Parallelizing Metaheuristics for Complex Optimization

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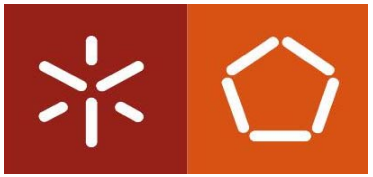
Optimization, search, and learning are healthy field targeted to find efficient solutions and algorithms to solve problems either in the academia and the industry. As the solved problems became harder a need for very efficient tools arose in computer science. One way to deal with this new requested efficiency is to use several computers to solve the same problem, either by using shared memory multiprocessors, clusters of machines or the Internet itself (also in grid). This talk will include some introduction to the field of parallelizing metaheuristic algorithms and will develop on important issues like exact versus heuristic algorithms, software tools, redefinition of metrics, and a set of illustrating examples to give the audience a brief state of the art in parallelism and optimization algorithms.

The talk will start by offering a wide definition of optimization through the utilization of nature inspired algorithms like genetic algorithms, simulated annealing, ant colony systems and some other methods using natural metaphors to solve complex problems. In addition to pointing out the difficulties and advantages of dealing with parallel techniques we will go through different facts occurring in the field of parallelization at least including the following ones:

1. Model and implementation are different
2. Metrics need a revision
3. Superlinear speedup is a fact
4. Heterogeneity is a must nowadays
5. The experimental setup is important
6. Algorithms are software
7. Other facts

In every case we will include examples illustrating the different milestones that researchers must face when working in parallel algorithms. Relevant books and projects will be briefly outlined, and a final discussion on applications will complete the presentation. Among the applications, combinatorial optimization, numerical continuous problems, telecoms, bioinformatics and neural networks design will reveal the true challenges open to researchers, and how parallel techniques can really endorse the creation of new techniques able of unseen efficiency and accuracy.



SEOOR - Systems Engineering Optimization and Operations Research
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University of Málaga, Spain

October 3, 2008
15:00-16:30
ANF, Esc. Eng. II
Campus de Gualtar
4710-057 Braga

Enrique Alba

Dr. Enrique Alba is a Professor of Computer Science at the University of Málaga, Spain. He got his Ph.D. degree on designing and analyzing parallel and distributed genetic algorithms. His current research interests involve the design and application of evolutionary algorithms, neural networks, and other bio-inspired systems to real problems including telecommunications, combinatorial optimization, and bioinformatics. The main focus of all his work is on parallelism.

Part of his ongoing research lies in the fields of ad hoc metropolitan network optimization, optimal design of GSM networks, logistics, vehicle routing, natural language tagging, software engineering for optimization tools, DNA fragment assembly, gene microarrays, cutting/packing, software testing and validation, and in general combinatorial problems lying in the base of real world problems.

New fields like multiobjective techniques, grid/P2P/Internet platforms, dynamic optimization of problems whose definition change in time, and heterogeneous algorithms are dealt with as part both of basic and applied research.

As to the techniques, Dr. Alba and his group are dealing mainly with metaheuristics, either bio-inspired or not, and also hybridization with other (maybe exact) methods. In concrete, genetic algorithms, particle swarm, ant colonies, simulated annealing, branch and bound, and related solvers are used.

Dr. Alba has published three books on metaheuristics and bio-inspired techniques, more than 30 papers in impact journals, and around 80 conference papers. He has coordinated several national and international research projects in the past. Some of the active projects are OPLINK (http://oplink.lcc.uma.es), INRIA-PERFOM, and an European CELTIC project (CARLINK). Dr. Alba holds collaborations (join publications, visits and exchanges) with more than 20 international universities and labs, and his research in Málaga is also provoking industrial transferences to several companies.

Finally, Dr. Alba works in the program committee of well known important conferences in several fields, like GECCO, IEEE CEC, PPSN, EvoCOP, IPDPS and many more, as well has he organizes international events like NIDISC or IEEE/ACM MSWiM. He also works as reviewer for IEE Transactions (on EC, PDS, Education, SMC), JPDC, PARCO, Journal of Heuristics, JMMA, EJOR, Computer Communications, etc. Besides, Dr. Alba works in the editorial board of several international journals related to optimization, telecommunications and parallel systems.
His research interests include Operations Research, and in particular Scheduling Problems and Network Optimization.

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