Automatic algorithm selection for multi-mode resource-constrained project scheduling problems

Tommy Messelis
Patrick De Causmaecker
CODeS Research group, member of ITEC-iMinds-KU Leuven
tommy.messelis@kuleuven-kulak.be

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In this talk, we will present the results of an experimental study towards building an automatic algorithm selection tool for the combinatorial optimisation problem of project scheduling.

At the basis of this tool lies the concept of empirical hardness models. These models are mappings from problem instance features onto performance criteria of certain algorithms. Using such models, the performance of a set of algorithms can be predicted. Based on these predictions, the tool can automatically select the algorithm with best predicted performance. For such a tool to work properly, the predictions must be sufficiently accurate.

Many state-of-the-art algorithms perform very well on a majority of benchmark instances, while performing worse on a smaller set of instances. The performance of one algorithm can be very different on a set of instances while another algorithm sees no difference in performance at all. Knowing in advance, without using scarce computational resources, which algorithm to run on a certain problem instance, can significantly improve the total overall performance.

We have applied this strategy to the classic problem of project scheduling with multiple execution modes. We selected two state-of-the-art algorithms that both perform relatively good on average. Combining these two algorithms in a portfolio with an automatic algorithm selection tool, we get a super-algorithm that outperforms any of it's components individually.