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12. PROTECTING MIGRANTS AGAINST THE RISKS OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES

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Introduction

In recent years, increasing attention has been paid to the potential of new technologies in the field of migration governance, whether to support the deployment of humanitarian aid for migrants, including refugees, or to better manage administrative processes. There has been notable interest in developing artificial intelligence (AI) technologies to make predictions related to migrant movements and to automate visa processing. However promising, these technologies are also currently weakly regulated, in that they do not yet benefit from the regulatory framework that other innovations might have to protect human beings against unintended consequences.¹

Although these technologies were used before the pandemic, COVID-19 has accelerated the deployment of AI in relation to migrants globally, both in higher-income countries and in those already experiencing humanitarian crises.² COVID-19 has, in fact, been named a data-driven pandemic.³ The use of AI models to mitigate the spread and severity of the disease has been largely driven by predictive and scenario-based models, which aim to work as support for public health agencies' decision-making.⁴ Artificial intelligence has also been used to track and control border crossing,⁵ and to administer social protection and vaccines.⁶

During COVID-19, we have also seen the vulnerability of certain migrants exacerbated, with women and gender non-binary persons adversely impacted globally.⁷ They tend to be at further risk of marginalization, as well as physical and sexual assault.⁸ Many non-binary persons, for example, may be fleeing persecution, and are at risk of violence even inside camps.⁹

¹ Molnar, 2019.

² McAuliffe et al., 2021.

³ Term first coined by Roberto Rocha; see Rocha, 2020.

⁴ Khemasuwan and Colt, 2021.

⁵ Bastani et al., 2021.

⁶ Greig, 2021.

⁷ On women, see, for example, UN-Women, 2021; on non-binary persons, see Tschalaer, 2021.

⁸ Obradovic, 2015.

⁹ UNHCR, 2021b.

Risks based on gender are further exacerbated by the mere fact of being a migrant.¹⁰ In fact, migrants are rarely consulted when it comes to AI or other technologies. For example, during the pandemic, citizens of Canada were extensively consulted when their Government deployed COVID-19 tracking applications.¹¹ Migrants have often not been extended the same opportunity to voice their concerns in relation to data collection, privacy, or algorithmic decision-making.¹²

In addition, AI-related risks for some migrants, go beyond the technology itself. Rather, these risks are impacted by the convergence of migration status with diverging objectives in migration management. Migrants are often negotiating complex visa and asylum systems, while also facing challenging immigration policies from destination countries. In this sense, governments tend to have less incentive to consult them in the development of AI policies, since they may not even be on a path to citizenship.

There are possible benefits to using AI in a migration context, such as protecting girls and women from trafficking,¹³ or predicting displacement to prepare humanitarian logistics.¹⁴ However, there are also many risks in doing so. Many organizations have recently warned against the unrestricted use of AI in migration contexts, particularly during the COVID-19 pandemic.¹⁵ Michelle Bachelet, United Nations Human Rights Commissioner, recently pressed for national and international AI regulations that would protect the human rights of vulnerable populations.¹⁶ In this context, it is critical to consider the possible risks that these technologies generate or enhance for migrants, not only to mitigate them in the short term but also to inform future policymaking and regulatory frameworks.

With this in mind, we discuss the impact of AI technologies used in the COVID-19 context on migrants. In this paper, we discuss uses of these technologies in relation to migrants, focusing on four types of technologies: migration forecasting; biometric identification; satellite image recognition; and automated decision-making for immigration processing. We then examine the risks in using these tools in a migration context, and detail examples of biases, errors and other issues, and their impacts on female and non-binary migrants. Finally, we detail the current legal and regulatory framework governing these technologies, and point to further policies that could mitigate the risks that artificial intelligence technologies pose for migrants.

Defining relevant artificial intelligence technologies

In this paper, we use the OECD definition of artificial intelligence: “a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments”.¹⁷ While this definition can include a broad range of technologies, we focus here on those that have direct application to migration, notably in relation to:

1. Predicting the movement of people;
2. Providing digital identities to refugees and migrants;
3. Managing visa and border processes;
4. Managing asylum processes.¹⁸

¹⁰ See the discussion on vulnerability and migration as discussed in Beduschi, 2018.

¹¹ Gamache, 2020.

¹² Latonero et al., 2019.

¹³ Zinser and Thinyane, 2021.

¹⁴ UNHCR, 2021b.

¹⁵ EDRI, 2020.

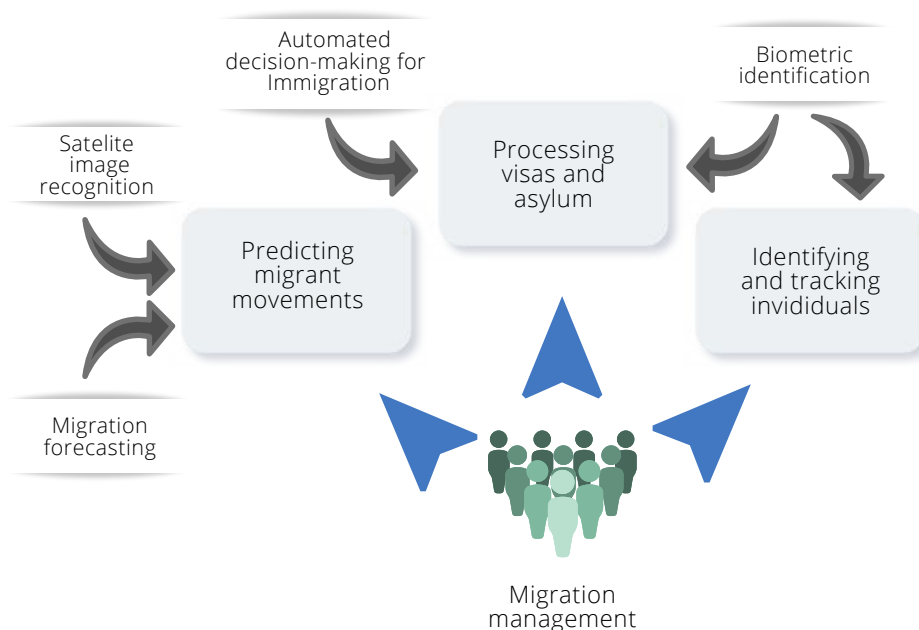
¹⁶ OHCHR, 2021.

¹⁷ OECD, 2019.

¹⁸ See Bither and Ziebarth, 2020.

Each one of these technologies uses entry data, which comes from a variety of sources. These might include photos and fingerprints of migrants, remote photos of informal dwellings or land, social media posts and survey results. This entry data is then used to make a variety of predictions impacting migrants. These can include identifying an individual migrant, predicting natural disasters impacting groups of migrants, or predicting the movement or needs of the migrant. Artificial intelligence systems can integrate enormous volumes of disparate data and make many kinds of predictions that influence human decision-making.

Figure 1. Uses of artificial intelligence technologies in migration management



Source: Authors' elaboration.

“Biometric identification” applies mathematical measurements to biology in order to provide a unique personal record.¹⁹ Biometrics are typically separated into three categories: biological (measuring DNA and blood patterns); morphological (measuring facial images, fingerprints, iris and retina features, and even voice patterns); and behavioural (measuring gait, handwriting, or keyboard strokes).²⁰ Although experimentation is happening in all categories, morphological biometrics are most used in relation to migration, notably facial recognition, fingerprinting and iris recognition. AI is used to build models that will identify a match between a person’s features and those stored in a central database.

“Satellite image recognition” is a means of using artificial intelligence to interpret satellite imagery, notably by recognizing certain entities in images, such as buildings, people and land cover, often to measure changes over time. Like biometric identification, satellite image recognition uses artificial intelligence to build models that will recognize certain patterns in the images based on a database showing features of informal and formal dwellings, for example. Unlike biometric identification, however, satellite image recognition does not aim to identify individuals, but rather is used to make general predictions about what is contained in a particular image.

¹⁹ OPC, 2011.

²⁰ Different categories of biometrics are discussed here by the biometrics company Idemia; see Idemia, 2021.

“Migration forecasting” involves developing artificial intelligence models that will predict the number of migrants arriving in certain locations,²¹ usually in a 1- to 6-month horizon.²² It can also involve predicting the needs of those migrants, allowing for preparation of food, water and medical supplies, along with shelter.

“Automated decision-making systems in immigration” rely on algorithms, and are used by governments to make a decision about a migration visa or claim for international protection, for example, to determine either the public security risk of accepting a migrant across its borders, or the possibility of fraud through misrepresentation. These tools use the information provided in the migrant’s case file, as well as, occasionally, external information, to recommend a decision to the case officer.²³

Impacts of artificial intelligence technologies on migrants

International organizations and governments have, over the last few years, invested considerably in technological innovation that affects displaced persons. This investment has increased during the pandemic.²⁴ Governments have also increased the use of technologies to monitor borders, notably to restrict the movement of migrants to limit the spread of the virus.²⁵

Predicting movements of people: Forecasting and satellite imagery

During the COVID-19 pandemic, national governments and international organizations alike used artificial intelligence methods to predict the number of infections and severity of illness among migrants, notably in refugee camps. These methods can be categorized into three types:

1. Predicting new migration flows related to compounding disasters or economic crises;²⁶
2. Including migration into epidemiological models to predict the spread and severity of the disease;²⁷
3. Predicting the spread and the severity of the disease among migrants who were not necessarily moving between borders, for example, those in informal dwellings.²⁸

Many of these forecasting models included satellite imagery data, which allowed for the inclusion of climatic factors as well as the visual observation of migration patterns. These data can be accessed relatively easily from Google Earth Engine,²⁹ as well as through partnerships with space agencies such as the European Space Agency.³⁰

While some of these models served to inform humanitarian interventions for the benefit of migrants,³¹ others resulted in an increase in movement restrictions for migrants. For example, researchers in India found that the unplanned movement of migrant workers threatened to increase the number of COVID-19 cases in the country. They recommended that the Indian Government limit internal migration and implement smartphone tracking systems, similar to COVID-19 tracking apps.³²

²¹ UNHCR, 2021a.

²² See United Nations Global Pulse, n.d., for numerous examples of this kind of research.

²³ For a more detailed description, see Citizen Lab, 2018.

²⁴ See, for example, the partnership between Google and the United Nations for Artificial Intelligence for crisis response: Google, 2021.

²⁵ European Union, 2021.

²⁶ This has been explored, for example, in disaster risk early warning systems. See ITU, 2020.

²⁷ Centre for Humanitarian Data, 2020.

²⁸ United Nations Global Pulse, n.d.

²⁹ Google Earth, 2021.

³⁰ ESA, 2021.

³¹ United Nations Global Pulse, 2020.

³² Pal et al., 2021.

Providing digital identities: Biometric identification

Biometric identification is increasingly used in migration management. The technology has the potential to facilitate border crossings and case management by reducing fraud and maintaining accurate and transferable records.³³ For those crossing internal borders, it can also facilitate the transfer of social protection services from one jurisdiction to the next. India, for example, has implemented Aadhar,³⁴ a biometric identification system used to access welfare, manage voting, and move between states while retaining access to services.

However, there are some concerns in relation to the use of this technology. Biometric identification systems that are built for the population at large may accidentally exclude some migrants, making it more difficult for them to access services than before. For instance, biometric identification systems that are built for the population at large may accidentally exclude some, such as migrants, making it more difficult for them to access services than before. The problem of exclusion was documented in the case of Aadhar, which did not account for those who might not physically be able to provide biometrics, such as manual workers who had damaged fingerprints.³⁵ The exclusion of those speaking indigenous languages, which are not currently supported by the platform, has also been described, as has the effects on migrant workers inside the country, who may also struggle with access.³⁶

Automated decision-making systems

Visa requests, asylum claims and other processes related to establishing short- and longer-term residency in new countries are increasingly processed by automated decision-making systems. These systems can take data provided by migrants in their case file – such as personal information, images and past locations – to provide a recommendation to the case officer. New data, such as data provided by a lie detector, are also sometimes collected.³⁷ These systems have also been known to include social media analysis or other analysis of Internet data to provide a bigger picture of the migrant's life and to identify whether the migrant could pose a security risk in the destination country. This, for example, is known to be the case for visa applicants to the United States, who may be asked to provide their social media accounts.³⁸

Several issues have been raised in relation to these activities, notably concerning the fairness and transparency of the decision-making.³⁹ These systems have also been critiqued for lacking nuance, particularly in cases of intersectional identities, as would be the case with female and non-binary migrants.⁴⁰

Furthermore, this type of analysis falls in the category of artificial intelligence technologies known as behavioural analytics, which typically try to predict human behaviour based on certain factors. A migrant may, therefore, be categorized as a potential public security risk and denied a visa, causing significant upheaval in their own lives. A study by the University of Toronto's Citizen Lab has raised concerns about the potential for racial and gender discrimination in these tools, which would increase the vulnerability of already vulnerable migrants.⁴¹

³³ IOM, n.d.

³⁴ Government of India, 2021.

³⁵ Krishna, 2018.

³⁶ Panigrahi, 2019.

³⁷ Molnar, 2019.

³⁸ Lazzarotti and Peck, 2020.

³⁹ Citizen Lab, 2018.

⁴⁰ Maat for Peace, 2018.

⁴¹ Citizen Lab, 2018.

Risks of artificial intelligence technologies for female and non-binary migrants

During COVID-19, women and non-binary migrants have had worse economic outcomes than other groups, increasing any pre-existing vulnerabilities they may have had.⁴² Inappropriate uses of AI technologies during the COVID-19 pandemic have also been shown to increase their vulnerability, notably due to algorithmic errors, biases and lack of privacy.

Table 1 shows the types of data used by each category of AI, their potential benefit for migrants and the risks associated with their use.

Table 1. Data used by types of artificial intelligence, and their benefits and risks for migrants

Artificial intelligence technology	Input data sources	Potential benefits to migrants	Potential damages to migrants
Biometric identification	Facial images, fingerprints, iris and retina scans	Ease of identification without requiring documentation	Misidentification, resulting in economic effects and deportation, surveillance
Automated decision support	Visa and asylum case files, social media data	Increase speed of visa and asylum processing	Inappropriate decisions with no possibility of appeal, surveillance
Satellite image recognition	Images of informal camps, urban dwellings, land cover	Preparing humanitarian community for migrant arrival, natural disasters	Misinterpretation, leading to logistics errors, privacy breaches
Forecasting	Social media data, socioeconomic data, public health data	Preparing humanitarian community, governments and border agencies for migrant movements	Forecasting errors, leading to logistics errors, privacy breaches

Managing errors and uncertainty in artificial intelligence

AI tools are predictive, in that they use past data to inform a decision which will always have a certain rate of error and uncertainty. If a certain indicator was not included in the model, or if the data used are flawed or biased, the prediction can be wrong.⁴³ Similarly, AI models predict future events, such as the arrival of migrants, based on certain assumptions and past data. In migration settings, there are high amounts of uncertainty,⁴⁴ in relation to unexpected events and conditions and mistaken assumptions. The forecasts made using artificial intelligence models can be useful in informing decision-making, but there is always the possibility of error.

In using artificial intelligence models, it is important to clearly communicate error rates and uncertainties to decision makers. Error rates are usually calculated by reserving a portion of data for testing.⁴⁵ On these test data, the model's results will then be compared to actual results, and two numbers will be calculated: the number of false positives, which is the number of – for example – entities that were identified as informal shelters but are really something else (for example, a car); and the number of false negatives, which is the number of informal shelters (in our example) that were not recognized by the algorithm.⁴⁶ AI models can be calibrated to be

⁴² UN-Women, 2021.

⁴³ Cortes et al., 1995.

⁴⁴ Napierala et al., 2021.

⁴⁵ Techopedia, n.d.

⁴⁶ Google, 2020.

more tolerant of false positives or to false negatives.⁴⁷ It is therefore important for policymakers to consider not only whether an entity is wrongly identified as something of importance, but also whether it goes unseen by the model.

In their research, Buolamwini and Gebru found that women and people of colour suffered both effects in common facial recognition software.⁴⁸ They were either not identified at all, or they were assigned by mistake to a different person. They found that the software was trained on faces that were more than 83 per cent white and 77 per cent male, resulting in misidentifications of up to 46 per cent for women of colour. This finding is particularly relevant to our analysis, where vulnerable migrants already face gender-based discrimination and racism.⁴⁹

Misidentification errors in facial recognition and other biometric processes such as fingerprinting have been documented,⁵⁰ whether they are matches with the wrong person or simply no match at all.⁵¹ These have been linked to migrants having their asylum cases rejected or delayed, as well as having problems accessing basic services.⁵²

Tracking, surveillance, and privacy

In addition to error management, one of the most important issues for some migrants is the possibility of personally identifiable information being shared widely. This can be due either to improper consideration of the right to privacy of migrants,⁵³ or to cybersecurity breaches that put the migrants at risk.⁵⁴ Data identifying migrants personally can include their location, age, sexual identification, gender identification, ethnicity and disability. In many cases, this information can be dangerous when shared, leading to discrimination, violence and even trafficking or re-trafficking.⁵⁵

Although there are many initiatives using AI to locate trafficked migrants,⁵⁶ there are also concerns that data about vulnerable migrants can be used to identify, recruit, and track them.⁵⁷ Smugglers who use social media to propose safe passage to Europe for work, for example, can begin to sexually exploit women and unaccompanied children as repayment.⁵⁸ Sex traffickers are also known to use exploit data available online to identify future victims.⁵⁹

A considerable amount of data is required when developing an AI tool. The United States, for example, is said to have a database that includes data about hundreds of millions of individuals who can be identified through remote biometrics systems.⁶⁰ In certain cases, a broader use of biometric tools – including not only facial recognition and fingerprints but also image recognition through social media – has enabled governments to arrest and detain undocumented migrants. A striking example is the United States Immigration and Customs Enforcement agency, which has partnered with the analytics firm Palantir since 2016 to track and apprehend undocumented migrants in the country.⁶¹

⁴⁷ Russell, 2020.

⁴⁸ Buolamwini and Gebru, 2018.

⁴⁹ Astles, 2020.

⁵⁰ Kaurin, 2019.

⁵¹ Oxfam and The Engine Room, 2018.

⁵² Gelb and Clark, 2013.

⁵³ Sandvick, 2021.

⁵⁴ ICRC, 2022.

⁵⁵ Kosevaliska, 2021.

⁵⁶ See, for example, Global Emancipation Network, n.d.

⁵⁷ UNODC, 2019.

⁵⁸ Zenko, 2017.

⁵⁹ Wulffhorst, 2017.

⁶⁰ Djanegara, 2021.

⁶¹ Amnesty International, 2020.

A 2021 report by Transnational Institute and Stop Wapenhandel documents the border surveillance industry,⁶² highlighting the activities of 23 companies and several investment firms lobbying governments to take a more “militarized” approach to border control involving artificial intelligence. Notably, the report documents the “Smart Borders” sector,⁶³ which involves biometric identification as well as phone and social media tracking.

More recently, the deployment of vaccine passports in numerous countries has accelerated the implementation of digital identity management, with governments now tracking access to restaurants, bars, public spaces, and social services through a combination of identification and health certification. This is of concern to anyone in vulnerable social positions, especially undocumented migrants who will see their access to public spaces nearly entirely curtailed.⁶⁴

Protection of migrants’ rights to non-discrimination and privacy

Migrants are currently protected under different international conventions. As we will see below, the rights to privacy and non-discrimination, which are included in the Universal Declaration of Human Rights and the 1966 International Covenant on Civil and Political Rights, are the rights most often cited as threatened by artificial intelligence.⁶⁵ However, migrants are also protected internationally by the 1951 Refugee Convention and its 1967 Protocol,⁶⁶ the 1954 Convention Relating to the Status of Stateless Persons,⁶⁷ and the International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families.⁶⁸ Women’s rights are also protected under the Convention on the Elimination of All Forms of Discrimination Against Women,⁶⁹ which includes further detail on non-discrimination.

Artificial intelligence is known to have the tendency to reinforce existing societal biases, if left unchecked.⁷⁰ Uses of AI that reinforce gender stereotypes and propagate discrimination against women exist even outside of the migration context.⁷¹ For example, as we have seen, there are certain cases in which AI systems are less accurate for women than for men.⁷² Some AI systems used for human resources were also found to recommend against the hiring of women,⁷³ and some that were used to assess loan applications approved lower financial amounts for women,⁷⁴ other indicators being equal. From a legal perspective, however, proving discrimination can be difficult.⁷⁵ Although the principles of equality and non-discrimination are protected under international law, they are particularly challenging to put into practice when AI is involved.⁷⁶

There have been several attempts recently to use existing legal instruments to protect human rights when using AI. For example, the Court of Justice of the European Union⁷⁷ has had requests for a preliminary ruling concerning the interpretation of exceptions on privacy and data protection by Member States,⁷⁸ read in light of the Charter of Fundamental Rights of the European Union.⁷⁹ Notably, these requests argued that national governments’ automated analysis of traffic and location

⁶² TNI and Stop Wapenhandel, 2021.

⁶³ EDRi, 2018.

⁶⁴ Renieris, 2021.

⁶⁵ CDPDJ, 2021.

⁶⁶ United Nations, 1951.

⁶⁷ United Nations, 1954.

⁶⁸ United Nations, 1990.

⁶⁹ United Nations, 1979.

⁷⁰ Noble, 2018.

⁷¹ Fournier-Tombs and Castets-Renard, 2022.

⁷² Buolamwini and Gebru, 2018.

⁷³ Dastin, 2018.

⁷⁴ *The Guardian*, 2019.

⁷⁵ Bathaee, 2017.

⁷⁶ Xenidis and Senden, 2020.

⁷⁷ CJEU, 2020.

⁷⁸ Article 15(1) of Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications.

⁷⁹ Articles 4, 6, 7, 8 and 11 and article 52(1) and article 4(2) of the Treaty of the European Union.

data should be limited to serious threats to national security. Privacy related to geolocalization, which could relate to satellite detection and data used in forecasting, might therefore become a more important consideration in the next few years.

In the meantime, national and international bodies have worked towards stronger regulations that would protect the most vulnerable. A notable example is the European Commission's recent regulatory proposal on AI (the European Union Artificial Intelligence Act),⁸⁰ which takes a risk-based approach, categorizing AI systems into four groups: no risk, low risk, high risk, and unacceptable risk. Many of the high-risk uses of AI are relevant in the context of international migration. These include biometric identification; management and operation of critical infrastructure; education; employment and access to employment; access to services; law enforcement; migration asylum and border management; and administration of justice and democratic processes. Companies and organizations wishing to deploy high-risk AI solutions in the European Union market will be required to obtain certification first. This certification process will involve providing technical documentation demonstrating that data biases, errors, privacy considerations and discrimination have been addressed before deployment.

The Office of the United Nations Commissioner for Human Rights recently called for a ban on all uses of artificial intelligence threatening human rights.⁸¹ In doing so, she cited several international instruments, including article 12 of the Universal Declaration of Human Rights,⁸² which protects privacy, and the International Covenant on Civil and Political Rights. Echoing the European Commission's regulatory proposal, she also called for the regulation of high-risk uses of AI.

Some national governments are currently considering how to develop their own regulatory frameworks. For example, the Government of Canada published a directive on automated decision-making,⁸³ which sets standards for the use of AI by the federal Government. This directive applies to automated decision-making in the case of migrants. The United States has also released two drafts of guidance for regulating AI applications, which set out some of the values, such as fairness and non-discrimination, which should be prioritized when developing a regulation.⁸⁴ China has also released, in the last few years, several documents related to AI regulation, including one on ethical norms for new AI generation,⁸⁵ which contains six ethical requirements including fairness, justice and privacy.

In addition, many organizations working with migrants have also developed ethical guidelines for their uses of artificial intelligence, such as the Humanitarian Data Science and Ethics Group (DSEG), which published a framework for the ethical use of advanced data science methods in the humanitarian sector.⁸⁶ On a larger scale, the United Nations Educational, Scientific and Cultural Organization (UNESCO) spearheaded the adoption of a recommendation on the ethics of artificial intelligence,⁸⁷ which will serve to inform standards and regulations globally. Although non-binding, these guidelines may serve to inform humanitarian standards, which would regulate the way that organizations provide support to migrants.

A key distinction in these existing human rights frameworks, in the European Union Artificial Intelligence Act and in these ethical frameworks is where they position themselves in relation to the deployment of artificial intelligence systems. The European Union Artificial Intelligence Act will require certification of these systems before they are deployed to the public. Like the European Union Artificial Intelligence Act, ethical frameworks attempt to pre-empt human rights

⁸⁰ European Union, 2021.

⁸¹ OHCHR, 2021.

⁸² Article 12: "No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation. Everyone has the right to the protection of the law against such interference or attacks."

⁸³ Government of Canada, 2021.

⁸⁴ United States Government, 2020.

⁸⁵ People's Republic of China Ministry of Science and Technology, 2021.

⁸⁶ DSEG, 2020.

⁸⁷ UNESCO, 2021.

violations by providing a verification process that should take place before the technology is used. Certification schemes such as these highlight the need to prevent violations of non-discrimination and privacy in the first place, rather than bringing cases to human rights tribunals after deployment. In such cases, it may be difficult to repair violations to human rights, particularly when it comes to non-discrimination and privacy.

Moving forward in a context of weak citizenship and divergence of intents

As we have seen, migrants are particularly vulnerable to the risks presented by certain uses of AI, especially during COVID-19. Some migrants may be in situations of high uncertainty in which they cannot advocate for their rights. They may be unable to express their privacy preferences clearly and safely, or negotiate algorithmic errors. As such, they may have very little recourse when technologies that affect them are deployed.

Furthermore, one of the greatest challenges in using AI in the context of migration is the divergence of intents amongst the various actors involved. Humanitarian organizations might want to support migrants and mitigate threats to them. National governments might have diverse intentions, supporting humanitarian work, encouraging some forms of migration while limiting others. Private companies, in turn, that develop a large portion of AI technologies that affect migrants, may be driven by a profit motive and unequipped to protect the rights of migrants without guidance.

In this paper, we examined four AI technologies: migration forecasting, satellite image recognition, biometric identification and automated decision-making for immigration. These are used in migration management, notably to predict migrant movements, process visas and asylum claims, and identify and track migrants. We presented several risks in using these technologies, such as managing errors and uncertainty, issues related to surveillance and privacy, and discrimination. We further showed that the legal framework protecting migrants' rights when it comes to AI is not yet adequate, although it is changing rapidly.

Female and gender non-binary migrants are particularly vulnerable to inappropriate uses of artificial intelligence, as well as to technological errors. During the COVID-19 pandemic, not only has this vulnerability increased, but so has the use of artificial intelligence and other new technologies, leading to an increased risk of harm to members of this group. This can be addressed primarily in two ways: by considering migrants' rights when developing new AI regulations; and by working directly with migrants to mitigate some of these risks.

Technological innovation has always been a part of the international community's response to migration. As the regulation of AI systems continues to evolve, paying attention to the protection of migrants will help to distinguish between innovations that will support migrants and those that will put them at risk.

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