

Stat/CSSS 567

Fall 2020, University of Washington

Textbooks: Kolaczyk, Eric D. 2009. *Statistical Analysis of Network Data* (SAND). and Kolaczyk, Eric D. and Csárdi, G. 2014. *Statistical Analysis of Network Data* (SANDr). Both are available as pdf from the UW Library website.

Reading: Readings come from several disciplines and, as such, assume different levels of background knowledge. You're encouraged to read as comprehensively as possible with the understanding that readings might be assuming familiarity with topics that are new to you. Forming interdisciplinary study groups is also highly encouraged!

Week 1 Overview & introductions (Week of Sept 28)

- Slides
- SAND chapter 1 & 2
- Readings:
 - Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network Analysis in the Social Sciences. *Science*, 323(5916), 892-895.
 - Butts, C. (2009). Revisiting the Foundations of Network Analysis. *Science*, 325(414).
 - Banerjee, A., Chandrasekhar, A. G., Duflo, E., & Jackson, M. O. (2013). The diffusion of microfinance. *Science*, 341(6144), 1236-498.
 - Kadushin, C. Who benefits from network analysis: ethics of social network research. *Social Networks*. 27(2):139-153.
 - Butts, C. (2003). Network inference, error and informant (in)accuracy: a Bayesian approach. *Social Networks*, 25:2:103-140.
 - 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.
- Lab: No lab this week; sign up for Github.

Week 2 Local & global properties of graphs (Week of Oct 5)

- Slides
- SAND chapter 3 & 4
- Readings:
 - Smith, S. (2005). "Don't put my name on it": Social capital activation and job-finding assistance among the black urban poor. *American Journal of Sociology*, 111(1), 1-57.
 - Lloyd-Smith, J. O., Schreiber, S. J., Kopp, P. E., & Getz, W. M. (2005). Superspreading and the effect of individual variation on disease emergence. *Nature*, 438(7066), 355-359.
 - McPherson, M., Smith-Lovin, L., and Brashears, M.E. (2006). Social isolation in America: Changes in core discussion networks over two

- decades. *American Sociological Review*, 71(3):353-375.
- Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, 78(6), 1360-1380.
 - Centola, D., & Macy, M. (2007). Complex contagions and the weakness of long ties. *American Journal of Sociology*, 113(3), 702-734.
 - Victor, B. (2011). Scientific Communication As Sequential Art.
 - Lee, H., McCormick, T. H., Wildeman, C., and Hicken, M. (2015). Racial inequalities in connectedness to imprisoned individuals in the United States. *Du Bois Review: Social Science Research on Race*, 12: 269-282.
 - McPherson, Miller, Lynn Smith-Lovin, and James M. Cook. 2001. “Birds of a Feather: Homophily in Social Networks.” *Annual Review of Sociology* 27:415-44
 - Resnick, P., Zeckhauser, R., Swanson, J., and Lockwood, K. (2006). The value of reputation on eBay: A controlled experiment. *Experimental Economics*, 9:79-101.
- Lab: Github practice Lab 1: SANDr chapter 2 & 3 (Graphs & Visualizing graphs)
 - Homework 1

Week 3 Modeling connections (overview/SBM) (Week of Oct 12)

- Slides
- SAND chapter 6
- Class reading
 - D Krackhardt (1988). Predicting with networks: Nonparametric multiple regression analysis of dyadic data.
 - Fafchamps, M., & Gubert, F. (2007). Risk sharing and network formation. *American Economic Review*, 97(2), 75-79.
 - Holland, P. W., Laskey, K., and Leinhardt, S. Stochastic blockmodels: First steps. *Social networks* 5, no. 2 (1983): 109-137.
 - Snijders, T., and K. Nowicki. (1997) Estimation and prediction for stochastic blockmodels for graphs with latent block structure. *Journal of Classification* 14(1), 75-100.
 - Airoldi, E. M., Blei, D. M., Fienberg, S. E., & Xing, E. P. (2008). Mixed membership stochastic blockmodels. *Journal of Machine Learning Research*, 9(Sep), 1981-2014.
 - Rohe, K., Chatterjee, S., & Yu, B. (2011). Spectral clustering and the high-dimensional stochastic blockmodel. *The Annals of Statistics*, 39(4), 1878-1915.
 - Chandrasekhar, A., & Lewis, R. (2011). Econometrics of sampled networks

Week 4 Modeling connections (latent distance models) (Week of Oct 19)

- Slides
- SAND chapter 6
- Homework 2
- Class reading
 - Hoff, P. D., Raftery, A. E., & Handcock, M. S. (2002). Latent space approaches to social network analysis. *Journal of the American Statistical Association*, 97(460), 1090-1098.
 - Hoff, P. D. (2005). Bilinear mixed-effects models for dyadic data. *Journal of the American Statistical Association*, 100(469), 286-295.
 - Hoff, P. (2008). Modeling homophily and stochastic equivalence in symmetric relational data. In *Advances in Neural Information Processing Systems* (pp. 657-664).
- Presentation reading
 - Airoldi, E. M., Costa, T. B., & Chan, S. H. (2013). Stochastic block-model approximation of a graphon: Theory and consistent estimation. In *Advances in Neural Information Processing Systems* (pp. 692-700). *Note: This is a more technical reading.*
 - de Paula, A. (2017) Econometrics of Network Models.
 - Fosdick, B. K., & Hoff, P. D. (2015). Testing and modeling dependencies between a network and nodal attributes. *Journal of the American Statistical Association*, 110(511), 1047-1056.
 - Ward, M. D., Siverson, R. M., & Cao, X. (2007). Disputes, democracies, and dependencies: A reexamination of the Kantian peace. *American Journal of Political Science*, 51(3), 583-601.
 - Barberá, P. (2015). Birds of the same feather tweet together: Bayesian ideal point estimation using Twitter data. *Political Analysis*, 23(1), 76-91.
- Lab: Latent variable models for graphs with *latentnet*

Week 5 Modeling connections (ERGMs) (Week of Oct 26)

- Slides
- Class reading
 - Robins, G. et al (2006) “An introduction to exponential random graph (p*) models for social networks” *Social Networks* p173-191
 - Hunter, D. R., Krivitsky, P. N., & Schweinberger, M. (2012). Computational statistical methods for social network models. *Journal of Computational and Graphical Statistics*, 21(4), 856-882.
 - Snijders, Tom AB, Philippa E. Pattison, Garry L. Robins, and Mark S. Handcock. New specifications for exponential random graph models. *Sociological methodology* 36, no. 1 (2006): 99-153.
 - Robins, G., Snijders, T., Wang, P., Handcock, M., & Pattison, P. (2007). Recent developments in exponential random graph (p*) models for social networks. *Social networks*, 29(2), 192-215.
 - Hunter, D. R., Handcock, M. S., Butts, C. T., Goodreau, S. M., & Morris, M. (2008). *ergm*: A package to fit, simulate and diagnose

exponential-family models for networks. *Journal of statistical software*, 24(3).

- Presentation reading
 - Steven M. Goodreau, James A. Kitts and Martina Morris, “Birds of a Feather, Or Friend of a Friend?: Using Exponential Random Graph Models to Investigate Adolescent Social Networks”, *Demography* 46 (2009): 103–125
 - Schweinberger, M. (2011). Instability, sensitivity, and degeneracy of discrete exponential families. *Journal of the American Statistical Association*, 106(496), 1361-1370. *Note*: This is a more technical reading.
 - Shalizi, C. R., & Rinaldo, A. (2013). Consistency under sampling of exponential random graph models. *Annals of Statistics*, 41(2), 508. *Note*: This is a more technical reading.
 - Mouw, T., & Entwisle, B. (2006). Residential segregation and inter-racial friendship in schools. *American Journal of Sociology*, 112(2), 394-441.
- Lab: SANDr chapter 6 (Statistical Models for Network Graphs, ERGMs)

Week 6 Peer influence & spillovers (Week of Nov 2)

- **No class Nov 3; Election day.**
- We'll discuss class readings on Thursday and presentation readings will be asynchronous.
- Slides
- Class readings:
 - Breza, E. (2016). Field experiments, social networks, and development. In *The Oxford Handbook of the Economics of Networks*. Oxford University Press.
 - Foster, A. D., & Rosenzweig, M. R. (1995). Learning by doing and learning from others: Human capital and technical change in agriculture. *Journal of Political Economy*, 103(6), 1176-1209.
 - Conley, T. G., & Udry, C. R. (2010). Learning about a new technology: Pineapple in Ghana. *American Economic Review*, 100(1), 35-69.
 - Cohen-Cole, E., & Fletcher, J. M. (2008). Detecting implausible social network effects in acne, height, and headaches: longitudinal analysis. *BMJ*, 337, a2533.
 - Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *The Review of Economic Studies*, 60(3):531–542
 - Goldsmith-Pinkham, P., & Imbens, G. W. (2013). Social networks and the identification of peer effects. *Journal of Business & Economic Statistics*, 31(3), 253-264.
- Presentation readings:
 - Beaman, L., BenYishay, A., Magruder, J., & Mobarak, A. M. (2018). Can network theory-based targeting increase technology adoption? (No. w24912). National Bureau of Economic Research.

- Heath, Rachel. 2018. “Why do Firms Hire Using Referrals? Evidence from Bangladeshi Garment Factories.” *Journal of Political Economy*, 126(4): 1691-1746.
- Miguel, E., & Kremer, M. (2004). Worms: identifying impacts on education and health in the presence of treatment externalities. *Econometrica*, 72(1), 159-217.
- Nickerson, D. W. (2008). Is voting contagious? Evidence from two field experiments. *American Political Science Review*, 102(01):49–57
- Carrell, S. E., Page, M. E., & West, J. E. (2010). Sex and science: How professor gender perpetuates the gender gap. *The Quarterly Journal of Economics*, 125(3), 1101-1144.
- Sacerdote, B. (2001). Peer effects with random assignment: Results for Dartmouth roommates. *The Quarterly Journal of Economics*, 116(2):681–704
- Carrell, S. E., & Hoekstra, M. L. (2010). Externalities in the classroom: How children exposed to domestic violence affect everyone’s kids. *American Economic Journal: Applied Economics*, 2(1), 211-28.
- Lab: Hoff (2016). “Dyadic data analysis with amen”

Week 7 Peer influence & spillovers (Week of Nov 9)

- Slides
- Homework 3 Note: I combined HW 3 and HW 4, so this is the last one!
- Readings
 - Angrist, J. D. (2014). The perils of peer effects. *Labour Economics*, 30, 98-108.
 - Carrell, S. E., Sacerdote, B. I., & West, J. E. (2013). From natural variation to optimal policy? The importance of endogenous peer group formation. *Econometrica*, 81(3), 855-882.
 - Booij, A. S., Leuven, E., & Oosterbeek, H. (2017). Ability peer effects in university: Evidence from a randomized experiment. *The Review of Economic Studies*, 84(2), 547-578.
 - Johan Ugander, Brian Karrer, Lars Backstrom, and Jon Kleinberg. Graph cluster randomization: network exposure to multiple universes. 2013.
- Presentation readings:
 - Graham, B. S. (2008). Identifying social interactions through conditional variance restrictions. *Econometrica*, 76(3), 643-660.
 - De Giorgi, G., Pellizzari, M., & Redaelli, S. (2010). Identification of social interactions through partially overlapping peer groups. *American Economic Journal: Applied Economics*, 2(2), 241-75.
 - Blume, L. E., Brock, W. A., Durlauf, S. N., & Jayaraman, R. (2015). Linear social interactions models. *Journal of Political Economy*, 123(2), 444-496.
 - Hardy, M., Lee, W. T., & McCormick, T. H. (2019). Estimating Spillovers Using Imprecisely Measured Networks.

- Yann Bramouille, Habiba Djebbari, and Bernard Fortin. Identification of peer effects through social networks. *Journal of Econometrics*, 150(1):41–55, 2009.
- Peter M. Aronow and Cyrus Samii. Estimating Average Causal Effects Under General Interference, with Application to a Social Network Experiment. *Annals of Applied Statistics*, 2017.
- Lab: Fitting the linear in means model

Week 8 Collecting network data (Week of Nov 16)

- Slides
- SAND chapter 5
- Class readings
 - Breza, E., Chandrasekhar, A. G., McCormick, T. H., & Pan, M. (2017). Using aggregated relational data to feasibly identify network structure without network data (No. w23491). *National Bureau of Economic Research*.
 - Goel, S., & Salganik, M. J. (2010). Assessing respondent-driven sampling. *Proceedings of the National Academy of Sciences*, 107(15), 6743-6747.
 - Mark S. Handcock and Krista J. Gile. Modeling Social Networks From Sampled Data. *Annals of Applied Statistics*, 4(1):5–25, 2010.
 - Diprete, T. D., Gelman, A., McCormick, T. H., Teitler, J., and Zheng, T. (2011). Segregation in social networks based on acquaintanceship and trust. *American Journal of Sociology*, 116, 1234-83.
- Presentation readings:
 - Merli, M. G., Moody, J., Smith, J., Li, J., Weir, S., & Chen, X. (2015). Challenges to recruiting population representative samples of female sex workers in China using Respondent Driven Sampling. *Social Science & Medicine*, 125, 79-93.
 - Mouw, T., & Verdery, A. M. (2012). Network sampling with memory: a proposal for more efficient sampling from social networks. *Sociological Methodology*, 42(1), 206-256.
 - David C. Bell, Benedetta Belli-McQueen, and Ali Haider. Partner Naming and Forgetting: Recall of Network Members. *Social Networks*, 29(2):279–299, 2007.
- Lab: Exploring missing data & egocentric graphs

Week 9 No class (Week of Nov 23)

- No class; holiday.

Week 10 Network models in the era of "big data" (Week of Nov 30)

- Slides
- Class readings:

- Butler D. (2007). Data sharing threatens privacy. *Nature*, 449:644-645.
- Slater, M. et al. (2006). A virtual reprise of the Stanley Milgram obedience experiments. *PLOS ONE*, 1:e39.
- Cesare, N., Lee, H., McCormick, T. H., Spiro, E., and Zagheni, E. (2018+). Promises and pitfalls of using digital traces for demographic research. To appear, *Demography*.
- Goel, S., Watts, D. J., & Goldstein, D. G. (2012, June). The structure of online diffusion networks. In *Proceedings of the 13th ACM conference on electronic commerce* (pp. 623-638). ACM.
- Eagle, N., Pentland, A. S., & Lazer, D. (2009). Inferring friendship network structure by using mobile phone data. *Proceedings of the National Academy of Sciences*, 106(36), 15274-15278.
- Presentation readings:
 - Narayanan, A., Shi, E., & Rubinstein, B. I. (2011). Link prediction by de-anonymization: How we won the kaggle social network challenge. In *The 2011 International Joint Conference on Neural Networks* (pp. 1825-1834). IEEE.
 - Dodds, P. S., Muhamad, R., and Watts, D. J. (2003). An experimental study of search in global social networks. *Science*, 301:827-829
 - Salganik, M.J., Dodds, P.S., Watts, D.J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *Science*, 311:854-856 (also read supporting online materials).
 - Kossinets, G., & Watts, D. J. (2009). Origins of homophily in an evolving social network. *American Journal of Sociology*, 115(2), 405-450.
- Lab: Scrape data using *rtweet*.

Week 11 (Week of Dec 7)

- Virtual poster sessions.