Temporal Causal Models for Massive Time-Series Data Mining: Climate Change Attribution and Other Applications

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Climate change is one of the most critical socio-technological issues mankind faces in the present century. Recent frequent occurrences of devastating extreme weathers, such as Hurricane Katrina, flooding in Australia, draught in Asia, raises great urgency to understand the attribution of climate change and provide action plans if possible. Traditionally, it is regarded as an environment and energy problem. However, as the astounding volume and rich varieties of climate related data become available, data analytic approaches could serve as an alternative solution to this problem, i.e., allowing us to analyze the large amount of time series data on the climate and climate forcing agents and revealing insights on how these factors affect each other. More specifically, we develop "temporal causal models", an emerging collection of graphical model techniques that allow us to model causal relationships between time-persistent features in the time series data. I will discuss its applications to climate modeling and attribution, and highlight other applications on computational biology and social media analysis.