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Títol: Modelització d'episodis de DANA mitjançant autòmats cel·lulars multi-n-dimensionals i arquitectura MQTT.

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Resum: Severe weather events like the DANA (Depresión Aislada en Niveles Altos) present a critical challenge for emergency response and urban planning, particularly in vulnerable Mediterranean regions like Valencia. Traditional predictive frameworks often struggle to seamlessly combine discrete geospatial structures with meteorological models and continuous physical fluid dynamics. This talk introduces a novel simulation and visualization pipeline that leverages the Multi-n-Dimensional Cellular Automaton (m:n-CA^k) framework. By utilizing its tensorial data structures and continuous space-time evolution, we successfully overcome the limitations of classical, rigid CA models to capture the complex, fluid boundaries of flash floods. To bridge the gap between theoretical simulation and real-time operational response, our architecture integrates the Lightweight Message Queuing Telemetry Transport (MQTT) protocol. Simulated events are pushed instantaneously from the server to a decoupled web-based viewer. Furthermore, this visualization platform can ingest live telemetry from remote sensors across the Valencia watershed, cross-referencing simulated projections with real-world empirical data, and become the engine of a digital twin to assist in emergency response management. We discuss how this combination of generalized tensorial simulations and low-latency IoT telemetry provides a highly scalable, high-fidelity tool for dynamic flood monitoring and risk mitigation. Furthermore, it may help in the educational purpose of making people aware of what it means to live in risk areas.

Sobre els Autors:

Dr. Jaume Barceló is Professor emeritus, Department of Statistics and Operations Research, Universitat Politècnica de Catalunya, UPC-Barcelona Tech, with over 45 years of experience in research and software development in the field of Traffic and Transport Modeling, Transport Planning, Optimization, and Simulation techniques in Transportation; including the development of the microscopic traffic simulator Aimsun. He has received numerous accolades, such as Narcís Monturiol Medal for Technological Innovation in 1997 and TRB Traffic Simulation Lifetime Achievement Award in 2019.

Professor Pau Fonseca i Casas is an academic in the field of Statistics and Operations Research. He is currently a professor at the Universitat Politècnica de Catalunya BarcelonaTECH (UPC). He obtained a MD degree in computer science, a MD in Statistics and Operations Research, and a Ph.D. from UPC. He is member of the InLab FIB (Barcelona informatics school laboratory). His research interests include simulation, Operations Research and Statistics.