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Our group conducts research on the structure and function of networks, particularly social and information networks, which we study using a combination of empirical methods, analysis, and computer simulation. Among other things, we have investigated scientific coauthorship networks, citation networks, email networks, friendship networks, epidemiological contact networks, and animal social networks; we've studied fundamental network properties such as degree distributions, centrality measures, assortative mixing, vertex similarity, and community structure, and made analytic or computer models of disease propagation, friendship formation, the spread of computer viruses, the Internet, and network navigation. Information Publications Recent presentations Press coverage Curriculum vitae Selected publications: The structure of scientific collaboration networks, M. E. J. Newman, Proc. Natl. Acad. Sci. USA 98, 404-409 (2001). Random graphs with arbitrary degree distributions and their applications, M. E. J. Newman, S. H. Strogatz, and D. J. Watts, Phys. Rev. E 64, 026118 (2001). Assortative mixing in networks, M. E. J. Newman, Phys. Rev. Lett. 89, 208701 (2002). The structure and function of complex networks, M. E. J. Newman, SIAM Review 45, 167-256 (2003). Modularity and community structure in networks, M. E. J. Newman, Proc. Natl. Acad. Sci. USA 103, 8577-8582 (2006). Hierarchical structure and the prediction of missing links in networks, A. Clauset, C. Moore, and M. E. J. Newman, Nature 453, 98â€"101 (2008). Power-law distributions in empirical data, Aaron Clauset, Cosma Rohilla Shalizi, and M. E. J. Newman, SIAM Review 51, 661-703 (2009). Graph spectra and the detectability of community structure in networks, Raj Rao Nadakuditi and M. E. J. Newman, Phys. Rev. Lett. 108, 188701 (2012). Percolation on sparse networks, Brian Karrer, M. E. J. Newman, and Lenka ZdeborovÃ¡, Phys. Rev. Lett. 113, 208702 (2014). Structure and inference in annotated networks, M. E. J. Newman and Aaron Clauset, Nature Communications 7, 11863 (2016). Aspirational pursuit of mates in online dating markets, Elizabeth E. Bruch and M. E. J. Newman, Science Advances 4, eaap9815 (2018). Network structure from rich but noisy data, M. E. J. Newman, Nature Physics 14, 542-545 (2018). Research group Group members: PI: Professor Mark Newman Dr. Jean-Gabriel Young George Cantwell Alec Kirkley Former group members: Dr. Brian Ball, Dotomi Inc. Professor Michael Gastner, Yale-NUS College Professor Gourab Ghoshal, University of Rochester Professor Michelle Girvan, University of Maryland Professor Petter Holme, Tokyo Institute of Technology Dr. Brian Karrer, Facebook Corporation Dr. Elizabeth Leicht, Oxford University Dr. Travis Martin, Google Inc. Professor Juyong Park, KAIST, Seoul Professor Bethany Percha, Mount Sinai School of Medicine Dr. Maria Riolo, Santa Fe Institute Dr. Xiao Zhang, Amazon A9 Inc. Courses Complex Systems 535, Network Theory, Fall 2020 Previous courses: Physics 288, Physics of Music, Winter 2020 Complex Systems 535, Network Theory, Fall 2019 Physics 411, Computational Physics, Winter 2019 Complex Systems 535, Network Theory, Fall 2018 Physics 411, Computational Physics, Winter 2018 Complex Systems 535, Network Theory, Fall 2017 Physics 411, Computational Physics, Winter 2017 Complex Systems 535, Network Theory, Fall 2015 Physics 390, Introduction to Modern Physics, Winter 2015 Complex Systems 535, Network Theory, Fall 2014 Physics 411, Computational Physics, Winter 2014 Complex Systems 535, Network Theory, Fall 2013 Physics 411, Computational Physics, Winter 2013 Complex Systems 535, Network Theory, Fall 2012 Physics 411, Computational Physics, Winter 2012 Complex Systems 535, Network Theory, Fall 2011 Physics 411, Computational Physics, Winter 2011 Complex Systems 535, Network Theory, Fall 2010 Physics 390, Introduction to Modern Physics, Winter 2010 Complex Systems 535, Network Theory, Fall 2009 Physics 390, Introduction to Modern Physics, Winter 2008 Complex Systems 511, Theory of Complex Systems, Fall 2007 Physics 406, Statistical and Thermal Physics, Winter 2007 Complex Systems 899, Theory of Complex Systems, Winter 2006 Complex Systems 535, Network Theory, Winter 2005 Physics 406, Statistical and Thermal Physics, Fall 2004 Complex Systems 535, Network Theory, Winter 2004 Physics 406, Statistical and Thermal Physics, Fall 2003 Physics 406, Statistical and Thermal Physics, Fall 2002 Other information The second edition of my book Networks is now available from Oxford University Press. Information about it is here. The Amazon page is also a good place to look for info. If you are looking for maps of the US election results, click here. Our work on generalized communities in networks was featured on the cover of Physical Review Letters. With Daniel Dorling and Anna Barford: The Atlas of the Real World, a popular book containing 366 cartograms showing all kinds of different features of the world today. Our work on density-equalizing map projections appeared on the cover of the Proceedings of the National Academy of Sciences. The web site accompanying my book Computational Physics is here. The Worldmapper Project collection of cartograms is here. A collection of network data sets from various sources is here. Data sets include the Zachary karate club and US college football networks that have been widely used as tests for community structure algorithms, and a number of coauthorship networks. Code for calculating the reduced mutual information is here. Code for calculating the number of communities in a network is here. Code for the uncertain networks algorithm is here. Code for the metadata community detection algorithm is here. Code for the overlapping communities algorithm is here. Code for the directed network ranking algorithm is here. Information and code for the degree-corrected block model is here. Information and code for the link prediction algorithm is here. Information and code for maximum likelihood fits to power-law distributions is here. Information and code for the fast community structure algorithm is here. Information and code for the cartogram algorithm is here. Information and code for the percolation algorithm is here. If you are looking for the summary tables of collaboration indices from my 2001 paper on coauthorships, they are here. Contact details: I am not the only professor called Mark Newman at the University of Michigan. I'm the physicist who works on networks. There is another Mark Newman in the UM School of Information who works on human-computer interaction. Here are my contact details: Department of Physics University of Michigan Randall Laboratory 450 Church Street Ann Arbor, MI 48109-1040 Phone: (734) 764-4437 Fax: (734) 764-6843 Email: mejn@umich.edu Last modified: October 22, 2019 Mark Newman, Department of Physics, University of Michigan Introduction to Network Science Student/Faculty's Expectations on Teaching and Learning Instructor: John C.S. Lui This is an introductory course on "Network Science", in particular, we will learn various algorithms, mathematical principles, and software platforms for large scale networks analysis. In here, the networks can be both physical or logical networks. Logical networks include online social networks (e.g., Facebook, WeChat, Twitters, ...etc), Internet, Skype P2P networks, geo-distributed data center networks (DCNs), or cities which have mass amount of Internet-of-Things (IoTs) devices. Phyiscal networks include power plant networks, biological networks,..etc. In this course, we cover fundamental principles and algorithms for such large scale network analysis. Furthermore, how one can use these basic analytical tools and algorithms to understand the structures and dynamic of such networks. Note that this course is especially important since companies like Tencent, Alibaba and Huawei are looking for engineers to carry out large scale network analysis on their services/networks. Teaching Assistants Mr. XYZ Office hour: Office, HSH Eng Bldg, Room 120, TBD. Textbook: Course Grades: Homework: 25% Project: 25%; Examination: 50% (note: you need to get at least 25% in the final exam to pass the course) Policy: Late homework or programming assignments will NOT be considered. Announcemnet: As students have voted, we will have the following format and dates for makeup classes. Instead of lecture on Sept 26, video lecture will be uploaded to the Blackboard (. Class swap: Instead of lecture on Oct 10, we will have it on Oct 13, 9:00am - noon. AIT G04. Instead of lecture on Oct 17 (Chung Yueng Festival), video lecture will be uploaded to the Blackboard (. Class swap: Instead of Nov 7, we have it on Nov 10th, 9:00 am - noon. AIT G04. Class swap: Instead of Nov 21, we have it on Nov 17th, 9:00 am - noon. AIT G04. In short, the classes will be on: September: 5, 12, 19, 26 (video lecture) October: 3, 13 , 17 (video lecture) , 24, 31 November: 10 , 14, 17 FINAL EXAMINATION : Date December 5, 7:00 pm to 9:00 pm, 2018. YIA Room 505 !!!!!! Final Examination : For the final examination, you are allowed to bring lecture notes (those we covered in class) to the examination room. Topics to be covered in the final exam are: Various centrality measures Components, funning effect, degree distributions Power law and scale-free networks Clustering coefficeint Assorting mixing Graph partitioning Community detection Modularity maximization Random Graphs Concept of Information Maximization ... more Tentative Outline for the Course: Introduction to Large Scale Networks Measures and Metrics, Centrality measures on degree, eigenvector, Katz, page-rank, betweenness, closeness,..etc The Large-scale Structure of Networks, e.g., components, funning effect, degree distributions, power law and scale-free networks, clustering coefficeint, assorting mixing Basic Concepts of Algorithms, e.g., useful data structures, time and space complexity Fundamental Network Algorithms, e.g., algorithms to determine degree distributions, clustering coefficients, BFS, variants of shortest path, max-flow min-cut Matrix Algorithms and Graph Partitioning, e.g., dominant eigenvector, graph partitioning, community detection, modularity maximization Random Graphs, e.g., degree and edges distributions, clustering coefficient, giant and small components, path length Random Graphs with General Degree Distributions Networks Formation, e.g, network formation algorithms Percolation and Network Resilience, e.g., nodes vs. bonds percoloation, network robustness Epidemics on Networks, e.g., influence models, network stability and information spreading Dynamic Systems on Networks Network Search Network Advertisement Network Search and Exploration Game-theoretic Analysis of Online Social Networks Data Center Networks (DCNs) Data Plane vs. Control Plane in networks Software Defined Networks (SDNs) more to be added later.... Lecture Notes: (Password Protected) Administrative matter Introduction to Network Science 1 Introduction to Network Science 2 More to come .... Project (Password Protected) Submission: Please submit your programming project by Dec XX, 2018. Programming Project (Graph Data for 964 nodes and 3,000 undirected edges) Reference books: Reference papers: R. Albert and A-L. Barabasi. Statistical mechanics of complex networks. Rev. Mod. Phys, Vol. 74, p 47-97, 2002 M. E. J. Newman. The Structure and Function of Complex Networks. SIAM Review, Vol. 45, p 167-256, 2003 S. Boccaletti et al. Complex networks: Structure and dynamics. Phys. Reports, Vol. 424, p 175-308, 2006 S. N. Dorogovtsev and J. F. F. Mendes. Evolution of Networks. Adv. Phys. Vol. 51, N 4, p 1079-1187 Related software: READING MATERIALS: Introduction to network science: Albert-Laszlo Barabasi and Eric Bonabeau. Scale Free Networks. Scientific American, p 50-59, 2003 Mark Newman. The physics of networks. 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