Self-Tuning Clustering: Toward Automated Parameter Optimization in Fuzzy C-Means Clustering Models

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Clustering remains one of the most widely applied unsupervised learning techniques, yet its practical success is often constrained by a persistent challenge: parameter sensitivity. Algorithms such as fuzzy c-means and its extensions require careful selection of parameters[1], including fuzzifier exponents, weighting factors, and robustness terms, whose inappropriate tuning can severely degrade performance. Traditional approaches rely on expert knowledge or costly trial-and-error procedures, making clustering difficult to deploy in large-scale, real-world scenarios.

This talk presents a series of contributions toward self-tuning clustering algorithms. We introduce adaptive parameter selection strategies that integrate heuristic and evolutionary mechanisms directly into the clustering process[2, 3], thereby enabling algorithms to adjust their own parameters in response to data characteristics. By combining self-tuning strategies with genetic algorithms[4, 5], we achieve a twofold advantage: the adaptive mechanism handles local refinements, while genetic search efficiently explores the global parameter space, outperforming exhaustive search both in speed and scalability. Case studies on these models demonstrate that self-tuning not only reduces the burden of manual configuration but also enhances robustness across diverse clustering scenarios[6].

References

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