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Mandar Chandorkar (CWI)
MDG-TAO Associate team

Title: « Dynamic Time Lag Regression: Predicting Time Lagged Effects of Solar Activity »

Abstract:

It is often the case with natural and man-made phenomena, that cause and effect are temporally separated i.e. there is a time lag between occurrence of an event and the observation of its consequences. In complex systems, this time lag between cause and effect can be uncertain and dynamic. Mathematically this can be expressed as y{t + g(xt}) = f(xt), where xt is a time series representing the causes, yt represents the effects and functions f and g represent the input-output and input-time lag relationships. In the context of space weather, one can see this when active regions on the Sun, give rise to high speed solar wind streams which cause disturbances in the Earth's geomagnetic state, several hours, or even days later. To increase the prediction window of space weather forecasting systems, it is important to model the temporal relationship between space weather drivers and geomagnetic quantities in the vicinity of the Earth. We present ongoing work in learning dynamic causal time lags from noisy time series. Our methodology is based on a neural network which learns the input-output and input-time lag relationships simultaneously. We evaluate our models performance on a set of toy problems as well as on the problem of solar wind propagation using Solar and OMNI data sets.