

**DIPARTIMENTO DI INGEGNERIA  
CORSO DI DOTTORATO IN INGEGNERIA INDUSTRIALE E  
DELL'INFORMAZIONE -  
PHD COURSE IN INDUSTRIAL AND INFORMATION ENGINEERING -  
34TH CYCLE**

Title of the research activity:	Algorithms and systems for graph drawing and network visualization
State of the Art:	Graphs and networks are ubiquitous in many domains, and in many of today's applications they are often very complex. Examples include financial, social, computer, and biological networks (e.g., [1][2]). In this scenario, the use of visual interfaces for data analytics is receiving increasing interest (e.g., [3][4]). In particular, the design of visualization algorithms to gain a deep understanding of a complex and large network, of its structural properties, and of its recurrent patterns is of utmost importance in several decision making processes (e.g., [5][6][7]).
Short description and objectives of the research activity:	The research project aims at developing new efficient algorithms and effective visual interfaces for complex networks. From a theoretical perspective, the research will focus on the design of graph drawing techniques capable of handling geometric and topological constraints. In particular, it will investigate the combinatorial properties of non-planar graphs and the use of hybrid graph visualization paradigms. From a practical perspective, the research aims to conduct experimental validations of the designed algorithms, and to integrate these algorithms into visual analytics systems, which can be effectively used in different application domains. This research activity fits into the research frameworks of Big Data Analytics and of Data Science.
Bibliography:	<p>[1] G. Di Battista, P. Eades, R. Tamassia, and I. G. Tollis, "Graph Drawing: Algorithms for the Visualization of Graphs", Prentice Hall, 1999.</p> <p>[2] R. Tamassia Ed., "Handbook of Graph Drawing and Visualization", CRC Press, 2013.</p> <p>[3] W. Didimo and G. Liotta, "Graph Visualization and Data Mining", Chapter in book: Mining Graph Data - Ed. D. Cook and L. Holder, pp. 35-63, Wiley, 2007.</p> <p>[4] C. Ware, "Information Visualization: Perception for Design", Third Edition, Elsevier, 2013.</p> <p>[5] W. Didimo, G. Liotta, F. Montecchiani: A Survey on Graph Drawing Beyond Planarity. CoRR abs/1804.07257 (2018).</p> <p>[6] W. Didimo, L. Giamminonni, G. Liotta, F. Montecchiani, D. Pagliuca: A visual analytics system to support tax evasion discovery. Decision Support Systems 110: 71-83 (2018).</p> <p>[7] Yifan Hu: Visualization of Large Networks. Encyclopedia of Social Network Analysis and Mining 2014: 2328-2336.</p>
Scientific coordinator (s)	Giuseppe Liotta, Walter Didimo
Contact (s)	<a href="mailto:giuseppe.liotta@unipg.it">giuseppe.liotta@unipg.it</a> , <a href="mailto:walter.didimo@unipg.it">walter.didimo@unipg.it</a>