Supervised Dynamic PCA

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Abstract

This paper proposes a novel dynamic forecasting method based on a large number of predictors using a new supervised Principal Component Analysis (PCA). The new supervised PCA provides an effective way to bridge the predictors and the target variables of interest by scaling and combining the predictors and their lagged ones, which is in line with dynamic forecasting. Unlike the traditional diffusion-index forecasting, which does not learn the relationships between the predictors and the target variables before conducting PCA, we first re-scale each predictor according to their significance in forecasting the target variables in a dynamic fashion, and a PCA is then applied to a re-scaled and additive panel, which builds a connection between the predictability of the PCA factors and the target variables. Furthermore, we also use penalized methods, such as the LASSO approach, to select the significant factors that have more predictive power than the others. Theoretically, we show that our estimators are consistent and outperform the forecasts using traditional methods under some mild conditions. We conduct extensive simulations to verify that the proposed method produces satisfactory forecasting results and outperforms most of the existing methods using the traditional PCA. A real example on predictions of U.S. macroeconomic variables using a large number of predictors shows that our method performs better than most of the existing ones in general. Overall, our proposed procedure provides a comprehensive and effective method for dynamic forecasting in large dimensions.