07/02/02

Summer Lecture Series 2002

No Free Lunch

Overview and References

Ironically, the first lecture of the summer lecture series 2002 on evolutionary computation theory does not deal with evolutionary computation. The topic is a famous theorem known as **N**o **F**ree **L**unch Theorem. It is concerned with optimization (or even more generally, with search) and tries to formally capture the situation of a general (randomized) search heuristic that is faced with the task of optimizing an arbitrary function. The NFL result may have been unexpected and its presentation was provocative. Thus it has led to many controversial discussions. This and the fact that it is a valid theorem with important implications for research concerned with general (randomized) search heuristics, motivates us to first get to know the NFL Theorem itself and learn how to prove it. Then we discuss its assumptions and implications. The relevance for the summer lecture series 2002 is given, since evolutionary algorithms are, of course, general randomized search heuristics.

Overview

"The Original" NFL Theorem: We get to know the NFL Theorem as presented by Wolpert and Macready (1997) and prove it. The benefit of discussing a proof is to develop a thorough understanding of the theorem and see that it is not a particularly deep result.

An improved NFL Theorem: We see that the assumptions of the NFL Theorem are too restrictive: It is possible to prove the same statement in a more general setting (Schumacher, Vose, and Whitley (2001)).

Discussion of NFL Assumptions: We discuss three aspects of the assumptions the NFL Theorem makes. We try to get a realistic perspective by discussing arguments against and in favor of the "NFL way of thinking" presented by Igel and Toussaint (2001) and Droste, Jansen, and Wegener (2002).

NFL Implications: We summarize our findings and try to find out what needs to be kept in mind.

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The following list of references is neither meant to be a complete list of papers in the NFL context nor does it cover all aspects. The papers here are a good starting point for studies and contain references to other relevant papers.

References

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C. Schumacher, M. D. Vose, and L. D. Whitley (2001): The No Free Lunch and problem description length. In L. Spector et al. (Eds.): *Proceedings of the Genetic and Evolutionary Computation Conference* (*GECCO 2001*), 565–570. Morgan Kaufmann, San Francisco.

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