Announcement of a BSc thesis/study project

with the topic

Critical review on the potential use of Artificial Intelligence in flood risk management

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Motivation

The recent floods in July 2021 which occurred in Germany, and the previsions of more extreme events due to climate change, justify an increased concern of authorities worldwide on adequate and expedite systems for flood forecasting and nowcasting. Many framing documents and discussion groups for global challenges classify floods as highly impacting events capable of catastrophic consequences (*IPCC — Intergovernmental Panel on Climate Change*, n.d.; *The Global Risks Report 2021 | World Economic Forum*, n.d.; United Nations General Assembly, 2015).

The use of Artificial Intelligence (AI) is common nowadays, from the most trivial human actions (going to the supermarket or taking the train) to the most complex applications (neuro surgery or visiting Mars). Examples of application of AI in the flood context exist already (Ogie et al., 2019; Sayers et al., 2014). Nevertheless, this topic is still quite novel and its potential to identify critical areas prone to flood hazard in the catchment, using a combination of low to high resolution information (maps, photos, media, etc), is yet to be explored.

Research objective

With this research we intend the student to:

1. Describe and discuss what is AI and to know the fundaments of the implementation of AI in engineering problems.

2. Identify the possible uses of AI in flood risk management and the relevant data to be used.

3. Identify knowledge gaps and opportunities for further research in the application of AI to flood risk management.

Methods

The work is mainly desk work, including critical reading of the state-of-the-art publications on the subject and consultation of available data. The student should also identify the correct networks of discussion of the topic, at the National and International level.

The student should use as reference a combination of historical and modelling data to be sourced to an AI model framework. WB-IWG has been developing work on flood risk management for more than two decades, which provides an excellent context for this work. Other data to be used may include online and freely available publications and resources (satellite images, media coverage etc). The student should understand how a combination of historical data with numerical model results can be used to identify in the landscape the locations of potential hazard related to extreme events. The student is expected to provide a critical assessment of the potential of AI in the context of flood risk management and to be able to discuss the possible applications of AI in the context of Hydraulic Engineering.

The final report should contain a literature review about AI, a concise state of the art on flood modelling approaches, a critical analysis of the potential use of AI for flood risk management, the identification of the main steps towards a platform for flood risk management based on AI, the identification of needs in terms of research and development for the use of AI for flood risk management. The final document is to be redacted in English and the discussions and presentations will also be done in English.

References

IPCC — Intergovernmental Panel on Climate Change. (n.d.). Retrieved May 4, 2022, from https://www.ipcc.ch/

Ogie, R. I., Rho, J. C., & Clarke, R. J. (2019). Artificial Intelligence in Disaster Risk Communication: A Systematic Literature Review. *2018 5th International Conference on Information and Communication Technologies for Disaster Management, ICT-DM 2018*. https://doi.org/10.1109/ICT-DM.2018.8636380

Sayers, W., Savić, D., Kapelan, Z., & Kellagher, R. (2014). Artificial Intelligence Techniques for Flood Risk Management in Urban Environments. *Procedia Engineering*, *70*, 1505–1512. https://doi.org/10.1016/J.PROENG.2014.02.165

The Global Risks Report 2021 | World Economic Forum. (n.d.). Retrieved May 4, 2022, from https://www.weforum.org/reports/the-global-risks-report-2021

United Nations General Assembly. (2015). Transforming our world: The 2030 agenda for sustainable development. In *https://sustainabledevelopment.un.org/content/documents/7891Transforming%20Our%20World. pdf* (Issue 1). https://doi.org/10.1007/s13398-014-0173-7.2