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LSU Professor Uses AI/ML To Predict Coastal Flooding

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BATON ROUGE, La., Jan. 18, 2022 (GLOBE NEWSWIRE) -- More than half of the U.S. population lives in coastal watershed parishes or counties that generate 58 percent of the nation's gross domestic product. These coastal communities and infrastructure are especially vulnerable to wind and flooding due to tropical storms, hurricanes, and heavy rainfall. With the aid of artificial intelligence and machine learning (AI/ML) techniques, LSU School of Computer Science & Electrical Engineering Adjunct Professor Hartmut Kaiser is working to improve their flood preparedness and mitigation capabilities.

Kaiser, who is also a senior scientist at LSU's Center for Computation and Technology, is a co-investigator on this project with a team of scientists from the University of Texas—Austin (Clint Dawson), University of Notre Dame (Joannes Westerink), and Lawrence Berkeley National Laboratory (Ruby Leung). Their project is one of three funded by the Department of Energy's Office of Advanced Scientific Computing Research, with each project receiving $15.1 million over three years.

"Collaborations between scientific disciplines like those created through this program pave the way for the future of scientific discovery by combining diverse knowledge, skills and tools in new ways to approach a variety of critical problems," said DOE Associate Director of Science for Advanced Scientific Computing Research Barbara Helland. "These projects can revolutionize the scientific productivity of our facilities while working towards solving some of America's big problems."

As part of the project—titled MuSiKAL (Multiphysics Simulations and Knowledge discovery through AI/ML)—Kaiser and his collaborators will couple the DOE Energy Exascale Earth System Model (ESM) with a high-resolution, multi-scale, multi-physics coastal circulation model; develop an AI/SciML-enabled high-fidelity Digital Twin (DT) of the coupled ESM to reduce latency in flood prediction and mitigation planning; develop scientific AI/ML-based data ingestion and web-based visual platforms to connect experimentalists and computing scientists for continuously ingesting situ and satellite data using the DT; and demonstrate the multifaceted capabilities and workflows of MuSiKAL using comprehensive datasets focused on the Gulf of Mexico with strong emphases on connecting multiple stakeholders to co-design data collection, co-analyze flood simulations, and continuous model-data integration and learning.

"The Gulf of Mexico coast along Texas, Louisiana, and Mississippi is home to important U.S. energy hubs but is also home to socially vulnerable populations," Kaiser said. "This proposed effort contributes to bringing science and knowledge discovery toward minimizing flood damage exposure and improving socioeconomic stability in the region."

Ultimately, the MuSiKAL project will make meaningful contributions toward the DOE Advanced Scientific Computing Research Integrated Computational and Data Infrastructure program by developing a scalable, distributed data storage and management platform under the FAIR (Findability, Accessibility, Interoperability and Reuse) principles and by implementing a seamless, model-driven DT platform to enable close collaborations between experimentalists and computer science peers.

"The well-being of all Americans depends on the environmental integrity and sustainable productivity of the ocean, our coasts and coastal watersheds," Kaiser said. "The current coastal flooding predictive capability is limited by the inadequate representation of coastal processes in the ESM, especially as they relate to coastal hazards, and by a lack of automated workflow for facilitating the two-way information transfer between experimentalists/domain experts and computational scientists. Our research aims to develop a DT framework capable of combining, in near and real time, a multitude of data and distributed and parallel computing resources coupled with AI/ML techniques to greatly strengthen current coastal hazard prediction skills."

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