

Measuring diversity in population metaheuristics

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Abstract:

The thesis will tackle the urgent necessity for refined diversity measurement within the domain of population metaheuristics. Existing metrics for quantifying diversity are due for reevaluation, as they frequently fall short of encapsulating the search space's complexity in evolutionary algorithms, including genetic algorithms and swarm intelligence. The research will initiate with a critical examination of current diversity measures, underscoring their theoretical and practical shortcomings.

Subsequently, a novel framework for the classification of diversity in metaheuristics will be proposed. The development of innovative metrics is planned, with the objective of providing a more precise reflection of diversity and its influence on the algorithms' convergence and efficiency. These metrics will undergo testing against conventional ones within the context of benchmark optimization problems, to evaluate their role in circumventing premature convergence.

Additionally, the project will incorporate these metrics into metaheuristic frameworks to validate their practical applicability. It will culminate in the provision of guidelines for the selection and application of diversity measures, thereby enhancing the metaheuristics' ability to identify global optima across diverse problem landscapes.

Literature:

- [1] PLUHACEK, Michal, et al. On the common population diversity measures in metaheuristics and their limitations. In: 2021 IEEE Symposium Series on Computational Intelligence (SSCI). IEEE, 2021. p. 1-7.
- [2] MORALES-CASTANEDA, Bernardo, et al. Population management in metaheuristic algorithms: Could less be more?. Applied Soft Computing, 2021, 107: 107389. RAIDL, Günther R.; PUCHINGER, Jakob; BLUM, Christian. Metaheuristic hybrids. Handbook of metaheuristics, 2019, 385-417.
- [3] POLÁKOVÁ, Radka; TVRDÍK, Josef; BUJOK, Petr. Differential evolution with adaptive mechanism of population size according to current population diversity. Swarm and Evolutionary Computation, 2019, 50: 100519.
- [4] SUN, Na; LU, Yong. A self-adaptive genetic algorithm with improved mutation mode based on measurement of population diversity. Neural Computing and Applications, 2019, 31: 1435-1443.
- [5] OSUNA-ENCISO, Valentín; CUEVAS, Erik; CASTAÑEDA, Bernardo Morales. A diversity metric for population-based metaheuristic algorithms. Information Sciences, 2022, 586: 192-208.