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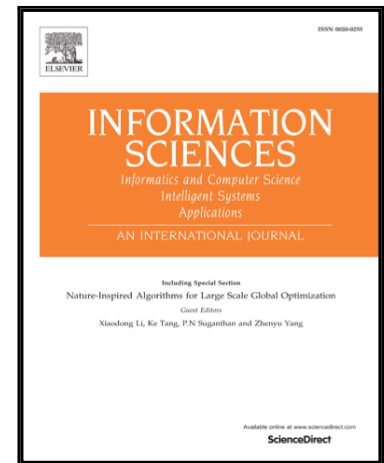
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Using Multiple Time Series Analysis for Geosensor Data Forecasting

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Abstract

Forecasting in geophysical time series is a challenging problem with numerous applications. The presence of correlation (i.e. spatial correlation across several sites and time correlation within each site) poses difficulties with respect to traditional modeling, computation and statistical theory. This paper presents a cluster-centric forecasting methodology that allows us to yield a characterization of correlation in geophysical time series through a spatio-temporal clustering step. The clustering phase is designed for partitioning time series of numeric data routinely sampled at specific space locations. A forecasting model is then computed by resorting to multivariate time series analysis, in order to predict the future values of a time series by utilizing not only its own historical values, but also information from other cluster-time series. Experimental results highlight the importance of dealing with both temporal and spatial correlation and validate the proposed cluster-centric strategy in the computation of a multivariate time series forecasting model.

Keywords: Time Series Forecasting, Spatio-Temporal Clustering, Multivariate Time Series Analysis,

1. Introduction

Natural processes and physical variables (e.g. rainfall, humidity and solar radiation) are being increasingly observed over time and across space. The ubiquity of this kind of spatio-temporal data, namely geophysical time series, has motivated us to investigate and develop appropriate models to analyze and forecast them. Forecasting can be useful in providing information to decision-makers. For example, accurate forecasts can be used, in order to anticipate actions (e.g. the prediction of solar radiation in a region allows us to define the best strategy to maximize profit in the energy market).

In the last two decades, the challenge of predicting the future by looking at the past has led to a variety of time series forecasting algorithms [12, 22, 28]. They determine a time series model by accounting

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