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Detection of spatial mortality patterns using functional principal components for areal data

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Abstract:

In recent years, the studies of demographic forecasts have grown significantly. One of the goals of demography is to statistically analyze and predict mortality and fertility rates without relying on subjective opinions of experts. Therefore, to identify the characteristics of the mortality dynamics of a population, many models were developed since the introduction of the famous model proposed by Lee and Carter (1992). Many research available in the literature tend to focus on the time series perspective of forecasting mortality rates. Lack of studies from the spatial framework sparked our interest in investigating the mortality rates from the spatial framework. The extension of the Lee-Carter (1992) model by incorporating the idea of functional data analysis (FDA) inspired the first part of this thesis where the FDA concept was applied to the spatial demographic analysis framework. We investigate the existence of spatial autocorrelation in mortality data of neighbouring countries. A functional spatial principal component method is proposed to reveal spatial patterns by directly considering spatial information. A functional Moran's I statistic is introduced. This statistic aids in determining the spatial autocorrelation in functional data through the implementation of the spatio-functional PCA.

Keyword : Functional principal component analysis; Moran's I; Spatial autocorrelation; KNN, contiguity; mortality

References

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