Parameterised Genetic Algorithm to resolve NP-hard problems in Data Envelopment Analysis

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Data Envelopment Analysis (DEA) is a non-parametric technique for estimating the technical efficiency of a set of Decision Making Units (DMUs) from a database consisting of inputs and outputs. This work studies DEA models based on maximizing technical efficiency, which aims to determine the minimum distance between the evaluated DMU and the production frontier. Usually, these models have been solved through unsatisfactory methods used for combinatorial NP-hard problems. Here, the problem is approached by metaheuristic techniques and the solutions are compared with those of the methodology based on the determination of all the facets of the frontier in DEA. The use of metaheuristics provides solutions close to the optimal with low execution time.

During this research, a genetic algorithm is used to determine the best solution for the problem. At the beginning, a lot of solutions are generated with metaheuristic techniques, using two different models to create these solutions. Once the solutions are generated, we try to improve the non valid solutions to find new valid solutions. The next step is to select a group of solutions for further processing using techniques like crossover and diversification. At the crossover, a property is combined between two or more solutions, with intent to obtain a new solution that shares characteristics of previous valid solutions. With the diversification method, few solutions survive, so a tool called CPLEX is used to find the better neighbour solution. These parameters are studied like a hyper-heuristic trying to find the best values for different problems.

A study on the difference of time is conducted, taking a tool like CPLEX to perform this type of NP-hard problems, and the time it takes this metaheuristic solution, having as a result a similar solution in less time.

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