Subject: Internship Proposal

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Project details

Title	Distributed Computation of Network Centrality Using the Game of Thieves Algorithm

Detailed description: The analysis of complex networks often requires the computation of centrality measures in order to identify the most important nodes and edges in a graph. However, classical centrality metrics such as degree, betweenness, and closeness can become computationally expensive when applied to large networks.
The Game of Thieves (GoT) algorithm is a stochastic approach designed to estimate both node and edge centrality through the simulation of agent movements on a network. In the GoT model, each node initially contains a set of virtual resources called vdiamonds and an agent called a thief. During the simulation, thieves move across the network by randomly selecting neighboring nodes. When a thief reaches a node containing a vdiamond, it steals the resource and brings it back to its home node. Nodes that are frequently visited by thieves tend to lose their vdiamonds quickly and are therefore considered more central. Edge centrality is estimated by measuring how frequently thieves carrying a vdiamond traverse a given edge during the simulation.
An implementation of the GoT algorithm is available at:
https://github.com/dcmocanu/centrality-metrics-complex-networks
The aim of this internship is to design and implement a distributed version of the GoT simulation in order to improve its scalability when applied to large graphs.
The internship activities will include:
- study of the GoT algorithm and its existing implementation;
- analysis of distributed computing approaches for network simulations;
- design and development of a distributed prototype of the algorithm;
- experimental evaluation of the scalability and performance of the proposed solution.
The final goal of the internship is to develop a prototype capable of executing the GoT

simulation in a distributed computing environment and to evaluate its behavior on networks of different sizes.

Duration (month – max 12)	6
Duration (hours)	100
Open positions	2

Internship Skills

Technical requirements: - Python and its development environments - Network analysis libraries (e.g. NetworkX) - Scientific computing libraries (e.g., NumPy, pandas) - Distributed computing tools and frameworks	
Other skills	- Scientific writing and documentation - Problem-solving attitude - Ability to read and understand technical documentation and research papers