Sequential detection of a temporary change in multivariate time series

Application to air pollution

Presentation to team seminar LMBA,

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In some cases a pollutant release can have premises and detecting these premises can allow an early response to a pollution threat and avoid an outbreak. These premises can be a small leakage in an industrial site or the imperfect containment of radioactive materials associated with an explosive device. In any case, these premises are supposed not to be very energetic and can happen in a very noisy environment. In the case of the propagation of a low energy event over a field of sensors, we assumed that the change in the statistical properties in the monitored signals can only be temporary. In this presentation I will address a detection problem and use a sequential detection technique to be able to detect very weak signals in time series. To detect these weak signals, Generalised likelihood Ratio Test (GLRT) techniques such as CUSUM, are well studied in univariate cases, but the extension to multivariate data is still a matter of research. Besides the difficulty to deal with multivatiate data, the CUSUM requires all exposed sensors to stay exposed until detection. In our case, the event can be transiting over the monitored area such that when the last sensors start monitoring the signal, other sensors who monitored it earlier have stopped being exposed. The Temporary-Event-CUSUM is a new technique with which one can tackle the synchronicity problem without loosing the recursive computation, hence keeping a low computational cost.