Sufficient Dimension Reduction in Supervised Forecasting with Many Predictors

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Abstract

We propose a forecasting method that estimates the conditional mean of a time series target variable non-linearly under the presence of a large set of highly correlated covariates. The target variable follows a multiple index model that depends explicitly on the latent factors determined by the set of predictors. The indices and the relevant unobservable common factors are estimated consistently using the Three Pass Regression Filter (3PRF) (Kelly & Pruitt (2015)) and the Sliced Inverse Regression (SIR) (Li (1991)) given that the number of indices and the number of relevant factors for each index are specified. Our approach considers two stages to reduce the dimension of the covariates: first, through latent factors, and second, through sufficient dimension reduction, i.e., the projected indices. Our method extends the sufficient dimension reduction to high-dimensional regimes by reducing the cross-sectional information through factor models in a supervised setting. When the proxies, variables that are spanned only by the set of relevant factors of the target, are not available we first generate pseudo targets following SIR. Then, we implement 3PRF for each pseudo target and the set of predictors. Our approach estimates consistently the projection indices of the underlying factors even in the presence of a non-parametric forecasting function when both the time dimension and cross section dimension become large and it only estimates the relevant factors of the target. We provide asymptotic results and show the good finite sample performance through simulations. We confirm the forecasting performance relative to alternatives with empirical applications using US macroeconomic data.

Keywords: *Supervised forecasting, factor model, sliced inverse regression, learning indices.*

References

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