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TM02\_DIP\_INF

## **Teach Mob – Visiting Professors**

### **Academic year 2015/2016**

<b>2nd term</b>
<b>COURSE TITLE</b> Analysis and Visualization of Complex Networks
<b>Scientific area</b> Computer Science
<b>Department of Computer Science</b>
<b>Language used to teach</b> Italian and English
<b>Course summary</b> Introduction to complex networks Graph theory survey. Simple graphs and bipartite networks. Weighted graphs. Undirected and directed graph. Networks topology and (local and global) structure: degree distribution, connectivity. Components. Centrality measures. Diameter of a network. Cliques and subgraphs. Definition and computation of the main measures of a network. Community detection. Graph partitioning; Homophily. Models of a network: Erdos-Renyi's random graphs. Parameters distribution and limit theorem for large scale networks Phase transition and giant component. Relationships between different parameters in a network (assortativity, connectivity vs. betweenness centrality). Small world models: high clustering and short distances ( $\log(n)$ ). Watts-Strogatz model: rewiring. Scale free networks. Growing model of Barabasi-Alberts: preferential attachment. Log-log scale. Histograms and statistical error. Heavy tail distributions. Network data visualization: methods (visualization algorithms for graphs, layout taxonomy, force based layout; tree layout; circular layout; geography layout; pros and cons of using maps); tools (igraph/networkx, python/R, d3.js, Google charts e Google Maps, data representation and NoSQL: Neo4J and MongoDB) Collective Intelligence: state-of-the-art; application to Web2.0 technologies; stigmergy, swarm intelligence, web science, collective decision-making, semantic web, crowdfunding, prediction markets.
<b>Learning objectives</b> Basics of data and network science; Overview (with practical skills) of network analysis tools; Social media and web mining skills; Understanding of fundamental models in complex science to get causal relationships between data-driven phenomena; Visualization tools for complex data and networks
<b>Lab activities</b> Experiments and exercises will require both theoretical (mathematical models) and practical (network analysis and visualization) tools
<b>Other activities besides the course:</b> i.e. seminars and conferences addressed to PhD students and research fellows, dissemination conferences (if applicable) (10 lines max)

Other invited seminars (often in english) are usually offered to students. In previous editions of this class, the following researchers have been invited to give talks about their ongoing projects:

Ciro Cattuto (ISI Foundation)

Daniela Paolotti (ISI Foundation)

Corrado Giannini (ISI Foundation)

Mario Giacobini (Department of Veterinary, University of Turin)

Alessandro Flammini (Indiana University)

Santo Fortunato (Aalto University)

### **Visiting Professor Profile**

We are looking for candidates with the following profile.

Research

We are looking for senior scientists with more than 10 years of experience after PhD with a strong background on computational social science, social media analytics, collective intelligence, informetrics, and digital libraries. The ideal candidate has a demonstrated record of independently designing and conducting research and publishing results in competitive conferences and journals. The candidate must also have a documented record of funded projects where she/he worked in as a PI or co-PI.

Teaching

The candidate must have teaching experience, at both graduate and undergraduate levels.

### **Contact person at the Department**

**Prof. Giancarlo Ruffo**

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