Awichi R.O.: A Technique of Incorporating Spatial Dependence in MSSA Forecasts

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Abstract

In this discussion, I present three major issues of time series analysis, namely: Singular Spectrum Analysis, SSA; Multivariate Singular Spectrum Analysis, MSSA and Spatial Dependence.
SSA is a recently developed tool for time series analysis. It is a model free approach to time series analysis and literally any time series with a notable structure can provide an application of SSA. Indeed it has a wide area of application including social sciences, medical sciences, finance, environmental sciences, Mathematics, Dynamical Systems and Economics. It is implemented under the platform of a software called CaterpilarSSA, although other packages, like Rssa exist.
The aim of SSA is twofold: i) to make a decomposition of the original series into a sum of a small number of independent and interpretable components such as a slowly varying trend, oscillatory components and a structure less noise; ii) to reconstruct the decomposed series to make a forecast in the absence of the noise component.
MSSA is an extension of SSA to multivariate statistics and takes advantage of the delay procedure to obtain a similar formulation as SSA though with larger matrices for multivariate data. In environmental sciences and other areas where spatial data is an important focus of investigation, it is not uncommon to have attributes whose values change with space and time and quite often, due to spillovers or unobservable variables or omitted factors. This leads to spatial dependence that subsequently influence data analysis.
In light of spatial dependence, Kriging and inverse distance weighting techniques may be used to improve SSA and MSSA predictions. Here, I explore the inverse distance approach to improve on the forecast of the values. This technique is applied to climate data recordings from Upper Austria.

Keywords: *Time Series Analysis, Kriging, Inverse Distance Weighting and Spatial Dependence.*