Dylan T. Walker

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Education:

2002-2008	Ph.D., *Stony Brook University* in theoretical physics of complex systems
1997-2002	Bachelors of Science in Physics from *New York University* (Magna Cum Laude)
1997-2002	Bachelors of Engineering in Electrical Engineering from *Stevens Institute of Technology* (Summa Cum Laude)

Research Experience:

Information networks, citation networks, collaborative networks (recommendation systems), social networks, biomolecular networks, internet (AS-level), WWW

Time-critical Information Networks – With the rise of social collaboration and web 2.0 concepts, many information systems have come into popular use that involve collaborative ranking. In particular, news aggregation systems such as digg.com or reddit.com rely on users to vote articles to their proper rank order. These information systems are time-critical in the sense that a news item must be promoted to sufficient rank quickly in order to make the headline before it is "old news". The information networks that represent these systems have two types of nodes: users and articles. These networks evolve throughout time as new articles are introduced and possibly become more connected. Ranking of such time-critical information networks is a challenging field of research. The bipartite nature of the network suggests the simultaneous ranking of articles and users. Multi-agent modeling of network evolution can uncover rich information about how different types of users interact and point to ranking algorithms that encompass user reputation and avoid sources of bias.

Protein Interaction Networks – Protein Interaction networks represent reversible protein binding interactions. In typical biological systems, (e.g., in the living cell) protein binding is dominated by dimer interactions (the binding of two single monomer proteins into a dimer). Proteins exist in large multiplicity within the cell in total concentrations dictated by the cellular machinery that regulates protein production. At any instant, proteins may be free or bound to other proteins. The equilibrium state in a well-mixed system is dictated by the law of mass action (LMA) equations. Fluctuations in free and bound concentration (large and small) about equilibrium occur and, due to the large number of interactions and the structure of the interaction network, can be nontrivial. Two types of interesting noise are present in these systems: spontaneous thermal noise and driven fluctuations. We calculate the network's collective effect on both types of fluctuations.

Citation Networks – Citation networks are formed by a set of documents that cite one another. A typical example is the network of scientific journal publications, where a publication is a node and a citation is a directed edge pointing from the citing publication to the cited publication. Due to their large size, it is untenable to navigate most citation networks without the aid of a content search and ranking scheme. Ranking schemes based on network topology are particularly useful in ranking large networks, a notable example being that of Google's PageRank for the web. Diffusion-based algorithms, like PageRank, are mathematically equivalent to diffusion processes where a large number of random walkers navigate the network by following links from one node to the next. Unlike in the case of the web, random walkers on citation networks always flow in the direction of older publications because citations are always made to papers that have been published in the past. This feature of citation networks, referred to as aging, biases naïve diffusion-based ranking algorithms towards the oldest papers. Our CiteRank algorithm corrects for aging effects and favors recent publications pertinent to modern research.

Publications & Presentations:

To Be Submitted	*Ranking of Time-Critical Information Networks*
To Be Submitted	*Noise in Mass Action Equilibrium of Protein Binding Networks*
2007	*Perturbations in Protein Interaction Networks* Boulder School for Condensed Matter and Materials Physics – Poster
2006	*Ranking Scientific Publications Using a Model of Network Traffic* D. Walker, H. Xie, K.K. Yan, S. Maslov, *J. Stat. Mech.* 6 10 (2007)
2006	*Designed & programmed CiteRank website: http://www.citerank.org*
2006	*Ageing in Citation Networks* International Conference on Network Science (Netsci '06) – Talk
2003	*CERN Workshop on Bump Bonding and Die Attach Technologies Summary* D. Walker, J. Heuser

Teaching Experience:

2004 – 2005	Honors Classical Physics, *Stony Brook University*
2003 – 2004	Classical Physics, *Stony Brook University*
2002 – 2003	Private student tutoring in the following subjects: pre-calculus, single- and multi-variable calculus, linear algebra, differential equations, all physics courses

Honors and Awards:

2006	*Boulder Condensed Matter Summer School*
2006	*International Conference on Network Science* (NetSci '06)
2003	*CERN Bump Bonding and Die Attach Technologies*
2003	*PHENIX / NA60 Silicon Pixel Detector Liaison @ CERN*
2002	Morse Medal for academic excellence, *New York University*
2001	Inducted into *Eta Kappa Nu Engineering Honors Society*
2000	Inducted into *Sigma Pi Sigma Physics Honors Society*

Skills:

Mathematics: Stochastic Systems, Nonlinear Dynamical Processes, Data Mining, Machine Learning
Programming: C/C++, Python, Matlab, PHP, SQL
Web Design: Adobe Suite, CSS, JavaScript

References available upon request