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Uncovering Causal Interactions and Network Dependencies in Temporal Event Streams

Temporal event streams—such as neural spike trains, social media postings, and financial transactions—often exhibit complex and evolving dependencies that are critical for accurate forecasting and system understanding. Traditional forecasting approaches face challenges in capturing these dynamic causal interactions and network structures. This talk presents a novel framework that combines directed acyclic graph (DAG) modeling with multidimensional temporal point processes to uncover interpretable causal networks from high-dimensional event data. Leveraging an advanced optimization technique, the method efficiently learns these structures while ensuring reliability even in non-stationary environments. I will demonstrate applications of this approach on two real-world datasets: neuronal spike train data and Internet Protocol television viewing records. These examples highlight how uncovering causal and network dependencies can improve predictive accuracy, offering new insights and tools for decision-making in complex temporal domains.