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RESEARCH ARTICLE

e-Securing the EU Borders: AI in European Integrated Border Management

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Abstract
In the European Union, the external borders were not always conceived as European ones. However, after experiencing a range of threats, the European policymakers identified external borders' importance to European security. Not forgetting that borders are connected with national authority, the EU through Frontex has made progressive steps towards a coordinated or even common border management. The main tools to achieve that are the shared European IT systems. Their enhanced capabilities, mostly based on Artificial Intelligence, will further establish the European Smart Borders. There is a complex "network" of IT border systems already operating or prospect automated ones that are necessary to be resilient and align with core fundamental rights.

Keywords: European Union, Integrated Border Management, European External Borders, Smart Borders, Schengen Area

Introduction

The borders have always been a core dimension of any state's sovereignty. Since the very old times, they are defining the state as a whole and its jurisdiction across its territory and in comparison, with others. Monitoring the borders is quite connected with the state's internal security. Border security has been transformed and improved through the years, due to the strengthening of international cooperation and the use of new technologies. Taking into account the consecutive developments of recent decades both in sociopolitical and technological level, the rates of interstate mobility have critically raised to unexpected numbers.

The most prominent case of such a thing takes place in the European continent. The last century, the "birthplace" of the system of states and borders is undergoing great reform. After World War II, the destroyed European countries realized that their interests were much more converging than contrasting. Thus, in 1951 the six-founding member-states set up the European Coal and Steel Community. That was the starting point of the so-called European integration process, the constantly deeper and wider cooperation between the member-states, which continues until nowadays. The amendments of the

Treaties and the creation of a European Union, consisting of European citizens holding a European identity have affected the role of borders.

The introduction of the Customs Union which evolved into a European Single Market in 1992 implied four freedoms, namely: the freedom of movement of persons, goods, services and capital. The Schengen Area was imperative, as the citizens were able to move without barriers across the Union. The abolishment of border checks internally, among the member-states, spotlighted the need to control the EU's external borders. Since then, the main objective is to prevent illegal activities and the flow of illegal travelers, who aim to cross the European external borders, jeopardizing the prosperity of the European citizens. Therefore, the member-states have agreed to the Europeanization of border management, accepting the involvement of the supranational level in the monitoring of their borders, that is the European external ones.

The modern globalized world has been characterized by interdependence and complexity, while people and cultures interact daily. At the same time, transnational threats, such as terrorism, organized international crime and mass refugee influx have struck European security and have enforced the adoption of effective practices to ensure the external borders' durability. New technologies and particularly Artificial Intelligence are key factors for addressing more efficiently the vulnerability of the "porous" European external borders (Marin, 2011). AI is the most disruptive technology, widely deployed in multiple sectors, and maximizes the positive impacts on society, the incomers and the administrative mechanism. The road towards a technologized European border management focuses on the deployment of new automated large-scale IT systems based on Artificial Intelligence and the interlinkage with the existing ones. However, it's necessary the adoption of reliable AI-embedded border technologies to align with the human rights and European values (eu-LISA, 2020).

The purpose of this paper is to examine the contribution of the Artificial Intelligence in the European Integrated Border Management and the concerns that have arisen by using such systems, framing the new border environment in the EU. The analysis has the following structure: Firstly, it is defined the term "border management" and shortly analyzed what constitutes the EU Integrated Border Management and the actors involved. Secondly, the developments regarding AI at EU level are described and the way that AI is deployed in European border management. Last but not least, emphasis is given on the constraints arising from the use of AI-embedded technologies for border control purposes.

Borders and Border Management

Border management refers to the procedures and measures that a state activates to control the mobility across its national sea, land and air borders, to confront the migration and criminal challenges and to keep the borders open but also secure. It consists of two main duties: border surveillance and border checks. The first one has a more preventive nature as it aims to monitor the areas close to the authorized border crossing points and detect any illicit activity. The second one includes the ad hoc checks in the crossing points, during the entry or exit of any person, vehicle or object (Wolff, 2008).

Following the collapse of the imperial systems, the Westphalian Treaty of 1648 inaugurated a new political organizational structure, the "state". The previously existing autocracies were divided and replaced by multiple national states with explicitly determined national borders. Borders set the lines that distinguish states, people, political systems and cultures among neighboring ones. Within their borders, the modern states are self-powered and have the exclusive authority to make decisions (Kokkalis, 2019). That means that the management and strict control of the borders are necessary parameters for the viability of the regime and the protection of the nationals. As time passes, those frontiers are metamorphosing depending on the human progress and the changes which this entails. With the dawn of the post-war era, the Western states met rapid development and improvement of their living standards, mostly owing to the enhanced international cooperation on trade and other political spheres.

Globalization reinforced states to stop being isolated, remove some barriers and outsource part of their sovereignty to international and supranational organizations and fora. On the one hand, this process promotes the "de-bordering", but on the other hand it imposes more stringent border monitoring to preserve the internal security threatened by widespread instability (Kokkalis, 2019). The rise of terrorism especially in the Middle East, the expansion of criminal networks internationally and the massive refugee waves are some troublemakers that enable dislocation and as a result stricter control of borders.

European Integrated Border Management

Undoubtedly, the European Union and its integration process has been a success story, deepening the collaboration of the member states and entrusting several absolute competences of them to the European level. The Schengen Agreement, signed in 1985, paved the way for the triumph of the Single Market (1992), which allowed the four freedoms and established an "area without internal frontiers" (Burgess and Kloza, 2021). By then, the Schengen Area has been the largest region (44.000 km sea

borders and 9.000 land borders) of free movement globally (Frontex, n.d.). The Maastricht Treaty (1992) introduced the structure of the three pillars. The third pillar was devoted to Justice and Home Affairs, which included the border and migration management policies, practiced through intergovernmental procedures. Nevertheless, in 1997 the Amsterdam Treaty assimilated to its legislation the Schengen Agreement and Convention, binding only the signatories to conform to the Schengen Acquis Communautaire. Also, it created the Area of Freedom, Security and Justice, "where the policies for migration, asylum and external border management, are in line with the fight against organized crime, drug trafficking and terrorism, gender equality and respect for fundamental rights" (Frontex, n.d.). Later, in 2007, the Lisbon Treaty repealed the pillars and instituted the three types of competences (exclusive, shared and supportive), regarding EU policy-fields. The border management was defined as a shared competence between the national states and the supranational level. The policy is not intergovernmental anymore (European Commission, 2021).

All the member states of EU and EEA are part of the Schengen Area, except of Cyprus, Ireland, Romania, Bulgaria and Croatia. The three last countries have significantly incorporated the Acquis Communautaire because they are in the throes of fully accession the Schengen "family" (European Parliament, Council of the EU, 2016). In the Schengen Area, the border monitoring is governed by the Schengen Borders Code of 2006. The border checks among member states, have been annulled and third country nationals enjoy unhampered mobility across the Union once they enter the Union (Marin, 2011).

This single area means that a threat happening in a member state will be rapidly diffused and will influence the other ones. That's why the effective management of EU external borders and its vital component, the Integrated Border Management rely on a comprehensive approach towards border security, where all the authorities-involved (interservice, interagency, international cooperation) coordinate their activities, exchange information and realize joint operation so as to effectively safeguard the European external borders. The Union has undergone five successful waves of enlargement that have led to the emergence of new European borders. The truth is that till a few years ago not all the member-states recognized the borders of peripheral countries as European borders. In fact, it was only after the refugee crisis of 2015, that most of them got convinced about the need to ensemble protect and strengthen those borderline countries' capacity to respond.

The IBM has both internal and external dimension, paying attention to the cooperation with neighboring countries at risk of "generating migrant flows" and follows a "four tier model" of border control (European Parliament, 2021):

1. focus on the origin or transit third countries of migrants, offering advisory and training assistance to local border authorities
2. initiatives for setting up cooperation and communication channels with volatile neighbors and exchanging information
3. efficient border monitoring in designated Schengen crossing point, controlling entry/exit and detecting irregularities
4. control and surveillance actions inside the Schengen area.

Stakeholders in European External Borders Management and the Role of FRONTEX

Considering the complexity and evolution of the above-described system, it's not surprising that the state no longer has the monopoly and a plethora of actors are engaged in European border management.

First of all, the state actors still possess the central responsibility concerning their borders surveillance and checks so as to prevent illegal crossings and combat international crime. The law enforcement national agencies, the border guards and coast guards (in case of coastal states) are obliged to protect the state borders and conform their practices to the existing both national and European law and procedures. Of course, their mission is facilitated by the capabilities offered by the supranational level. The Union has established bewildering network of national agencies, EU institutions competent to monitor the progress in the field (EU Commissions), shared IT-systems (Eurodac, SIS, VIS) and EU-bodies to implement its Integrated Border Management, as Europol, EASO and FRONTEX.

FRONTEX or the European Border and Coast Guard Agency was founded in October 2004, during a period of turmoil, when terrorist attacks of 2001 in USA and Madrid in 2004 and the Iraqi "War against terrorism" had convulsed the International Community. Initially, it was created to support logistically the national agencies in their operations for maximizing the outcomes and thus, states participated voluntarily. It is primarily tasked to secure the EU external frontiers, being the principal executor of IBM. Moreover, it conducts joint operations with the member states' relevant authorities, coordinates their functioning and evaluates their performance, safeguarding simultaneously the compliance with the Charter of Fundamental Rights of the EU (Frontex, n.d.). The agency possesses standing corps that are expected to reach the number of 10.000 until 2027.

The externalization of BM by the EU also promotes the proper cooperation with third-countries exploiting the existing channels of interaction such as the European Neighborhood Policy, bilateral Trade Agreements and Interpol's platform to combat criminality and increase administrative

preparedness of third-countries' national actors and efficient handling of internal insecurities that can easily transform to transnational ones (European Commission, 2021). Last but not least, except from externalized, the border management has been technologized and so the states unilaterally and the Union as a whole are reliant on non- state actors such as private digital companies. These players provide to border and other authorities the adequate equipment to sufficiently exert their powers (Burgess and Kloza, 2021).

Artificial Intelligence: The European Approach towards AI

It is arguable that the humanity is experiencing the AI age, the cornerstone of the fourth industrial revolution. Artificial Intelligence is a very promising and rapidly growing technology, which has induced positive transformative effects in most of people's everyday life sectors, such as communication, education, healthcare, finance, transportation etc. (European Commission, 2022). There is lack of a globally agreed definition for AI. Generally speaking, Artificial Intelligence refers to intelligent systems designed by humans, which autonomously examine their enviroment and assist the decision-making processes (Kokkalis, 2019). This type of technology aims to imitate the human way of thinking, processing and decision-making automatically, without requiring human supervision. AI is trained by humans to recognize patterns, evaluate and compare a huge amount of data from different sources and then produce a policy-recommendation based on credible algorithms and statistical models. These disruptive systems are continuously upgraded and can be multipliers of the desirable policy outcomes by processing a huge amount of data in a timely and cost-effective manner, since it avoids the waste of resources (European Commission, 2021). There isn't a concrete, irreversible format based on which AI systems are built. In contrast AI technologies are "adaptive", which mean that they self-adjust to the new conditions that characterize the environment and can easily exercise functions that wasn't programmed to do so (Kazim et al., 2021).

The European Union and its member states have realized how impactful AI systems are and that's why they are striving to incorporate them to as many as possible policy fields. Taking the advantage of AI implications will encompass the galloping development of societies and economies and will give precedence to the EU in the race of Superpowers for innovation and progress. For instance, China has already identified the importance of an AI by announcing the creation of an "AI Development Park" on its soil, aspiring to become the global leader in AI. Notwithstanding, the international regulatory system is deprived of an internationally accepted and respected law for AI, which sets global standards and boundaries of its use.

That's an opportunity window for the EU to take the lead and establish the first regulatory framework of AI, which of course will be adapted to its needs and special features. An infant attempt is the proposed by Commission Artificial Intelligence Act in April 2021. The vision is the formulation of European standards concerning these automate algorithms, in order to ensure a trustworthy AI European policy in the new digital era, in accordance with the human rights and GDPR law (Kazim et al., 2021).

AI-based Technologies in Border Management

Artificial Intelligence is a game-changing technology that covers a wide range of policy areas. The border management represents a sensitive field of sovereign states' power. The contribution of AI tools in border management can counterbalance the physical or technical border deficiencies by bringing extended capacity and effective surveillance of border crossings. Stemming from the recent "techno solutionism" wave, there is an abundance of data deriving from multiple commercial and strategic systems, and remarkable technological advancement. The suitable combination of those two elements can be translated into AI-based systems competent for asylum, migration and border control (Burgess and Kloza, 2021). AI tools can exploit the vast amount of data from databases, ad hoc border checks or travel documents, evaluate them, conduct risk assessments for individuals, forecast potential criminal threats, respond automatically to asylum applications and then make proposals to decision-makers concerning the optimum undertaken measures and resources management (use of biometrics, UAVs, thermal cameras, lie detectors/ polygraphs, face/ fingerprints scanners etc.) (Kokkalis, 2019). Those capabilities satisfy the more rigorous border monitoring and surveillance and prevent states from raising "walls" (as former US President Donald Trump did), as a response to outburst of migration and international criminality.

Additionally, AI technologies enhance the situational awareness around the borders. Situational awareness refers to the ability of being properly informed at the right time, about the operational environment and the threats that accompany it. By recognizing the environment opportunities and dangers, border guards can get prepared and select the most appropriate and cost-effective response. State of the art sensors, UAV swarms, thermal cameras, laser radars, CCTVs ease the articulation of the situational image, through using persistent intelligence, surveillance and reconnaissance (ISR) that can enable end-users make coherent decisions. AI-embedded systems can also lead to e-gates, automated border controls that will automatically identify the devious profiles, cross-check them with the material of their databases and decide the entry or not of individuals and further the granting of asylum or international protection status to applicants. In a world of digitalized and interconnected

border systems cutting-edge AI-based algorithms permit the development of predictive models and finally the prevention of illicit activities before the conventional border checks (Kokkalis, 2019). Those AI-assisted border technologies can be reflected to automated biometric identification and verification systems of travel documents (identity, passport cross-checked with face/ iris/ voice/ fingerprints/ DNA recognition), profiling and risk analyses systems (European Commission, 2022).

EU Smart Borders

The last decade is quite decisive for the European security. Europe has been exposed to an array of misfortunes such as the financial crisis, rise of eurosceptism, Brexit, terrorism, climate change, state collapse or turbulence in the neighborhood and refugee crisis, highlighting that external and internal security coincide. People especially from MENA region are fleeing their homeland and are migrating to Europe whispering a better future. However, the implications of that situation are detrimental to both the internal safety of EU and the well-functioning of European external borders. The massive influx of migrants and asylum-seekers have paralyzed the border mechanisms and have reduced their efficiency. At this point, the prevalent AI technologies are conceived by policy-makers as the "deus ex machina", which will offer an added value to the border security and surveillance exercises. The EU is investing in developing large-scale IT systems and upgrading the existing ones, so as to prevent, detect and confront successfully unlawful cross border activities.

The European Union displays a number of surveillance technologies, programmed to patrol its sea, land, air borders and decide upon migrants' entry. Those IT-systems are centralized compose the European "smart borders", the broadest sophisticated border regime in the world, that governs the Schengen Area (Vavoula, 2021).

The Schengen Information System (SIS) is the first and most popular information system founded in 1995 after the adoption of Schengen Convention. Actually, it is a common database, through which member states' relevant authorities issue and get aware of alerts for suspected individuals and objects. It is has undergone two updates, the last one in 2018, which allowed the use of further biometric data, such as photos and fingerprints. SIS I & II includes alerts on missing or wanted persons and on third-country nationals overstayed or banned to enter or obliged to return (Vavoula, 2021). The system is expected to be revised once again in 2022 to extend its functioning. Besides, each Schengen state and the Europol too have national SIRENE Bureaus, which facilitate the SIS functioning and information exchange.

The new century carried the creation of Eurodac in 2000 hand in hand with the Dublin Convention, a database that gathers, stores and automatically identifies (only) the fingerprints of individuals over the

age of 6 seeking international protection and asylum. Eurodac recognizes if the applicants have already submitted an asylum request in another member-state and thus, valuably contributes to the fulfillment of the Common Asylum Policy (Sadik and Ceren, 2020). In addition, the database is at the disposal of law enforcement agencies, especially when it comes to criminal or terrorist profiles. Eurodac preserves the fingerprints of asylum-seekers for 10 years, for unauthorized crossers for 18 months and by these deadlines the data are automatically deleted from the database (ETIAS, n.d.).

Eurodac's role is completed by the Visa Information System (VIS), a database fully operational in 2011 with the mandate to store information about short-stay visa applicants, pursuing to land on European soil (Vavoula, 2021). The data are 10 fingers' scan and photos of persons-concerned, which are kept in the database for a 5-year-period. The VIS, the authorities of the Schengen states and their consulates in third countries intercommunicate and exchange information, seeking to detect fraud, combat "visa shopping" incidents and accelerate the verification of IDs at border-check points (Sadik and Ceren, 2020). In 2021 the revised VIS was adopted by the Council, which expands the competence of the system by aggregating data for long-stay visas and residence permits (European Parliament, 2021).

In the context of FRONTEX, the European Border Surveillance system (EUROSUR), founded in 2013, in order to strengthen the integrated cooperation and info-sharing between FRONTEX and member-states. Each country has a National Coordination Centre (NCC) which interacts with the central agency (FRONTEX) and work together to thwart illicit activities at the European external borders. The surveillance concerns the land, sea and air borders and includes ad hoc checks at designated BCPs and comprehensive monitoring for articulating the optimum situational border picture. Its action is expanded to third countries, surveilling and patrolling certain coasts and BCPs and authorized pre-frontier areas (European Parliament, 2021). EUROSUR envisions to create a pre-warning mechanism, as a result of annually risk assessments and vulnerability assessments regarding the reaction capacity of member states, realized by the NCCs in coordination with FRONTEX. EUROSUR is a key player in the implementation of EIBM (Marin, 2011).

The structured management and R&D activities regarding the above-mentioned centralized IT European architecture are attributed to the European Union Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice (eu-LISA). The agency, based in Tallin (Estonia) provides twenty-four-hour technical support to member states and supranational systems and ensures their safe and non-stop intercommunication by using encrypted methods (eu-LISA, 2020). Except from SIS II, VIS and Eurodac databases, eu-LISA has taken over the

development, preparation and future operation of the forthcoming information systems EES, ETIAS, ECRIS-TCN (still under development) and their interoperability. The decision of extending the spectrum of the European IT architecture counts back in 2013 when the Commission submitted two proposals, which later called “Smart Borders Package”, for setting up EES and ETIAS (European Parliament, 2021).

The Entry Exit System (EES) is a disruptor for digitalizing the European border management and shielding the Schengen Area and internal security. The system is still in early stage of development, aspiring to become operational in May 2023. EES will be registering digitally every border crossing, exit or entry, of all third-country nationals, excepted or not from holding visa, who are meant to stay for a short-time period in Schengen territory. It will scan their travel documents, record the place and date of crossing the borders and collect four fingerprints and facial images, replacing the current time-consuming manual stamping process. Having stored travel history records of the incomers and refusals of entrance and following a procedure of biometric matching, ESS will recognize the overstayers and document-cheaters, issue alerts and admit the time-saving and accurate automated border control (Valila, 2021).

The next provisioned system of the Security Union is the European Travel Information and Authorization System (ETIAS). ETIAS refers to the prescreening of visa waiver travelers who wish to visit EU. They have to fill a mandatory online application form prior to their travel, either on website or app, pay a 7-euro fee and request authorization to enter the Union. Using AI technology, the system will perform an automated risk assessment follows based on the risk indicators that ETIAS algorithms are programmed to spot. That means automated cross-checks with other EU IT-systems, ETIAS watchlist of suspicious profiles, Europol and Interpol and verification whether the pre-travel preconditions are fulfilled (European Parliament, 2021). The algorithms will determine whether travelers pose a potential threat and prevent their entrance to EU. ETIAS is expected to be operatable in November 2023, enhancing the proactiveness of border management mechanism and satisfying the bona fide travelers with proper and without delays service on ad borders control (eu-LISA, 2020).

Last but not least, eu-LISA is in charge of building the European Criminal Records Information System (ECRIS-TCN) an additional centralized IT system which comes to complement the existing decentralized ECRIS. It fosters the exchange of information about the criminal past of convicted third-country citizens (foreigners holding also European nationality) or stateless persons, among the judicial and other relevant authorities. The access in information upon previous criminal records will assist the database’s users better perform their duties on combating cross-border crime (Burgess and Kloza,

2021). ECRIS-TCN is not yet into force, but once it is, it will process fingerprints and facial images of the people-concerned.

All the above systems can be fully exploited once their interoperability is safeguarded. Interoperability covers a variety of the existing systems (SIS II, VIS, Eurodac), prospect ones (ETIAS, EES, ECRIS-TCN), national systems, Europol, Interpol and operating assets in the area of freedom, justice and security, which will get interconnected by 2023. Initially, SIS, VIS and Eurodac were supposed to operate independently, but the interoperability proposal seemed quite more effective. The establishment of communication channels, the exchange of information and the accessibility in common databases will enhance the situational awareness of the competent authorities, ameliorate the quality of border control. The interoperability scheme is ruled by two Regulations of 2019, and consists of four elements:

- the European Search Portal (ESP), linkage of EU large-scale IT systems
- the shared biometric matching service, storage of biometric templates and their cross-evaluation
- the common identity repository, individuals' file containing information and their biometric data
- the multiple identity detector, detection of fraudulent multiple identities (Vavoula, 2021).

AI-embedded technologies play a substantial role in implementing interoperability both in national and supranational level, and subsequently, covering the existing information gaps (European Parliament, 2021).

Examination of AI-centered EU Border Management

Artificial Intelligence is an ace of spades for Europe and its asylum, migration and border management. The wide availability of advanced technologies has inspirited the use of AI in the borders. The investment to the development of large-scale AI systems will offer the European border and other agencies an enhanced toolbox to effectively police the external borders. The establishment of e-gates (namely remote and automated system for crossing the borders), the gathering of multiple alphanumeric and biometric data and automated decision-making on visa/asylum applications are some of the opportunities that AI can bring. Therefore, the Area of Freedom, Justice and Security can be e-secured in front of transnational criminality and irregular migration. The deployment of chatbots would provide assistance to end-users and alleviate the pressures upon them and the border mechanism. In June 2021, RAND run research on behalf of FRONTEX, which examined nine AI

technologies that would be useful in European Border and Coast Guard (ECBG): "automated border control, maritime domain awareness, machine learning optimization, surveillance towers, heterogenous robotic systems, sUAS (autonomous unmanned aerial systems), predictive asset maintenance, object recognition and geospatial data analytics using satellites" (Frontex, 2021). Apart from the centralized IT systems, there are four categories of AI-based technologies that the EU integrates in its border management, explored by European Parliament's relevant analysis:

1. "Automated biometric systems
2. Emotion detection
3. Algorithmic profiling and automated risk assessment
4. AI tools for migration monitoring, analysis and forecasting" (European Parliament, 2021).

Firstly, the EU border managements relies on biometric-enabling technologies which have two tasks, the automated biometric identification (one-to-many matching) and biometric verification/ authentication (one-to-one matching). In the European case, biometrics refer to facial images, fingerprints, and photographs. Almost, all European IT-systems (SIS II, VIS, Eurodac, EES and ECRIS-TCN) except from ETIAS use or will use Automated Fingerprint Identification (AFIS) for border crossings. The automated collection and evaluation of fingerprints is extensively used in SIS, VIS, Eurodac and EES, where latent fingerprints are also applicable (collected from a surface and then digitalized) and usually border guards take sample (prints) from ten fingers and then compare it with existing biometric data in the central interconnected databases.

Thanks to deep learning, face recognition technologies has been a tool for matching facial images with other reference faces, authenticating persons and thus providing automated border controls (ABC). This process is a novelty, gradually met at airports, where live CCTV photos are collected and compared with the ones in the passports' microchips. However, no EU border control system includes face recognition for verification or identification purposes, excluding EES, which is expected to automatically process facial images. So, there are no Automated Border Gates in the Schengen Area. Also, having understand the importance of facial recognition the EU is funding a project titled "Towards the European Level Exchange of Facial Images" (TELEFI, n.d.). At this stage the interoperability regime significantly influences the quality of the identification through the Common Identity Repository and the shared Biometric Matching Service, while biometrics' exchange (facial images and dactyloscopies) is taking place.

As far as emotion detection technologies are concerned, it is a method of recognizing mental situation and emotions (neutrality, nervousness, surprise, anger etc.) via gestures and facial expressions. With the help of AI, those feelings are detected and witness the deception and irregularities in illegal border-crossers' claims. These are the proof that something goes wrong. In EU external borders, no emotion detection system is materialized, even if EU is funding a sort of such R&D projects. One of these, is the "iBorderCtrl", Intelligent Portable Control System (2016-2019), which has absorbed more than 4 million euros from the EU Budget. iBorderCtrl was AI-embedded and developed only experimentally at four BCPs of EU land borders in Greece, Latvia and Hungary. An avatar was interrogating the aspiring traveler, posing some preliminary filtered questions (European Commission, 2022). Then, the system was analyzing his/her nonverbal micro-gestures in order to profile the candidate and verify its liability. iBorderCtrl seemed to a lie-detector, spotting eye blink, voice, gaze direction and body temperature) and tended to imitate the Automated Deception Detection Systems (ASSC) (Kokkalis, 2019).

Artificial Intelligence has the privilege to gather the above-mentioned data and psychographic indications, process and interpret them so as to examine whether an unknown person poses a threat to the internal stability and safety. The automated risk assessment embraces algorithmic profiling, which "flags" suspicious to the border authorities' individuals. At European level, VIS and ETIAS are competent for the algorithmic profiling of non-Europeans as stemming from two Directives: PNR and API Directives, which pursue the info-sharing about passengers with abnormal behaviors, from air companies to national authorities prior to the flight departure. Both revised VIS and ETIAS will wage risk evaluation for unknown visa-waiver or not persons. The applications on the online systems will be compared with specially-articulated watchlists of suspected individuals and a package of pre-determined risk indicators, such as "sex, age, level of education, place of residence, nationality etc.". Nonetheless, those risk indicators are not common for all member states and differ from state to state. The risk indicators lead to the profiling of individuals, categorize them to high-risk incomers and urge the authorities to elaborate more rigorously on these applications (Vavoula, 2021).

Some AI- based tools are capable of predicting the intensity, the period and the direction of refugee flows and cross-border criminal activities, based on predictive analytics. Consequently, the readiness of the border authorities is enhanced, they can well-organize their reaction and face their technical/operational insufficiencies. That kind of analytics can forecast potential malfunctions of the existing systems and methods. In any case the automated tools will provide early warnings to the end-users and increase the efficiency of their surveillance. FRONTEX, exploiting data of EUROSUR rules out R&D initiatives and risk analyses concerning forthcoming security threats. Moreover, EASO,

European Asylum Support Office has established an "Early Warning and Forecasting System" practicing in non-EU soil and forecasting third-country nationals' arrivals. The model analyzes the sociopolitical and other environmental changes in neighboring countries, defines the causes of displacement and then predicts the potential number and roots of asylum-seekers.

ROBORDER is another EU-funded project seeking to achieve the automated surveillance of European external borders, helping authorities to get aware of prospective threats on time. The main tools are the aerial and submarine AI-based unmanned mobile robots, which are equipped with state-of-the-art sensors, thermal cameras and radars. Its goal is to remotely confirm criminal signs and prevent illegal migration, smugglers' activities, cross-border crime, but also detect maritime pollution. In particular, it successfully recognized a simulated sea oil spill in Portugal. The pilot system has been twice tested, once in Greek sea borders and in Bulgarian land borders. The key tool are the aerial and submarine AI-based unmanned mobile robots, which are equipped with state-of-the-art sensors, thermal cameras and radars. The project received more than 8 million euros and was completed in August 2021 (Tyler, 2022).

Each and every of the AI-embedded tools requires hiring high-skilled personnel and regular training of the existing, to get harmonized and familiarized with the cutting-edge technologies and their unique capabilities. EU hasn't still fulfilled its vision for a technologized border security network. The transition to the automation of the European external borders control, benefiting from Artificial Intelligence will have been materialized till 2025. At this effort, it's substantial the contribution of R&D activities initiated and profoundly funded by the EU. The HORIZON 2020 scheme, with a budget of nearly 80 million euros for R&D activities, deploys pilot projects in the field of AI-based border management with the technical support of European Commission. Already HORIZON (2020 and Europe) projects, such as REBORDER and iBorderCtlr have been uptaken by this scheme and have provided the foundation for exploring new AI-assisted border capabilities (European Commission, 2022). Also, FRONTEX works for innovative border security capacity-building and capabilities and is committed to promoting research activities which will boost the operational preparedness of border monitoring mechanism (Frontex, n.d.).

"Second Thoughts" on Extended Use of AI at European Borders

Artificial Intelligence has been both a blessing and curse for the European Borders. Despite its beneficial implications, AI-based systems have raised concerns and criticism about: ethics, accuracy, cyber-attacks and EU-funding transparency.

To begin with, border management to a great extend means human management. However, it is often dehumanized (Kokkalis, 2019). On the one hand, the national and supranational authorities work for safeguarding the fundamental rights and security of European citizens, while on the other hand their practices scorn citizens' liberties. In 2019, FRA, EU Agency for Fundamental Rights, condemned the unrestricted use of such systems and urged for human rights violations, stemming from automated border management. AI-embedded risk evaluation and profiling algorithms determine how much risky an individual is for European security (FRA, 2019). The pre-defined risk indicators, such as, race, sex, nationality, can lead to discriminative and unlawful profiling of the aspiring asylum or visa applicants. The automated classification as a high or low risk incomer jeopardizes human dignity and surpasses the human side of the assessment, which is biased. The automated predictive algorithms are functioning as senseless machines and that results in false decision-making. Then, due to the opacity of the automated systems, the human decision-makers are not able to justify the system's decision. Hence, the applicants are deprived from their right to information. The iBorderCtrl system is the adequate example. The avatar interviewing the applicants is programed to ask and not respond. So, in case of non- native speakers, if they cannot understand the context of the question, they are getting nervous and this behavior may be translated by the automated system as suspicious and fraudulent indicator. Of course, this conclusion is inaccurate (EDRi, 2021). Algorithmic profiling implies both direct and indirect discrimination. Risk indicators, as race, nationality, religious beliefs show clearly the identity of the applicant and are conducive to biased results. Simultaneously, non-sensitive information, such as dietary preferences could be a proxy for religion or ethnicity, protected data by the EU primary law and EU Charter of Fundamental Rights.

The collection of biometric data (fingerprints and facial images) for verification and identification, used for algorithmic profiling brings stigmatization of specific demographic groups such as women and darker skin tone people. In spite the fact that ETIAS and revised VIS mustn't form risk models that include sensitive information of persons, even indirect risk indicators reveal private data (Vavoula, 2021).

Concerning data privacy, border management AI technologies aren't aligned to data protection legislation. Biometric systems collect sensitive data that declare the identity of an individual. The use of remote surveillance borders systems infringes the right of individuals to privacy. Such actions can be coincided with surveillance societies, that are policing continuously, and their facial images can be extracted by CCTVs at any time. These technologies are invasive and fundamental rights are at risk during their unlimited usage. Exhausting screening procedures and databases (such as SIS, VIS, Eurodac) storing and sharing is detrimental to human privacy (EDRi, 2021). The interoperability of

EU AI-based border systems facilitates the border monitoring but endanger the data protection of foreigners. At EU level, GDPR is a strict legislative framework, but there are no specific provisions for guaranteeing data protection in AI-based border control systems. The use of personal data has to ascertain the principle of proportionality. The info-shared and the automated border and applicants' surveillance should be limited to the "need to know" data and avoid the over-expansion of systems' competence.

Technical weaknesses of AI-embedded EU border systems impact their accuracy and effectiveness. Accuracy is strongly connected with the quality of automated algorithms and the quality of collected data. The EU systems suffer from data errors mainly during the data entry, such as false name and birth date registration and spelling errors. Algorithms are trained to execute their duties according to pre-set data and past experience, occurring false matches and false profilings (Vavoula, 2021).

Starting from the automated biometric systems, it is widely accepted that the accuracy of AFIS is dependent on factors such as: age and weather. Fingerprints of an individual change as he is growing, something that makes difficult the identification in VIS where the fingerprints are kept for five years. Except from biological obstacles, the insufficient training of operators in combination with special weather conditions worsen the proper automate collection of fingerprints in the designated BCPs, due to dryness, dirty scanner's surface and inappropriate use of collection, and interpretation technologies. Facial recognition systems are much more inclined to false results. The quality of facial images is usually flimsy because most of them are live pictures, aggregated by CCTVs or ad-border e-gates during border registration and stored in European AI-embedded databases. As a result, the future cross-check with the photos from passport chips is impossible or false. Again, children as getting older have totally different appearance and thus the facial matching may be out of point. During remote facial recognition based on AI the threat of manipulation of the system is increasingly possible. The AI technologies are prone to "morphing attacks", realized by lawbreakers to avoid their criminal identification and detection (European Commission, 2022). This method involves the blending of photos of two people with no criminal background and the emergence of a new morphed one, that confirms the validity of the travel document-presented. Those irregularities are bringing false positives and false negatives, are provoking applicants' grievances, due to delays and wrong assessments, and more seriously are questioning the reliability of AI-centered border technologies as a whole (OSCE, 2021). Of course, the nightmare of AI technologies' users is the potential "disobedience" of the automated systems. That means loss of control by human oversight and 100% automatically decision-making performed independently by the machine, that decreases its credibility as an evaluation tool because it is unable to understand the human aspects when it comes to risk profiling (Kokkalis, 2019).

The technological progress is accompanied by new threats to the security and robustness of AI-embedded technologies. Cyber-attack is a new non-conventional way of digitally “affronting” critical systems, which include tactful information in terms of national security. AI-based border control systems mean autonomy and automate, machine-driven decision making. A cyberattack to the independent “e-brain” of border control would increase the vulnerability of such technologies, but also of the borders, the integral part of national security and sovereignty. In case of organized crime and terrorism, non-state actors use this multiplier- “weapon” to paralyze the border systems and thus achieve crossing the borders and expanding their illegal action. Cybersecurity is a necessity since it is a shield to any unfavorable attack. Such an attack aims to manipulate the functionality of the IT border infrastructure assets and the quality of data processing. Hackers’ impact can be irreversible and disastrous (eu-LISA, 2020).

Conclusions

Lately, the incorporation of Artificial Intelligence to various human-life sectors has been a million-dollar question for both IT-specialists and policy-makers. With reference to the EU border management, it is admittable that the European IT border-infrastructure is one of the most developed and labyrinthine. Most of those systems are newly introduced, revised or still under development, confirming their emerging importance and character.

The border control sector has been quite sensitive and that’s why the EU is deprived of coherent automated border monitoring and solidarity. National sovereignty issues are responsible for the existing fragmentation among member states’ approaches, whose national competent agencies actually use distinct practices due to the different nature of threats, operational domain, legal or cultural formalities and capabilities (European Commission, 2020). Considering the fragile geopolitical environment and the multi-dimensional threats, menacing the EU external borderline, the AI can be seen as a powerful lifeline that will establish advanced borders technologies, permitting the deeper European coordination and cooperation and the security of the Union. Those new IT systems are complementary to the existing national ones and in no way fully replace the existing infrastructure in national level. Of course, the European AI-embedded border technologies have to be robust in order to efficiently repel the imported instability of neighboring states in disarray, reflected in massive migrants' influx. The Union, on many occasions, has affirmed its intention to invest in Artificial Intelligence and benefit from the implications of its adoption. In the Area of Freedom, Justice and Security, the Commission in 2021 published its "Strategy towards a fully functioning and resilient Schengen area” (European Parliament, Council of the EU, 2016) and underpinned the need to digitalize

the border procedures, enhance the EU smart borders' infrastructure and ensure their interoperability. Nevertheless, at this point the Union and the member states should be careful and avoid transforming EU into a technological fortress, by raising virtual walls (Frontex, 2021). It is noteworthy that even the operational and administrative advantages that AI –based border technologies entail, their immunity has to be always safeguarded. If that happens, the systems will be well-functioning, identified as credible ones and will enjoy high levels of social acceptance (ETIAS, 2021). This kind of acceptance is correlated with the lawfulness, compliance with Fundamental Rights and usefulness of AI-based systems deployed at the borders, principles that may prevent the creation of surveillance societies (European Commission, 2020). The EU proposal for an AI Pact recognized the AI systems being operated in the border monitoring area as "high-risk" ones and that's why the previously-mentioned values are important to be guaranteed (European Parliament, 2021). At the same time, the EU will maintain its difficulty built "normative power" profile. Concluding, innovative border management at EU level implies the comprehensive Frontex monitoring, cooperation among state or non-state stakeholders, full exploitation of the existing and developing systems, information derived from satellites by using Galileo system or 5G networks and for sure their interoperability. The enlargement of AI legislation in border management field can partially be a "golden ticket" for EU becoming a global leader regulator in Artificial Intelligence.

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