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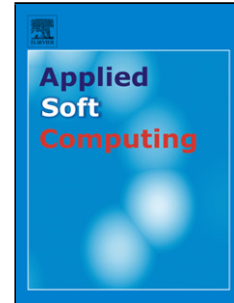
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Fuzzy Clustering with Nonlinearly Transformed Data

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Highlights

- Proposed is a novel nonlinear data transformation method for Fuzzy C-Means algorithm.
- Original data are projected in a nonlinear fashion into a new space with no change of space dimensionality.
- Particle Swarm Optimization is used to optimize nonlinear transformation.

Abstract

The Fuzzy C-Means (FCM) algorithm is a widely used objective function-based clustering method exploited in numerous applications. In order to improve the quality of clustering algorithms, this study develops a novel approach, in which a transformed data-based FCM is developed. Two data transformation methods are proposed, using which the original data are projected in a nonlinear fashion onto a new space of the same dimensionality as the original one. Next, clustering is carried out on the transformed data. Two optimization criteria, namely a classification error and a reconstruction error, are introduced and utilized to guide the optimization of the performance of the new clustering algorithm and a transformation of the original data space. Unlike other data transformation methods that require some prior knowledge, in this study, Particle Swarm Optimization (PSO) is used to determine the optimal transformation realized on a basis of a certain performance index. Experimental studies completed for a synthetic data set and a number of data sets coming from the Machine

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