

Spatial Autocorrelation-Based Spatial Clustering for the Formation of Zones of Regional Economic Growth

Rahma Fitriani

Universitas Brawijaya, Jawa Timur, Indonesia

Abstract:

Clustering techniques, which are part of unsupervised machine learning, are used to identify groups of objects with similar attributes. When applying clustering techniques to spatial data, the assumption of independence between objects/regions is violated due to the similarity in variable values between adjacent regions. This dependence or interaction between regions is known as spatial autocorrelation. To account for this property, spatial clustering techniques have been developed, utilizing both non-spatial attributes and spatial attributes. The first type of attribute refers to the basic grouping used in traditional clustering, while the second type refers to the geographical location of each spatial unit. These two types of attributes are assigned different weights, with the weight magnitude indicating the level of importance in determining the cluster. In the context of economic growth, the formation of clusters for administrative areas is crucial for optimizing policies that promote economic development. It is expected that strong interaction of economic activities within a cluster of regions will accelerate economic growth. In this case, the regions within a cluster must be geographically contiguous and exhibit high spatial autocorrelation. Failure to consider geographical position and spatial autocorrelation in cluster determination makes it difficult to achieve the goal of accelerating economic growth through grouping. Therefore, this research aims to develop an unsupervised machine learning system for spatial data, particularly a spatial clustering technique that incorporates optimal weights for spatial attributes based on the nature of spatial autocorrelation. The optimal weights are determined by conducting a simulation study using economic growth data from the regencies/municipalities in East Java in 2023 as input for data generation.

The simulation results indicate that when there is a strong spatial autocorrelation, the weight for spatial attributes should be given more importance than the weight for non-spatial attributes, and vice versa. Based on the optimal weight determined at the level of spatial autocorrelation, this method is then applied to the economic growth data of districts/cities in East Java. A slight difference is observed in the cluster results when compared to the economic zones established by the government. These findings suggest that the existing economic zones can be readjusted in order to achieve the goal of accelerating and promoting equitable economic growth in this province in a timely manner.