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EXPLAINABLE AI FOR COMPUTATIONAL MECHANICS

600 - DATA SCIENCE, MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

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ABSTRACT

The mini-symposium “Explainable AI for Computational Mechanics” will bring together researchers from academia and industry working on the development of efficient techniques that are suitable for enhancing the transparency, accountability, and understanding of Artificial Intelligence (AI) methods when applied in Computational Mechanics.

Computational Mechanics plays a crucial role in the design, analysis, and optimization of complex mechanical systems, where precise predictions and decisions are essential for ensuring safety and efficiency in real-world situations. However, merely providing inference is no longer sufficient. Thus, Explainable AI (XAI) is getting an increasingly important role in Computational Mechanics. Before deploying AI methods, domain experts and engineers seek answers to questions such as how a machine learning model works, what parameters play a role in the prediction and what uncertainties and biases are incorporated in the data and the models.

Our mini-symposium welcomes contributions aimed at providing innovative perspectives on the usage of XAI in Computational Mechanics tasks related to the study of structures, materials, and fluids. We will consider both applied and methodological studies, offering valuable insights into (1) concrete results of using XAI to make better-informed decisions in engineering design problems, and (2) interesting XAI methods that show high application potential in real-world situations, including the field of Computational Mechanics.

Contributions may address new developments in the following subfields (non-exclusive list):

- Model prediction interpretation. XAI can help engineers and researchers understand why a specific prediction was made by a computational model.

- Feature Importance and Sensitivity Analysis. XAI techniques can provide insights into the importance of input features in the computational model, guiding engineers to focus on refining and optimizing the most influential variables.
- Uncertainty Quantification. By combining uncertainty quantification concepts with XAI methods, it is possible to trace the propagation of uncertainty through the computational model that may be due to input data variability, model simplifications, and inherent limitations of numerical simulations.
- Algorithm Design and Model Selection. In Computational Mechanics, multiple models and algorithms are often available. XAI can assist in comparing different models and understanding their strengths and weaknesses for a given problem.
- Human-centered Design. XAI enables human engineers to collaborate effectively with AI systems, allowing engineers to use XAI explanations and incorporate domain-specific knowledge into optimization and machine learning pipelines.
- Anomaly Detection. Computational models can produce unexpected outcomes. XAI can help diagnose the problem by revealing the source of failure or anomaly.

We look forward to receiving your contribution!