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(57) Abstract :
The present invention relates to a collaborative human–artificial intelligence system (100) for generating adversarial instances in combinatorial optimization heuristics. The system includes a hardware processing unit (101) running a large language model engine (102), a program database module (103) storing generated programs with performance scores, an evolutionary search controller (104) for iterative refinement, a human expert interface (105) for manual analysis and improvement, and a scoring evaluation unit (106) for computing metrics. The method begins with simple program instances, followed by iterative generation of improved variants by the model, evaluation using problem-specific scoring functions, and storage of high-performing programs. Selected programs are analyzed and generalized by human experts, then refined further through feedback loops. This human-AI collaboration enhances heuristic performance and achieves improved lower bounds for problems such as bin packing, knapsack, clustering, and resource allocation.

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