

Visualization in the Big Data Era: Data Mining from Networked Information

Dimitrios Tzovaras

Information Technologies Institute, Centre for Research and Technology, Greece

Abstract. Network graphs have long formed a widely adapted and acknowledged practice for the representation of inter- and intra-dependent information streams. Nowadays, they are largely attracting the interest of the research community mainly due to the vastly growing amount (size & complexity) of semantically dependent data produced world-wide as a result of the rapid expansion of data sources.

In this context, the efficient processing of the big amounts of information, also known as Big Data forms a major challenge for both the research community and a wide variety of industrial sectors, involving security, health and financial applications.

In order to address these needs the current presentation describes a proprietary platform built upon state-of-the-art algorithms that are combined to implement a top-down approach for the facilitation of Data & Graph Mining processes, like behavioral clustering, interactive visualizations, etc.

The applicability of this platform has been validated on α series of distinct real-world use cases that involve large amounts of intra-exchanged information and can be thus help as characteristic examples of modern Big Data problems. In particular, they refer to (i) DoS attacks in a real-world mobile networks and (ii) early event detection in social media communities, (iii) traffic management and (iv) DNA sequences analysis.

In all these cases, the large volumes of data are addressed via a Data Minimization approach that starts with an aggregated overview of network at its whole, and gradually the focus is put on smaller data subsets (i.e. approach upon successive levels of abstraction). In parallel, insights on the network's operations are allowed through the detection of behavioral patterns. Similarly, a dynamic hypothesis formulator and the corresponding backend solver can subsequently be exploited through graph traversing and pattern mining. This way, an analyst is provided with the appropriate equipment to set and verify concrete hypotheses through simulation and extract useful conclusions.

Dr. Dimitrios Tzovaras is a Senior Researcher Grade A' (Professor) and Director at CERTH/ITI (the Information Technologies Institute of the Centre for Research and Technology Hellas). He received the Diploma in Electrical Engineering and the Ph.D. in 2D and 3D Image Compression from the Aristotle University of Thessaloniki, Greece in 1992 and 1997, respectively. Prior to his current position, he was a Senior Researcher on the Information Processing Laboratory at the Electrical and Computer Engineering Department of the Aristotle University of Thessaloniki. His main research interests include network and visual analytics for network security, computer security,

data fusion, biometric security, virtual reality, machine learning and artificial intelligence. He is author or co-author of over 110 articles in refereed journals and over 300 papers in international conferences.

Since 2004, he has been Associate Editor in the following International journals: Journal of Applied Signal Processing (JASP) and Journal on Advances in Multimedia of EURASIP. Additionally, he is Associate Editor in the IEEE Signal Processing Letters journal (since 2009) and Senior Associate Editor in the IEEE Signal Processing Letters journal (since 2012), while since mid-2012 he has been also Associate Editor in the IEEE Transactions on Image Processing journal. Over the same period, Dr. Tzovaras acted as ad hoc reviewer for a large number of International Journals and Magazines such as IEEE, ACM, Elsevier and EURASIP, as well as International Scientific Conferences (ICIP, EUSIPCO, CVPR, etc.).

Since 1992, Dr. Tzovaras has been involved in more than 100 European projects, funded by the EC and the Greek Ministry of Research and Technology. Within these research projects, he has acted as the Scientific Responsible of the research group of CERTH/ITI, but also as the Coordinator and/or the Technical/Scientific Manager of many of them (coordinator of technical manager in 21 projects – 10 H2020, 1 FP7 ICT IP, 7 FP7 ICT STREP, 3 FP6 IST STREP and 1 Nationally funded project).