# EVENFLOW: Robust Learning and Reasoning for Complex Event Forecasting

## Description

A growing number of applications rely on AI-based solutions to carry-out mission-critical tasks, many of which are of temporal nature, dealing with ever-evolving flows of information. Crucial for mitigating threats and taking advantage of opportunities in such domains, is the ability to forecast imminent situations and critical complex events ahead of time. EVENFLOW will develop hybrid learning techniques for complex event forecasting, which combine deep learning with logic-based learning and reasoning into neurosymbolic forecasting models.

The envisioned methods will combine (i) neural representation learning techniques, capable of constructing event-based features from streams of perception-level data with (ii) powerful symbolic learning and reasoning tools, that utilize such features to synthesize high-level, interpretable patterns of critical situations to be forecast. Crucial in the EVENFLOW approach is the online nature of the learning methods, which makes them applicable to evolving data flows and allows to utilize rich domain knowledge that is becoming available progressively, over time.

To deal with the brittleness of neural predictors and the high volume/velocity of temporal data flows, the EVENFLOW techniques will rely on novel, formal verification techniques for machine learning, in addition to a suite of scalability algorithms for federated training and incremental model construction. The learnt forecasters will be interpretable and scalable, allowing for fully explainable insights, delivered in a timely fashion and enabling proactive decision making. EVENFLOW will be evaluated on three challenging use cases related to oncological forecasting in precision medicine, safe and efficient behavior of autonomous transportation robots in smart factories and reliable life cycle assessment of critical infrastructure.

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