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Enhanced MOGA-DBSCAN: Improving Clustering Quality with a Density-Adjusted Outlier Index

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Abstract

Clustering is a crucial aspect of data mining and machine learning, and its performance can significantly depend on parameter selection. The DBSCAN algorithm, known for its efficacy in detecting clusters of arbitrary shapes, relies heavily on its two parameters: *Eps* and *MinPts*. This paper presents an enhanced version of the Multi-Objective Genetic Algorithm (MOGA) for optimizing the parameters of DBSCAN, named Enhanced MOGA-DBSCAN. Our approach incorporates a modified Outlier Index that accounts for the density of clusters, providing a better evaluation of outliers. Additionally, we parallelized the computation of the Outlier Index to significantly reduce the runtime, enabling practical applicability to larger datasets. Experimental results on two benchmark datasets demonstrate that Enhanced MOGA-DBSCAN outperforms the original MOGA-DBSCAN algorithm, achieving higher Silhouette scores and Rand indices while requiring less computational time. This advancement not only improves clustering efficiency but also offers more meaningful insights into the underlying data structure.

Keywords: DBSCAN, Multi-Objective Genetic Algorithm (MOGA), Outlier Index

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