XU HUANG

De Montfort University, United Kingdom

MULTIVARIATE ANALYSIS ADVANCEMENTS AND APPLICATIONS BY SUBSPACE-BASED TECHNIQUES

Abstract:

Alongside the increasing speed of human society developments and technological advancements, the complexity level of multivariate analysis has rapidly risen due to the prevalence of knowledge and science, regardless of the existing controversial drawbacks of the wide range of empirical methods (parametric and limited nonparametric approaches). This research aims to expand the multivariate extension of subspace-based techniques on multivariate analysis and brings novel contributions to not only the theoretical advancements but also broadening the horizon of the corresponding applications in complex systems like economics and social sciences. Subspace-based techniques adopted in this research include Singular Value Decomposition (SVD), Singular Spectrum Analysis (SSA) and Convergent Cross Mapping (CCM), which all have the advantages of being nonparametric approaches, assumption-free, no limitations to nonlinearity or complex dynamics, signal and noise together as a whole as the research object. This research proposed two novel multivariate analysis methods based on the study of subspace-based techniques: the mutual association measure based on eigenvalue-based criterion; and the hybrid causality detection approach by combining SSA and Convergent Cross Mapping (CCM). Both simulations and several successful implementations are conducted for the critical evaluation of the proposed advancements with promising robust performances. The proposed approaches offer the interested parties a different angle to resolve the multivariate analysis questions in a reduced form, data-oriented aspect. It is also expected to open the research opportunities of nonparametric multivariate analysis through the advanced, inclusive subspace-based techniques that show strong adaptability and capability in the complex system analysis in economics and social science.

Keywords:

Subspace-based Techniques; Multivariate analysis advancements; Causality detection; Mutual Association Measure; Singular Spectrum Analysis; Convergent Cross Mapping;