

A Gentle Introduction to the Time Complexity Analysis of Evolutionary Algorithms

Abstract: Great advances have been made in recent years towards the runtime complexity analysis of evolutionary algorithms for combinatorial optimisation problems. Much of this progress has been due to the application of techniques from the study of randomised algorithms. The first pieces of work, started in the 90s, were directed towards analysing simple toy problems with significant structures. This work had two main goals:

1. to understand on which kind of landscapes EAs are efficient, and when they are not
2. to develop the first basis of general mathematical techniques needed to perform the analysis.

Thanks to this preliminary work, nowadays, it is possible to analyse the runtime of evolutionary algorithms on different combinatorial optimisation problems. In this beginners' tutorial, we give a basic introduction to the most commonly used techniques, assuming no prior knowledge about time complexity analysis.

By the end of the tutorial participants will be able:

1. to understand theoretically the behaviour of EAs on different problems;
2. to perform runtime complexity analyses of simple EAs on the most common toy problems;
3. to understand more complicated work on the analysis of EAs for combinatorial optimisation;
4. to have the basic skills to start independent research in the area.

Biography:



Pietro S. Oliveto is a Senior Lecturer and an EPSRC Early Career Fellow at the University of Sheffield, UK where he leads the Rigorous Research team.

He received the Laurea degree in computer science from the University of Catania, Italy in 2005 and the PhD degree from the University of Birmingham, UK in 2009. He has been EPSRC PhD+ Fellow (2009-2010) and EPSRC Postdoctoral Fellow (2010-2013) at Birmingham and Vice-Chancellor's Fellow at Sheffield (2013-2016).

His main research interest is the performance analysis of bio-inspired computation techniques including evolutionary algorithms, genetic programming, artificial immune systems and hyperheuristics. He has won best paper awards at GECCO 2008, ICARIS 2011 and GECCO 2014. He is part of the Steering Committee of the annual workshop on Theory of Randomized Search Heuristics (ThRaSH), Associate Editor of the IEEE Transactions on Evolutionary Computation, Chair of the IEEE CIS Task Force on Theoretical Foundations of Bio-inspired Computation and member of the EPSRC Peer Review College.

He has been delivering time complexity analysis tutorials regularly at the main conferences on bio-inspired computation since 2012.