S08-4 (02/17 14:40-15:05)

Feature Estimation and Testing for High-Dimensional Linear Regression with Dependent Regressors

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Abstract

There exist many real data examples, where the regressors of interest are high-dimensional and come from a time series. For example, in econometric applications when dealing with multivariate models, the variables of interest are often observed at different time frequencies, such as financial and macroeconomic variables. The former is observable at high frequencies (e.g. daily, hourly or minute-by-minute), and the latter at far lower frequencies (often monthly or quarterly). Similarly in geostatistical applications, it is important to understand how climatological data impacts climate change indicators, such as ice-shelf extent. Again, the climatological data (such as temperature) can be observed at a very high frequency, whereas the climate change indicators are often observed yearly. Consistent parameter estimation is usually only achieved with regularization, which is usually done through dimension reduction or an additive penalty. But a disadvantage of most regularization methods is that the type of regularization is tied to how the model is specified (smooth, sparse, periodic, etc). Misspecification of the model can lead to spurious conclusions. However, if we treat the regressor as a random variable, then the normal equation will lead to a system that is well-posed (without the need to regularize). Therefore, in place of any knowledge of the structure of the coefficients, the structure of the time series can be exploited to estimate the normal equations and thus consistently estimate the regression coefficients. In this talk, we propose a method for estimating the coefficients in a high-dimensional linear regression model, where the regressors come from a second-order stationary time series. The proposed approach is based on deconvolution. This estimates, both the regression coefficients and its Fourier transform, which allows us to estimate different types of features in the regression coefficients.

Keywords:
Deconvolution; Feature Estimation; High-Dimensional Linear Regression; Second-Order Stationary Process.