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High Performance Computing for Nature Inspired Metaheuristics

Wednesday, 5 December 2018 11:00 (20 minutes)

Genetic algorithms and genetic progamming are metaheuristics taking inspiration from Darwin's theory of evolution to solve optimization problems. Genetic algorithms explore a solution space to find solutions to problems while genetic programming works in a program space to identify a program which when executed will find an optimal solution to the problem. Both these approaches have high runtimes when applied to complex problems and are usually implemented using distributed computing in these instances. More recently, genetic algorithms and genetic programming have been employed by hyper-heuristics and have been used for the automated design of machine learning and search techniques. Hyper-heuristics explore the heuristic space rather than the solution space and hence search in the heuristic space is mapped to the solution space. Automated design of machine learning and search techniques is an emerging field aimed at removing the load of design, which is a time consuming task, from the researcher. This will also enable non-experts to use machine learning toolkits that automate the design and hence allow the researcher to focus on the problem being solved. The use of genetic algorithms and genetic programming in hyper-heuristics and for automated design require additional processing time. The talk will firstly look at the high performance computing architectures implemented by our research group to reduce the runtimes of genetic programming and genetic algorithms, particularly for hyper-heuristics and automated design. An overview of some of the real-world problems that this has enabled us to solve will then be presented. These include inducing human competitive heuristics for solving timetabling problems, network intrusion detection in the area of computer security, the automated design of techniques for financial forecasting, computer security, packing and logistics problems and the introduction of multi-space search algorithms that perform search over more than once space with applications in packing and forecasting.

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