Directing selection within an extended great deluge optimisation algorithm

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The challenge of producing scheduling solutions for problems such as Course and Examination timetabling involves a combination of practical and research based approaches [1]. Due to the complexity of the issues involved research has focused on the use of search based heuristic techniques. Within the area of examination scheduling, progress in research has been facilitated by the availability of benchmark data sets [2, 3]. Results using a wide range of techniques have been reported as a result, with varied levels of success based on generality and time taken [4]. A successful technique can be viewed as one which can produce good solutions to a range of differing problems within a problem domain, in a practical timescale.

The 2nd International Timetabling Competition (ITC2007) [2] introduced an examination scheduling track, and new result sets continue to be validated using the competition's online validation service despite the competition closing almost five years ago. The next timetabling Competition (ITC2013) to be announced will further develop the problem definition to take into account additional real world issues. A technique which had previously been very successfully introduced to Course scheduling [5] was adapted and used for the ITC 2007 Examination data sets [6]. This technique is based upon the Great Deluge algorithm and was able to produce feasible and competitive solutions for all of the data sets presented in the ITC2007. It was noted that a link may exist between the initial adaptive construction phase and the stochastic extended great deluge optimisation phase [7].

The technique uses two phases of optimisation for scheduling; construction, to create an initial feasible solution and; improvement, to explore the solution space of the constructed solution for further better solutions. During adaptive based examination timetable construction, an ordered list of “difficult” (hard to schedule) examinations, is maintained [8]. When the improvement phase is reached, this information is discarded in favour of the fully stochastic selection routine, to ensure as much time as possible is spent trying to find an optimal solution. Indeed, when an adaptive based constructor was combined with a stochastic extended great deluge optimiser, it was able to produce results that beat those of the ITC2007 winner in six of the twelve datasets when run on identical hardware [5].

The purpose of this abstract is to investigate the link between an adaptive construction phase and a great deluge based optimisation phase. To this end, we will be investigating two different selection criteria for directing examination selection within the improvement phase. The first selection criteria will use the list of hard to schedule examinations, as it exists in its final state at the end of the construction phase. The second criteria will also initially use the list in this form, however with each iteration of the optimiser this list will be updated with new penalties, therefore the list of difficult to schedule examinations will continue to evolve. In each criteria, we will be investigating the effect of both replacing and supplementing the existing stochastic selection routine. We will also attempt to identify any trends within the adaptive examination list, such as what portions of the list provide the greatest benefit to the optimiser.

For the purposes of this abstract, we will be using the datasets introduced during the ITC2007, which have previously been discussed in great detail [9] to allow us to compare the results generated using this new selection routine against both those presented by B. McCollum, et al [5] and those of the competition winner. The results of this will be presented at PATAT 2012.

References

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