UNIVERSITÀ DELLA CALABRIA

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Ph.D. programme in Mathematics and Computer Science

Title: **Introduction to Evolutionary Computation with special focus on methods for the problem of Community Detection in Complex Networks**

Speaker: **Prof.ssa Clara Pizzuti**

Abstract: Evolutionary computation is a powerful search and optimization technique inspired by the Darwin's theory of evolution. Evolutionary computation aims to use principles of nature's process of natural selection and genotypic variation to derive computer algorithms for solving hard search and optimization tasks. During the past fifty years, many instances of evolutionary algorithms, such as genetic algorithms, evolutionary strategies, evolutionary programming, genetic programming, have been proposed starting from the initial algorithm consisting of population initialization, followed by variation and selection operators to improve the value of a criterion, able to escape from local minima, while exploring the search space during the optimization process. The objective of this short course is to provide the notions at the base of evolutionary computation methodology for the solution of complex problems. More in detail, after an introduction to the general concepts of evolutionary algorithms, different instantiations will be taken into account, such as genetic algorithms, differential evolution, and genetic programming. As a practical application, we show how the problem of community detection in complex networks can be effectively tackled with evolutionary techniques. In the last years, complex networks have been receiving a lot of interest by researchers because of their capability of representing the relationships among objects composing many real world systems. One of the main problems in the study of complex networks is the detection of community structure, i.e. the division of a network into groups of nodes having dense intra-connections, and sparse inter-connections. In this course several types of networks are considered, such as undirected, directed, weighted, signed, multi-dimensional, time evolving, and the most recent proposals exploiting evolutionary techniques for finding communities in these types of networks, both non-overlapping and overlapping community structure, are described.
Moreover, the differences among the representations adopted by methods, along with single objective versus multi-objective approaches, are discussed.

Course organization :
Tuesday, February 5, 2019: 9:00 - 11:00, room LAN - 30A
Wednesday, February 6, 2019: 9:00 - 12:00, room LAN - 30A
Tuesday, February 12, 2019: 9:00 - 12:00, room LAN - 30A

Short Biography:
Affiliations: Senior Researcher at the National Research Council of Italy (CNR)- Institute for High Performance Computing and Networking (ICAR), Rende

Scientific Research Interest: evolutionary computation, knowledge discovery in databases, data mining, data streams, bioinformatics, complex networks, social network analysis and mining.