



Almighty Google knows everything! - Big-data and Network Science

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Abstract

Network science is an interdisciplinary academic field which studies complex networks such as engineered networks, information networks, biological networks, and social networks etc. This field has received a major boost caused by the availability of huge network data resources on the Internet. The field draws on theories and methods including graph theory from mathematics, statistical mechanics from physics, data mining and information visualization from computer science, and social structure analysis from sociology to understand the complex systems, the problem to be solved in 21st century. Yet, another research field gaining huge attention nowadays is about big-data. Big-data is defined as “high-volume, high-velocity, and/or high-variety information assets that require new forms of processing to enable enhanced decision making, insight discovery and process optimization.” by Gartner, Inc. This field of research has huge potential for practical applications but it also promises new discovery in science. However, these big-data should be combined and analyzed together to be useful, and in this respect, network science will shed a light on analyzing these big-data in more combined way. In this presentation, I will briefly review what we can do by combining big-data, especially using Google and network science together to study various complex systems such as social network between people, biological networks, and prediction of science and technology trends & even presidential election results etc.

Profile

Prof. Hawoong Jeong is currently KAIST-chair professor at physics department at KAIST, Korea. He got his Ph.D. in physics at Seoul National University, and his research area includes complex systems, statistical computational physics and interdisciplinary science. He published about 100 research papers with more than 15,000 citations in diverse areas including physics, computer science, social science and biology. He got several awards including KAIST best lecturer, KPS research prize, the Scientist of the month award. He has also been selected as Young Scientist at 2012 Summer Davos World Econo Forum.



Education

- 1998: Seoul National University (Ph. D. in Physics)
- 1993: Seoul National University (M.S. in Physics)
- 1991: Seoul National University (B.S. in Physics)

Employment History

- 2001–Present: KAIST, Assistant/Associate/Professor/KAIST-Chair-Professor
- 1998–2001: Univ. of Notre Dame, Post-doc/Research Assistant Professor

Research Interests

- Complex systems
- Structure and dynamics of complex networks
- Bioinformatics
- Molecular dynamic simulation
- Computational methods in statistical physics
- Dynamics of fluctuating interfaces and growing surfaces

Selected Honors & Awards

- 2016 National President 's Commendation (Science and Technology Medal)
- 2014 Hall of Fame: 100 people who will lead Korea after 10 years by Dong-A Newspaper
- 2013 Research Prize by Korean Physical Society (KPS)
- 2012 Young Scientist by Summer Davos World Economic Forum
- 2010 The Scientist of the Month (May 2010) by MOST &KRF
- 2009 Grand prize for excellence in teaching, by KAIST
- 2007 Yong-Bong Prize by Korean Physical Society (KPS)

International Activities

- 2011/7– Associate Editor for “ BMC Biophysics ”
- 2010/3– Review Editorial Board of “ Frontier in Systems Biology ”
- 2015/7– Chairman of NetSci2016 / Board member of Network Science Society
- 2012/7– Editorial Board of EPJ Data Science
- 2012– International Advisory Committee of STATPHYS25

Selected Publications (out of 100, over 15,000 total citations)

(for full list, see <http://stat.kaist.ac.kr/publications.php>)

- [1] “Large-scale quantitative analysis of painting arts” Sci. Rep. 4 7370 (2014)
- [2] “Fundamental structural constraint of random scale-free networks”, Phys. Rev. Lett. 109 118701 (2012)
- [3] “Googling social interactions: Web search-engine based social network construction” PLoS ONE e11233 (2010)
- [4] “Dynamics and Directionality in Complex Networks” Phys. Rev. Lett. 103 228702 (2009)
- [5] “Scaling laws between population and facility densities” PNAS 106 14236 (2009)
- [6] “Price of anarchy in transportation networks: Efficiency and optimality control” Phys. Rev. Lett. 101 128701 (2008)
- [7] “Metabolite essentiality elucidates robustness of E. coli metabolism” PNAS 104 13638 (2007)
- [8] “Universality Class of Fiber Bundle Model on Complex Networks”, Phys. Rev. Lett. 94 025501 (2005)

- [9] "Role of the cytoskeleton in signaling networks", *J. of Cell Science* 117, 2769 (2004)
- [10] "Subnetwork Hierarchies of Biochemical Pathways", *Bioinformatics* 19 532 (2003)
- [11] "Classification of Scale-free Networks", *PNAS* 99 12583 (2002)
- [12] "Modeling the Internet's large-scale topology", *PNAS* 99 13382 (2002)
- [13] "Comparable system-level organization of Archaea and Eukaryotes", *Nature Genetics* 29 54 (2001)
- [14] "Lethality and Centrality in Protein Networks", *Nature* 411 41 (2001)
- [15] "The Large-scale Organization of Metabolic Networks", *Nature* 407 651 (2000)
- [16] "Error and Attack Tolerance of Complex Networks", *Nature* 406 378 (2000)
- [17] "The Diameter of the World Wide Web", *Nature* 401 130 (1999)