Readings for *"Social Network Analysis",* Spring 2020
771A23/771A24

Revised 17 January 2020

Course literature

Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical Analysis of Network Data with R*. New York: Springer.

This book is available electronically via the LiU Library. Additional literature is listed below in section "Schedule", we expect you to read at least the material marked as *core readings*.

Schedule (see Lisam for would-be updates)

Calendar week 4: Introduction, What Is Social Network Analysis

Lecture: Wednesday 22 January 2020, 10:15-12:00, in room SP34 *Károly Takács*

Lab class: Wednesday 22 January 2020, 13:15-15:00, in room KO25 Károly Takács / Robert Krause

Literature class: Friday 24 January 2020, 10:15-12:00, in room K24 *Károly Takács*

Topics of the first week are an introduction to *network thinking*, i.e., what is and what is not a network research question, and *network lingo*, a first delivery of technical terms that network analysts use in their work. We will have an introduction to Social Network Analysis and to its most influential concepts in its history: social capital, the strength of weak ties, and more.

Core readings

- A cultural sociologist's introduction to social network analysis is given in Charles Kadushin's 2004 text "Introduction to network theory". The text is a pre-print of some chapters of Kadushin's book *Understanding Social Networks*, which appeared at Oxford University Press in 2012. This is a reasonably good non-technical book about social networks – but it is quite bad where it gets technical (and it does, at places).
- An introduction to organizational researchers is another Borgatti piece: Borgatti, S. P., & Foster, P. C. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management*, *29*(6), 991-1013.
- A very readable historical overview of the SNA discipline is given by famous social network analyst Linton Freeman in his 2004 book *The Development of Social Network Analysis: A Study in the Sociology of Science*. ΣP Empirical Press, Vancouver, BC Canada [205 pages].
- Hidalgo, C. A. (2016). Disconnected, fragmented, or united? a trans-disciplinary review of network science. *Applied Network Science*, *1*(1), 6.

In the practical, we will download the necessary packages in R, and get an introduction to the data formats that we might use. In addition, we familiarize with some elementary data transformations that could be necessary to prepare our data for social network analysis. Hence, you can expect a workshop on data handling and processing. You will get to know how network/relational data can be collected/obtained, how can it be stored, and how to get it into the right format for analysis. Finally, we will discuss various transformations, for instance, methods and implications of converting weighted network data to binary formats.

Core readings for the lab

- Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical analysis of network data with R* (Vol. 65). New York: Springer. Chapters 1 and 2.
- Chapters 1 [16 pages] and 2 [21 pages] of: Garry Robins (2015). *Doing Social Network Research*. This book addresses an audience of social science researchers familiar with non-network research methods. It gives a more abstract, meta-level perspective on why, when, and how to do social network research.

Peripheral readings (for the literature seminar)

- Brass, D. J. (1984). Being in the right place: A structural analysis of individual influence in an organization. *Administrative Science Quarterly*, 518-539.
- Lin, Nan - Ensel, Walter M. - Vaughn, John C. (1981): Social Resources and Strength of Ties: Structural Factors in Occupational Status Attainment. *American Sociological Review*, 46: 393-405.
- Bearman, P., Moody, J., & Stovel, K. (2004). Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks. *American Journal of Sociology, 110*(1), 44-91.
- Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94, S95-S120.

Calendar week 5: Basics of Social Network Analysis, Descriptives, Visualization

Lecture: Wednesday 29 January 2020, 10:15-12:00, in room KO25 *Károly Takács*

Lab class: Wednesday 29 January 2020, 13:15-15:00, in room K25 *Károly Takács / Dorottya Kisfalusi*

Literature class: Friday 31 January 2020, 10:15-12:00, in room SP34 *Károly Takács*

We focus on *basic descriptive concepts* of network analysis and on micro level indices, notably notions of *centrality* of actors in networks. Graphs and matrices: elementary matrix algebra and its use for studying networks. At the lecture, we will touch upon substantial theories that link structural positions and power / success.

In the practical, we will work with the R-packages *igraph* and *sna* for distilling this information from network data sets, and we will generate first *visualizations* of social networks. We will also discuss 2-mode network data – so-called affiliation networks – and how these can be projected into 1-mode networks.

Core readings

- Padgett, John F. - Ansell, Christopher K. (1993): Robust Action and the Rise of the Medici, 1400-1434. *American Journal of Sociology*, 98:1259-1319.
- Uzzi, Brian (1996): The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. *American Sociological Review*, 61(4): 674-698.

Core readings for the lab

- Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical analysis of network data with R* (Vol. 65). New York: Springer. Chapters 3 and 4.1-4.2.
- Moody, James – McFarland, Daniel - Bender-deMoll, Skye (2005): Dynamic Network Visualization. *American Journal of Sociology,* 110: 1206-1241.

Peripheral readings

- Grund, T. (2012) Network Structure and Team Performance: The Case of English Premier League Soccer Teams. *Social Networks,* 34, 4, 682-690.
- Page, A.E., Chaudhary, N., Viguier, S., Dyble, M., Thompson, J., Smith, D., Salali, G.D., Mace, R. and Migliano, A.B., 2017. Hunter-gatherer social networks and reproductive success. *Scientific Reports*, *7*(1), p.1153.

Calendar week 6: Community Detection, Network Properties

Lecture: Wednesday 5 February 2020, 10:15-12:00, in room SP34 Károly Takács

Lab class: Wednesday 5 February 2020, 13:15-15:00, in room SP35 Károly Takács / Srebrenka Letina

Literature class: Friday 7 February 2020, 10:15-12:00, in room KO25 Károly Takács

This course week's topic are *partitions* of the set of network actors into (a small number of) sociologically meaningful groupings. We address the notion of *subgroup* membership, and discuss meso-level concepts in social network studies that are in-between the individual social actors and the total network. We will address subgroup detection algorithms, cohesive subgroups, and methods/heuristics for finding such. At the discussion of network cohesion and graph partitioning, we cover modularity, the Louvain method for community detection, and the Newman-Gervain algorithm. We discuss examples of extracting communities in larger networks.
Introduction to hierarchical clustering. Defining similarities: cosine similarity, the Jaccard index.
The analysis of Online Social Networks.
Network-level indices such as *reciprocity* and *network autocorrelation*. The theory of structural holes, Burt's constraint.

Core readings

- Chapter 11 [25 pages] of: Stephen Borgatti, Martin Everett and Jeffrey Johnson (2013) *Analyzing Social Networks*.
- Moody, James - White, Douglas R. (2003): Structural Cohesion and Embeddedness: A Hierarchical Concept of Social Groups. *American Sociological Review*, 68: 103-127.
- Fortunato, S., & Hric, D. (2016). Community detection in networks: A user guide. *Physics reports*, *659*, 1-44.

Core readings for the lab

- Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical analysis of network data with R* (Vol. 65). New York: Springer. Chapters 4.3-4.6.

Peripheral readings

- Bruggeman, J., Traag, V.A., and Uitermark,J. (2012). Detecting Communities through Network Data. *American Sociological Review,* 77, 1050-1063.
- Girvan, M., & Newman, M. E. (2002). Community structure in social and biological networks. *Proceedings of the National Academy of Sciences*, *99*(12), 7821-7826.
- Fortunato, S. (2010). Community detection in graphs. *Physics reports*, *486*(3-5), 75-174 is a bit long, use sections 1-6, and 15-17.
- Burt, Ronald S. (2009): Network Duality of Social Capital. In: Bartkus, V. and Davis, J. H. (eds.): *Social Capital: Reaching In and Reaching Out.* Edward Elgar.
- Gargiulo, M. and Benassi, M. (2000): Trapped in Your Own Net? Network Cohesion, Structural Holes, and the Adaptations of Social Capital. *Organizational Science,* 11(2): 183-197.
- Lőrincz, L., Koltai, J., Győr, A., and Takács, K. 2019. Collapse of an Online Social Network: Burning Social Capital to Create It? *Social Networks*, 57: 43-53.

Calendar week 7: Scale-free networks, small worlds, simulation

Lecture: Wednesday 12 February 2020, 10:15-12:00, in room SP35 *Christian Steglich*

Lab class: Wednesday 12 February 2020, 13:15-15:00, in room KO25 *Christian Steglich*

Literature class: Friday 14 February 2020, 10:15-12:00, in room SP35 *Christian Steglich*

Core readings

- Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical analysis of network data with R* (Vol. 65). New York: Springer. Chapter 5.
- Watts, D. J., & Strogatz, S. H. (1998). Collective dynamics of 'small-world' networks. *Nature 393* (6684), 440-442.
- Barabási, A. L., & Albert, R. (1999). Emergence of scaling in random networks. *Science 286* (5439), 509-512.
- For an audience of physicists and mathematicians who are used to viewing networks the way they are portrayed by Albert-László Barabási, the following is a good introduction: Mark E. J. Newman and Juyong Park (2003). Why social networks are different from other types of networks. *Phys. Rev.* E 68, 036122 (2003) [8 pages]

We explain the difference and the overlaps between Social Network Analysis and Network Science. We give an introduction to power law degree distributions, to scale-free networks, to small worlds, and discuss mechanisms such as preferential attachment.

Peripheral readings

- *t.b.a.*
- *if you know of a paper related to the week's topic that you want to discuss, please contact us!*

Calendar week 8: Exponential random graph models (ERGMs)

Lecture: Wednesday 19 February 2020, 10:15-12:00, in room SP35 *Christian Steglich*

Lab class: Wednesday 19 February 2020, 13:15-15:00, in room SP35 Christian Steglich / Srebrenka Letina

Literature class: Friday 21 February 2020, 10:15-12:00, in room SP34 *Christian Steglich*

The topics of this course week are the *interdependencies* that characterize network data, and some statistical techniques that allow handling these interdependencies. We address *exponential random graph models* (ERGMs) for cross-sectional data. An introduction to ERGMs is given in the paper by Robins et al. (2007). De la Haye et al.'s (2010) paper addresses with the help of ERGMs the topic of whether the body mass index may be socially contagious, while the paper by Goodreau et al. (2009) addresses segregation in adolescents' school networks.

Core readings

- Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical analysis of network data with R* (Vol. 65). New York: Springer. Chapter 6.1-6.2.
- 1st chapter of Lusher, D., Koskinen, J., & Robins, G. (Eds.). (2013). *Exponential random graph models for social networks: Theory, methods, and applications*. Cambridge University Press.

Peripheral readings

- De la Haye, K., Robins, G., Mohr, P., & Wilson, C. (2010). Obesity-related behaviors in adolescent friendship networks. *Social Networks*, *32*(3), 161-167.
- Goodreau, S. M., Kitts, J. A., & Morris, M. (2009). Birds of a feather, or friend of a friend? Using Exponential Random Graph Models to investigate adolescent social networks. *Demography*, *46*(1), 103-125.

Calendar week 9: Stochastic Actor Oriented Models (SAOM) basics

Lecture: Wednesday 26 February 2020, 10:15-12:00, in room SP34 Károly Takács

Lab class: Wednesday 26 February 2020, 13:15-15:00, in room SP34 Károly Takács / Dorottya Kisfalusi

Literature class: Friday 28 February 2020, 10:15-12:00, in room K24 Károly Takács

This week we will have an introduction to *stochastic actor-oriented models* (SAOMs) for longitudinal network data. We will cover models of network dynamics and discuss network drivers of reciprocity, transitivity, and homophily.

Core readings

An introduction to SAOMs is given by Snijders et al. (2010):

• Snijders, T. A., Van de Bunt, G. G., & Steglich, C. E. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks*, *32*(1), 44-60.

• Snijders, T. A. B., & Koskinen, J. (2013). Longitudinal models. Chapter 11 of Lusher, Koskinen & Robins (see above), 130-140.

Peripheral readings

Corbo et al. (2015) employ SAOMs to study how the terrorist attacks of 11 September 2001 have affected collaboration in the global airline industry:

→ Corbo, L., Corrado, R., & Ferriani, S. (2015). A New Order of Things: Network mechanisms of field evolution in the aftermath of an exogenous shock. *Organization Studies*, 0170840615613373.

→ Brouwer, J., Flache, A., Jansen, E., Hofman, A., & Steglich, C. (2018). Emergent achievement segregation in freshmen learning community networks. *Higher Education*, *76*(3), 483-500.

- Per Block, Christoph Stadtfeld, and Tom A. B. Snijders (2019). Forms of Dependence: Comparing SAOMs and ERGMs From Basic Principles. *Sociological Methods & Research*, 48, 202-239. DOI: http://dx.doi.org/10.1177/0049124116672680

Calendar week 10: Modelling diffusion and social influence in a network

Lecture: Wednesday 4 March 2020, 10:15-12:00, in room SP35 Christian Steglich

Lab class: Wednesday 4 March 2020, 13:15-15:00, in room K21 Christian Steglich / Robert Krause

Literature class: Friday 6 March 2020, 10:15-12:00, in room SP35 Christian Steglich

The topic of this week is *peer influence*, and the combination of *influence and selection*. Peer influence was already addressed in the readings of calendar week 9 (Snijders et al. 2010), now it stands central. The paper by Steglich, Snijders & Pearson (2010) contains a sketch how stochastic actor-based models

address the methodological problems of peer influence assessment (*generic confounding*, see Shalizi & Thomas in the peripheral readings). In Chapter 10 of Robins' book, the topic of social influence modelling is put into a broader perspective. Because there has been a somewhat fierce debate on what is and what is not acceptable as a model for the purpose of peer influence detection, I add a few voices in this debate to the peripheral readings.

Core readings

- The influence-relevant texts of Chapter 10 of: Robins, Garry. *Doing social network research: Network-based research design for social scientists*. Sage, 2015.
- Steglich, Ch., T.A.B. Snijders, and M. Pearson (2010). Dynamic networks and behavior: Separating selection from influence. *Sociological Methodology* 40: 329-393. You need not finish the reading this week, we continue with the simulations next week (see readings there).

Peripheral readings

- Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine*, *357*(4), 370-379.
- Aral, S., Muchnik, L., & Sundararajan, A. (2009). Distinguishing influence-based contagion from homophily-driven diffusion in dynamic networks. *Proceedings of the National Academy of Sciences*, *106*(51), 21544-21549.
- Centola, D., & Macy, M. (2007). Complex contagions and the weakness of long ties. *American Journal of Sociology*, *113*(3), 702-734.
- Shalizi, C. R., & Thomas, A. C. (2011). Homophily and contagion are generically confounded in observational social network studies. *Sociological Methods & Research*, *40*(2), 211-239.
- Labun, A., Wittek, R., & Steglich, C. (2016). The co-evolution of power and friendship networks in an organization. *Network Science*, *4*(3), 364-384.

Calendar week 11: Simulation integrated

Lecture: Wednesday 11 March 2020, 10:15-12:00, in room KO25 *Christian Steglich*

Lab class: Wednesday 11 March 2020, 13:15-15:00, in room K21 *Christian Steglich / Robert Krause*

Literature class: Friday 13 March 2020, 10:15-12:00, in room SP35 *Christian Steglich*

The topic of lecture and lab is *simulation* of network data and the use of simulations to assess, for instance, sensitivity of network-level outcomes to manipulations of the model or underlying data. We already addressed the two most famous models from network science (Watts' *small world networks* and Barabási's *scale-free networks*) earlier, we now address how ERGMs and SAOMs can be used for simulation purposes. We discuss how the micro-macro processes can be modeled considering key network mechanisms.

Core readings

- Robins, G., Pattison, P., & Woolcock, J. (2005). Small and other worlds: Global network structures from local processes. *American Journal of Sociology*, *110*(4), 894-936.
- Snijders, T. A., & Steglich, C. E. (2015). Representing micro–macro linkages by actor-based dynamic network models. *Sociological Methods & Research*, *44*(2), 222-271.
- The "decomposition" part towards the end of the paper by Ch. Steglich, T.A.B. Snijders, and M. Pearson (2010). Dynamic networks and behavior: Separating selection from influence. *Sociological Methodology* 40: 329-393.

Peripheral readings

- Schaefer, D. R., Adams, J., & Haas, S. A. (2013). Social networks and smoking: exploring the effects of peer influence and smoker popularity through simulations. *Health Education & Behavior*, *40*(1_suppl), 24-32.

Calendar week 12: Role models, blockmodelling, simulation

Lecture: Wednesday 18 March 2020, 10:15-12:00, in room KO25 *Carl Nordlund*

Lab class: Wednesday 18 March 2020, 13:15-15:00, in room KO25 *Carl Nordlund*

Literature class: Friday 20 March 2020, 10:15-12:00, in room SP34 *Carl Nordlund*

We recapitulate upon community structures, that is, cohesive subgroups as an entry-point to role structures - as cohesive subgroups can be seen as a special type of blockimage. We address the notions of *position* and *role* in social networks.
The applied papers by Galaszkiewicz & Burt (1991) on inter-organisational contagion and by Kreager et al. (2011) on the structure of adolescent peer groups illustrate the use of positions (defined by structural equivalence) and subgroup detection, respectively. The paper by Snyder and Kick (1979) is indeed old but was the first in a series of papers using blockmodelling to study globalization, demonstrating how network methods indeed are applicable to study social relations at the highest level. There are two more applied papers in the peripheral readings: DiMaggio's (1986) investigation of organisational fields from a network perspective, and Herman's analysis of factions in a church congregation. Both apply blockmodelling.

Core readings

- Kolaczyk, E. D., & Csárdi, G. (2014). *Statistical analysis of network data with R* (Vol. 65). New York: Springer. Chapter 6.3.
- Chapter 12 [25 pages] of: Stephen Borgatti, Martin Everett and Jeffrey Johnson (2013) *Analyzing Social Networks*.
- Galaskiewicz, J., & Burt, R. S. (1991). Interorganization contagion in corporate philanthropy. *Administrative Science Quarterly*, 88-105.
- Kreager, D. A., Rulison, K., & Moody, J. (2011). Delinquency and the structure of adolescent peer groups. *Criminology*, *49*(1), 95-127.
- Snyder, D., Kick. E.L. (1979). Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational interactions. American Journal of Sociology, 84(5), 1096-1126. [Quite a lot on political economy and world-system theory; feel free to skip to the goodies, i.e. blockmodeling applications]

Peripheral readings

- Herman, N. J. (1984). Conflict in the church: A social network analysis of an Anglican congregation. *Journal for the Scientific Study of Religion*, 60-74.
- DiMaggio, P. 1986. Structural analysis of organizational fields: A blockmodel approach. *Research in Organizational Behavior* 8: 335-70.
- Doreian, P., Batagelj, V., Ferligoj, A. 2005. Positional analysis of sociometric data. (chapter 5) In: Models and Methods in Social Network Analysis (Structural Analysis in the Social Sciences). Carrington, P., Scott, J., Wasserman, S. (eds.)

Calendar week 13: Project consultations

The last week is reserved for your in-depth work on the final project. For this, we urge you to make appointments with the teachers. The course rooms listed in the online schedule will be available for us to meet and discuss.

Walk-in consultations (be there at the beginning or make an appointment)

Wednesday 25 March 2020, 10:15-12:00, in room KO25	*Christian Steglich / Dorottya Kisfalusi*
Wednesday 25 March 2020, 13:15-15:00, in room KO25	*Christian Steglich / Dorottya Kisfalusi*
Friday 27 March 2020, 10:15-12:00, in room K25	*Christian Steglich / Károly Takács*