Powerful Predictive Software for Sudden Critical Events

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Critical transitions are macroscopic systemic changes that are comprised of a large number of microscopic elements. Sudden onset of critical transitions such as stock market crashes and rapid deterioration of complex diseases are difficult to forecast using data analysis.

GW Researchers developed an algorithm that analyzes time series data to identify key groups of variables that can predict the sudden onset of critical transitions. The algorithm analyzes large sets of time series data to identify groups of key variables (“nucleation sites”) whose unique collective behavior precede sudden onset of critical transition events. While the individual variables of a ‘nucleation site’ are weak signals on their own, as a group, it can be a powerful predictor of the onset of critical transitions.

Using the algorithm, the researchers were able to identify ‘nucleation sites’ in disease models by analyzing a publicly available time series microarray (large scale gene expression profile) data. In addition, the researchers successfully validated the predictive power of the algorithm for influenza in healthy human volunteers (See Figure).

Applications:

Prediction of sudden complex events based on time series data, including:

- Predict social unrest from internet traffic data
- Predict sudden financial market events from trading data
- Prediction of onset and progress of complex diseases based on time series microarray data

Advantages:

- Useful wherever large time series data is readily available.
- Higher predictive power from clusters of weak signals.
- Applies to long time frames.
- Applies to broad range of variables
Inventors

Chen Zeng
Department of Physics

Chenghang Du
Department of Physics