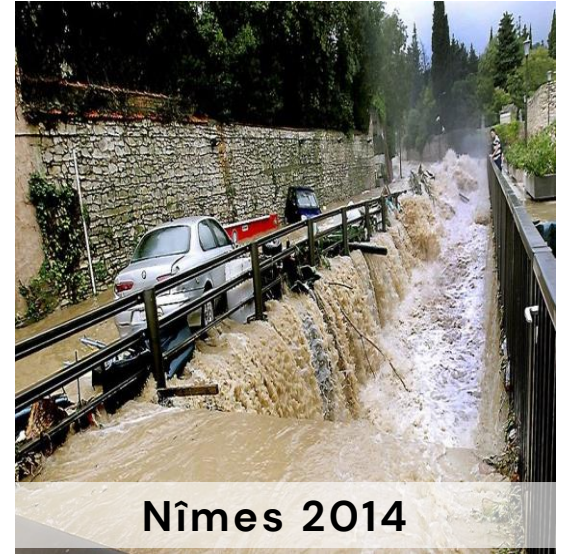


Explainable AI (XAI) for trust building in artificial intelligence Applications in Flash Flood Prediction

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CONTEXT

- **Floods and flash floods** are among the most devastating natural hazards, and their frequency is expected to rise with climate change and human activities.
- **Prediction is challenging** due to nonlinear hydrological processes, intense rainfall, spatial variability, karst contributions, and the complexity of small and/or urbanized basins.
- **AI approaches (e.g., Artificial Neural Networks (ANNs))** offer promising solutions, improving predictive accuracy and showing strong potential for real-time flash flood forecasting at operational scales, but their "black-box" nature limits trust and operational use.
- **Explainable AI (XAI)** enhances transparency, identifies key drivers, and strengthens confidence in AI-based flood prediction systems.



SCIENTIFIC OBJECTIVES

- Developing interpretable neural network models for flash flood prediction
- Incorporating high-level physical understanding into **ANNs** models to improve reliability and interpretability.
- Explaining these models using **Knowledge eXtraction (KnoX)** method and compare it with other XAI techniques such as SHAP or LIME, etc.

THE MISSION

- Literature review on Explainable AI (XAI) techniques and their applications in hydrology, with emphasis on flash flood prediction.
- Support and collaborate with a postdoctoral researcher on integrating XAI techniques into flash flood forecasting models.
- Develop and implement ANNs in RNF-Pro and Python for flash flood prediction in the Nîmes city, aiming to extend the forecast horizon.
- Incorporate prior hydrological knowledge into ANNs models to improve realism and reliability.
- Apply **KnoX** method to extract meaningful insights from ANNs models, and compare it with others XAI techniques (e.g., SHAP, LIME) to assess their effectiveness in enhancing interpretability and operational trust.

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THE RESEARCH UNIT: HSM Site in Alès

- Integration in the CREER Center at IMT Mines Alès, within the HEC Team
- Strong interdisciplinary approach, addressing major water challenges and contributing to collaborative research projects and scientific networks.
- Students will join a dynamic and welcoming team that supports their integration and provides opportunities to engage in cutting-edge multidisciplinary research.

