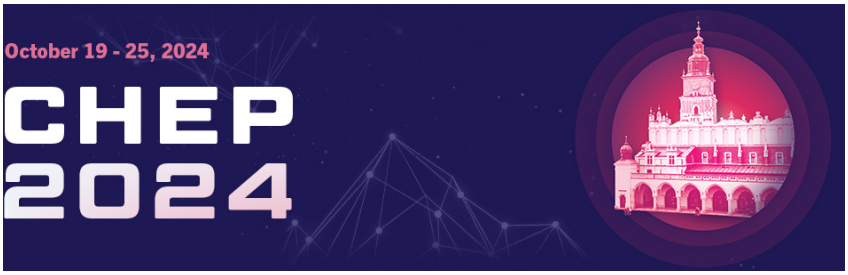

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GlitchFlow, a Digital Twin for transient noise in Gravitational Wave Interferometers

Thursday 24 October 2024 16:15 (18 minutes)

Gravitational Waves (GW) were first predicted by Einstein in 1918, as a consequence of his theory of General Relativity published in 1915. The first direct GW detection was announced in 2016 by the LIGO and Virgo collaborations. Both experiments consist of a modified Michelson-Morley interferometer that can measure deformations of the interferometer arms of about 1/1,000 the width of a proton. The sensitivity of GW interferometers is limited by noise. Non-Gaussian transient noise artifacts, also known as glitches, are particularly challenging due to their similarity with astrophysical signals in the time and frequency domains. Noise reduction and subtraction is one of the most important and challenging activities in GW research.
InterTwin is a EU-funded project with the aim of building Digital Twins (DT) for various scientific use cases based on a co-designed blueprint architecture. Within InterTwin, we are developing GlitchFlow, a pipeline for modeling and generating glitches for GW interferometers using deep generative algorithms. In this contribution, we present results of the glitch generation using several Neural Network (NN) architectures, and describe the implementation of the pipeline as execution of DAGs (Directed Acyclic Graph) with an Apache Airflow instance deployed on Kubernetes. We show how the most computing intensive tasks such as model training can be off-loaded to Vega, the EuroHPC, using InterLink, a module developed within the InterTwin framework.

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