

# Local Optima Networks: Current Results and Perspectives

Gabriela Ochoa<sup>1</sup>      Sébastien Verel<sup>2,3</sup>      Fabio Daolio<sup>4</sup>  
Marco Tomassini<sup>4</sup>

<sup>1</sup> School of Computer Science, Univ. Nottingham, UK,

<sup>2</sup> DOLPHIN team, INRIA Lille Nord Europe

<sup>3</sup> I3S Laboratory, University of Nice, Sophia Antipolis, France

<sup>4</sup> Computer Systems Department, University of Lausanne, Lausanne, Switzerland

## Abstract

In a series of papers we introduced a novel model for combinatorial landscapes that we called Local Optima Networks [1],[2],[3]. This is a view of landscapes derived from the previously proposed notion of 'inherent network' of potential (continuous) energy surfaces in physical-chemistry [4], but it has been modified and adapted to work for the configuration spaces generated by discrete combinatorial problems. It is based on the idea of aggregating the information given by the whole problem configuration space into a smaller mathematical object which is the graph having as vertexes the optima configurations of the problem, and as edges the possible weighted transitions between these optima. The model has proved useful for describing combinatorial landscapes (some measures on the optima networks have been found to be related with problem difficulty). However, we would like to focus now in using this model for understanding the dynamics of local search heuristics in combinatorial problems, which in turn may lead to suggestions to improve their design.

This talk will summarise our main findings using the local optima network model on NK landscapes with and without neutrality [3][5], and the quadratic assignment problem (QAP) [6]. We will also present the differences between the first-improvement and best-improvement local search heuristics, when used for extracting the networks. More importantly, we would like to discuss the perspectives of this line of work for understanding the dynamics of local search. For example, the potential uses of the local optima networks for (i) exploring the trade off between exploration and exploitation; and (ii) deducing approximate bounds of the running times of local search.

## 1 Bibliography

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