

ARS '17

**SIXTH INTERNATIONAL WORKSHOP
ON SOCIAL NETWORK ANALYSIS**

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BOOK OF ABSTRACTS

**ARS '17 INTERNATIONAL WORKSHOP
CHALLENGES IN SOCIAL NETWORK RESEARCH**

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Organized by

University of Salerno, University of Naples Federico II, University of Macerata, University of Trieste, University of Ljubljana, Catholic University of Milan, Cognitive Science and Communication research Centre.

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General Information

The scientific program includes plenary, special and contributed sessions with oral and poster presentation

What flow centrality measure to use? Central questions and an integrated approach*Filip Agneessens, University of Surrey, UK***Abstract**

Social network analysis is often interested in flow processes. Money, books, emails, gossip, and viruses are examples of “resources” that flow through a network. Recent decades have seen an extensive increase in measures to capture a person’s centrality in a flow network (e.g. degree, closeness, Beta centrality). Nevertheless, it often remains unclear which centrality measure is most appropriate for a specific study. Building on recent work (Borgatti, 2005; Agneessens, Borgatti & Everett, 2017), we argue that the relevance of a specific centrality measure is dependent on two crucial factors: the type of flow process and the properties of the resources being transmitted in the specific study. We show how, depending on the answer to these two factors, we are better able to identify the most appropriate measure to capture a person’s centrality in a specific case. We also discuss how a single enumeration/simulation approach is able to capture the wide variety of flow centrality measures.

Innovation Network of maize farmers in La Frailesca, Chiapas, Mexico - Red De Innovación De Productores De Maíz En La Frailesca, Chiapas, México

Juan Manuel Aguirre López, Chapingo Autonomous University, Mexico

Petra Chaloupková, Czech University of Life Science, Czech Republic

Julio Díaz José, Instituto Tecnológico Superior de Zongolica/IPBES, Mexico

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Abstract

Innovation is the driving force for the progress of any organization or enterprise. Agriculture as an economic activity, must be based on the highest possible innovations. The management of innovation network can achieve social welfare through improved yields. Applying social network analysis (SNA), a detailed mapping of actors (AMD) was performed during October 2013 to 18 maize farmers of La Frailesca, Chiapas, Mexico; identifying their characteristics and their production units. The results show a positive relationship between yields and the rate of adoption of innovations ($r^2 = 43\%$). On the other hand, technical innovation network proved to be an immature low density network (1.8%), with greater needs for information than available, taking into that account the index of output centralization (14%) is twice as large, than input (7%). In addition to the information in the network is limited, low quality, not reflected in yields. Therefore a strategy that includes a permanent source of quality information for innovation network that would achieve the purpose of a management strategy in the innovation network (technical) is proposed.

Spillover Effects in Observational Social Networks Data*Edoardo Airoldi, Harvard University, USA**Laura Forastiere, University of Florence, Italy**Fabrizia Mealli, University of Florence, Italy***Abstract**

Causal inference based on complex network data presents technical challenges in both randomized and observational studies, including how to account for social interference and how to deal with complex response functions. In the presence of interference, potential outcomes have to be defined based on both the individual treatment and the vector of treatments received by the unit's interacting individuals (e.g., friends or neighbors). In observational studies, a further issue is that when the treatment of individuals spills over to neighboring individuals along an underlying social network the usually invoked unconfoundedness assumption involves both the individual and the neighborhood treatment. Therefore, proper covariate-adjustment methods are needed to make this kind of assumption more plausible. Formal theory for designing and analyzing observational studies with units organized in a network is still in its infancy. For this purpose, we define a generalized propensity score that balances individual and neighborhood covariates across units under different levels of such a bivariate treatment. If we assume interference to operate only through a function of the vector of friends' treatments, then spillover effects can be seen as a dose-response function of a multivalued treatment. We factorize the bivariate-treatment propensity score and estimate the dose response function by combining subclassification on the individual binary-treatment propensity score and parametric adjustment for the neighborhood multivalued-treatment propensity score.

Routes of Russian-speaking tourists in Andalusia: networks of itineraries between cities*Deniza Alieva, University of Seville, Spain**Isidro Maya Jariego, University of Seville, Spain***Abstract**

In this study, we used social network analysis to describe tourist movements between cities. Specifically, we analyzed 1,681 displacements between 80 cities made by 354 Russian-speaking tourists in Andalusia (South Spain). The most travelled itineraries correspond to the province of Malaga, which constitutes the core of the network of journeys. Secondly, the itineraries between four provincial capitals – Seville, Cordoba, Granada and Cadiz – stand out. Most travelers arranged the trip on their own. The tourists who organized their trip with agencies are more likely to focus their visit on just one provincial capital and are more likely to come from St. Petersburg or from other cities than from Moscow. The route network showed a significant QAP correlation with the matrix of kilometers between cities, and a negative relationship with car journeys. No differences were found with the offer of agencies (according to catalog) or with the public transport network between cities. With the application of the E-I index we observed that the "sun and beach" itineraries show a lower intra-class density than itineraries for "cultural cities and monuments". The routes of the Russian-speaking tourists in Andalusia seem to be more influenced by the airport of arrival and the geographical distance between cities, than by the offer of the agencies or the attractions associated with each tourist destination. With regard to this general trend, there are only two elements of differentiation the occasional cultural visits by sun and beach tourists and the rental of cars by a small percentage of travelers.

A Bayesian semi-parametric model for classification of terrorist networks*Emanuele Aliverti, University of Padua, Italy***Abstract**

During last years, social network analysis expanded to the “dark networks” frameworks, i.e contexts in which criminal groups are involved in terroristic or illegal operations. Our motivating application stems from a dataset referred to the terrorist “Noordind Mohamad Top” and his affiliates, recorded by the Indonesian government in 2006. Data are coded into a multilayer network, in which a fixed set of nodes represents terrorists, and edges the presence of a different relation, one for each layer, between pairs of nodes. Some of the available relations are the following: “Communication between individuals through direct means”, “Common attendance at at least one terroristic attack”, “Meeting at the same scheduled gathering”, “Attendance at the same school”.

From a strategical point of view, different layers are given different importance: some may encode rather legit bonds between individuals, such as the same school attendance; more interesting, instead, are those networks related to obscure or criminal activities. We propose an asymmetric approach that treats one critical network, related to terrorists' collaboration in the same bombing attack, as response, introducing then other networks as covariates in a Bayesian semi-parametric additive model. The parametric component takes into account the effect of explanatory networks on the response network, as a standard GLM mixed-model with node-specific random effects, hence easily interpretable. The non-parametric structure decomposes the residual dependences between response and covariates networks through a non-parametric matrix factorization, allowing then a proper estimation of the parametric component, which inference will focus on. Through suitable prior specification, our approach is able to identify influential terrorists and to automatically favor sparse structures. Inference is achieved through an efficient Gibbs-Sampler, and the proposed approach can easily provide estimation for new nodes' potential behavior through the posterior predictive density.

Modelling temporal relevance of relational events*Viviana Amati, University of Konstanz, Germany**Alessandro Lomi, University of Italian Switzerland, Switzerland***Abstract**

In the last decade several models for the analysis of time stamp relational data, that is series of events originated from a sending entity and directed to a receiving entity, have been developed. Recently, Vu (2012) proposed a model based on the assumption that the observed series of relational events is the realization of a temporal marked point process, in which a sender entity has the opportunity of initiating an event, and conditional on this opportunity, a receiver entity is chosen. The opportunity of initiating an event and the choice of the receiver are modelled by statistics expressing the effects of past events and/or exogenous factors on future events. A distinctive characteristic of the model proposed by Vu (2012) is that the dependence between future and past is expressed by statistics defined by a weighted count rather than on a mere count of past events. Due to the assumption that recent events are more relevant to explain future events, the weights are computed using a decay function which needs to be fully specified before estimating the model. Here, we investigate the robustness of the model to different choices of the decay function and we present a method to choose among the different specifications.

Identification and Estimation of Network Models with Heterogeneous Externalities*Tiziano Arduini, University of Bologna, Italy**Eleonora Patacchini, Sapienza University of Rome, Italy**Edoardo Rainone, Bank of Italy, Italy***Abstract**

This paper considers a linear-in-means model for spillover effects in economic networks. We generalize the standard linear-in-means model to allow for multiple groups with between and within-group interactions. We give conditions for identification of the unknown parameters and derive asymptotic properties for a 2SLS estimator that may use a large number of instrumental variables. Simulation experiments show that the estimators perform well in finite samples. We illustrate the empirical relevance of our model in the context of the policy evaluation literature. Peer effects are seen as a mechanism through which a treatment could propagate through the network. When interactions among groups are at work, a shock on a treated group has effects on the non-treated. Our framework allows for quantifying how much of the indirect treatment effect is due to variations in the characteristics of treated peers (treatment contextual effects) and how much is because of variations in peer outcomes (peer effects).

Derived networks and multimode network analysis

Vladimir Batagelj, University of Ljubljana and University of Primorsk, Slovenia

Abstract

A two-mode network is based on two disjoint subsets of nodes (modes) and each link has one end-node in both sets. Linked or multimode network is a collection of networks over at least two disjoint subsets of nodes and consist of some one-mode networks and some two-mode networks linking different modes. For example: modes are Persons and Organizations. Two one-mode networks describe collaboration among Persons and among Organizations. The linking twomode network describes membership of Persons in Organizations.

An important approach in analysis of linked networks is the use of derived networks obtained by network multiplication of compatible networks from the collection. We discuss the problem of sparsity of a product of two sparse networks and the problem of normalization of weights (fractional approach). The product of networks can be extended also to temporal networks. Several examples from analysis of bibliographic networks will be presented for illustration.

Women in science. Research collaboration in Italian Academia from a gender perspective

Elisa Bellotti, University of Manchester, UK

Luigi Guadalupi, IRIS National Research Council, Italy

Abstract

The presentation analyses the position and outcome of female scientists in the local system of public funding to academic disciplines in Italy. In specific, we look at 10 years (2001 ? 2010) of the Italian Ministry of University and Research funding of Projects of National Interest (Prin) in all the disciplinary areas: in this dataset we observe the percentage of women funded in each discipline, their role in the grants and in the academia, their tendency to collaborate across gender compared to their male counterpart, and the total amount of funding they receive in the ten years under analysis. While results presented here are preliminary, they suggest that women are still under-represented in Italian academia, they occupy less prestigious roles and overall receive less money than male scientists. Differences across disciplinary areas are discussed, and used to inform a future research agenda on the role of gender in scientific research.

Clustering Data that are Graph Connected

Stefano Benati, University of Trento, Italy

Antonio Rodriguez-Chia, University of Cádiz, Spain

Justo Puerto, University of Seville, Spain

Abstract

A new combinatorial model for clustering is proposed for all applications in which individual and relational data are available. Individual data refer to the intrinsic features of units, they are stored in a matrix D , and are the typical input of all clustering algorithms proposed so far. Relational data refer to the observed links between units, representing social ties such as friendship, joint participation to social events, and so on. Relational data are stored in the graph $G = (V, E)$, and the data available for clustering are the triple $G = (V, E, D)$, called attributed graph. Known clustering algorithms can take advantage of the relational structure of G to redefine and refine the units membership. For example, uncertain membership of units to groups can be resolved using the sociological principle that ties are more likely to form between similar units. The model proposed here shows how to take into account the graph information, combining the clique partitioning objective function (a known clustering methodology) with connectivity as the structural constraint of the resulting clusters. The model can be formulated and solved using Integer Linear Programming and a new family of cutting planes. Moderate size problems are solved, and heuristic procedures are developed for instances in which the optimal solution can only be approximated. Finally, tests conducted on simulated data show that the clusters quality is greatly improved through this methodology.

Solidarity and Competition between Collaboration Partners: An Agent-Based Computer Simulation Study of Multiplex Networks using SOAMs*Federico Bianchi, University of Brescia, Italy**Andreas Flache, University of Groningen, The Netherlands**Flaminio Squazzoni, University of Brescia, Italy***Abstract**

This study aims to understand the consequences of competition between collaborating partners on the emergence of solidarity between them. Previous research has suggested that peers engaging in economic exchanges, e.g. professional collaboration, can develop expectations of social support if trust arises between them, which fosters confidence in receiving support from the partner. Yet, these results might have been favoured by context-specific lack of competition. In order to study this, we developed a stochastic Agent-Based Model (ABM) which includes a multiplex network of collaboration, trust and social support. The model is an adaptation of Snijders' Stochastic Actor-Oriented Models simulation algorithm. By running computer simulations, we manipulated heterogeneity in resource endowment and need for social support among agents who competed over resource-rich partners for collaboration. This allowed us to study the connectivity and integration of the emergent social support networks. Preliminary results showed that competition in collaboration can be detrimental for the connectivity of the emergent social support network if resource heterogeneity was sufficiently high. Moreover, the emergent networks were highly segregated along differences in resource levels, giving rise to a core-periphery structure in the collaboration network, in which resource-rich actors found the most attractive partners to relate to. However, once heterogeneity in need for support is added, the effect of resource heterogeneity is neutralized by a 'double-edge' effect of heterogeneity on social support relations. Resource-poor but needy actors established mutual help relations due to their stronger social activity in search for attractive partners, which made them less peripheral in the emergent network than without heterogeneity in neediness. Finally, resource inequality could generate networks where integration between high- and low-resource agents was similar to what was produced without competition. Our study also showcases the potential of ABMs to expand the scope of empirical network research results.

Networks of Co-production in Science*Michał Bojanowski, University of Warsaw, Poland***Abstract**

Collaboration in science takes many forms. Some of these forms, such as providing substantive research input, can be understood as contributing resources to collective "projects". We propose a mathematical model of intellectual collaboration that is based on the following assumptions: (1) scholars do research and write scientific publications; (2) each publication consists of a finite set of research components/pieces; (3) scholars are characterized by a finite set of skills that enable them to create above mentioned components, but with varied effectiveness; (4) scholars form collaboration ties to pool their skills and work more effectively. We analyze the model analytically and with computational methods. We discuss implications for actor-oriented modeling of dynamics of collaboration networks.

The complexity of knowledge - a network approach*Tom Broekel, Utrecht University, The Netherlands***Abstract**

Measuring the complexity of knowledge has long been on the agenda of various fields in the social sciences. For example, technologies have been understood as complex adaptive systems wherein complexity is defined as a function of the number of knowledge components, their recombination patterns and their interdependencies (Fleming & Sorenson 2001). However, when being empirically measured, traditional approaches exclusively make use of the classification scheme of patents (Fleming & Sorenson 2011). In another (more recent) approach, economic complexity has been studied on the basis of the spatial distribution of export products, namely the method of reflection (Hidalgo & Hausman 2009). However, the method of reflection creates a black box, as the ubiquity of products/technologies can have multiple reasons among which complexity is only one potential source. Crucially, existing approaches of measuring complexity, do not take into account social interactions, as the main source of the recombination process. The aim of this paper is to develop a new measure of technology complexity. I extend the knowledge diversity based perspective by considering the complexity of technology advancement systems from a network perspective. For the latter, I make use of the theories on complex systems and those of social networks. The conceptual foundation is translated into a new technology complexity measure. More precise, by estimating the diversity of inventors patenting activities, mapping co-inventor interactions jointly with their citation behavior, I evaluate the complexity of more than 500 technologies.

Innovative tools for European rural development: A network approach for the evaluation of social capital and governance in LEADER*Antonio Bubbico, University of Padua, Italy**Elena Pisani, University of Padua, Italy**Catie Burlando, University of Padua, Italy**Laura Secco, University of Padua, Italy***Abstract**

This paper proposes an analytical method and a visualization tool to monitor and evaluate social capital as promoted by the Local Action Groups (LAGs) of the EU-funded LEADER (Liaison Entre Actions du Développement de l'Economie Rurale) approach.

The proposed method allows to measure structural and normative-cognitive forms of social capital and related governance aspects, subdivided into 15 dimensions, 33 sub-dimensions and 78 indicators corresponding to different levels of aggregation. The method is based on data collected through three surveys, respectively to directors, members and beneficiaries of nine LAGs across Italy.

Social capital is visualised through an interactive tool, configured as a network where nodes represent the coded survey questions, the indicators, the sub-dimensions, dimensions, and the forms of social capital and governance. The ties of the network link questions to indicators first, and then to different sub-dimensions, dimensions and forms, depending on the rational of the analytical framework used. The size of the nodes graphically shows the endowment of social capital at different levels of aggregation. The network is interactive, since the user may decide to look at only one node and its links. Moreover, by clicking on a node directly onto the main screen it is possible to open a window called "statistical fiche" which provides summary statistics on the item selected. The proposed tool contributes to the analysis of social capital supported by LAGs. If a LAG decided to adopt this tool to collect data during different times of the programming period, it would be able to verify its capacity and progress in promoting social capital among its members and beneficiaries over time, by using a longitudinal assessment.

Modelling interdependent ego-networks

Alberto Caimo, Dublin Institute of Technology, Ireland

Paolo Campana, University of Cambridge, UK

Isabella Gollini, Birkbeck University of London, UK

Abstract

Ego-networks consist of a focal node ("ego") and the nodes to whom ego is directly connected to ("alters"). We present an Bayesian latent variable network modelling framework for describing the connectivity structure of interdependent ego-networks (network of ego-networks) by using latent space approach. This allows us to visualise both the ego-ego and ego-alter relational structures by estimating the positions of all the individuals in a latent "social space". We apply this new methodology using an efficient variational algorithm in order to explore the structure of human smuggling network out of Libya (operation Glauco I) consisting of 29 interconnected ego-networks and involving more than 15 thousand alters.

Deep learning for Bank distress in news and financial data

Paola Cerchiello, University of Pavia, Italy

Giancarlo Nicola, University of Pavia, Italy

Peter Sarlin, Hanken School of Economics, Finland

Samuel Rönnqvist, Åbo Akademi University, Finland

Abstract

In this paper we focus our attention on the exploitation of the information contained in financial news to enhance the performance of a classifier of bank distress. Such information should be analyzed and inserted into the predictive model in the most efficient way and this task deals with all the issues related to text analysis and specifically media analysis.

Among the different models proposed for such purpose, we investigate the so called deep learning approach, based on a doc2vec representation of the textual data, a kind of neural network able to map onto a reduced latent semantic space the initial bag of words structure.

Afterwards, a second supervised neural network is trained combining new data with standard financial figures to classify banks whether in distressed or tranquil states, based on a small set of known distress events.

Then the final aim is not only the improvement of the predictive performance of the classifier but also to assess the importance of news data in the classification process. Does news data really bring more useful information not contained in standard financial variables? Our results seem to confirm such hypothesis

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Segregation with Social Linkages: Evaluating Schelling's Model with Networked Individuals*Roy Cerqueti, University of Macerata, Italy**Luca De Benedictis, University of Macerata, Italy***Abstract**

In the 1970s Thomas C. Schelling [1969, 1971a, 1971b, 1978] presented a series of models where the heuristic choice of individuals about staying or moving out from a neighborhood would generate a segregated city notwithstanding individual agents' preferences over residential integration. The mild micro preference about majority of its own group generates macro segregation. We propose an extension of the Schelling model that allows individuals to be connected by social links and we highlight the contrast between Schelling original heuristic and the role played by social connections in characterizing the long-term dynamics of the model.

The main technological trends and the evolution of social networks: the Russian context

Svetlana Chernozub, Federal Research Centre "Computer Science and Control" of Russian Academy of Sciences, Russia

Abstract

The resource of trust and civic solidarity that could be mobilized to support innovation plays an important role (R. Putnam, F. Fukuyama). So this paper offers a new methodological contribution to study social networks as a basic condition for the effectiveness of an innovative product. I mean blockchain technology, the basis of the Economics of trust and a new stage in the development of social networks. The trust in blockchain is not limited by the credibility of the Protocol or a "smart contract". The composing of a block chain and its existence, are impossible without trust in the cooperation among the participants of blockchain communities. Therefore, the attractive consequences of the expansion of blockchain technology could be in the countries with developed institutions of civil society. In Russia, as elsewhere in the world, there are many enthusiasts, who see the blockchain as the technological trend and social innovation. The problem is that in Russia the state is traditionally stronger than the society and the level of trust between people, their ability to prompt self-organization, and thus the receptivity the country to technological innovation, according to many experts, is low. Therefore, it is the scene of a fierce competition between different generations of social networks: centralized and decentralized. If the "independence of cyberspace" (J. Barlow) in the case of a centralized network depends only on the goodwill of the person who controls the information storage unit, the decentralized network (blockchain), by definition, has no single point of failure. How serious is the Russian leadership fears the unpredictable consequences of development of blockchain shows lasted for three years, the discussion of the so-called Law about bitcoin, which is to determine the state's attitude to its most famous product the blockchain technology.

Board Network Structure across the U.S.*Tuugi Chuluun, Loyola University Maryland, USA***Abstract**

This proposed study examines the structure of board networks of firms across the U.S. Many individuals serve on corporate boards of multiple firms effectively creating a network of direct and indirect ties among firms. A preliminary data analysis of the directors of 3,838 unique firms that were included in the S&P 1500 Index from 1996 to 2013 shows that all the firms were connected to at least one other firm during any given four-year period. Centrality, cohesion, and diversity of firm networks based on board interlocks may vary across the U.S., and I examine whether local economic environment, location, culture and other local factors have an impact on the structure and characteristics of these networks. I also examine the effect of network structure on various corporate governance outcomes. The subject of board connections and interlocks has become the focus of considerable research in finance. However, most of these studies examine how the existence of interlocks affects various firm practices such as corporate finance policies and earnings management. Very little work is done on the determinants of board network structure or the variation in board network structure across the country. Hence, this interdisciplinary study can make significant contributions to the growing body of research on social networks in finance and economic geography.

A Mixed Methods Approach to Measuring Scientific Collaboration Network in an Italian Community

Rita Cimmino, Federico II of Naples, Italy

Anuška Ferligoj, University of Ljubljana, Slovenia

Giancarlo Ragozini, University of Naples Federico II, Italy

Anja Žnidaršič, University of Maribor, Slovenia

Abstract

Scientific collaboration describes when scientists employ a mix of formal and informal activities when working together. In the social network analysis, it has mainly been analysed by using quantitative approaches with a particular focus on formal collaboration. This reflects the fact that formal ties can more easily be collected by using, for example, the usual methods for retrieving data from research catalogues. Informal ties, instead, require alternative and specific ways for collecting data that often require the scholar's engagement in the collection process. In the present paper, the use of the mixed methods approach to investigate different types of scientific collaboration is explored and the results of a research study conducted in an Italian scientific community are described. First, we chose to analyse the co-authorship network to detect how the authors formally collaborate. Second, we employed in-depth interviews and a web survey to measure informal relationships and cover other formal types of collaboration (e.g., collaboration in a project, co-membership on an editorial board, mentorships). The results show that co-authorship is only a partial indicator of collaboration and adopting a mixed methods approach to data collection can be extremely useful when analysing a scientific collaboration network.

Bounding Dyadic Interactions Using the Network Structure

*Matteo Cinelli, University of Rome "Tor Vergata", Italy
Giovanna Ferraro, University of Rome "Tor Vergata", Italy
Antonio Iovanella, University of Rome "Tor Vergata", Italy*

Abstract

The study of assortative mixing in networks represents an interesting possibility to investigate homophilic patterns even when we possess information about nodes that goes beyond their degree. The analysis of assortative mixing is performed using two main approaches. The first is based on a second order network metric introduced by Newman and called assortativity coefficient to discrete characteristics. The second approach introduced by Park and Barabási, uses a third order network metric, more related to the occurrence of certain dyad types and to the dyadic effect, i.e. to the phenomenon that occurs when the number of links between nodes sharing a common characteristics is larger than expected if the characteristics were distributed randomly on the network. The dyadic effect is analysed through a methodology that considers all the possible configurations of a binary characteristic over network nodes using a phase diagram which lies into a two dimensional space constrained by certain upper bounds. Current bounds are computed a-priori considering either particular networks arguments or the number of featured nodes, which results in a space that is often much larger than necessary. Our contribution consists in the improvement of current upper bounds and in the introduction of two lower bounds to reduce the region where the dyadic effect takes place. This reduction is performed through considerations related to structural arguments surrounding a given network and mainly rooted in the degree sequence of the network under investigation. Indeed the degree sequence contains many information about the potential presence of particular sub-structures as cliques or stars whose maximum order represents a first approximation to the occurrence of specific dyad types. The obtained bounds use analytical arguments and are computed independently of the network size. The proposed bounds lay the bases for computationally efficient studies of homophily.

Network Environmental Governance: the case study of Vesuvio National Park

Fabio Corbisiero, University of Naples Federico II, Italy

Luigi Delle Cave, University of Naples Federico II, Italy

Ilaria Marotta, University of Naples Federico II, Italy

Abstract

During the last years, the social sciences are discussing about the issues of participation, collaborative management (Borrini Feyerabend, 2000) and co-management (Borrini Feyerabend, 1997), with regard to the management of protected areas, in particular wildlife parks. Behind these themes there is the concept of environmental governance, which combines the application of environmentally sustainable behaviors to participatory culture. The main crux of the natural parks management becomes, therefore, to implement a conscious and open governance (Graham et al, 2003), surpassing the system of constraints, rules and barriers.

Starting from these reflections, the paper presents the early results of a research on the governance of Vesuvio National Park, using analytical and methodological categories of Social Network Analysis. The main purpose is to show the differences between formal and informal networks in which the actors are involved, moving on two analytical levels: the first level (reconstructed through a desk analysis) is represented by the formal dimension of relations between the actors that current legislation identifies as actors who manage the processes of governance, within a framework that situates the natural parks as nodes of regional, national and international systems; the second level, instead, (realised through interviews with stakeholders) reconstructs the configuration of informal networks that impact on the management of parks and that act in the perspective to making the protected area a resource (economic, social and cultural) for the local community, pro-active part in the governance of protected areas processes.

Detecting political instability and conflict risk by means of control-charts

Marcella Corduas, University of Naples Federico II, Italy

Giancarlo Ragozini, University of Naples Federico II, Italy

Abstract

The identification of key factors and thresholds signalling an increasing risk of crises in weak and fragile countries is the ultimate goal of early warning systems for conflict management. The conventional approach relies on causal models that combine structural and dynamic indicators in order to produce a global representation of countries. These models are generally designed for predictive purposes and often assume that the involved explanatory variables change very slowly. The use of such models for prediction is difficult because the data available from international open-source providers are annual, published with a large delay (two or more years) and, in the case of fragile countries, affected by a massive presence of missing values. Moreover, those models are rarely able to take external influences and interference in the political scenario into account. For this reason, it is important to search for new tools that rely on alternative data-bases in order to get an updated representation of current events that may generate social and political instability, and conflicts. The integration with classic approaches will help to provide a more comprehensive and accurate picture of the current state of a given country. Specifically, we consider the GDELT database that provides a real-time, open-source index of the world's news media. We discuss how control-charts can help to establish a statistical system control procedure, based on recorded news, that automatically detects the emerging of out-of-control conditions. The main problems concerns: a) the identification of the keywords that identify the phenomenon under monitoring ; b) the choice of the type of control-chart to be used; c) the extension of the control scheme to take the autocorrelation of the observations into account. The proposed methodology is applied to the events generated by the Boko Haram insurgency in Nigeria.

Network analysis as a method of information retrieval: an application concerning the elite topic*Enrico Cristoforetti, Univeristy of Trento, Italy***Abstract**

Every research starts by retrieving important articles in order to review the literature concerning the topic of interest. Usually, the following methods are used. 1) Making a query with an academic search engine and instancing for each retrieved article semantic and value properties until the time devoted to review literature runs out. 2) Making a query with an academic search engine, ordering the output by number of citations and reading only the articles whose quotations exceed a certain threshold. 3) Asking suggestions to someone considered an expert of the field.

After having showed some shortcomings of these methods, I propose a new method which I argue capable to deal with them: the network analysis on a citation network. This method, since it uses network analysis techniques and works with large datasets, is argued to enable a deep, global, and not factious, description of the studied field, and a clear definition of the semantic similarities between studies.

An application of this method is provided by analyzing the citation network regarding the elite topic. Two graphs had been built (using data from Web of Science core collection) and analyzed in order to enhance the reliability of the clustering. The first was a directed graph constituted by articles and the direct citations between them. The second was an undirected valued graph where two articles were connected if they had been co-cited. Clusters have been detected in two ways: using the Community Louvain algorithm for the directed network and using the Island algorithm for the undirected one. Partitions have been compared via Cramer's V: they are highly similar.

Then, using the directed graph, for each article by community has been calculated the proximity prestige in order to estimate its value and, finally, a list of the most important essays for each field concerning the elite topic is provided.

Generating random networks with a given blockmodel structure by considering triads and other local network structures

Marjan Cugmas, University of Ljubljana, Slovenia

Anuška Ferligoj, University of Ljubljana, Slovenia

Aleš Žiberna, University of Ljubljana, Slovenia

Abstract

Based on many empirical observations and theories about social processes, several types of global structures were defined over the last 50 years by, e.g., Cartwright and Harary (1956), Davis (1967), Holland and Leinhardt (1971). The list of all allowed and forbidden types of triads for each global network structure was also proposed. Based on this, one can test the hypothesis regarding the global network structure. The presentation addresses the question of generating networks with a given global structure, where different global structures are defined by different blockmodels (Wasserman and Faust 1994, Doreian et al. 2005). To check whether only considered triads are sufficient to generate the networks with a given blockmodels, two methods are used: the method of relocating of links (RL method) and less deterministic Monte Carlo Multi Chain algorithm (MCMC algorithm) implemented in Exponential Random Graph Modeling (ERGM) R package. It can be shown that considering only different types of triads is enough to generate networks according to the most of analyzed types of blockmodels. Yet this is not true for hierarchical blockmodel structure without complete blocks on the diagonal where additional restrictions are needed. Cartwright, D., & Harary, F. (1956). Structural balance: a generalization of Heider's theory. *Psychological review*, 63(5), 277. Davis, James A. (1967). Clustering and Structural Balance in Graphs. *Human Relations* 20 (2), 181-187. Doreian, P., Batagelj, V., & Ferligoj, A. (2005). *Generalized blockmodeling* (Vol. 25). Cambridge university press. Holland, P. W., & Leinhardt, S. (1971). Transitivity in structural models of small groups. *Comparative Group Studies*. Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications* (Vol. 8). Cambridge university press.

Structural holes and tie redundancy in scientific exchange networks*Dominika Czerniawska, University of Warsaw, Poland**Michał Bojanowski, University of Warsaw, Poland***Abstract**

On some fundamental level, we can think of scholars as actors possessing, or controlling, various types of resources. Engaging in scientific collaboration requires a lot of time and energy to provide resources needed to reach desired outcome. In principle we should assume that in scientific collaborations scholars combine resources they control and share the outcomes according to agreed terms in contrary to passing resources from one to another. The more diverse resources a scholar is engaging into a collaboration, the more time- and energy-consuming a collaboration becomes. In order to reduce the engagement a scholar may decide to invite an additional collaborator to delegate the responsibility for providing some of the resources directly to herself and to other common collaborators. We argue that such process should lead to higher specialization levels in densely connected subgroups (more redundant ties, less opportunities to bridge structural holes). The study is based on 40 individual in-depth interviews. Data contains information about collaboration ego networks and resources engaged in collaboration by egos and alters. Resources are coded into several large categories like knowledge and skills, funding, connections. Every ego-alter relation is described with sets of resources engaged by each party. We explain the diversity of resources engaged in different collaborations with the extent of structural redundancy between corresponding collaboration ties. The measure of redundancy is based on the connectivity and embeddedness of alters being compared (geodesic distance and number of shared partners after removing ego-alter ties).

Causal inference with networked observations

Bruno Arpino, Pompeu Fabra University, Spain
Luca De Benedictis, University of Macerata, Italy
Alessandra Mattei, University of Florence, Italy

Abstract

Causal inference can be confounded by the presence of a network structure among the individuals exposed to a treatment. The effect of a treatment can be transmitted to untreated individuals through her own connections in the network. This indirect effect on the potential outcome depends on the structural characteristics of the network. In this paper we explore, via a simulation study, how the structure of the individual linkages affects cause inference.

The efficiency/security trade-off: testing a theory on criminal networks

Tomáš Diviák, Charles University in Prague, Czech Republic and University of Groningen, The Netherlands

Jan K. Dijkstra, University of Groningen, The Netherlands

Tom A. B. Snijders, University of Oxford, UK and University of Groningen, The Netherlands

Abstract

The efficiency/security trade-off hypothesis has become prominent in the field of criminal network analysis, although it has been empirically tested in only a small number of studies. The history of this idea dates back to early 90's with studies pointing out the crucial need for concealment in criminal networks. This hypothesis states that criminal networks and actors involved in them generally manoeuvre between Scylla and Charybdis of immediate profit from its activities (efficiency) and working slowly towards long-term goals while remaining undetected (security). Whether the structure is efficient or secure depends on the goal of the particular network – networks driven by financial profit (e.g., drug traffickers) are supposed to opt for efficiency, while networks driven by ideology (e.g., terrorists) are supposed to opt for secure network structure. Although network characteristics related closely to this thesis are mainly density and centralization, I argue that in order to properly test the thesis, it is essential to formulate network mechanisms behind security and efficiency. Based on these mechanisms (e.g., closure, brokerage etc.) the exponential random graph model is specified and fitted to a sample of criminal networks of both aforementioned types. Parameter estimates are subsequently metaanalyzed. In the discussion, I propose to refine the theory by accounting for network dynamics, their environment as well as for other types criminal networks such as gangs or corruption networks.

The impact of personality of friendship and conflict formation*Evgenia Dolgova, RSM Erasmus University, The Netherlands**Olga Kornienko, Arizona State University, USA***Abstract**

How does personality affect social network formation in organizations? We study how the Five Factor personality traits affect friendship and conflict to shed light on the origins of the social network dynamics and the evolution of multiplex relationships. We examine these associations in data collected from marching band that serves as a model system for a large social organization. Participants ($n = 193$; 53% female; M age = 19.4 years, 62.1% European-American) provided panel data on friendship and conflict networks and Big 5 personality at the beginning and end of a training season. Stochastic actor based modeling of social network dynamics (RSiena) reveals that individuals who are open to experience, extraverted and neurotic are less likely to befriend others. People prefer agreeable and extraverted individuals as friends, and do not establish friendship to individuals who are open to experience. Our data show that individuals prefer to befriend others who are similar to them in terms of extraversion (homophily), and are different to them in terms of emotional stability (heterophily). Openness to experience proves to be an asset in avoiding conflict, and extraverted individuals experience more difficulties with others, while agreeable band members bond faster with others. This study contributes to the literature on antecedents of social network dynamics by illustrating how personality affects friendship and conflict dynamics in groups.

Some Interesting but Major Problems while Studying Signed Networks

Patrick Doreian, University of Pittsburgh, USA and University of Ljubljana, Slovenia

Abstract

Despite considerable success, the balance theoretic approach to studying signed relations has encountered some serious problems, both substantive and methodological. The more consequential problems are outlined along with arguments for why solving them is so critical. An agenda of research problems is laid out with many juicy problems to solve. The focus here is about looking to the future to identify problems whose solutions hold the potential for transforming the field. There are some juicy and interesting problems to chew upon when studying signed networks. It will certainly be an exciting and fun ride for those pursuing it.

Overlapping Communities and Network Structure

*Carlo Drago, University of Rome "Niccolò Cusano", Italy
Germana Scepi, University of Naples Federico II, Italy*

Abstract

The presence of different communities represents a relevant feature of most networks. In particular, the community detection can be seen as a way to find different communities on a network and to detect the nodes belonging to the same community. The essence here is that nodes of the same community are highly similar while on the contrary, nodes across communities present low similarity. But, in many real networks, communities overlap and the nodes belonging to more than one community spread the information among the different communities (see Jierui Xie, Stephen Kelley, Boleslaw K. Szymanski 2012 for a review).

In this paper, we propose a strategy for identifying the structural role of the key nodes in overlapping communities. We will show the effectiveness of our propose on different simulated data sets.

Bayesian Nonparametric Modeling of Dynamic Contact Networks*Daniele Durante, University of Padua, Italy**David B. Dunson, Duke University, USA***Abstract**

Real world networks are often associated with a dynamic component, and the development of statistical methodologies to learn how the connectivity patterns among interacting actors are wired across time is a fundamental goal in many fields of application. The accurate characterization of these processes allows deeper insights in many complex phenomena, while providing inference and prediction strategies in different dynamical systems, covering social and epidemiological processes. Although the number of available contributions in statistical modeling of dynamic networks has registered an exponential growth in the recent years, current proposals still raise open questions about inference, flexibility and computational tractability. Motivated by time-varying data on face-to-face social interactions, I will present recent Bayesian nonparametric models for dynamic networks which characterize the edge probabilities as a function of actors's positions in a latent space, with these positions changing in time via Gaussian processes or nested Gaussian processes. These formulations have theoretical justification and incorporate flexibility along with adaptive dimensionality reduction, allowing improvements in posterior computation, inference and prediction of future contacts.

Clustering and Partitioning in Two-mode networks

Martin Everett, University of Manchester, UK

Abstract

In this talk we shall look at methods for finding cohesive subgroups/communities in two-mode networks. First we shall suggest a sharpening of terminology drawing a distinction between cohesive subgroups and communities (this terminology would apply equally to single mode networks). We shall then review the methods that have been proposed drawing from both the social network and network science literature. We shall compare and contrast the different approaches using the classic Davis dataset as the canonical and over analyzed example. In particular we shall carefully draw distinctions between methods that simultaneously form groups consisting of both modes and methods that independently cluster each mode and then combine these clusters in different ways. Finally we discuss extensions to datasets that consist of more than two modes and issues with more complex forms of multimode data.

System-Wide Cultural Districts: A TWC Approach. Case studies from Sweden

Guido Ferilli, IULM University, Italy

Massimo Buscema, University of Colorado, USA

Pier Luigi Sacco, IULM University, Italy

Abstract

We analyze the spatial patterns of organization of cultural activities and facilities in various local contexts in South-West Sweden with the help of innovative network-based analytic techniques. We extrapolate some deep structural features of the spatial profile of activity and in particular investigate the role of culture in the local socio-economy and possible policy approaches to unleash its full developmental potential through simulation analysis. The conceptual background of our analysis is the notion of System-Wide Cultural District, already developed in the literature, that illustrates how culture may act as an organizational gateway among different value chains in deploying local development dynamics. Through the comparative analysis of various local cases, we show how our methodology can provide the basis to a new perspective of analysis of particular interest for cultural economists, cultural geographers, and regional scientists.

Round Table: "challenges in social network research"

Anuška Ferligoj, University of Ljubljana, Slovenia

Abstract

The last two decades there has been a huge interest in network research across the social scientist and natural scientists. Hidalgo (2016) argues that social and natural scientists have diverging academic goals. *'Social scientists focus on explaining how context specific social and economic mechanisms drive the structure of networks and on how networks shape social and economic outcomes. By contrast, natural scientists focus primarily on modeling network characteristics that are independent of context, since their focus is to identify universal characteristics of systems instead of context specific mechanisms'* (Hidalgo, 2016). He argues that these diverging academic goals prevent social scientists and natural scientists to understand and collaborate with each other. Nevertheless, there are some attempts to overcome these differences (e.g. one of the goals of the previous ARS conferences was to connect research efforts in network research of social scientists and natural scientists) and there is some convergence towards the general network analysis.

Borgatti et al. (2009) state that for social scientists, the theory of networks has been a gold mine, yielding explanations for social phenomena in a wide variety of social sciences disciplines. There were many different social network approaches, methods and models proposed. Many of them were picked up by natural scientists but there are several ones that are very specific for social science and are developing only in the social sciences, e.g. ego-centered network approach, network measurement issues (e.g. different survey measurement instruments, estimating the quality of network data).

In the ARS round table the trends and future development of social network analysis will be discussed, especially those topics that we assume scientists in the other field are not interested in. Several very esteemed social network researchers working on different social network topics were asked to participate at the discussion on the future of social network analysis. Also how to overcome the gap between social network analysts and network natural scientists will be discussed.

Evaluating balancing on social networks through the efficient solution of graph clustering problems*Rosa Figueiredo, Université d'Avignon, France***Abstract**

One challenge for social network researchers is to evaluate balance in a social network. The degree of balance in a social group can be used as a tool to study whether and how this group evolves to a possible balanced state. On the one hand, the solution of clustering problems defined on signed graphs can be used as a criterion to measure the degree of balance in social networks. For example, this measure can be obtained with the optimal solution of the correlation clustering problem, as well as a variation of it, the relaxed correlation clustering problem. However, solving these combinatorial optimization problems is no easy task, especially when large network instances need to be analyzed. On the other hand, classical well studied community detection algorithms designed to process only positive links could also be applied to evaluate balance in a social network, resulting in easier optimization problems. We study the relevance of negative links for graph partitioning problems related with structural balance. We first discuss the efficient solution of some clustering problems defined on signed graphs and then we compare the solutions obtained with the ones obtained by a classical community detection algorithm. For this purpose, we extract and analyze a collection of signed networks representing voting sessions of the European Parliament (EP).

Using Two-Mode Networks to Examine Leadership Challenges in Educational Contexts*Kara Finnigan, University of Rochester, USA**Alan Daly, University of California, San Diego, USA**Kim Garrison, University of Rochester, USA***Abstract**

This study uses administrative records from the Chicago Public Schools to examine the connectedness among educators resulting from ongoing leadership churn in the district. Our study involves a longitudinal two-mode network design to study the movement of assistant principals and principals across the district given the turmoil resulting from high-stakes pressures as well as accountability policies that result in staffing changes. We seek to understand whether this high level of churn has an unintended positive consequence of connecting low performing and high performing schools in some instances and whether in those situations the schools move off of accountability sanctions. Over three academic years we examine three time points per year to study the ego networks of leaders and their affiliations to different schools. Our focus is on the schools that are facing sanctions under accountability policies to see whether there are patterns relating to the schools that were able to move off of sanctions and the connectedness of these leaders. For example, if a principal moved from a high performing school to a low-performing school and then to another low-performing school during the three-year period this establishes a tie between each of these schools, which helps to diffuse best practices from the high performing schools in a way that may, ultimately, increase the likelihood that a school will move off of sanctions. While social network analysis is becoming more widespread in educational research, few studies use two-mode network data and even fewer focus on leaders within educational system (with the exception of our own prior work). This underexplored area is extremely important because the most challenging districts across the country continue to struggle to improve. Through this study of low-performing schools and educator churn in Chicago, our study seeks to move research relating to low-performing schools and improvement forward both conceptually and methodologically.

Semantic Knowledge Detection in Open-ended Questionnaire

Giuseppe Giordano, University of Salerno, Italy

Michelangelo Misuraca, University of Calabria, Italy

Ilaria Primerano, University of Salerno, Italy

Abstract

In this work we focus on the definition and analysis of a text-graph structure as a device for the interpretation of a theoretical concept. Concepts are multidimensional in their own nature and they can be investigated by a set of open-ended questions in a survey. We consider a questionnaire organized in several sections constituted by one or more open-ended questions. The questionnaire's sections correspond to the essential features of the concept under investigation. For instance the concept of "friendship" could be defined by different semantic dimensions, like altruism, empathy, tolerance, etc. Investigating on these specific features we may obtain a representation of the concept as a whole. The set of answers to each question become a bag of words provided from all respondents. In the framework of network data, they can be represented by slices of a multilayer network. Analytic tools of Social Network Analysis allow to explore and interpret this peculiar data structure. The network representation provides a simple and efficient way to visualize the connections among texts, while their statistical analysis may highlight a useful description of a concept through the investigation of such relations. A pair of words is connected if they are both used in the same answers. The frequency of co-occurrence can be used as a weight of the link and can be normalized according to different criteria (e.g. Term Frequency, TF-IDF, etc.). The main goal is to identify patterns of related words and the network core of all the words for all the layers jointly considered. In such a way, we will discover the latent meaning in a coherently way with the emerging definition of the concept. A case study will be used to illustrate some interpretative rules of the proposed approach.

Applications of Tensor Decompositions for Analysis of Citations Networks

Vladimir Glazachev, National Research University Higher School of Economics, Russia

Dmitry Ignatov, National Research University Higher School of Economics, Russia

Alexandr Semenov, National Research University Higher School of Economics, Russia

Abstract

The main task of the study is a description of the niches around which the Russian sociological journals and publishers are structured. For that purpose we collected a dataset from the Russian Index of Scientific Citations (RISC) which contains not only citations network but also allows us to work with journal publisher network, topics, related to journal, and other journal meta-data which can be used to construct 2-mode networks. Although this kind of networks have long been studied, to the best of our knowledge, tensor decomposition has never been used in the domain of bibliometrics. Tensor factorization/decomposition techniques (i.e. PARAFAC) can be applied to such problems as authority ranking, community detection, projection into one-mode graph, using all the additional information. Our work investigates its application to the citation networks of journals and publishers. We can work with this data separately or build projections (i.e. LSA) into same dimensions, but for a complete analysis it is natural to construct 3-dimensional tensor where each of its slices represents an adjacency matrix for one relation type or two relations represented dynamically in time. For each of the journals, information was collected about publishing organizations and citing organizations. In addition, we included data on the age of the journal, publisher, impact factor, publication volume, profile. This information was used to classify publishers (State, Private Commercial, Private Educational, Private, NGO, Russian Academy of Sciences) and the journals themselves in the following types: Bulletin, Interdisciplinary Journal, Multidisciplinary Journal, Sociological Journal, Other. Based on this data, we were able to analyze the structure of the scientific field of Russian sociology and type of niches that exist there. We will demonstrate the numerical experiments and how they contribute to the results obtained with traditional network analysis approach.

Extending latent variable models for complex relational data*Isabella Gollini, Birkbeck University of London, UK***Abstract**

Recently there has been a growing interests in probabilistic analysis of networks. The amount of information available on the nodes is often very large, we may have access to diverse types of actor attributes and relational connection between actors. And generally, these attributes and connections are often in strong relation.

We extend the Bayesian framework of latent variable network models to combine the information given by heterogenous relational structures in order to identify latent traits or groups, visualise network data and predict missing links and nodes.

We adopt a variational approach to estimation which turns out to improve considerably the computational efficiency. The analysis is carried out with the *lvm4net* package for R (available on CRAN).

Defining r/The_Donald: An examination of the roles of moderators and users in the norm-setting of online communities*Ella Guest, University of Manchester, UK***Abstract**

Online communities often have the freedom, and responsibility, to define their own community norms. The social news site Reddit is an example of a platform that imposes no editorial control over content produced. Reddit's administrators instead encourage users to create topic-based forums, called subreddits, according to their own desires and to develop unique standards of acceptable behaviours. A small number of community members who volunteer as moderators together with the wider community of nonmoderating contributors work to define the purpose and tone of their subreddits, and detail a code of conduct for participating in the space. These developments are made both implicitly and explicitly and can highlight irreconcilable desires within the community. As such Reddit makes a fascinating subject of study for gaining understanding of the techniques and methods members and moderators of online communities use in the delicate process of norm-setting.

This research represents a pilot study in to potential methods for identifying the role of community members and moderators in creating and redefining community norms. This first stage examines a recent and highly public example of a subreddit in flux - r/The_Donald, a forum for supporters of US President Donald Trump. Since its creation in July 2015, when Trump announced his intention to run for the Republican Party nomination, the subreddit community has had numerous difficulties agreeing on accepted aims and behaviours. This research uses social network analysis techniques to identify changes in the network of r/The_Donald moderators over time, determining the presence of distinct moderation eras. It is hypothesized that these moderation eras correspond with different eras of community norms and standards. Text analysis techniques are then used to examine whether shifts in the moderator network correspond to shifts in the informal community discussions and formal moderator controlled standards of behaviour – i.e. the implicit and explicit sources of community norms on r/The_Donald.

Georg Simmel and the triadic structure of competition: A biographical network approach?*Claudius Haerpfer, Goethe-University Frankfurt, Germany***Abstract**

The German philosopher and sociologist Georg Simmel (1858-1918) is known today, as one of the predecessors of the science of networks. Relevant in this context is among others his work on the quantitative conditioning of the group. Therein are important thoughts on the triadic structure of the social world. The presentation aims in a first step to reconstruct these remarks systematically in the light of his use of the concept of Interaction and with a side glance on his work on competition, where one can find similar structures. In a second step a passage of Simmel's academic biography serves as an empirical example. This passage contains Simmel's starting position as student of the founders of early German folk psychology, Lazarus and Steinthal, and his thereof resulting difficult positioning at the philosophical faculty in Berlin, where he was forced to compete with Dilthey's protégé Max Dessoir, which finally led to his unpaid extraordinary professorship.

Dynamics of segregation: Investigating the the role of endogenous network effects for the change of ethnic friendship segregation in 190 swedish classrooms

Robert Hellpap, University of Oxford, Nuffield College, UK

Abstract

With growing possibilities for collecting social network data and methods of analysis, research of friendship segregation has received increasing attention. However, the interdependent character of social network data poses also new challenges to theoretical implications and drawn conclusions from conducted research. One of such challenges is the example of how homophily as a process can lead to a segregated network state. As some previous research points out, endogenous network effects (such as transitivity) can amplify low tendencies of homophily leading to strongly segregated networks. With the increasing availability of longitudinal network data, this allows to extend that notion to get a better understanding on the role of such endogenous effects for the change of levels of segregation in networks. First, stochastic actor oriented models are applied to investigate how different theoretically derived scenarios could lead to the segregation of cross-sectional network observations. Scenarios differ by accounting for different group-specific endogenous network effects (transitivity, reciprocity and popularity) as well as homophily. Networks are simulated by estimating SIENA models from an empty network to the first observation with differing rates of change and then compared to the segregation of observed networks. Second, simulated and observed networks are then compared with regard to predicting the change of segregation for longitudinal data based on absence or presence of different group-specific network structures. The observed longitudinal data stems from a sample of 250 Swedish classrooms from the CILS4EU-project.

Brazilian agrarian reform promoting the emergence of a new middle class? opportunities and threats empirical evidence from a social network study in 3 settlements in Northeast Brazil

Carla Inguaggiato, Training Center for International Cooperation, Italy

Abstract

There is an on-going debate on the role of agrarian reforms in fostering social and economic development between pro-poor and pro-market reforms (Borras, 2003). In contrast with a neutral vision of pro-market development, we focus on the role that different organizations had in implementing the reform.

The context of analysis, 3 agrarian reform villages in Northeast Brazil, selected based on extreme case sample, are quasi-natural experiment in terms of village composition and network creation as they include both old and new settlers and family farming sector represents a complete innovation for the context. A unique database, collected by the author, based on extensive field-work and household survey, allowed to describe households' socio-economic characteristics and to map, intra-village networks ties (kinship, friendship and labor exchange) among all households permanently residing, in the three villages along with a description of the history creation of the three villages and the personal trajectories of new and old settlers.

The main argument is that the different visions of the organization that led the process of agrarian reform namely social masses mobilization versus emergence of an agrarian entrepreneurship had an effect both on the typologies of households recruited and networks' configuration: more inclusive versus more segregated.

A new definition of the clustering coefficient through a social interaction perspective

Antonio Iovanella, University of Rome Tor Vergata, Italy

Roy Cerqueti, University of Macerata, Italy

Giovanna Ferraro, University of Rome Tor Vergata, Italy

Abstract

Networks can be considered as a valuable representation of many complex systems. In particular, the presence of weights in the arcs and the nodes formalizes quantitatively the relevance of the actors involved in the graph and the entity of their interactions. In this context, the clustering coefficient of a node i captures the local cohesiveness of such node by considering also the clustered structure, with a peculiar reference to the intensity of the interactions of i with its neighbors. The conceptualization of the clustering coefficient of i moves from that of the triangles associated to i . This work proposes a new definition of the clustering coefficient of a network when nodes are viewed as “socially” interacting. At this aim, we advance a novel concept of triangle, which is not here viewed necessarily as a closed loop. Specifically, the presence of strong connections between two couples of nodes (i,j) and (i,k) provides by transitivity a (indirect) connection between (j,k) , even if the associated arc does not exist. The offered framework provides a justification of several real-world network models, which will be extensively discussed. Moreover, some simulations will be carried out to compare the standard concepts of clustering coefficients with the one proposed here.

The Detection of Collaboration Networks of Editors in Russian Wikipedia

Dmitry Kafflik, Federal Research Center "Computer Science and Control" of Russian Academy of Sciences, Russia

Michael Aleksandrovich Sheeraj, Federal Research Center "Computer Science and Control" of Russian Academy of Sciences, Russia

Abstract

We present a mechanism of unfolding and analysis of the edit history of articles in Russian version of Wikipedia (<https://ru.wikipedia.org/>) that allows us to make an estimate of quantitatively contribution of the author to total volume of edits chosen category (theme). We present, visualize and analyze more than 130 000 articles of logged authors (those who created a personal account to participate in the project). The methodology we used permits us to identify the stable virtual collaboration networks on the data from different thematic categories of the Wikipedia. A quality metric estimation of the author contribution is established based on the received quantitative assessment. This metric allows us to distinguish the affiliation criteria of the author to the virtual collaboration. Besides the comparative analysis of the existing collaboration networks in connection with statistical data from the Wikipedia was performed.

Modelling Online Social Network Users by Attitude to Key Events

Iliia Karpov, National Research University Higher School of Economics, Russia

Innokentii Lebedev, National Research University Higher School of Economics, Russia

Abstract

This study implements the mathematical model that represents Online Social Network (OSN) actor as a set of sentiment vectors in the multidimensional space of topics. We perform state of the art entity based sentiment detection method to determine user's attitude to the specified sentiment object and combine sentiment objects to topics with AdaGram distributional semantics model. Supposing that the user has the same attitude to the topic i.e all sentiment objects inside, we limit topic growth by natural threshold – new sentiment object can be added to the existing topic only if all users have no attitude contradictions between new object and the topic. Resulting list of topics describes key problems, discussed by the given set of OSN users so that each user in the set can be described as a vector of topics labeled with his attitude to them.

Effective solution of the described task was limited by low quality of the natural language processing of texts, written by OSN users. The latest results in automatic sentiment detection, based on deep neural network architectures shows F1 measure 0.6-0.7, that makes them efficient enough for generating a dataset suitable for model training. Our evaluation is based on the analysis of political groups in Russian segment of Facebook and Vkontakte social network. We study communities, involved into the discussion of the Russian Revolution in 1917 and political aspects of recent elections to the lower house of the Federal Assembly in 2016. The first dataset contains 5 862 posts and 375 236 comments, written by 67 388 actors and the second dataset includes 67662 posts and 5 523 399 comments, given by 390 288 actors.

The following research questions are addressed in this work: whether the proposed model is commutative - can the user be described by mean vector of his groups and will the group post messages like its average user? What comes first, user post scripting or group membership? Does OSN actors tend to be homophilic in their discussions within the proposed model?

Proposed method can be used for collaborative filtering, political and sociological surveys. The model can be used to predict community reaction to the given newsmaker before it will be widely widespread in the OSN.

Using Text Clustering for Social Network Data Filtering

Ilya Karpov, National Research University Higher School of Economics, Russia

Galina Gradoselskaya, National Research University Higher School of Economics, Russia

Abstract

The any Social Network Analysis tasks can be effeciently accomplished by text analysis methods. One such task is the formation of a relevant actor dataset for a given topic. Text clustering and topic modelling can greatly simplify the task of selecting the relevant nodes of the network, giving the answer to such questions as "Which actors are interested in the given topic" and "Which topics are interesting for this group of actors". Based on the homogeneity of the actors hypotheses and using the iterative analysis of a small initial sample by means of network and text analysis, the researcher can generate a detailed sample for his research problem. We present an efficient method and software tool for iterative cluster and network analysis that allows the researcher to collect and filter the research collection with a simple visual analysis tool. Proposed method can be applied in different areas from the analysis of citation networks to measuring the influence models in Online Social Networks. The tool supports Russian and English languages and can use external data collection libraries.

Bayesian hierarchical modelling of longitudinal networks*Johan Koskinen, University of Manchester, UK***Abstract**

We review current and recent developments to longitudinal network modelling that attempt address heterogeneity. We focus on the framework for modelling multiply observed networks implemented for stochastic actor-oriented models in RSiena. The canonical data structure consists of networks with school classes observed for multiple school classes. This translates directly to longitudinal networks across different organisations but there are also other types of data for which the framework applies with minor or greater modifications. We discuss some of these extensions and the associated modifications and limitations. For example, egonets require carefully consideration of the node set definition. Furthermore, the hierarchical framework allows us to investigate how network-level effects affect the tie-formation process as well as different context may be related either through meaningful relations ties or observed or unobserved characteristics. An example of the former can be that the role of homophily may be different depending on gender composition. When the hierarchical model is applied to model heterogeneity over time for a single network we might expect autocorrelation in the way parameters change over time. The emphasis put on either inferring processes on the tie-level on the one hand or on the network level on the other has implications for the number of networks needed for inference. We explore this issue by reference to different classes of hierarchical prior distributions.

Multiple Imputation for Stochastic Actor Oriented Models*Robert Wilhelm Krause, University of Groningen, The Netherlands**Mark Huisman, University of Groningen, The Netherlands**Tom A. B. Snijders, University of Oxford, UK and University of Groningen, The Netherlands***Abstract**

Missing data on network ties are a fundamental problem for network analyses. The biases induced by missing edge data, even when missing completely at random (MCAR), are widely acknowledged. In this paper we present a new method to handle missing data due to actor non-response in the framework of stochastic actor oriented models (SAOMs). We compare the standard procedure of handling missing data within SAOMs with multiple stochastic imputation in a simulated setting. The proposed method imputes missing tie variables in the first wave using Bayesian exponential random graph models (BERGMs) and imputes missing tie variables in later waves utilizing a SAOM. Because the underlying data was completely observed and missing data was simulated, we are able to estimate the biases of both methods. The results have relevant implications for the analysis of network dynamics as the proposed method allows for more reliable estimation of SAOMs on networks with actor non-response.

The Network of Agriculture Value Added Trade in Sub-Saharan Africa

Valerio Leone Sciabolazza, University of Florida, USA

Davide Del Prete, FAO, IMT School for Advanced Studies Lucca, Italy

Abstract

Global Value Chains (GVCs) represent a golden opportunity for supporting the on-going transformations of the Sub-Saharan African agriculture and food market but, at the same time, the complex structure of their connections may also play a fundamental role in the transmission of shocks from external agents to the domestic economy. We argue that network analysis represents a privileged way to look at how these idiosyncratic shocks can be propagated and amplified. For this reason, in this paper we investigate the nature and dynamics of Global Value Chains in the context of Sub-Saharan agro-food trade from a network perspective. To this aim, we map the EORA multi-regional Input-Output tables into a global value network, where nodes are represented by the individual sectors in different countries and edges are the value-added trade relationships. Our purpose is to investigate the statistical and structural characteristics of the network architecture and its evolution over time, in order to assess the stability of these regional flows, identify possible sources of systemic vulnerability, and determine the impact of political alliances and trade agreements on their organization. Our result is an assessment of the fragilities of the network and a number of mitigation policies for the reduction of systemic risks and external shocks.

Evaluating the impact of scientific networks on academic productivity at a research university

Valerio Leone Sciabolazza, University of Florida, USA

Hector Hugo Sandoval Gutierrez, University of Florida, USA

Perihan Saygin, University of Florida, USA

Abstract

Access to knowledge is crucial for the development of new and innovative ideas. In the last 20 years, an increasing number of scholars have explored the role of scientific collaborations in connecting a diverse pool of knowledge and in reducing the cost of access to information, as well as their effect on scientific productivity. Along this line of research, in this paper we explore the importance of intellectual interactions among the scientists in the University of Florida, the state's flagship university, as channeled by their network of publication co-authorship between 2008 and 2014 (approximately 5,000 nodes and 20,000 edges). Assessing the significance and the magnitude of the effect of interactions on academic productivity contributes to the literature on social interactions and scientific networks, and provides policy implications encouraging academic collaborations. An inherent selection effect arises in the formation of co-authorships. We use data on spatial and social proximity of investigators to account for this endogeneity problem. After controlling for endogenous co-authorship formation, unobservable heterogeneity, and time varying factors, we find a positive impact of intellectual collaboration on individual performance, measured in terms of success rate for grant funding.

Global warming is different from Racism: on the price of polarization in Wikipedia*Juergen Lerner, University of Konstanz, Germany***Abstract**

In this talk we treat the question whether controversy and disagreement among Wikipedians is harmful for team productivity and article quality. It can be shown that undoing and redoing edits often displays network patterns predicted by structural balance theory which, in turn, gives rise to factions of users that appear to be mutually in conflict. We hypothesize that extreme polarization of the team of contributors can lead to irrational behavior where users undo even high-quality edits that seem to support the opposite point of view. Such opinionated editing could explain low quality of the produced article. Several ways to tackle this hypothesis will be presented.

Social support networks and social integration processes for immigrants

Rosaria Lumino, University of Naples Federico II, Italy

Elena De Filippo, University of Naples Federico II, Italy

Salvatore Strozza, University of Naples Federico II, Italy

Abstract

In recent years many scholars have been more and more interested in exploring the association between personal networks and social integration processes for immigrants.

As widely known, the availability of social support networks for immigrants in the country of destination is crucial to modulate the impact of first settlement (Gurak and Caces 1992; Massey, Arango et al. 1993; Palloni, Massey et al. 2001) and to foster social integration. Of course, the effects of social support on social integration depend on the different relational patterns on which personal networks are based and on the type and amount of resources that networks can provide (Ryan et al. 2008; de Miguel & Tranmer 2010). From this angle, networks characteristics in terms of structure and composition could have powerful implications for the type of support that immigrants receive, the self identification in the country of destination they form, and the interactions they experience (McPherson et al. 2001; Lubers et al. 2008).

Here, our particular interest is to explore the association between ego-networks characteristics and social and economic integration processes for immigrants. We focus on two ethnic groups, Sri Lankan and Ukrainian, by using data from a more comprehensive survey on living conditions for immigrants living in a Southern Italian city (Naples). We adopt an ego-centric network approach in order to address three main issues.

First, we aim to describe and explore the structure of social relationships that immigrants activate in order to obtain different kind of supports. Second, we investigate the main factors that affect the amount and variety of resources embedded in the immigrants support networks. Third, we analyse the relationship between the social support patterns embedded in the ego networks and the degree of social and economic immigrants' integration.

Determining valid adjustment sets to compute total causal effects*Marloes Maathuis, ETH Zurich, Switzerland**Markus Kalisch, ETH Zurich, Switzerland**Emilija Perkovic, ETH Zurich, Switzerland**Johannes Textor, Radboud University Medical Center, The Netherlands***Abstract**

Covariate adjustment is a widely used approach to estimate total causal effects from observational data. Several graphical criteria have been developed in recent years to identify valid adjustment sets. These criteria can handle multiple causes, latent confounding, or partial knowledge of the causal structure. However, their diversity is confusing and some of them are only sufficient, but not necessary. We present a criterion that is necessary and sufficient for four different graph classes: directed acyclic graphs (DAGs), maximum ancestral graphs (MAGs), completed partially directed acyclic graphs (CPDAGs), and partial ancestral graphs (PAGs). We also provide an adaptation for CPDAGs with background knowledge. Our unified criterion will be illustrated in several examples.

Of Trees and Monkey. Explaining the technological specialization of European regions*Mario Agostino Maggioni, Catholic University of Milan, Italy**Emanuela Marrocu, University of Cagliari, Italy**Erika T. Uberti, Catholic University of Milan, Italy**Stefano Usai, University of Cagliari, Italy***Abstract**

The technological and productive specialization of regions has always been an important issue both from a theoretical and empirical viewpoint. While globalisation and the ICT revolution have transformed the geography of production, contrary to some early prophecies (such as “the World is Flat” and “the Death of Distance”), which forecast the irrelevance of location, they have spurred the importance of regional specialisation in order to compete (or even survive) in the global arena. The question about how regions develop and evolve along their productive and technological path has been recently raised in many scientific fields. We believe that a region is most likely to develop new industries or new technologies which are closer to its pre-existing specialization. The theoretical framework behind this approach is a mix of “recombinant growth” (RG, Weitzman 1998) and “localised technological change” (LTC, Atkinson and Stiglitz, 1969): new technologies emerge from the recombination of existing knowledge, skills and competences, and that technological, spatial and social proximities are crucial to develop new knowledge, skills and competences.

Our research builds on a stream of literature (Hausman and Klinger, 2007; Hidalgo et al. 2007; Hidalgo and Hausman, 2008) initially conceived for a country-based analysis in order to map the evolution of industrial specialisation based mainly on trade flows. We refocus this line of analysis on the regional European technology/knowledge space in order to investigate the evolution of regional specialisation in terms of the interaction of (i) endogenous processes of knowledge recombination, (ii) exogenous technological paradigm shifts and (iii) trans-regional spatial and technological spillovers and networking dynamics.

The results show that both LTC and RG significantly influence the sector-region RTA. However, while LTC of first order proximate sectors is relevant for both the macro (regional cospecialisation) and the micro (co-classification in patents) representations of the knowledge space, the LTC attributable to higher order neighbouring sectors is relevant only in the former case and RG is effective only in the latter case. We also find evidence of negative spillovers generated by proximity in space, possibly due to competition effects, and positive externalities generated by socio-technological proximity.

Networks Studies In Russia: Structure Of A Scientific Community

Daria Maltseva, National Research University Higher School of Economics, Russia

Ilya Karpov, National Research University Higher School of Economics, Russia

Abstract

The exclusion of Russia from the context of social sciences during the Soviet period has led to certain lags in some areas. Network analysis, recognized as an independent discipline in the 1970-80's in American and European science, is one of these areas not so well-developed in Russia. However, in recent years we can observe the growing number of scientists who implement SNA instruments into their studies in different disciplines (sociology, economy, political studies, management, etc.). This emerging community of Russian scientists involved into network research is the main subject of our study. We consider it as important not only from epistemological view, but also from practical point of field's development. Distinguishing clusters and main groups of knowledge exchange among network scientists in Russia, we can observe whether they see each other as competitors or "invisible colleges", interact with each other or prefer some "significant others". Such mapping could be the first step on the way to increase the possibility of scientists' cooperation. We analyze the citations in articles devoted to network topics published in Russian scientific journals. The data is taken from the electronic library of Russian-language scientific periodicals eLibrary.ru. Using the key words corresponding to network studies, we collected the initial data set of more than 8 000 articles. On the second step, we collected all the references mentioned in the bibliography lists of the initial articles. Combining the data from initial and secondary sets of articles, we can build networks of citations between native and foreign authors, thus representing the structure of the community of network scientists in Russia. This study contributes to the studies in the field of sociology of science, as well as to those focused on the SNA development in different national scientific traditions.

Innovation Clusters as Collaboration Networks: Principles of Governance and the Role of Communication

Viacheslav Maracha, The Russian Presidential Academy of National Economy and Public Administration, Russia

Tatiana Krasnikova

Abstract

Innovation clusters are considered as nodes of a territorial innovation activity with synergetic effect which expressed in mutual competitiveness growth of their components. The main background of these synergies is informal knowledge exchange, generation of new value chains and enterprise projects. Analyzing clusters we distinguish three main types of the organization structures: hierarchical, market and network. Correspondingly in the western countries at different stages of evolution the organization of innovative activity relied on various leading subjects. There are "classical" corporations, "plain" corporations and startup companies, innovation clusters. In turn, the cluster organization has passed two stages of formation: - industrial clusters (without innovation specifics) which based on market cooperation for creation of value chains; - innovation clusters based on the collaborative network organization and creating additional competitive benefits due to informal knowledge exchange. The survey results of 12 Russian clusters show that in some developed Russian regions there are appeared a number of industrial clusters, but rarely innovation clusters. For describing the network nature of innovation clusters the model of a flexible, adaptable and informal form of organization (adhocratic management) offered. It is based on collaboration networks which provide the deliberative communication and interaction between stakeholders and management. So, essential factor of innovation features emergence is the presence of a network management structure. In cluster network organization one of the nodes accepts a role of the «kernel» providing the coordinating and infrastructure functions. The relations between the «kernel» and other nodes (elements of a cluster) look like a «vertical» structure, but in fact they are based on a voluntary delegation at the «kernel» of the sovereignty of the cluster elements without being forced. In general, the cluster elements relationships are saved as market and hence, horizontal.

Marginal modelling and Variational Nonparametric Bayes for Relational Events

Antonietta Mira, University of Italian Switzerland, Switzerland and University of Insubria, Italy
Stefano Peluso, Catholic University of Milan, Italy
Francesco Bartolucci, University of Perugia, Italy

Abstract

In many relational contexts, a set of events is observed, with each event involving a group of actors. Current relational data analyses suffer from two limitations: (a) the representation of an event through edge variables may lead to a loss of information when the events generate a set of multiple relations rather than bilateral connections or ties (b) clustering of actors in the latent social space embedding their closeness strongly depends on a prespecified number of clusters. To fully exploit the information of relational events, we model an event as a binary vector of response variables representing actors that participate to the event. Univariate and bivariate distributions of the events are parameterized by a marginal model with clear social interpretation. Furthermore, a variational approach for latent space models with clustering induced by Dirichlet Process Mixtures can infer the number of components and keep the computational burden under control.

Galois Lattice and Positional Dominance*Maria Mircea, Technical University of Munich, Germany**Jürgen Pfeffer, Technical University of Munich, Germany***Abstract**

Galois lattices can be used to analyze two-mode data, containing actors and affiliations. They can be applied to study the structure of a network, e.g. to identify groups. Galois lattices are used to define hierarchical structures among the data by using set theory. The position of a node in the graph is defined by its relations to the adjacent nodes. This paper aims to give insights into the concept, definitions, and inner working of Galois lattices. Furthermore, we discuss how Galois lattices are highly related to the recently introduced concept of positional dominance, which describes a relation between two nodes based on their neighborhoods. Both, Galois lattice defined by a algebraic set theory and positional dominance defined by the network relation coincide in their definition for binary two-mode networks. We demonstrate that by utilizing a reduced labeling approach, all paths from the global lower bound to the global upper bound of a Galois lattice determine exactly the definition of positional dominance applied on two-mode networks. By comparing path lengths starting either in the global upper bound or global lower bound, hierarchical levels can be identified. Hence we conclude that a Galois lattice describes positional dominance and hierarchical levels among actors and respectively among affiliations.

Scientific community of Russian Sociologists: Network Analysis of Biographical Interviews

Stanislav Moiseev, National Research University Higher School of Economics, Russia

Daria Maltseva, National Research University Higher School of Economics, Russia

Abstract

The main purpose of our study is to reconstruct networks of interactions between the key figures of the Soviet and Russian sociology. We will examine different types of formal and informal networks (based on professional, educational and other relationships). It will provide the basis for the allocation of generations of Russian sociologists, and will help us to trace the history of the development of sociology in the USSR and Russia. Additional methodological purposes of the study are to develop procedures of transferring data from biographical interviews in a form suitable for network analysis and to test opportunities and constraints of the BORIS (Biography Oriented Research Information System) program for the analysis of biographical interviews. Our project contributes to the studies devoted to the analysis of the collaboration networks between scientists and complements studies of the community of Russian sociologists and its history conducted by other authors.

Do our personal networks bias our online choices?

Gabriela Morales Martinez, The University of Sheffield, UK

Abstract

The information people choose (in the form of opinions, advice or ideas) determines to a great extent the knowledge they acquire (Bartheleme, Ermine, & Rosenthal-Sabroux, 1998; Nonaka, 1994). However, due to our species' limited cognitive capacity, and in order to forego the costs of individual learning, people have evolved to acquire knowledge through social learning processes like teaching, language and imitation (Mesoudi, 2011). Yet, with almost half of the world's population making use of the internet (Internet Live Stats, 2015) and given the amount of information that is being produced and consumed by users, online communities have had to implement different structures that simplify the sharing of information. But at the same time that these structures simplify and tailor the information we need, they also make us prone to obtaining biased knowledge (Kahneman, 2003; Tversky & Kahneman, 1981). Specifically, in recent years, social networking sites and content communities have exploited users' personal networks in their websites. This research will focus on how this affects the transmission of information in online environments, drawing from evolutionary theory of knowledge transmission within groups. The researcher will conduct a quasi-experiment using an educational virtual environment, questionnaires and focus groups, to unravel the impact that personal networks can have in online choices. The findings of this research are expected to be applied in a wide range of topics including user-generated content, online reviews, and educational online environments.

Beyond Artistic Individualism: Social Networks Analysis and Artists Interactions

Dafne Muntanyola-Saura, Autonomuos University of Barcelona, Spain

Abstract

Is artistic practice necessarily interactive? Discourse about the creative process is the product of a particular habitus (Mauss; 1936; Bourdieu, 1979, Muntanyola-Saura, 2017) that is inscribed in the individualism of distinction (Simmel, 1908). Still, artistic practice is a social activity that takes place in space and time and includes elements such as other participants, schedules, norms, objects, tools, accessibility, funding and clients. Increasing individualization brings awareness of the need for being strategic. Artists create their work with an eye on how it will be distributed Becker (2014). The current market is a restrictive epistemic community within a singularity regime (Heinich, 2014). Our claim is that while extreme strategic individualism is part of the artists professional identity, there artistic practice has an interactive dimension that builds their professional carrer. Our objective is to represent the personal networks of artists from different communities (visual arts and dance) to analyze the mobilization patterns of contacts that are part of their social capital. Methodologically, we collected out data from two cognitive and visual ethnographies, one on Wayne McGregor Random Dance Company in London, the other on EART visual arts community in Barcelona. Through a mixed- methods analysis with Egonet, ELAN and ATLAS.ti softwares, our findings show importance of contacts to move forward professionally. So artists build their professional careers by accumulating and managing these personal networks that emerge during their education, work and daily life. We see how brokers such as friends from university of family friends are important figures for explaining artistic success. Also, the place of contact mobilization deems relevant: formal education seems to be the main source for collaborations. Finally, social factors such as gender and cultural capital seem to shape the type and volume of contacts that are mobilized by the artist.

Social network analysis and environmental management: the case of groundwater contamination in the Lombardy plain*Arianna Musacchio, University of Pavia, Italy**Viviana Re, University of Pavia, Italy**Elisa Sacchi, University of Pavia, Italy***Abstract**

Groundwater supplies nearly half the world's drinking water and around 43 % of all water consumed in irrigation. Despite the advances in scientific knowledge and the increasing regulations for its protection, in some areas groundwater contamination still represents a major environmental concern. Therefore, sustainable groundwater management requires a shift towards a more holistic approach that could permit to consider the social implications of environmental investigations. To test the effectiveness of Social Network Analysis in integrating the social dimension in groundwater-related investigations, a socio-hydrogeological assessment was performed in the Lombardy plain (Italy). Groundwater in the region is extensively exploited to sustain human activities, and increasing trends in contamination have been observed over the years. The investigation was conducted in the framework of the INTEGRON project, funded by the CARIPLO Foundation (Grant number: 2015-0263), targeted to evaluate the role of groundwater in contaminants removal and storage. The stakeholder analysis was performed to identify which group of actors is likely to support the correct implementation of new groundwater management practices resulting from INTEGRON. To this end, a Stakeholder Network Analysis was carried out using the Net-Map toolbox, involving different groups of key-informants: authorities, farmers, researchers and trade unions. Each group was asked to draw an Influence Network Map, showing their perception of the relationships (technical information exchange, control and authorization, advice, money flow, conflicts), the influence level and the economic or environmental priorities of the involved stakeholders. Network centralization measures were hence computed and the differences in perception between the groups were assessed. The complexity of the networks and the emerging multiple perceptions, confirm the need to enforce a holistic approach in groundwater investigations. Social network results a powerful tool to evaluate the interface between environment and society and to reach a more comprehensive representation of the links between groundwater and human systems.

Mapping the informal organizations through the activities of the activists: the case of the self-organized spaces in the city of Naples

Pasquale Napolitano, IRISS, National Research Council, Italy

Rita Lisa Vella, University of Salerno, Italy

Pierluigi Vitale, University of Salerno, Italy

Abstract

Contemporary cities seems aimed at increasing new configurations of urban life where “bottom-up” initiatives will play a central rule. The Naples associative dimension “from below” is an excellent case study due to characteristics forms and methods that put it as a unicum at national and international level.

At present there is a cluster of varied vocation spaces in strong territorial proximity, a kind of community hub based right on the informality of its activities, impacting on the territories through forms of action that complement and enable the social capital of the territory. The added value of this phenomenon is constituted precisely by its lack of organizational formalization and consequent adaptive dynamics of their capabilities. The informal archipelago (Latouche, 1993), a sub-fund of western economies that responds to its own rules, not easy to decode because of atypical logics, Therefore, they should be considered and analysed firstly as “a form of social life”.

The contribution is to investigate a methodology of mapping the network of these organizations, by virtue of their organizational informality, exploiting the potential of data mining from social-media platforms in a user generated way. The basic assumption is that no formal organization is composed mainly by the dust of its activists, hence the need of methods to capture this social capital. It will also be necessary to be able to meet the social capital of such organizations, to verify their relations and key relational topic.

The aim is to equip the policy maker with a tool to evaluate the action of informal organizations - both in terms of networks and geographical coverage that the definition of the activities undertaken - which at this time are set as a strategic asset for the urban development, as they are a self-organizational response to the radical crisis of the welfare policies.

Identities in Hybrid Environments: Socio-Semantic Approach*Aleksandra Nenko, ITMO University, Russia***Abstract**

In this paper we trace identity formation in hybrid environments applying socio-semantic network approach. We analyze self-managed artistic teams uniting professionals with different identities – artists and managers. We base our theoretical framework on Bourdieu's concepts of the logic of field and the logic of practice and the interaction between the two. Traditionally taken professional identity is defined by the logic of field (Bourdieu, 1993); the logic of art field induces artists to seek novel modes of representation to achieve symbolic recognition (Bourdieu, 1993; Crane, 1989; Giuffre, 1999). The logic of cultural management field forces managers to act along with utilitarian and goal-oriented norms to ensure market success for artists and art organizations (Bendixen, 2000; DeVereaux, 2009). However, joint practice of artists and managers involved in collective projects might mould identities and result in new interpretations of the latter. In order to trace the dual impact of fields and practices on artists and managers identities we employ socio-semantic network analysis to study two art collectives based in Madrid and Barcelona, using ethnographies, interviews, sociometric surveys and texts by team members as research data. On the one hand, the analysis gives evidence that identities of artists and managers are formed in accordance with the logics of fields. Activities of managers and meaning structures shared by them correspond to pragmatic efficiency-oriented norms and values. Simultaneously, activities of artists and meaning structures inherent to them are focused on artistic tools and conceptual basis for art projects. On the other hand, in both collectives activities and meaning structures different from traditional role division are observed. For example, in both cases managers reflect on conceptual side of art while artists dwell upon organizational sustainability of projects. Blended meanings and mixed activities give evidence that joint practice endows the identities of managers and artists with new understandings.

The disciplinary homogeneity in the university departments after Gelmini- law: an exploratory analysis using social networks

Eugenia Nissi, University G. D'Annunzio, Italy

Fabrizio Muratore, University G. D'Annunzio, Italy

Abstract

The law n. 240/10 so-called Gelmini-law has re-regulated the entire university system (Vesperini, 2009) by addressing strategic issues for the development of universities: the organization, the system of evaluation of the universities, until the recruitment and the legal status of teachers (Battini, 2011; Bologna and Endrici, 2011). At the bottom of the reform-law, there is the assertion of a different model based on a process of selective use of resources in which the assessment to be carried out according to the objectives and strategic guidelines set by the Ministry, plays a central role in the verification of "quality" of the results achieved by each university (Natalini, 2011). In terms of governance, the Gelmini-law identifies the figure in the department within which to gather the exercise "of functions aimed at the conduct of scientific research, education and training activities and the activities related to them facing outward or ancillary" assuming the elimination of the current faculty (Carlioni, 2011) and the possibility of joint and connecting structures constitute the second level with functions of coordination across departments in them grouped. The purpose of this paper is to carry out an exploratory statistical analysis in order to verify how the scientific principle of homogeneity required by Gelmini-law was applied. The methodology used in this work was that of social networks. In particular, we considered twelve departments that belong to the disciplinary scientific sectors of area 13. The analysis will focus on the new formed departments in the universities classified "medium" (with an enrollment of between 20000 and 40000) located in central Italy. Through the methodology of Social Network Analysis will be analyzed for each department, networks resulting from the aggregation of the sectors, and for each of them will be provided appropriate descriptive measures. Next, we point to put a co-sector data matrix (binary and weighted ties) and a hierarchical analysis in cliques of the scientific disciplinary sectors. Finally, we discuss the results finding the reasons that actually the University still do not become a homogenous research center.

Using twitter data to evaluate italian constitutional referendum campaign

Lucio Palazzo, University of Salerno, Italy

Francesco Santelli, University of Naples Federico II, Italy

Abstract

The development of online social media is having significant effects on the contemporary political dynamics.

In Italy, while in previous years the politicians relied on tradition mass media sources, during last constitutional referendum, that took place in December, 4th 2016, the debate between the two opposite factions arose strongly on social networks, such as Twitter.

From a Twitter network based dataset, it is possible to detect most popular hashtags related to referendum topics, then, it is possible to identify two distinct classes of users: for and against the referendum question.

The hashtags choice is made both taking into account the literature reviews and the analysis of the occurrences, leading to a two-mode network analysis made by hashtags and users.

The purpose is firstly to figure out who were the most important Twitter influencers of the campaign for the "Yes" and for the "No" by analysing the hashtags that marked strongly the two fields.

After that, using the information about influencers and hashtags, it will be shown how to use Twitter as a useful tool to predict the global trend in the key moments of the dispute before the referendum day.

These are only words: a social network analysis investigation on young italian poets*Sabrina Pedrini, AlmaMater Studiorum-Bologna University, Italy**Cristiano Felaco, University of Naples Federico II, Italy***Abstract**

What role does contemporary Italian poetry play in actual society? What the role and the dynamics in young contemporary art languages? This work, placed in a wider work on contemporary art languages, drawing from extensive survey, and interview data gathered in Italy, explores the social dynamics and the interactions between young Italian poets and the other member of the "poetic Italian network" in order to understand better what are the dynamics and who are the gatekeepers in contemporary artistic fields. While the network is spread, with heterogeneous actors, the trend is clear: through the formal social network analysis methods (SNA) the paper finds that, in this low density network, full of isolated experiences, publishers are crucial to poetry economies and personal careers because they foster and maintain distribution networks for contemporary poetry in a marketplace that tends to "squeeze out". However we also find that the new on line activities, thanks to peers, are giving to everyone a way to survive and to spread poetics and language. The live activities (readings, festivals) are still strategic connect actors each other. The analysis in this work allows us to understand what are the limits in this sector and, above that, even in this field, Italy "is not a country for young people".

Estimating the size of regional innovation network through a capture-recapture approach*Elvira Pelle, University of Trieste, Italy**Domenico De Stefano, University of Trieste, Italy**Susanna Zaccarin, University of Trieste, Italy***Abstract**

In recent years a relevant issue in the analysis of regional innovation policies supporting collaboration between firms and other organizations (e.g.: other firms, universities, research centres, etc.) is to evaluate the impact of such policies on the personal network of the targeted firms in a given region. To deal with this issue, it becomes of primary importance to have a reliable estimates of the size of innovation networks.

In this work, we propose a novel use of capture-recapture approach to estimate the size and the composition of the personal networks of firms involved in regional innovation networks. Capture-recapture is a statistical method widely used to estimate the size of hidden population using two or more samples drawn from the population. The number of individuals observed in a sample and the number of those observed in both samples is used to estimate the number of those not selected in any sample. The method can be also used if two or more incomplete and overlapping lists of ascertained cases from different sources are available.

We apply the proposed method on data from a survey conducted on a sample of 536 companies located in Friuli Venezia Giulia (a region in the north-east of Italy) who participated in the POR-FESR 2007-2013 call, named "Innovation, research, technology transfer and entrepreneurship". The collaboration ties they claimed to entertain with other organizations (also not regionally bounded) before and after their participation to the call will be considered as the two lists on which the proposed capture-recapture approach is applied. The idea is to account for unobserved ties (and thus to estimate the network size of companies) using the number of ties observed only before or only after the participation to the call and the number of ties common to both.

Capturing communities dynamics through latent space models*Sonia Petrone, Bocconi University, Italy**Isadora Antoniano Villalobos, Bocconi University, Italy***Abstract**

The study of the temporal evolution of networks and relational data is of crucial relevance and has seen a growing interest in the recent years. In this talk, we propose a dynamic extension of popular latent space models, that, in particular, may capture the temporal expansion or contraction of a community.

In the static case, latent space models envisage that each actor has a position in a latent social space. The probability of a relationship between two actors depends on individual covariates, and on the distance between them in the latent space. The latter term allows to model residual dependence in the adjacency matrix, through row-column exchangeable errors. We extend this model by introducing a temporal evolution in the "sociability" parameter which governs the dispersion of the actors' positions in the latent space. Such evolution is described through a hidden Markov model, where we allow the number of states to be unknown. This leads to a Bayesian infinite hidden Markov model for dynamic networks which extends the latent space representation and can well describe the communities evolution.

Social similarity and spatial proximity in inter-organizational collaboration networks: A longitudinal study

Anna Piazza, University of Greenwich, UK

Francesca Pallotti, University of Greenwich, UK

Abstract

According to extant literature, spatial proximity is one of the most important factors affecting inter-organizational resource transfer. The main idea underlying this argument is that risks and costs associated with resource transfers make collaboration more likely to occur between physically proximate organizations. Building on the theoretical distinction between physical and social spaces, in this paper we test the conjecture that the effect of geographical distance (i.e., distance in a physical space) on inter-organizational collaboration is mediated by the effect of social distance (i.e., distance between positions that organizations occupy in a relational space). Specifically, we seek evidence of an effect of social proximity on the strength of collaboration that increases as geographical distance among organizations increases. To test this conjecture we use longitudinal data on patient transfers that we have collected within a regional community of hospital organizations over a period of four years. We use the aggregate number of patient transfer events to measure the intensity of inter-hospital collaboration. We use distance in kilometers to measure spatial distance between pairs of hospitals in our sample. Finally, we use co-membership in cliques and similarity in network positions as alternative measures of proximity in social spaces. We employ a dyadic dynamic panel design to model inter-organizational collaboration as a function of geographical distance, social proximity, and of a number of organizational and institutional variables that we use to control for additional factors affecting inter-organizational collaboration. Preliminary results show that the negative effect of geographical distance on inter-organizational collaboration is mediated by different measures of social proximity, suggesting that the effects of physical and social distance need to be understood jointly.

Integrate DEA with SNA: a way to study potential networks?*Claudio Pinto, University of Salerno, Italy***Abstract**

In this paper we propose an integration strategy between a benchmarking approach as the Data Envelopment Analysis and the Social Network Analysis. The objective is to use the SNA to study the network among the entities (for example the production units) based on the strenght of the potential relationships. These latter are approximate by the DEA optimal lambda solution. Once obtained the optimal lambda square matrix we go forward to apply the SNA techniques (visualization, index analysis and so on) and study the network.

Ripple Effects: How Civility and Incivility Spread in Workplace Social Networks

Christine Porath, Georgetown University, USA

Sebastian Schorch, Universidad de los Andes, Colombia

Kristin Cullen-Lester, Center for Creative Leadership, USA

Alexander Gerbasi, University of Surrey, UK

Abstract

Over the last several decades, work has grown more interconnected increasing the importance of civil and uncivil workplace interactions for effective performance. Yet, workplace incivility has continued to rise and relatively little is known about how civility or incivility spread in social networks. Using social exchange theory, we hypothesize how civility and incivility spread through reciprocity and third party exchanges ('friends of friends'). In a longitudinal study of all employees in a research and development department of a biotechnology firm ($n = 40$), we find that civility grows through reciprocation and extension to third parties (transitive triplets). Incivility, however, does not spread in the network. Instead, the experience of incivility mounts around those that already feel treated uncivilly, without a significant tendency of spilling over to others. We discuss theoretical and practical implications.

Financial and Business Relationships in Naples during the First Globalization Era (1860-1913). A Network Analysis perspective

Ilaria Primerano, University of Salerno, Italy

Francesca Caiazzo, University of Naples Federico II, Italy

Giuseppe Giordano, University of Salerno, Italy

Maria Carmela Schisani, University of Naples Federico II, Italy

Maria Prosperina Vitale, University of Salerno, Italy

Abstract

Since 1860, European business world experienced massive international capital flows moving from the core area to peripheral countries, this way progressively realizing a process of integration, historically known as “first globalization”. The case of Naples well exemplifies this process. Grown untidily and completely lacking efficient services, it became a catalyst for broad-ranging investment projects. Groups of international business and financial actors came massively to Naples over the period of the Italian political unification, pushing such a peripheral area in the first wave of globalization. We aim to show the changing chains of relations that these groups set up around the business opportunities, arising from the city modernization projects: infrastructures (railways, harbour), urban public utilities (gas enlightenment, water supply) and urban space expansion, both in the eastern area (industrial area) and in the western one (residential quarters: Chaia, Posillipo). Naples became the hub of a complex network of relations within a space beyond the geographical and economic borders, thus being embedded in the wider process of the “first globalization”. The work is based on a unique and original database covering the whole amount of enterprises and companies operating in Naples between 1808 and 1913 (source: IFESMez). We deal with a relational approach that emphasizes both institutional, political, economic, and cultural connections between international agents and the host place. The main goal is to witness how the network of such multiple and interdependent relationships shaped during the time, how it worked and whether and how it enabled actors to continue to raise finance to foster their wide-ranging business and to cope with temporary crises.

On relational case study design

Laura Prota, The American University of Rome, Italy

Abstract

New developments in statistical network methods together with the increasing availability of network data have recently spread the application of Social Network Analysis to a variety of policy, economic and social issues. Giving this increasing interest in the application of SNA, this study aims at i) reviewing the available literature on relational case study design; ii) highlighting some of the major challenges inherent in developing a cost-effective, methodologically coherent relational case study design; iii) comparing the effects of alternative research designs on the research outcome. To illustrate this latter point, the study evaluates the implications of using different relational research designs to investigate the role of labor-related Civil Society Organizations (CSOs) in the context of Vietnam transition from party-led to “free” Unions.

From core-periphery to small-words: managing innovation networks in strategic, high-tech districts*Laura Prota, The American University of Rome, Italy**Maria Rosaria D'Esposito, University of Salerno, Italy**Maria Prosperina Vitale, University of Salerno, Italy***Abstract**

This study uses social network analysis to investigate the topology and evolution of collaboration networks in a policy anchored, high-tech district in Italy. The district involves lead firms from strategic industries such as defence, military, transports, energy, and aerospace along with public and private institutions. The governance of the district is based upon an active and formal management of project partnerships. The authors use pre-specified block-modelling to identify the structural configuration of collaboration at each time point from 2005 to 2013, tracing the evolutionary path of collaboration within the district. Empirical results show that collaboration initially took a core–periphery configuration characterized by a single, small bridging core of research organizations. After the year 2009, this core–periphery configuration cannot explain the data anymore, signalling a structural change occurred at the level of the network as a whole. An assessment of the district management strategy is provided.

Prototyping and comparing networks through Archetypal Analysis

Giancarlo Ragozini, University of Naples Federico II, Italy

Domenico De Stefano, University of Trieste, Italy

Maria Rosaria D'Esposito, University of Salerno, Italy

Abstract

In recent years, in different fields, it has become possible to observe large collections of networks referring to the same phenomenon, e.g. sets of collaboration networks, each describing different scientific field; sets of ego networks, where egos belong to the same category; sets of governance networks; sets of brain networks. Given such sets of networks, it could be of interest the comparison of networks among each other. At the same time it could be relevant the detection of a small number of representative networks that can serve as a condensed view of the entire collection of networks. In this paper we focus on this latter aim which amounts, in a statistical perspective, in finding what would be called prototypical networks able to typify the network structures starting from the observed ones. To this aim, we adopt the approach proposed in Ragozini et. al, (2016) in the framework the analysis of N statistical units, described by p variables, synthesized by a set m prototypes. The procedure we propose goes through 3 steps: i) describe a network through a mixture of features referring to local, global, and intermediate-scale (meso-scale) network structure ii) find in the space of descriptors a set of prototypes by applying the procedure proposed in Ragozini et. al, (2016); iii) find in the original space of the networks, on the base of results of the previous steps, the prototypical networks and profile them. This procedure allows us to typify the most characteristic network structures in the observed set of networks, and to have prototypical networks that are characterized by clear and interpretable profiles in terms of their most relevant features and their specificity in contrast to the others. We demonstrate via a simulation study how the proposed procedure is able to discriminate and describe different types of networks derived from several generative models.

Analysis of the influence of social networks on the innovation capacity of individuals*Desi Raulin, Toulouse I Capitole University, France***Abstract**

Individuals' innovative capacity promotes organizational performance. Knowledge creation and professional networks are strongly linked because networks play a central role in the processes of knowledge combination and exchange (Nahapiet and Ghoshal, 1998, Tsai and Ghoshal, 1998). Empirical studies carried out in research laboratories and R & D units of high-tech firms have shown that individuals' social networks favor individuals' creativity and innovation capacity (Perry-Smith, 2006, Rodan and Galunic, 2004; Obstfeld, 2005, Wang, Rodan, Fruin and Xu, 2014). Research on the relationship between knowledge diversity and social network structure neglects the role of individuals' positions in networks that may prove beneficial and foster individuals' capacity for innovation (Rodan and Galunic, 2004; Rodan, 2010, Wang, Rodan, Fruin and Xu, 2014). Researchers estimate that the personal characteristics of individuals are often neglected and tend to be treated as "residual variables" of the structure of social networks (Kilduff and Brass, 2010, Burt, Kilduff and Tasseli, 2013). The research objective is to answer the main question: How do social networks influence the innovation capacity of individuals? In order to address the current limitations of the literature and to extend this work, we propose to decompose the research question into several questions: (1) How do the intermediation and the centrality of individuals in a social network, as well as the heterogeneity of the knowledge accessed by these individuals, influence their capacity for innovation? (2) To what extent do the personal characteristics of individuals influence the innovation capacity of individuals and how these characteristics interact with variables related to social networks? In order to answer our research questions, we adopt a hypothetico-deductive approach. The design of the research is based on a complementarity of the qualitative and quantitative methodologies.

Intermittency, geography and multiplex networks*Raymond Rivers, Imperial College London, UK**Tim Evans, Imperial College London, UK***Abstract**

Most network models of spatial interactions are static. Typically, the existence of an edge or the weight of an edge reflects a relationship between two geographical nodes which is taken to be unchanged. However, if we take the 'cost' of the exchange of goods, people, etc. between two sites as an example, this is rarely fixed even if the geographical distances are unchanged. Climate variability means rain and mud can make land routes much slower, an adverse wind will greatly increase the time taken to cover the same distance with a sailing vessel while the extent of ice still impacts on modern trade. Events such as strikes or technical failures will also change the costs of interactions. We will show how to generalise spatial network models to include this type of temporal variability by using an entropy-based approach. Our model for exchange flows accommodates and combines different patterns of interaction like those above, appropriately weighted by their likelihood of occurring. This views the system as a multiplex network, with each layer corresponding to a different set of interaction costs. The inevitable constraints on interactions between sites across long time scales e.g. limited costs, benefits of consolidation, forces exchange to take place in ways which are different from those suggested by simple a priori probabilities. We will show how this occurs for exchange happening over a time period in which there is significant variation. The example we will use to motivate and illustrate our approach is the effect on Middle Bronze Age Aegean sail-based exchanges of having winds from different directions occurring with different frequencies over a summer's sailing season. This is particularly relevant for trade from N Crete, the centre of Minoan culture, to the Aegean to its north, given the dominance of Northern winds in the summer.

Rationale for a network-based overdose prevention program in rural Appalachia

Abby Rudolph, Boston University School of Public Health, USA

Jennifer R. Havens, University of Kentucky, USA

April M. Young, University of Kentucky, USA

Abstract

While overdose is on the rise globally, US fatalities are disproportionately concentrated in the rural Appalachian region. This analysis used social networks and geographic road networks to examine the potential reach of an overdose prevention program that capitalizes on existing rural drug use networks. Between 2008-2010, 503 rural persons who use drugs were recruited to participate in the Social Networks among Appalachian People Study. Interviewer-administered surveys collected information on recent sex, drug use, and social support ties. We restricted the sample to individuals with ≥ 1 first-degree alter, resulting in 448 individuals and 1380 first-degree ties. Through dyadic analyses that clustered on egos with GEE, we identified relationship-level correlates of ego-alter dyads where alters had previously overdosed. We then examined network-level factors associated with (1) having ≥ 1 first-degree alter who had overdosed (logistic regression) and (2) each additional first-degree alter who had overdosed (linear regression). While only 26% of the sample had previously overdosed, 57% were one-degree away from someone who had overdosed and 39% were within 5 miles of someone who had overdosed. On average, egos had 2.05 first-degree alters, of whom 0.81 had previously overdosed. Ego-alter dyads where alters had previously overdosed were characterized by shorter road-network distances between ego and alter residences ($AOR_{\text{miles_between_residences}}=0.99$) and relationships that were considered to be on better terms ($AOR=1.41$). Egos with ≥ 1 first-degree alter with an overdose history were more geographically central ($AOR_{\text{miles_to_town_center}}=0.97$) and occupied more central network positions ($AOR_{\text{in-degree}}=1.53$; $AOR_{\text{out-degree}}=1.36$). Similarly, the number of alters with an overdose history increased with decreasing distance to the town center ($ARR_{\text{miles_to_town_center}}=0.99$) and increasing network centrality ($ARR_{\text{in-degree}}=1.20$; $ARR_{\text{out-degree}}=1.17$). These findings suggest that strategies that target more central individuals (both geographically and based on their network positions) with overdose prevention interventions may optimize intervention reach and have the potential to curb overdose fatalities in this region.

Clustering and Network Analysis of Techno-Economic Segments Characterizing Emergent Industries*Margherita Russo, University of Modena and Reggio, Italy**Annalisa Caloffi, Università di Padua, Italy**Federica Rossi, Birkbeck University, UK**Pasquale Pavone, University of Modena and Reggio, Italy***Abstract**

To analyse the structure of networks in techno-economic segments (TES) characterizing emerging industries (photonics, space industry, ecc), we will focus on overlapping communities of agents resulting from FP7 and H2020 programmes consortia, patent application development and ownership, business structures ownership, situation of ownership and control in general (ie HQ controlling some research centres), merges and acquisitions, belonging to communities of different types. Communities will be detected by applying Infomap multilayer analysis. The main questions to which this methodology could allow to answer concern: (i) the analysis of community structure in each TES; (ii) the role of agents involved (by individuals and by category) with respect to the whole network, the individual layers and the detected communities. With regard to agents' centrality, multilayer Infomap flow is strongly correlated to eigenvector centrality and to other network centrality measures: all these measures are embedded in the structure of the network. The value added of the multilayer analysis is that it makes possible to single out the contribution of each agent (or groups of agents), of each layer and of the detected communities to the generation of the total Infomap flow. All these aspects can be investigated in their spatial (i.e. geographical) dimension. For instance, both agents centrality and multiple affiliation to communities could be affected by characteristics of the eco systems in which the agents are active. These characteristics, observed at city and regional level, are expected to drive spatial concentrations of specific typologies of agents, hence the spatial distribution of their relationships, thus adding a significant contribution to policy makers. The paper presents some methodological results of the research activity CLUES that will be further explored in collaboration with the EU "JRC B6 Digital Economy" unit ? in the EU project PREDICT (Prospective Insights on R&D in ICT).

The social network structure of young Italian contemporary art

Pier Luigi Sacco, IULM University, Italy

Sabrina Pedrini, University of Modena, Italy

Abstract

The Italian contemporary visual arts field suffers from many structural deficiencies, and in particular from its relatively marginal position in the global contemporary arts scenario. In this paper, we analyze two different samples of young to mid-career Italian contemporary artists to understand to what extent they tend to form peer networks to mutually sustain themselves in their career development. We find substantial differences in social connectedness within our sample, and in particular that relatively more successful artists tend to be more connected even if it is probably improper to speak of cooperative interactions. We discuss this interaction structure in the wider contexts of peer networks of contemporary artists from different countries as related to the level of legitimization deriving from a certain country of origin.

Collaboration in water sector: A global view*Yasaman Sarabi, University of Greenwich, UK***Abstract**

The participation of private companies in providing water and sanitary services has varied throughout the years in different parts of the world. But, in all cases, such companies have formed collaborative ties with the local authorities while engaging in PPI (private participation in infrastructure) projects. Many studies in the literature have focused on case studies, investigating activities of a particular company in a specific region or country. However, the literature does not effectively provide a holistic view of the changing patterns of collaboration between private companies and various local authorities on a global level. This work attempts to investigate the factors affecting the formation of collaborative ties between private water companies and local authorities. For the purpose of this study, the World Bank's Private Participation in Infrastructure (PPI) Project Database has been used. This database includes information on PPI trends in the developing world (low and middle income countries), covering projects in the energy, telecommunications, transport, and water and sewerage sectors; this study has only made use of the data on the water and sewerage sector. Using this database, a panel data-set has been created with private companies and countries involved in each PPI projects as senders and receivers of ties. Using the GMM (Generalised method of moments estimation) approach, this work attempts to reveal how new alliances being formed between private companies and local authorities are dependent on the previous experience between the entities involved, the success of companies in fulfilling past projects, and similarities (economically and geographically) between companies' countries of origin and the local authorities. Hence, the formations of new collaborative ties are investigated with regards to factors associated with embeddedness, centrality and homophily of entities in the network created from the data.

Characterising social structure in schools: how ethnographic data can enrich social network measurements*Marc Sarazin, University of Oxford, UK***Abstract**

Many studies of social structure in schools use name generator methods to look at whole networks of relations (e.g. friendship, dislike) between students. While enlightening, these studies point to at least two assumptions. Firstly, that students' relations, rather than interactions or co-presence, are the key determinants of social structure in schools. Secondly, that the aggregate of each individual student's relations is an accurate representation of this social structure, independently of relations that students may have with other school actors.

I problematise these assumptions by presenting results from a mixed-methods case study of a French primary school going through a collective music-making intervention. The study combines ego-network measurements with all students for several relations (including friendship and disliking) at two time points with ethnographic data collected throughout the school year, focusing on students' social lives. Through first analysing the study's qualitative and quantitative data separately and then contrasting the findings that emerge from both strands of data, the study identifies trends that either method alone would be unable to reveal. The ethnographic findings namely suggest that co-presence had a crucial influence on students' relations, in a way that was not represented in the social network measurements. The structuring of the school day meant that students were almost always co-present and in groups with other students, creating a kind of interdependency between students which shaped their interactions and relations. This co-presence made new social contagion dynamics possible, turning social contagion into a major concern for both students and adults. The study's findings also suggest that reciprocity between students could only be understood in the light of non-reciprocal relations and interactions between students and adults. Overall, the study seeks to highlight how social structure in schools can be shaped by factors which have been left out of previous studies focusing on certain student-student relations. This leads to new considerations on the kinds of data needed to fully understand social structure in schools, and to a reconceptualization of how school social structure relates to social structure in other contexts.

Stochastic actor-oriented models with measurement error

Felix Schöenenberger, University of Konstanz, Germany

Tom A. B. Snijders, University of Oxford, UK and University of Groningen, The Netherlands

Abstract

Stochastic actor-oriented models are models for analyzing dynamic network data collected by observing a network and a behaviour over time. They assume that observations are exact measurements of the process leading to the observed panel data. However, collected data might be affected by errors which might lead to the observation of incomplete networks (networks with missing information on some relationships) or biased networks (where the number of relationships of some actors are overestimated or underestimated). In this situation the observed networks are only a partial representation of the true states of the Markov chain leading the network evolution. Here, we propose and discuss a formulation of the stochastic actor-oriented models based on Hidden Markov chains to account for the presence of errors in the observed data. In this formulation the probability distribution of the observed networks conditional on the latent networks can be specified in several ways, ranging from simple probabilistic models to exponential random graph models. The sensitivity of the proposed stochastic actor-oriented model to the choice of this conditional probability is discussed.

Exploiting Social Network Analysis and Network Science in the context of policy modeling and policy evaluation

Giovanni Paolo Sellitto, Independent Scholar, Italy

Abstract

The interest in policy modeling and policy impact assessment has been steadily growing over the last year, given the importance that they have for a smart regulation approach to policy-making in the context of a specific environment. A whole bunch of tools and methodologies are nowadays applied to these purposes, there comprising some emerging opportunities, like big-data and some edge technologies like machine learning. However, the application of these tools and techniques may fall (and at times, it does fall) short of objectives if their selection is not grounded in a sound theoretical framework and if they are not backed with models that take into account all the complexity aspects that a socio technical environment (like our society) offers. In this context, Social Network Analysis and Network Science may give a valuable contribution to avoid the pitfalls of a reductionist and linearized approach to policy making (the one that is typical of the current econometric point of view) and the lack of theoretical coherence and scientific grounding that is a distinctive characteristic of some results obtained through machine learning applied to big data, which are also prone to the so called Bonferroni effect. If we oversee the networked structure of the environment or population where our policies will be implemented and the complexity that this kind of structure brings into account, we can miss the target of policy implementation, causing unintended consequences. In addition to a classic, descriptive Social Network Approach, System Science and control theory applied to a networked environment can be employed in the definition of an integrated framework of tools for policy modeling and policy evaluation: this framework is intended to support and give theoretical means to govern a big data infrastructure and machine learning- based tools. Along with some suggestions for the inclusion of SNA in an integrated framework for policy modeling and policy evaluation, some examples based on real world datasets will be presented to shed light on the shortcomings of an oversimplified approach that does not consider the network structure of the target environment. One example is based on the panel data regarding interlocking directorate boards in some nations and the effect of the policies aimed at increasing the presence of women in corporate governance. If we look at this effort from a SNA point of view, an increased presence of women inside the boards does not necessarily mean a grown-up centrality of women in the overall system. In order to exploit this SNA-based approach for policy impact evaluation, we need methods for large network analysis, especially methods targeted at following the evolution of large networks over time and robust methods for bayesian evaluation of policy implementation.

Network analysis of the scientific field of Russian sociological journals

Alexandr Semenov, National Research University Higher School of Economics, Russia

Vladimir Glazachev, National Research University Higher School of Economics, Russia

Katerina Guba, European University of St. Petersburg, Russia

Abstract

Network analysis of citations between scientific articles and authors has become popular in scientometric research. However the studies of citation patterns among journals on the level of scientific field of a country are still rare. Our research fills this gap by presenting the analysis of the network structure of the scientific field of Russian sociology based on the citation data of its journals. As the initial data for our study we selected 589 journals, which are included in the thematic category of sociological journals in the Russian Index of Scientific Citations (RISC). In order to obtain information on the immersion of sociological journals in the general context of Russian science, we also collected data on all the journals that cited articles from the primary sample of sociological journals since 2012. Thus, the final dataset consisted of 3090 journals. With this data we tested a number of hypotheses about the properties of citation networks of these journals: 1. Center-periphery vs. Segmentation: the network of journals themselves has a clearly expressed center-peripheral character, where the most central and connected journal are "Sociological Research"; 2. Homophily: we have not been able to find statistical confirmation that journals belonging to the same type tend to quote each other more than magazines of a different type. The same applies to classification by publisher types. However, in the case of building a network between the publishers themselves, based on the citation of their journals, we were able to detect a moderate propensity for homophily; 3. Assortativity: by measuring the assortativity between the journals in terms of their centrality, we managed to find that the most central journals do not tend to quote each other and they have much more citation links with periphery journals. We present this and other findings alongside with plans for future research.

On the use of multidimensional analysis of network data in field theory: the case of theatre co-production

Marco Serino, University of Naples, Federico II, Italy

Daniela D'Ambrosio, University of Naples Federico II, Italy

Giancarlo Ragozini, University of Naples Federico II, Italy

Abstract

This paper aims at presenting a novel way to combine Bourdieu's field theory and social network analysis (SNA) in both theoretical and methodological terms, focusing on the theatre industry as a case study. The theatrical field is formalized as an affiliation network of companies involved in stage co-productions in Italy's Campania region, over four theatre seasons. Our methodological framework relies upon the positional approach of SNA as its main analytic strategy, pursued through Multiple Correspondence Analysis (MCA), Multiple Factor Analysis (MFA) and blockmodeling for affiliation networks. Multidimensional data analysis is used to analyse both network ties and attributes (denoting the relational and the 'objective' structure of the field, respectively), while blockmodeling permits us to gauge the extent to which the network structure exhibits hierarchy and segmentation. Our findings show that different partnerships in co-productions determine unequal positioning in the field and that prominent network positions are associated with high economic and symbolic capital. In particular, this study depicts the oppositions among companies due to their differential partnerships in co-productions, and relates such oppositions to the models of network structure revealed by blockmodeling. Moreover, our approach allows describing the 'objective' social space of the field, defined by the attributes of companies and co-productions (positions and position-takings), and its 'relational' social space, at the same time.

On the joint use of Multiple Correspondence Analysis and Blockmodeling for two-mode networks

Marco Serino, University of Naples, Federico II, Italy

Daniela D'Ambrosio, University of Naples Federico II, Italy

Giancarlo Ragozini, University of Naples Federico II, Italy

Abstract

Multiple Correspondence Analysis and Multiple Factor Analysis have proved appropriate for visually analyzing affiliation (two-mode) networks. However, more could be said about the use of these tools within the positional approach of social network analysis, relying upon the ways in which both these factorial methods and blockmodeling can lead to an appraisal of positional equivalences. In this paper we discuss how to use these techniques jointly in order to perform a positional analysis of time-varying affiliation networks.

Factorial methods could help in the specification step of blockmodeling for two-mode networks, and at the same time the results of blockmodeling could be incorporated in factorial methods. We present some examples of a time-varying affiliation network. The examples show how the joint use of Multiple Factor Analysis and blockmodeling helps us understand network positions and the longitudinal affiliation patterns characterizing them.

Automated measure of correlation between valuable events of Real World and Index of Publication Activity of Wikipedia's logged authors

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Dmitry Kaflik, Federal Research Center "Computer Science and Control" of Russian Academy of Sciences, Russia

Abstract

The paper presents an automated method of detection a positive correlation between significant social and scientific events of Real World (offline events) and an edit splash of Wiki-community in Russian version of Wikipedia, logged authors (those editors who created a personal account to participate in the project). At the first stage of our study Index of Publication Activity (IPA) was built. It has been calculated as a result of analyzing of 5 000 000 revisions and is introduced for some selected scientific categories of wikipedia.ru. The set of real world events for chosen categories is composed. The analysis of the correlation between IPA and offline events was made on the timeline, as the result the statistical correlation function have been found. The methodology we used (based on a combination of clustering techniques and social network analysis) allows us evaluate validity of the hypothesis of correlations between offline events and publication activity on big data in such categories as Nanotechnology, Astronomy, Biology, Science studies, Gender Studies.

Social Network Analysis and organised crime. The dissolved municipality of Brescello: a case study

Antonia Roberta Siino, University of Bologna, Italy

Abstract

Organised crime is one of the most serious problems in Italy. Contrarily to popular belief, mafia-type organisations are active both in the Southern Italy and in the Northern. In this perspective, one of the most worrisome signs is mafias' infiltration in the political domain, especially at a local level, since it is a threat for the democracy itself. If suspected to be concretely influenced by mafia groups, a local municipality can be dissolved by the National government. The application of this measure in Northern areas is an alert sign since it shows the expansion of mafias influence in the so-called "not traditional areas" too. Moreover, it shows the role played by networks in the criminal context and the capability of mafia groups to rely on them.

For these reasons, this essay will analyse the case of the first dissolved municipality in the rich region of Emilia-Romagna, Brescello, applying the social network analysis approach. The analysis will define economic, politic, and criminal networks, describing who were the main actors and in which way they were tied to each other. This essay pays specific attention to the role of economic actors, to find out if the economic network of the municipality had an active role and not merely a passive one. This aspect is highly relevant because economic actors are, in most cases, the firsts who face to mafia groups, considering the fundamental interest of mafias in laundering illicit money and entering the legal market. The analysis assume that three different networks exist, connected to each other by some of their actors, and it aims to find out by whom the spread of mafia phenomenon is leaded in the considered context. The analysis will be supported using the Python programming language and the Gephi visualisation software.

Longitudinal Analysis of Multilevel Networks

Tom A. B. Snijders, University of Oxford, UK and University of Groningen, The Netherlands

Abstract

Networks are quite complicated entities already, but combined with the word 'multilevel' they become even more complex. To limit the curse of everything depending on everything else, a longitudinal approach gives a bit of support; but more specific structuring is needed for cutting through the complexities.

A variety of multilevel structures is possible. Type I, for the 'multilevel analysis of networks', refers to a set of unrelated networks, for each of which the same model is applicable, but with different parameters. This is a nested structure of parallel networks. Type II, for the 'analysis of multilevel networks' as defined by Wang et al. (2013), refers to a structure with several distinct node sets, and networks on or between several of these node sets. The networks on a node set are one-mode networks, those between node sets are two-mode networks. This can be regarded mathematically as one network on the union of the node sets, but also as multiple networks on various combinations of the node sets. A simple case is the co-evolution of a one-mode and a two-mode network for a given set of actors. Type III, for 'network analysis on a multilevel node set', refers to a network on one node set, where the node set has itself a nested structure. This is one network on a nested node set. Undoubtedly more types and sub-types may be distinguished.

Panel data for multilevel networks of these kinds can be analysed using Stochastic Actor-oriented Models, implemented in the Siena software. Such models can be extended with dependent nodal variables, which for Type II could be given for one or several of the node sets. For this purpose, multilevel networks of Types II and III can be represented by multivariate networks with structurally zero blocks in the adjacency matrices. Examples for the various Types will be discussed, and procedures will be presented for how to analyse this using Siena.

Network multiplexity and business innovation: insights from a developing country*Giacomo Solano, Eindhoven University of Technology, The Netherlands**Gerrit Rooks, Eindhoven University of Technology, The Netherlands***Abstract**

In this study, we examine the impact of network characteristics on small business innovation. This article focuses specifically on multiplexity, here the degree to which a person is included in both the core and business networks. We compare the influence of multiplexity on innovation between urban and rural one. Based on the results of a recent research on entrepreneurs in Uganda (Africa), we show that - among other determinants of innovation - multiplexity has two different effects depending on the context where the multiplex relations take place (urban or rural context). In the urban area, the effect is positive: the more multiplex relations the entrepreneur has, the more innovative he/she is. On the contrary, the effect of multiplexity on innovation is negative in the rural area. We explain this different effect in terms of cultural context. In rural areas, where a collectivistic culture is more predominant, people are led to 'automatically' involve in the business strong ties. In urban areas, where the culture is more individualist, entrepreneurs choose which strong ties involve in the business. In this way, only innovative and 'useful' ties are included.

Modeling the dynamics of a rural credit market in the 19th Century

Martin Stark, ILS- Research Institute for Regional and Urban Development, Germany

Matthias Bixler, University of Zurich, Switzerland

Abstract

Over the last decade social network analysis has made its way from a frequently used buzzword to an accepted methodological approach in historical research that goes beyond a purely metaphorical use of its terms. A substantial number of studies on different topics from all historical periods have shown that theories and methods from SNA can be fruitfully applied to selected bodies of historical sources. However, most historical network studies are still subject to methodological limitations: 1) with very rare exceptions existing studies are limited to descriptive structural measures and visualizations of network graphs and 2) despite historical data being inherently longitudinal most often they are aggregated and analyzed like cross-sectional data. This paper seeks to contribute to further close this gap. First, potentials and limitations of historical data with respect to stochastic network models will be discussed. This will be further illustrated with a showcase, in which longitudinal stochastic actor-oriented modeling (SAOM) is applied to analyze the structural dynamics of a 19th century rural credit market. The analysis is based on panel data derived from archival records of the village of Ohmenhausen, located in the Kingdom of Wuerttemberg in Southwestern Germany. The credit market is modeled as an evolving two-mode social network, where debtors are linked to creditors through economic ties (mortgages). The period under study follows a significant reform of mortgage legislation to increase transparency regarding the pledging of immovable property. Preliminary results indicate that, as a consequence, the credit market expanded significantly while the market power of single creditors decreased at the same time.

The "Bibliographical Database Historiography in Ottoman Europe (15th–18th centuries)"*Vivian Strotmann, Ruhr University of Bochum, Germany**Ovidiu Olar, Ruhr University of Bochum, Germany***Abstract**

The planned "Bibliographical Database Historiography in Ottoman Europe (15th–18th centuries)" – a joint project of the History Department and the University Library of Ruhr-Universität Bochum – aims at establishing the first comprehensive bibliography of early modern historiography in Ottoman Europe, highlighting and making tangible the variety of its cultures, languages, and religions. In the framework of a culture mainly shaped by religious writing, the polyglot historiography of the region represented an important section of secular writing and has constantly been drawn upon as a source for the study of social and cultural history and of the intellectual entanglement among the cultural spheres within Ottoman Europe and their intercommunication with the Mediterranean and Central European regions. The project will merge the core meta-data on historiographical texts written in the various languages into one integral bibliography. Advanced bibliographic indexing of the scattered and hardly available texts will allow for searching the material irrespective of language and genre, for highlighting the inter-textual entanglements and interdependencies, and for indicating the currently available printed or online editions. Besides information on these various historiographical texts, the data also includes extensive indexing of secondary literature past and present and will be supplemented by interactive maps to display and track locations of different writings. This sheds light on the reception of texts into different languages and contexts, showcasing the migration, transformation, reception and afterlife of the historiographical documents, which also are documentations of social structures and their transformation. On a more abstract level, this may make the database itself both a tool and a potential object of scientific scrutiny in the future. On the hands-on level, early modern South Eastern European and Mediterranean studies will gain a durable and easily updatable key instrument for their particular research interests, which has great potential for future international development.

On convexity in complex networks*Lovro Šubelj, University of Ljubljana, Slovenia**Tilen Marc, University of Ljubljana, Slovenia***Abstract**

Metric graph theory is a study of geometric properties of graphs based on a notion of the shortest path between the nodes. Metric graph properties lie in the heart of the analysis of complex networks. Classical examples include Milgram's experiment of degrees of separation and node index called betweenness centrality.

In this talk, I will present a study of convexity in networks based on mathematical definition of a convex subgraph. A subgraph is convex if every shortest path between the nodes of the subgraph lies entirely within the subgraph. According to our perception of convexity, a convex network is such in which every connected subset of nodes induces a convex subgraph.

Study shows that convexity is an inherent property of many networks that is not present in a random graph. Most convex are spatial infrastructure networks and social collaboration graphs due to their tree-like or clique-like structure. Core-periphery networks are regionally convex as they can be divided into a nonconvex core surrounded by a convex periphery. Random graphs, however, are only locally convex meaning that any connected subgraph of size smaller than the average distance between the nodes is almost certainly convex. I will present different measures of network convexity and discuss its applications in the analysis of networks.

How to become a criminal leader: Exploring criminal capital of 'Ndrangheta bosses involved in different activities*Elisa Superchi, Catholic University of Milan, Italy***Abstract**

New approaches to research on leadership focus on its relational dimension. Sociologists underlined the presence of relations among individuals that generate social capital. Among relations, those connecting otherwise disconnected people are more valuable. Leaders usually occupy such strategic positioning. This concept was transposed in criminology and several studies found that leaders were usually brokers within criminal networks. However, some scholars underlined that leaders of networks involved in drug trafficking tend to be more marginal. Notwithstanding these claims, no studies have analysed neither criminal leaders' relations nor differences in leadership among networks involved in different activities. This study explores leaders' strategic positioning in selected case studies of 'Ndrangheta networks involved either in drug trafficking or in other typical Mafia-related crimes, as assessed in pre-trial court order documents. 'Ndrangheta networks are a specific form of Mafia-type organisations: they have a strong hierarchical internal structure that they replicate across Italy and abroad. They are therefore suitable to study whether and how leadership change according to the illicit activities performed. The study adopts a two-step methodology. Firstly, it will analyse leaders' social relations and assess which network measures (i.e. centrality and ego-network measures) increase the probability of being a leader through logistic regression models. Secondly, results will be discussed during interviews with experts. A set of descriptive and inferential static results across case studies, and specifically between the 'Ndrangheta groups involved in drug trafficking and other Mafia-related crimes, will unveil possible patterns depending on the illicit activities performed. Results will enrich current knowledge on the internal structure of criminal networks and shed light on criminal leaders' distinctive features.

Random walks on the World Input-Output Network*Lucia Tajoli, Politecnico Milan, Italy**Carlo Piccardi Politecnico Milan, Italy**Zhen Zhu, IMT school for advanced studies Lucca, Italy***Abstract**

The world economy has been increasingly shaped by international fragmentation of production scattered across different countries, ensuing that goods are often produced through the assembly of components produced in many locations. As a result, economic systems are intricately connected through countries and industries, as highlighted by the rapid propagation of economic shocks. The economic relations between countries and industries arising from this global organization of production processes are described by input-output relationships, the so-called in-ter-country input-output matrices, to which network analysis can be applied to better understand the structure of this interconnected system and the mechanism of propagation of economic shocks. Our paper detects the communities on the World Input-Output Network (WION) using a random-walk approach based on Markov chains. Given the strong linkage between Markov chains and input-output systems, our method is highly appropriate and the results obtained can be intuitively interpreted. The aim of the paper is precisely to ascertain, through community detection, the presence of strong production links across countries and to assess the determinants of economic integration across industries. We find that the community detection results are sensitive to the different specifications. These differences highlight the different extent of economic integration in different markets. Adding to the recent stream of literature analyzing the role of global value chains in economic integration across countries, we show global value chains as endogenously emerging communities in the world production system, and we highlight how different markets' perspectives produce different results in terms of the pattern of integration.

Unraveling the complexity of legal decisions with network science*Fabien Tarissan, CNRS, University of Paris-Saclay, France***Abstract**

Do case citations reflect the "real" importance of individual judgments for the legal system concerned? This question has long been puzzling empirical legal scholars. Existing research typically studies case citation networks as a whole, applying traditional metrics stemming from graph theory. Those approaches usually focus on degree-related properties to quantify the importance of a judgment.

In this presentation, I will argue that although the number of citations is indeed an indicator of importance, it is not the unique way for a case to influence future judgments. I will try to sketch the different profiles landmark cases can have by taking into account the two-level structures induced by the citations. Indeed, judgments refer to previous judgments but also to articles of law, domains of law, etc. By exploiting these elements, one can track in particular how versatile a case is and measure its effect in terms of diffusion.

To illustrate this approach, I will present recent results obtained in a series of empirical studies conducted on two different jurisdictions: the International Criminal Court and the Court of Justice of the European Union. Those studies show how different properties can provide complementary points of view that are essential to obtain a comprehensive picture of case importance.

Network Analysis of the Behavior Patterns in Russian Volunteer Computing

Victor Tishchenko, Federal Research Center "Computer Science and Control" of Russian Academy of Sciences, Russia

Abstract

In presentation we will analyze with a help of cluster analysis the behavior of Russian participants ("crunchers") in volunteer computing (VC), a type of distributed computing in which computer users donate their computing resources to one or more academic research projects (e.g., Seti@home, ClimatePrediction.net, etc.). Projects that require huge computing power and use a complete middleware system BOINC (Berkeley Open Infrastructure for Network Computing). Based on the methodology of complex networks we construct a mathematical model of BOINC.RU community in the form of a bipartite graph (or bigraph) whose vertices can be divided into two disjoint sets – «participants» and «projects». The participants – are the members of Russian BOINC community, described in accounts registered on <http://boinc.ru> web site. The projects – are all the projects in which community members participated and registered in the system of BOINC-based projects. In bigraph, representing the Russian BOINC-network, every edge connects a vertex in the set «Participants» to one in the set «Projects», all BOINC-based projects to which the Russian crunchers donate computing resources (such as processing time, power and storage). By bipartite graph clustering we could verify the basic models of behavior of Russian participants in VC in selecting and joining the research projects. In contrast to the literature based on sociological surveys our study has been based on clustering technique and shows that the science and thematic preferences are decisive of Russian VC participant's motives. In contrast to behavior of the participants from Western countries there is no any effect on the team or individual behavior of the points system (crédits), a numerical measure of how much work that user's computers have done for the project. The results can be significant for optimizing the background of the model of Internet-based citizen science.

Dynamical models of social balance and the evolution of cooperation*Vincent Traag, Leiden University, The Netherlands***Abstract**

Social balance is a prominent theory of the structure of signed networks. If a network is completely socially balanced, the network is structured into two mutually antagonistic groups. However, it is not clear how social balance may emerge from micro-interactions. In particular, even though some changes may make some triads balanced, it may make other triads unbalanced. An earlier dynamical model of was shown to converge to social balance from almost any initial condition. However, we prove that this is only the case for symmetric networks. We introduce a new model that converges to social balance both for symmetric and asymmetric initial conditions. Moreover, there is an interesting connection with the evolution of cooperation and the role of reputational mechanisms such as indirect reciprocity. We find that a reputational mechanism such as social balance can indeed lead to cooperation. However, it also leads to a separation of the population into two mutually antagonistic groups. This makes an interesting paradox: reputation can lead to cooperation, but it also leads to conflict.

Using non-hierarchical multilevel models to analyze overlapping personal networks*Raffaele Vacca, University of Florida, USA**Jeanne-Marie Stacciarini, University of Florida, USA**Mark Tranmer, University of Glasgow, UK***Abstract**

Multilevel or mixed-effects models are increasingly used in sociology and other social sciences to analyze tie-level variation in personal (or ego-centric) network data, particularly in studies of social support. Existing research employs hierarchical linear or generalized linear models based on the assumption of no overlap between different personal networks in the data. We argue that this assumption is not plausible in many real-world research designs, and propose an extension of the method using cross-classified multilevel models to accommodate network overlap. We illustrate the method with an application to personal network data on social support among Hispanic immigrants in rural US counties. Using Markov chain Monte Carlo techniques, different hierarchical and non-hierarchical models are estimated to evaluate the consequences of ignoring network overlap and applying traditional hierarchical methods to overlapping data. Findings provide insights on ways to identify overlap among personal networks and to correctly estimate effects on tie-level outcomes when alters and/or egos are shared across multiple networks.

Board appointments as a flow of events: understanding the network dynamics of the Danish corporate elite

Diliara Valeeva, University of Amsterdam, The Netherlands

Abstract

Board interlock networks, in which directors hold positions at the boards of one or more firms, are widely studied. Whereas a snapshot of board interlock networks provides a static insight in the structure of corporate elites, its dynamics uncover the evolution of the network aspects of corporate governance. However, the dynamic analysis of board interlock networks is usually restricted to the study of a limited number of discrete snapshots of board composition. As a result of this aggregation of events, it becomes difficult to distinguish the different fine-grained network mechanisms causing the network to evolve the way it does. Furthermore, in longitudinal studies the bipartite nature of these networks is rarely taken into account: the majority of board interlock network research considers one-mode network projections. However, both types of nodes in the bipartite network are active decision-makers that influence the process of board formation and evolution. Moreover, unipartite projection causes biases in network measurements, for example, because dense fully connected clusters form around busy directors. In this paper, we use relational event modeling for bipartite networks, considering daily data on board appointments at the larger Danish firms in 2015. This study of the dynamics of board interlock networks reveals how a combination of network (e.g., assortativity and transitivity) and status-related (e.g., individual position in a network and past director experience) mechanisms drive the dynamics of board appointments. Besides an empirical contribution to studies of board interlock networks, the paper also contributes to theoretical discussions about levels of analysis. While interlocking is traditionally analyzed as an action produced exclusively by firms, its dynamics cannot be revealed in details without taking into account individual-level mechanisms such as status-seeking or enhancing personal career paths. In this study, we show the possibilities for combining both firm and individual levels of analysis that allow to uncover the dynamic nature of board interlock networks.

Tractatus de Sphaera of Johannes de Sacrobosco; diffusion of innovations and transformation of knowledge

Matteo Valleriani, Max Planck Institute for the History of Science, Germany

Abstract

The Tractatus de Sphaera of Johannes de Sacrobosco, a work on cosmology, was published over 300 times during the early modern period. While the original text remained unchanged during the entire history of this commentary, new scientific subjects were added in the frame of the printed books, either in form of printed annotations or in form of additional chapters and sections. Because of the extremely high diffusion of these treatises and because they were mandatory textbooks in almost all the European universities until the 17th century, the history of this commentary tradition mirrors the history of formation of a common scientific identity in Europe during the early modern period. The commentary works changed in its history because new scientific elements and aspects were added to specific editions and then such innovations were adopted by subsequent editions produced somewhere else and in different contexts. The spread of these innovations, and therefore the mechanisms of transformation of a knowledge system, are analyzed by making use of a model of diffusion of innovation and, at least conceptually, are framed in a multi level network.

Economic networks in the seventeenth-century Dutch Atlantic. Social capital in New Amsterdam and Rotterdam

Maarten Van Dijck, Erasmus University Rotterdam, The Netherlands

Abstract

Economic theory states that trust can lower transaction costs. Social scientists – such as Putnam and Woolcock – claim that mutual trust is often associated with social capital. This means that trade networks are more successful if the two contracting parties already have some kind of social bond before they meet each other at the market. Research by Alfani and Gourdon points out that early modern merchants used ritual kinship to enlarge their social network and to strengthen existing social relationship. This implied that they used ritual kinship to accumulate social capital and lower transaction costs. This paper will look at trade networks in seventeenth-century New Amsterdam and Rotterdam. A combination of notarial records and baptism registers enable us to compare the institutionalized social capital of merchants with their trade networks. The comparison of the networks found in these two sources make it possible to find out if merchants used existing social capital to lower transaction costs. A second comparison between New Amsterdam and Rotterdam allow us to investigate how the different set-up of cities on both sides of the Atlantic Ocean influenced trade networks. The small-scale of the new colonies of VOC and WIC made it possible to establish dense relations within local society while this was more difficult in larger cities in Europe. However, both cities struggled with the complications of long distance relations which was typical for the early modern transatlantic trade.

Social network, board interlocks and firms' financial decisions: The case of Italy*Srinidhi Vasudevan, University of Greenwich, UK**Riccardo De Vita, University of Greenwich, UK***Abstract**

There is a growing interest in finance to analyse how economically significant corporate connections and board interlocks are. The main idea is that when directors sit in boards of multiple organisations, the decisions that they take are influenced by the social groups they belong to which not only affects the direction the firm takes but also the return on investments. This is because networks serve as conduits of information and resources between interlocked organisations. Understanding board interlocks helps investors in weighing up the investment risks and the likely returns of different investments. The research focuses on understanding how corporate interlocks influence the financial decisions of listed firms. It also analyses if firms with higher centrality or connections to certain types of organisations enhances their ability to earn higher returns on investment. Hypotheses that link network connectivity, financial risk and return are put forward in light of relevant theories and explored in an original dataset. For this research, we use longitudinal data from 2010 – 2015. We combine data from two different databases, BoardEx and Orbis to obtain information about the listed firms in Italy. Information about how organisations are connected through shared directors and composition of boards is provided by BoardEx. This information is analysed using Social Network measures and is then integrated with firm specific financial information and performance ratios that is obtained from Orbis. By providing empirical evidence, the results from this study are likely to contribute to specifically understanding the role of networks in financial decisions and performance of listed organisations.

On the Use of Multidimensional Statistical Techniques for the Analysis of Multiplex Network Data*Maria Prosperina Vitale, University of Salerno, Italy**Giuseppe Giordano, University of Salerno, Italy**Giancarlo Ragozini, University of Naples Federico II, Italy***Abstract**

Multilayer networks arise when there exists more than one source of relationship for a common set or different sets of nodes. For instance, in social networks, one can consider several types of different actors' relationships (e.g., friendship, kinship, membership, etc.). A multiplex network is a special case of multilayer network that consists in a fixed set of nodes that interacts through different types of connections. To cope with the complexity of multiplex networks, it might be useful to use tools stemming from multivariate statistics. Canonical correlation analysis and cluster analysis, for example, have been proposed to identify dimensions along which two networks are related to each other and to deal with dimension reduction in presence of several layers. In this framework, the present contribution aims at extending the use of factorial methods to visually explore the hidden structure of multiplex networks preserving the inherent complexity. More specifically, we focus on one-mode networks analyzing the corresponding set of adjacency matrices through the DISTATIS technique. This represents an extension of the multidimensional scaling applied to a set of distance matrices derived on the same set of objects. Our approach allows to represent the different kinds of relationships (inter-structures) in separate spaces and in a common space, called compromise. More specifically, it enhances the visual exploration of: i) network structure in terms of nodes' similarity in each single layer, ii) common structure of all layers, iii) nodes' variation across layers, and iv) similarity among layers' structure. How the proposed analytic procedure works will be demonstrated through a real-world data.

Network analysis of social media activities to explore tag sharing communities on brand fan pages

Pierluigi Vitale, University of Salerno, Italy

Giuseppe Giordano, University of Salerno, Italy

Stefano Perna, University of Salerno, Italy

Ilaria Primerano, University of Salerno, Italy

Abstract

Online social networks, such as Facebook and Twitter, have become very attractive communication media where individuals can virtually interact each other. Using social media to reach potential consumers is one of the main activities of brands on their own fan pages. In this framework, user-interactions, i.e. posting, tagging, liking, sharing, commenting, are very important feature to be considered in order to evaluate the influence of these pages on their fans. In this work we study user-interactions on Facebook brand-pages by looking at the effect of tag sharing. The tag is not yet considered as a way to indicate the presence of an individual, but it becomes a tool to share something. In particular, we want to investigate the behavior of tagged users after the tag occurs, trying to identify their role in the brand community. Recent developments in Social Network Analysis enable us to handle the huge amount of data from social media networks with appropriate methods. The use of multilayer networks, for instance can put emphasis on the different user-interaction tools.

The informal social networks toward the upcoming urban challenges. The case of the Neapolitan Social Centers

Maria Patrizia Vittoria, IRISS, National Research Council, Italy
Pasquale Napolitano, IRISS, National Research Council, Italy

Abstract

As it is widely known, city regions often manifest strong differences in their de-facto informal political cultures and forms of political mobilization. Social capital indexes, which measure the patterns of participation, show that there is much more participation in some city-regions than in others, though the meaning of this for political outcomes has not firmly established. In addition, other scientists studying the processes of economic specialization of particular places have founded that successful adjustment – or resilience – depend from the local ability to capture activities that can become the basis of new regional economic specializations. Although there are various ways that this can occur from region to region, less known is the ‘why’ some places do better at adjustment than others. A useful perspective, or even, the current common ground on which converges most of the above-mentioned attention, is the analysis of the processes of formation of the informal social networks, not less, of the inherent situated collective actions to tackle the recent EU Urban Agenda’s priority themes. Based on some Neapolitan social centers’ features, already recognized as best practices in the activity of urban decision-making, this study makes an explorative analysis on the social networks emerging from their activities. The analysis focalizes on the ‘inclusion of migrants and refugees’ – one of the twelve EU Urban Agenda Themes – to explore the emerging social links established to encourage local citizens to socialize as well as explaining new cultural practices. As known, cultural activities can be 1) inclusive in relation to incoming migrants and refugees and 2) responsible for the revitalization of urban wastelands. Thus, the evidences – in the form of some network visualizations – allow us to identify the nodes (and links) responsible for efficient social revitalization and urban productivity.

Tripartite Networks: The case of underground punk in North West England*Joseph Watson, University of Manchester, UK***Abstract**

Social networks are often inherently complex and it is important to develop new methods to deal with these complex structures. Methods and models are now well developed to deal with networks containing actors of two different types, networks that we consider as 'bipartite'. This poster will show how we might go about analysing a 'tripartite' social network with three different types of actors in a network of punk musicians, bands and venues in the North West of England. It will show how we can test this analysis against current methods, and what type of tripartite configurations might be of interest to social network researchers.

The interplay between ethnic composition and out-group attitudes as possible explanation for ethnic homophily in schoolchildren's friendship networks*Mark Wittek, University of Cologne, Germany***Abstract**

A growing strand of literature applies network analysis to investigate ethnic homophily in social networks. As one possible cause of ethnic homophily scholars studied the relationship between the ethnic composition of classrooms and ethnically homogenous network structures in schoolchildren's friendship networks. This paper tries to contribute to this literature by analyzing the interaction between out-group attitudes and compositional aspects of the social context that could lead to ethnically segregated friendship networks. The German subsample of the first wave of the CILS4EU project (5013 students; 3909 parents; 271 classes) will be used to carry out the empirical analysis. Analytical strategy: 1. Estimate exponential random graph models for each school class to measure ethnic homophily above the opportunity structure and network endogenous processes. The ethnic homophily parameter is estimated as change statistic, which is interpretable as the increase in the conditional log-odds of a network by adding one same-ethnic friendship nomination given all other local network structures included in the model specification (like the overall number of edges, reciprocated ties, etc.). 2. Aggregate the results using an univariate meta-analysis. 3. Use metaregressions (with ERGM coefficients for ethnic homophily as the dependent variable) to investigate between-context variation in ethnic homophily. The first aim of the study is to test if inter-ethnic friendship nominations sent by students with negative out-group attitudes are observed systematically less often than inter-ethnic friendship nominations sent by students with positive out-group attitudes. ERGM specifications will be proposed that allows differentiating between these two types of nominations for native and immigrant students separately. In a second step, a set of nested metaregressions will be applied to estimate how well variation in ethnic homophily on context level is explained by the classroom-specific mean level of negative out-group attitudes, the ethnic composition of the classrooms and the interaction of these two factors.

Assessing recall bias in network ties reported by people who use drugs

April M. Young, University of Kentucky, USA

Jennifer R. Havens, University of Kentucky, USA

Abby Rudolph, Boston University School of Public Health, USA

Abstract

Previous research has revealed under-reporting of alters in network studies involving people who use drugs (PWUD). This analysis aims to characterize relationships most likely to be under-reported with free-listing approaches. Data for this analysis are from a prospective cohort study that examines HIV, hepatitis C, and herpes risk among PWUD. At baseline, 6-, 12-, 18-, 24-, and 30-month assessments, participants were asked to free-list the names of those with whom they used drugs, had sex, or received social support in the past 6 months (up to 8 alters/category; maximum of 24 alters possible) and to describe individual- and relationship-level characteristics of/with each alter. At the 30-month follow-up assessment, the free-listing questions were followed by what is hereafter referred to as 'prompting' in which participants were provided with a list of previously reported alters and asked to indicate if they had used drugs with, had sex with, or received social support from any of the listed individuals in the past 6 months. Participants then described individual- and relationship-level characteristics for alters free-listed and those confirmed only after prompting. Using log binomial generalized estimating equations, we identified individual- and relationship-level characteristics associated with being reported only after prompting. Overall, 399 participants free-listed 784 alters (343 drug co-usage, 329 sex, and 574 social support). Prompting elicited an additional 249 alters (68 drug co-usage alters, 71 sex partners, and 191 social support). After adjusting for alter age, relationship duration, trust, and receipt of financial support, relationships reported only after prompting were more likely to involve kinship (APR=1.38; $p=0.022$) and less likely to involve drug co-usage (APR=0.73; $p=0.033$) and sex (APR=0.71; $p=0.012$). These results indicate that the free-listing technique may have under-ascertained kinship ties and elicited more complete data on risk relationships compared to other ties not involving risk behavior.

Multilevel blockmodeling and extensions*Aleš Žiberna, University of Ljubljana, Slovenia***Abstract**

In this work, blockmodeling of multilevel network data will be presented. Multilevel network data consist of networks that are measured on at least two levels (e.g. between organizations and people) and information on ties between these levels (e.g. information on which people are members of which organizations). Several approaches are possible: a) separate analysis of the levels; b) transforming all networks to one level and blockmodeling on this level using information from both/all levels; c) truly multilevel approach, where both/all levels and ties between them are modeled at the same time. Here we will focus on the last approach.

The approach was initially developed within generalized blockmodeling. However, for larger networks (several hundred units), this approach is not appropriate. Therefore, algorithms for multilevel blockmodeling based on two-mode k-means and stochastic blockmodeling were also developed. Advantages and disadvantages of these approaches will also be discussed.

In addition (time permitting), use of the same procedure for blockmodeling networks in several time points will be presented. This procedure is especially useful for blockmodeling networks in a few time points where we want the groups from different time points to be connected, while not necessary the same. The procedure is also useful when not all units are present in all time points.

Missing network data and their impact on clustering results

Anja Žnidaršič, University of Maribor, Slovenia

Patrick Doreian, University of Pittsburgh, USA and University of Ljubljana, Slovenia

Anuška Ferligoj, University of Ljubljana, Slovenia

Abstract

Networks are used to represent a real world dynamics of relations among units. The complexity of the gathered network data depends on the selected measurement level of ties among units. Network could be binary, where only presence of a tie is recorded, in valued network the magnitude of tie value is taken into account, while in signed networks the distinction between positive and negative relationships is important. All collected network data, regardless their source and employed collection techniques, are prone to measurement errors. Missing data could have several forms: actor non-response, item non-response, and measurement errors in recorded ties. Actor non-response treatments have been investigated mainly for binary networks and valued networks through simulated data. Here, the impact of seven actor non-response treatments on different clustering techniques (indirect and direct blockmodeling) on the selected set of real networks will be presented. The actor non-response treatments will be modified in a way that also item non-response could be treated and possibly measurement errors in recorded ties could be reduced (or even eliminated). Seven treatments are as follows. A null tie imputation procedure replaces all missing ties by zeroes. If the modal or mean value of incoming ties for a non-respondent is used instead of absent tie the procedure is called imputations based on modal values or mean values, respectively. In the reconstruction procedure missing outgoing ties are replaced by corresponding incoming ties. Reconstruction of ties between two non-respondents is not possible, therefore in the simplest case the null tie imputations are used, while the second option uses imputations based on modal values for ties between non-respondents. Also a total mean could be used estimate missing ties. The k-nearest neighbors approach searches for k closest actors according to their incoming ties and then calculates the outgoing ties of the non-respondent as a median of outgoing ties of selected nearest neighbors.

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