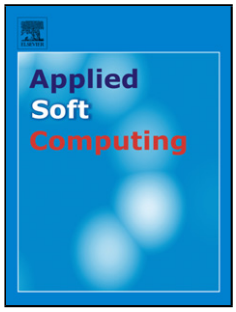

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PII: S1568-4946(17)30110-2
DOI: http://dx.doi.org/doi:10.1016/j.asoc.2017.02.031
Reference: ASOC 4081

To appear in: *Applied Soft Computing*

Received date: 10-2-2016
Revised date: 22-1-2017
Accepted date: 27-2-2017

Please cite this article as: David Jesenko, Marjan Mernik, Borut Žalik, Domen Mongus, Two-level Evolutionary Algorithm for Discovering Relations Between Nodes' Features in a Complex Network, *<![CDATA[Applied Soft Computing Journal]]>* (2017), http://dx.doi.org/10.1016/j.asoc.2017.02.031

Two-level Evolutionary Algorithm for Discovering Relations Between Nodes' Features in a Complex Network

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Abstract

Complex network theory offers an efficient mathematical framework for modelling natural phenomena. However, these studies focus mainly on the topological characteristics of networks, while the actual reasons behind the networks' formation remain overlooked. This paper proposes a new approach to complex network analysis. By searching for the optimal functional definition of the network's edge set, it allows an examination of the influences of the physical properties of the nodes on the network's structure and behaviour (i.e. changes of the network's structure when the physical properties of nodes change). A two-level evolutionary algorithm is proposed for this purpose, whereby the search for a suitable function form is achieved at the first level, while the second level is used for optimal function fitting. In this way, not only the features with the largest influences are identified, but also the intensities of their influences are estimated. Synthetic networks are examined in order to show the superiority of the proposed approach over traditional machine learning algorithms, while the applicability of the proposed method is demonstrated on a real-world study of the behaviour of biological cells.

Keywords: complex networks, topology, function fitting, machine learning, evolutionary algorithms

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