An Improved Master-Apprentice Evolutionary Algorithm for Minimum Independent Dominating Set Problem

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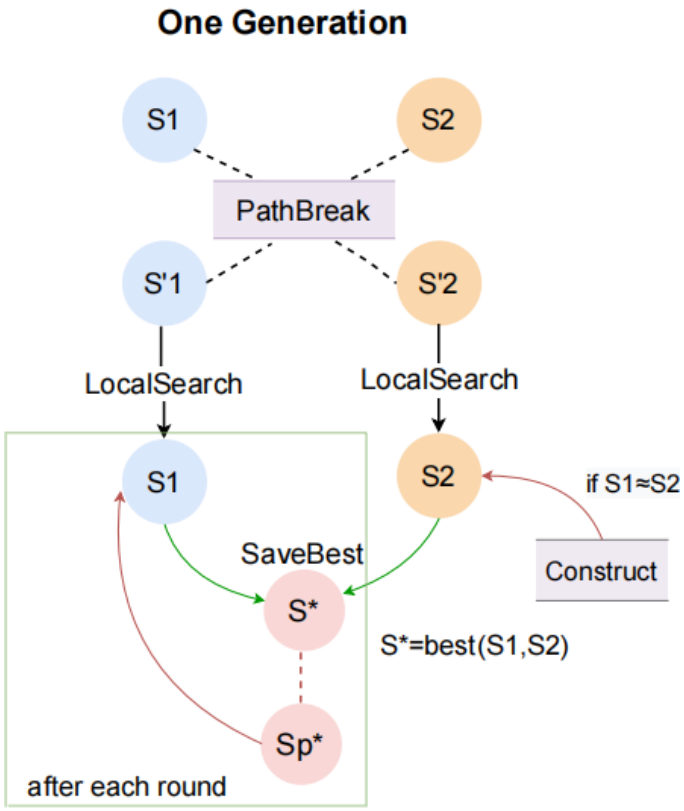
Problems & Ideas

- Minimum Independent Dominating Set Problem:
  - A dominating set (DS) is a subset *D* of V such that each vertex not in *D* is adjacent and an independent set (IS) is a subset *I* of V, where any two vertices in *I* are not adjacent.
  - An independent dominating set (IDS) refers to a subset of V, which is both an IS and a DS.
  - The purpose of the minimum independent dominating set (MIDS) problem is to find an independent dominating set with the minimum size in a given graph.

- Ideas:

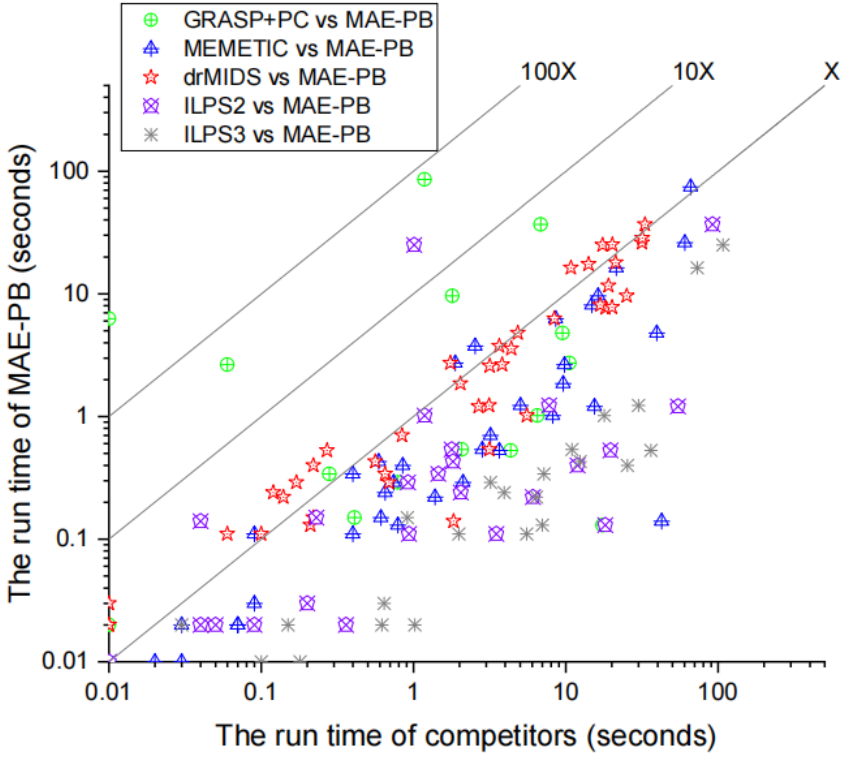
An improved master-apprentice evolutionary algorithm for solving the MIDS problem based on a path-breaking strategy called MAE-PB.

Consists of five main components: master-apprentice initialization, path-breaking distribution, local search, master-apprentice updating, and apprentice reinitialization.
It utilizes an evolutionary mechanism based on two individuals, making the exploration space of solutions in this algorithm more diversified because it updates two individuals simultaneously.

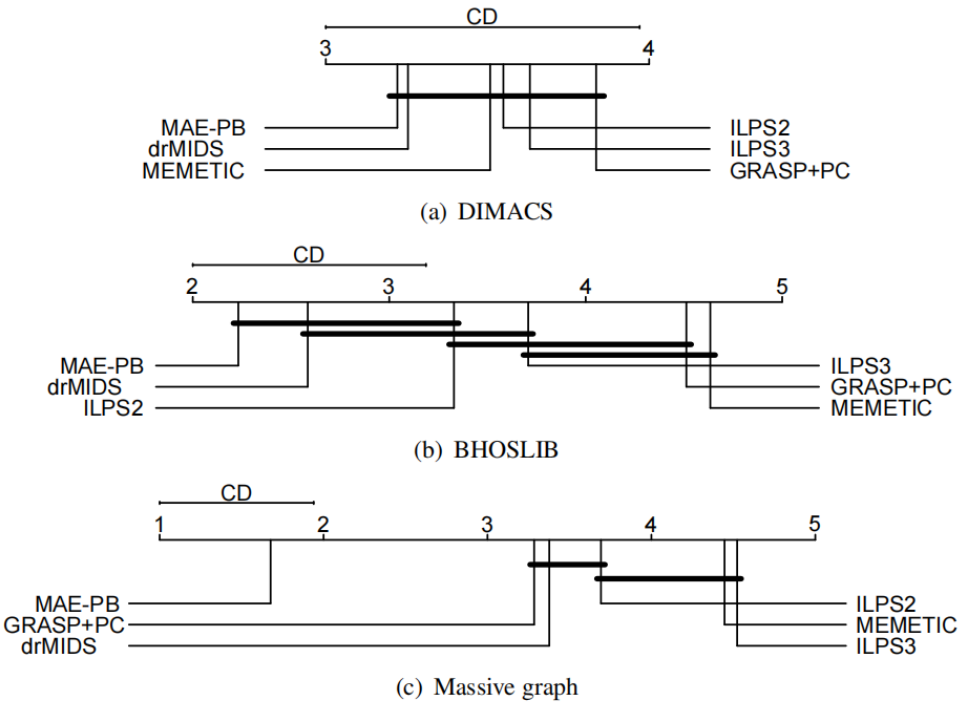


Main Contributions

- The proposed MAE-PB algorithm combines a construction function for the initial solution generation and candidate solution restarting;
- A path-breaking strategy for solution recombination based on master and apprentice solutions;
- A perturbation strategy for disturbing the solution when the algorithm cannot improve the solution quality within a certain number of steps.



Average run time of MAE-PB and competitors .



Critical difference plots about MAE-PB, GRASP+PC, MEMETIC, drMIDS, ILPS2 and ILPS3 on each benchmark.