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Multi-Step Ahead Time Series Forecasting via Sparse Coding and Dictionary Based Techniques

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Abstract

Sparse coding is based on the concept of having a large dictionary of candidate basis vectors. Any given vector is expressed as a sparse linear combination of the dictionary vectors. It has been developed in the signal processing field, and has many applications in data compression and image processing. In this paper we propose applying sparse coding to the time series forecasting field. Specifically, the paper investigates different dictionary based local learning techniques for building predictive models for the time series forecasting problem. The proposed methodology is based on a local learning framework whereby the query point is embedded and coded in terms of a sparse combination of the training dictionary atoms (vectors). Then this embedding is used for estimating the target value of the query point, by applying the same embedding to the target vectors of the dictionary training atoms.

We present an experimental study of several sparse coding algorithms. Experiments are performed on the large monthly time series benchmark from the M3 competition, and these experiments showed that the sparse methods *Lasso* and *Elastic-Net* presented the best results among the sparse coding algorithms. Moreover, they outperformed the K-nearest neighbor (KNN) regression and most of the compared machine learning and statistical forecasting techniques,

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