by next year. This means that one room will be reached for every 2.3 persons.

The same dynamic is registered in Europe and the United States, taking into account the percentage scale of the population. In Europe, over 1000 arrests have been made in the last year, based on facial recognition technologies. The police can track the suspects' movements, find missing persons, but even prevent illegal acts, thanks to this ultra-fast surveillance system.

The production companies say that they have reached an identification accuracy of 99.8% regardless of the shooting angle or the lighting conditions. The percentage remaining close to 100, however, allows errors to slip and that is why a still perfectible system is not yet 100% credible, so even it is a small one, it becomes important when it comes to people's freedoms and rights.

In the middle of globalization era, when consumers have at their disposal more and more prosperous livelihood, when technology is more and

more present, everyone looks for the newest and the most modern thing (Marcut L., 2014).

China is making a continuous effort to be a leader in the artificial intelligence industry, and facial recognition is only a small part of the entire system. As proof of the purpose of the Chinese is the number of artificial intelligence patents registered; in 2017, China registered five times more than the US. All of these were possible and in turn attracted more investments than the US in the international AI platform.

The number of lawsuits in which the state incriminates citizens by using evidence obtained from the misuse of this system is increasing. As long as it is not known who uses the data of citizens and for what purpose it represents an abuse against the rights of citizens.

By the middle of this year, San Francisco became the first American city to ban police and other agencies from using facial recognition software. Immediately thereafter, Somerville Local Council (Massachusetts) also voted to prohibit the use of facial recognition, making the city the second community to make such a decision, and a month later Oakland, California, made the same decision and became the third US city that prohibits the use of facial recognition technology.

Another month later but on another continent, this time the European one, the Swedish Data Protection Authority decided to ban the technology of facial recognition in schools and fined a local high school (the first GDPR fine in this country).

The biggest concerns are really around civil liberties and no matter how permissive you are it is not difficult to perceive the risk of skidding to some characteristics of the totalitarian state based on the abusive use of this technology.

Even though this facial recognition appeared in the 1960s with poor infrastructure then compared to today, it has steadily developed and gained momentum around 2012 when high resolution cameras met with artificial intelligence and intelligence and large databases.

But the positive examples have prevailed and it does not occur more and more often, so less than a year ago the London police made the first arrest on the basis of facial recognition, after cross-checking the images of pedestrians from the tourist sites with the base of data of known criminals at that time.

In April of last year, in just four days, New Delhi police, using facial recognition systems, identified nearly 3,000 children who were reported

missing. The examples could continue, but all this shows us that technology comes with pluses and minuses and that it takes time, interest and institutions to find balance.

3. Main findings and discussions

A study by MIT Media Laboratory found on a sample that the correct identification rate is around 98%, which means that errors can still occur. Microsoft and Amazon have said they will invest more funds to reduce these errors to zero because they have admitted that there is no clear regulation around using this technology, but at the same time, they cannot lose the opportunity and market share from participating in the trade such systems.

At the end of June last year, Microsoft announced that it had made solid improvements to its biased facial recognition technology, and a month earlier, Amazon reported actively promoting its cloud-based facial recognition services, known as Rekognition, to agencies, law enforcement.

In addition to lawsuits openly filed by citizens claiming the misuse of facial recognition, there are also institutions trying to monitor the controlled management of the data thus obtained and examples recognized in this could be "Algorithmic Justice League" or "Georgetown University Law Centers »and others.

Significant advances in the use of facial recognition technology can be identified in medicine and healthcare. For example, by careful examination and face analysis, it is possible to monitor the use of the drug more precisely by the patient. Even the discovery of genetic diseases such as DiGeorge syndrome with 96.6% accuracy and even the control of the anesthesia procedure during the operation were successful, and the research continues, one of the giants that invest enormously in this direction is Facebook.

So there are many benefits of facial recognition and all of them do not make it a dangerous technology, the applications of technology are huge. Marketers can better offer us the desired goods by customizing the offers following our searches, the key being our authentication. In the sense of security, the perpetrators are also trapped, bad things are avoided due to security, time savings (Facebook automatically tags friends in photos for years), less personally necessary hotel guests can be recognized and access in various areas can be achieved very Easy. Also, even more importantly, health can be monitored and quickly evaluated.

Schools are another excellent example of the positive results that face recognition offers. Facial recognition is or could be used to identify individuals who are not authorized to be on campus.

Of the Internet gossips, Apple seems to be one of the pioneers in using facial recognition to authenticate payments.

So far most examples are in favor of facial recognition and it seems we may not have a choice. Everything seems to depend on who owns the technology. But as history has shown, despite the good intentions of the Facebook colossus, the data it collected could have been misused for the manipulation not once (the latest case being Cambridge Analytica).

Facial recognition has the greatest chance of improving society by encouraging civic behavior, but risks are waiting around the corner.

These technologies have evolved and been attached by drones so that recognition can be done even at greater distances, which is useful for face recognition during protests and mass events. Some drones can carry cameras weighing 10 kg and more, which can recognize a potential killer from a distance of 800 meters from an altitude of 100 meters. Furthermore, communication with the ground control station cannot be intercepted.

If this were the first use, it should be remembered that in the economic field they are not any worse. Two years ago, one of the largest retail chains launched its own solution based on face recognition technology. The system can determine the mood of each customer while shopping, and can measure customer satisfaction immediately after visiting a supermarket. This chain is Walmart and is widely known in the world as a pioneer in many directions, so it is only a matter of time until other businesses have to take over the technology.

Thus, if the system finds a customer with an unhappy or unhappy face, the store employee will be notified. Walmart believes that this innovation will help improve its customer services and increase customer satisfaction. After all, the employee will be able to quickly respond to customer dissatisfaction and help them solve the problem in a timely manner. Also, as in e-commerce where the clicks are analyzed this system for the real environment will help to analyze the behaviour of customers in a certain period.

This innovative service can compare customers' emotions with what they buy and how much they spend, to provide the best cost-benefit ratio for each level of income. This helps to change the habits of different customers according to the budget and the expenses for shopping.

Also in the United States, attempts have been made to use this face recognition technology in stores to prevent theft. Strange is that Walmart was just one of the big retailers who rejected the idea, as the system proved extremely unprofitable at the time. In addition, many human rights activists have opposed the introduction of such a system in supermarkets because it violates user privacy.

On the other hand, Chinese retailers believe that face recognition technology is safer than scanning fingerprints, retina or using traditional passwords. As a result a year ago supermarkets in this country began to test the technology at cash registers.

As a customer, you can now check out the stand-alone ATMs. First, you need to scan the bar codes of all the products in the basket, and then the camera embedded in the terminal dashboard will recognize if your face matches the one assigned to your online account. To complete the purchase, you must enter your mobile phone number, which must also be linked to the customer's online account.

Another benefit of this face recognition technology is that it will be able to eliminate the sale of cigarettes and alcohol to minors in supermarkets and kiosks. In this respect, software programs have already been introduced at the self-service counters and at some supermarkets in the UK. A pilot project has already been submitted last year, and this year, this recognition is expected to be extended to UK supermarkets and beyond.

Here are just a few of the solutions offered for the business, but let's now look at the potential of financial markets. American Express Co. is as usual before the wave. According to the Wall Street Journal, the company is actively experimenting with facial recognition and modern technologies in search of new capabilities for some of its mobile applications, including solutions for clients traditionally underestimated by financial services companies.

Some time ago, American Express invested huge amount of money in creating its own innovative lab. The purpose of this lab is to take advantage of emerging technology to provide better and safer services to customers and stakeholders.

American Express Enterprise Growth has tested ways to capture and authenticate face images accurately and quickly on a mobile device. A customer could use it when making sensitive transactions through mobile devices, such as payments and money transfers. However, the product is not

yet ready for the market, because there were some errors that have not yet been solved, but this is only a matter of time.

If we have presented the utility of facial recognition for the sectors of health, security, financial, commercial, we can also notice the interconnections with the hotel and catering sector. In this regard, the popular fast food restaurant chain, KFC, in partnership with financial services company Ant Financial, a division of Alibaba, launched in 2017 an unusual payment service, called Smile to Pay. The novelty appeared in one of the fast food establishments in Hangzhou. The service was introduced for the first time in 2015 by Jack Ma, the founder of Alibaba, who presented it at the CEBIT international exhibition.

To buy a plate from the menu, just take two steps: 1) enter the phone number connected to the Alipay wallet and 2) smile at the camera built into the biometric terminal. Then follows the process of confirming the identity of the owner of the wallet, after which the payment is made successfully. Smiling is necessary to allow the system to understand if there is a living person in front of it and not just an image. The recognition process takes place instantly in 2-3 seconds.

Moreover, the system is a very advanced one that even if you change your hair, hair color and makeup, the service determines the unique individual characteristics of a person. Last year, Alibaba's face recognition technology was tested at two Marriott hotels in Hangzhou as well as in Hainan Island. In order to obtain the keys to the room, the guest must go to a special self-service center, where they must scan their passport, enter their contact details and take a picture. Then the system compares the photo in the ID with the guest's face. If the system confirms that it is the same person, then he or she receives the room key card. Introducing such a system in hotels will reduce the check-in time from 3 minutes to just one minute.

In addition to Marriott, face recognition technology is planned to be used by a Chinese Airbnb analog Xiaozhu. In particular, the company will replace ordinary locks with "smart" locks equipped with the latest face recognition system. With this system in place, the procedure for renting short-term housing will be safer and more comfortable. Face recognition technology will help owners rent their apartments remotely, meaning they won't have to come every time to give the keys to the guests who have booked the apartment.

Despite these wonderful discoveries we must remember that the technology also has a number of minuses that are being analyzed and are still waiting for solutions.

A February 2018 study by the Massachusetts Institute of Technology found that face recognition systems of technology giants such as Microsoft, IBM and Megvii often make mistakes (Tetiana Panasiuk, 2019). Thus, none of the systems was able to correctly identify Negroid women. In May 2018, it was reported that US-based retailer Amazon was actively promoting its own cloud-based face recognition services, called Rekognition, to law enforcement agencies. The software can recognize about 100 people in a single image, comparing their faces with tens of millions of people from different databases.

Talking about the evolution of face recognition technology, Facebook launched the DeepFace program in 2014. This service could determine if the two faces photographed belong to the same person with a precision of 97.25%. However, when people did the test, they gave correct answers in 97.53% of the cases, which is over 12% better than the FBI's new generation identification system (Amit Chowdhry, 2014).

One year ago, cyber security experts from a Vietnamese company used a 3D printed mask to integrate into a Face ID feature of the new iPhone X. They could prove that the system actually only uses parts of a person's face, so it can be easily mistaken and deceived. At about the same time, cyber security experts from a German company entered the Windows Hello feature, which can be used to access Windows 10 through face recognition. This was done using a photo printed on an ordinary printer.

An article in Forbes says that researchers at the University of Toronto have developed an algorithm to disrupt facial recognition. In short, the user can use a filter that changes certain pixels in the image. These changes are invisible to the human eye and are very confusing for facial recognition systems.

4. Conclusion

The main face recognition applications can be grouped into three key categories: security, health and marketing and sales.

The latter interests us the most, despite the fact that it was not the most expected. And yet, if we look now at the figures offered by the global market, it is the one that promises the most. The important tendency of marketing to know the best of the client is extremely well supported by the facial recognition technology. By placing the rooms in the retail stores, it is

now possible to analyze the behavior of the buyers and improve the customer buying process, as well as the recently designed system of Facebook, in which the sales company that is present on the Facebook platform, receives information about the customers taken over from socialization profiles to produce personalized responses in particular.

More and more stores are already using such a system and are now moving on to the next step of connecting to the payment possibilities of the customer through simple facial recognition. Chinese retail and technology giant Alibaba is already testing a payment solution through face recognition in Hangzhou, China.

A study published in June 2019, estimates that by 2024, the global facial recognition market would generate revenues of over \$ 7 billion, supported by an annual growth rate of about 16% from 2019 to 2024. And by the end of this year, the market is estimated to exceed \$ 3.2 billion.

In conclusion, although face recognition technology is still in its infancy and leaves much to be desired in terms of accuracy and reliability, it is not a way for any modern industry to find use. As we already live in a strongly digitized world, IT rates are rising year by year, leading to both innovative startups and established brands to increase their R&D investments in face recognition and to collaborate with AI laboratories and software development teams around the world looking for new tools that will help face recognition to the next level of maturity.

5. References

- Amit Chowdhry (2014), Facebook's DeepFace Software Can Match Faces With 97.25% Accuracy, *Forbes Consumer Tech*, <https://www.forbes.com/sites/amitchowdhry/2014/03/18/facebooks-deepface-software-can-match-faces-with-97-25-accuracy/#f4f284f54fc9>
- Fuciu Mircea (2019), Is the addiction to the online social media, of some Individuals, affecting the business environment?, *Revista Economica*, Volume 71, Issue 2, pp53-64
- Haomiao Liu, Ruiping Wang, Shiguang Shan, Xilin Chen (2016), Deep Supervised Hashing for Fast Image Retrieval, The IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2016, p. 2064

- Marcut Liviu, Marcut Alina, Marza Bogdan, (2014) Modern Tendencies in Changing the Consumers' Preferences, *Procedia Economics and Finance* vol. 16, pp. 535-539
- Popescu Doris (2019), The virtual enterprises challenges and tendencies, *Revista Economica*, Volume 70, Issue 5, pp.86-22
- Sinead Baker, (2019), American Airlines has launched facial recognition at the boarding gate, part of a trend sweeping US airports, *Business Insider*, 29 august, <https://www.businessinsider.com/american-airlines-facial-recognition-boarding-dfw-aviation-trend-2019-8>
- Sloane, M., Moss, E., 2019, AI's social sciences deficit, *Nature Machine Intelligence* 1, August, 2019, pp. 330–331
- Tetiana Panasiuk, (2019), Face recognition technology to change the world, *Payspace Mmagazine*, 13 March, 2019, <https://payspacemagazine.com/tech/face-recognition-technology-to-change-the-world/>
- Vishra Patel, (2018), Airport Passenger Processing Technology: A Biometric Airport Journey. *Dissertations and Theses*. 385. <https://commons.erau.edu/edt/385>