**Artificial intelligence for disaster**

**management**



* On the 23rd of June, I participated in the[**Second Workshop for AI (Artificial Intelligence) for Natural Disaster Management**](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0623/Pages/default.aspx) that hosted around 400 scientists, UN advisors, practitioners and policymakers from all over the world interested in machine learning for supporting disaster prediction and early warning. AI is not my research area; however, I have always been interested in the new advances that technology offers us in disaster risk identification and management. I discovered that AI is not yet part of the *modus operandi* in natural hazards and disaster management despite its potential in several directions. Hereafter, a synthesis of what the ​**[Focus Group on AI for Natural Disaster Management](https://www.itu.int/en/ITU-T/focusgroups/ai4ndm/Pages/default.aspx" \t "_blank)** (FG-AI4NDM), the host of the workshop, highlighted to help lay the groundwork for best practices in the use of AI.
* The ​Focus Group on AI for Natural Disaster Management converges the information and communication technology expertise of the International Telecommunication Union (ITU) with natural hazards and disaster expertise from the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP). The group aims to assist with data collection and handling, improving modelling across spatiotemporal scales, and providing effective communication. In addition, it actively engages stakeholders and experts to build and integrate perspectives and competencies in developing AI-based technologies into disaster risk management, making means and creating opportunities to withstand challenges to an open science at the national, regional, and international levels.
* Before moving forward into the three main themes of the workshop (communication, modelling and detecting), it is worth explaining what AI is and where AI can be used in pills. AI or Artificial Intelligence mimics human intelligence and processes by computer systems procedures. As Andrew Harper, Special Advisor on Climate Action of the United Nations High Commissioner for Refugees (UNHCR), reminded us, **AI has the potential to speed up our understanding of natural hazards, analysing large volumes of data** (and images) **from different sources and improve proactive rather than reactive actions for disaster risk reduction** (DRR).
* According to the Coordinator of Global Risk Analysis and Reporting Section, United Nations Office for Disaster Risk Reduction (UNISDR), Adam Fysh, communication in DRR means posing the right questions on who creates the risks and who suffers the consequences of risk. For this reason, **stakeholders involvement is crucial to strengthen the understanding and the response to multiple risks**, but only if the key informants are included rather than convinced, and a two-way communication based on trust is built.
* One perfect example was suggested by [Ioannis Andredakis​](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0623/Pages/bios.aspx#Andredakis), ​a Senior Analyst on Disaster of the Directorate for Civil Protection and Humanitarian Operations of the European Commission. He recalled a couple of years back of a wildfire in Athens in Greece that killed 110 people. The biggest problems raised were two. The first was understanding the level of risk in terms of the number of people involved, how the fire was evolving, in which direction, and how fast. And the second was how to effectively roll out an emergency evacuation plan avoiding fear-related behaviours that would have exposed more people than those already involved. “With AI, the situation would have been understood rapidly and communicated efficiently, possibly reducing the number of people involved”, he concluded.
* Recent experiences with natural hazards show that we still confront challenges regarding the accuracy, reliability and modality of information being communicated and individuals’ ability to elicit the appropriate response and accept its uncertainty. “The risk of being wrong” is still a big challenge, and recent advanced technology may host more uncertainty that is yet to be taken into account. However, technology is still an ally in disaster risk analysis and an essential instrument for scientists, industries, and policy-makers involved in DRR. AI is a fast-analysis instrument that has not seen its full application in the aftermath of disasters yet. For example, it has not been used to classify the damages (humans still do it), Andredakins reminds. So, **AI’s deployment is at the utmost priority to enhance the understanding of all phases of disasters, and this can be done by accelerating the development of algorithms that are reliable for our safety**.

**AI for modelling: forecasting, and projecting**

* We are quite familiar with the use of predictive models in weather forecasts. However, **AI can help scientists with multiple natural hazards prediction** as well. It is a helpful compound and scalable flood prediction instrument, as demonstrated by Feyera Hirpa, a Senior Data Scientist of One Concern Inc., who tested his predicting models during the 2019 flood in Chikuma River in Japan after [Typhoon Hagibis](https://blogs.egu.eu/divisions/nh/2019/12/16/a-coffee-with-mr-fujitsuka-typhoon-hagibis-and-the-recovery-process/). The observed inundation model obtained a good match of the actual flood, validating AI’s power for flood prediction. In fact, models might fit the[training dataset](https://www.techopedia.com/definition/33181/training-data) perfectly well, but there are no guarantees that it will do equally well in real-life scenarios. Promising prediction applications are also seen in wildfire vulnerable areas, noted [Helen Li​](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0623/Pages/bios.aspx#Li), Senior AI Researcher at the China Academy of Information and Communication Technology​ (CAICT). However, real-time forecasting is still a struggle for computer-based modellers.
* Another challenging example relates to “*forecasting the onset, size, duration and hazard of [volcanic] eruptions by integrating observation with quantitative models of magma dynamics”*, said [Corentin Caudron](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0623/Pages/bios.aspx#Caudron), Research Officer, Research Institute for Development (IRD). However, earthquakes and tremors characteristics can help better understand the manifestation of eruptions and their evolution. All thanks to machine learning (ML), which helped manage and extrapolate vast volcanic-seismic data to achieve high accuracy in forecasting and prediction. To complicate things, every volcano behaves slightly differently from one another, and machine learning has shown to provide a promising volcano-independent forecasting approach. It seems that **AI helps accelerate data acquisition and analysis, taking into account the spectrum of heterogeneity owned by each natural hazard and situation.**

**AI for data: monitoring and detecting**

* One of the challenges regarding extreme weather changes is connected to food insecurity around the world. Andrea Toreti, Senior Scientist/Scientific Officer at the European Commission’s Joint Research Centre (JRC) in Italy, showed how **AI can help monitor weather-related risks to food security**. He introduced the ‘Climate Service’, a system designed to support informed decisions able to reduce risks and disasters related risks to agriculture with the support of climate variability models. The Climate Service is a tool to detect extreme events, such as droughts, in the agricultural sector, in relation to crop productivity, for example. He strongly believes that technology must be computationally scalable and sustainable to have an impact.
* Food security is also jeopardised by the presence or overabundance of locusts, especially in West Africa, where the crop damage has been estimated to be $2.5 billion in 2003-2005 only. These data are alarming, said Hadia Samil, Researcher at the MILA Quebec Artificial Intelligence Institute. AI can be used to detect in ‘real time’ the attacks of locusts and predict their movements to some extent by analysing remote sensing images.
* Finally, [Nicolas Longépé​](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0623/Pages/bios.aspx#Long%C3%A9p%C3%A9), Earth​ Observation Data Scientist, Phi-lab Explore Office​, European Space Agency (ESA/ESRIN),​ highlights the limitations of AI while emphasizing its ability to detect ‘near real time’ situations because of the associated unpredictability of the models. The detection of tropical cyclones is one of the core research objectives of the European Space Agency by the use of a visual pattern analyst on atmosphere clouds and satellite images. The Agency also focuses on the detection of wildfires using hyperspectral data. One of the technologies used now is “AI at the edge” or “AI@edge”, where AI is deployed directly on the spacecraft, making it more secure, versatile, highly responsive and requiring low data exchange with the user. **There are new opportunities for AI in Space and related technologies that can also have an actual application in disaster risk detection, analysis and then reduction**.

We understand that smart and timely decisions are needed to avert, mitigate and manage all kinds of risks. In this respect, **the use of artificial intelligence (AI) in the decision-making process has shown tremendous promises**. Despite those promises, the **key challenges** are:

* to actively involve stakeholders in all phases of the project, building trustful cooperation
* to transfer usable, useful information to key actors to efficiently communicate the risk and its uncertainty
* to create hybrid models that would include classic statistics with human behaviours
* to enhance the accessibility and transparency of data and methods.