

Hanghang Tong

IBM T.J. Watson Research Center
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Research Interests Data mining, machine learning, social networks analysis, multimedia.

Education

- 9/2008-11/2009 Ph.D in Machine Learning Department, School of Computer Science, Carnegie Mellon University (Advisor: Prof. **Christos Faloutsos**)
Dissertation title: "Fast Algorithms for Querying and Mining Large Graphs"
- 9/2005-9/2008 M. Sci. in Machine Learning Department, School of Computer Science, Carnegie Mellon University (Advisor: Prof. **Christos Faloutsos**)
Thesis title: "Center-Piece Subgraphs: Problem Definition and Fast Solutions"
- 9/2002-7/2005 M. Eng. In Pattern Recognition and Intelligent System, Tsinghua University (Advisor: Prof. **Chongrong Li**)
Thesis title: "Machine Learning for Internet Traffic Prediction and Anomaly Detection"
- 9/1998-7/2002 B. Eng. In Automation Technology, Tsinghua University

Employment History

- 7/2010-present: Research Staff Member (full time),
IBM T.J. Watson Research Center
19 Skyline Drive,
Hawthorne, NY 10532
Lead the projects on large scale network infrastructure and anomaly detection at multiple scales.
- 12/2009-7/2010 Post-Doctoral Fellow (full time),
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, 15213 PA
Do research on virus and influence propagation on real large networks.
- 8/2005-11/2009 Graduate Research Assistant (part time)
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, 15213 PA
Do research on querying and mining large networks.
- 6/2008-8/2008 Summer Intern (full time)
IBM T.J. Watson Research Center
19 Skyline Drive,
Hawthorne, NY 10532
Do research on measuring graph proximity with side information
- 5/2006-7/2006 Summer Intern (full time)
AT&T Labs
180 Park Ave - Building 103
Florham Park, NJ 07932
Do research on directionality-aware proximity measure on large graphs

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Awards

- 2008 SDM 2008 Best Paper Award
2006 ICDM 2006 Best Research Paper Award

Patents

1. Yehuda Koren, Christos Faloutsos, *Hanghang Tong*. Direction-aware proximity for graph mining. Publication number: US 2009/0204554 A1, US Pat. 12069500. Filed Feb. 11, 2008
2. *Hanghang Tong*, Huiming Qu, Hani T. Jamjoom. System and method to measure node proximity on graphs with side information. Application Serial No.: 12/638531. Filed Dec. 15, 2009
3. *Hanghang Tong*, Huiming Qu, Hani T. Jamjoom. An efficient method to compute node proximity with on line feedback on large graphs. Application Serial No.: 12/638514. Filed Dec. 15, 2009

Conference Presentations

1. "Non-Negative Residual Matrix Factorization with Application to Graph Anomaly Detection"
The 11th SIAM International Conference on Data Mining (SDM 2011), April 28-30, 2011, Mesa, AZ, USA
2. "Proximity Tracking on Time-Evolving Bipartite Graphs"
The 8th SIAM International Conference on Data Mining (SDM 2008), April 24-26, 2008, Atlanta, GA, USA
3. "Colibri: fast mining of large static and dynamic graphs"
The 14th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD 2008), August 24-27, 2008, Las Vegas, NV
4. "Fast mining of complex time-stamped events"
The 17th ACM Conference on Information and Knowledge Management (CIKM 2008), October 26-30, 2008, Napa Valley, CA
5. "Fast best-effort pattern matching in large attributed graphs"
The 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD 2007), August 12-15, 2007, San Jose, CA
6. "Fast direction-aware proximity for graph mining"
The 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD 2007), August 12-15, 2007, San Jose, CA
7. "Fast Random Walk with Restart and Its Applications"
The 6th IEEE International Conference on Data Mining (ICDM 2006), December 18-22, 2006, Hong Kong, China
8. "Center-piece subgraphs: problem definition and fast solutions"
The 12th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD 2006), August 20-23, 2006, Philadelphia, PA

Invited Talks

"Fast Algorithms for Querying and Mining Large Graphs"

- ◆ Department of Computer Science, University of Maryland, College Park, MD, 2009
- ◆ IBM T.J. Watson Research Center, Hawthorne, NY, 2009
- ◆ Department of Electric Engineering, Zhejiang Univeristy, Hongzhou, China, 2009
- ◆ Department of Computer Science, Peking Univeristy, Peking, China, 2009
- ◆ Department of Computer Science, Tsinghua Univeristy, Peking, China, 2009

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- ◆ Microsoft Research Asia, Peking, China, 2009
- ◆ IBM T.J. Watson Research Center, Yorktown Heights, NY, 2010
- ◆ School of Computational Science and Engineering, Gatech, Atlanta, GA, 2010
- ◆ Yahoo! Labs, Sunnyvale, CA, 2010

Publications

Book Chapter

1. **Hanghang Tong**, Yehude Koren, and Christos Faloutsos. Direction-Aware Proximity on Graphs. Book chapter in Encyclopedia of Data Warehousing and Mining 2009: 646-653.
2. **Hanghang Tong**, Spiros Papadimitriou, Philip S. Yu and Christos Faloutsos. Proximity Tracking on Dynamic Bipartite Graphs: Problem Definitions and Fast Solutions. LINK MINING: MODELS, ALGORITHMS, AND APPLICATIONS 2010, Part 2, 211-236, DOI: 10.1007/978-1-4419-6515-8_8.

Refereed Journal Publications

1. **Hanghang Tong**, Spiros Papadimitriou, Philip S. Yu and Christos Faloutsos. Fast Monitoring Proximity and Centrality on Time-Evolving Bipartite Graphs. SAM Special Issue on Best of SDM08
2. **Hanghang Tong**, Christos Faloutsos, and Jia-Yu Pan. Random Walk with Restart: Fast Solutions and Applications. Knowledge and Information Systems: An International Journal (KAIS), Volume 14 Number 3/ March 2008, pp327-346.
3. **Hanghang Tong**, Jingrui He, Mingjing Li, Wei-Ying Ma, Hong-Jiang Zhang, Changshui Zhang. Manifold-Ranking Based Keyword Propagation for Image Retrieval. EURASIP Journal on Applied Signal Processing, vol. 2006, Article ID 79412, 10 pages, 2006. doi:10.1155/ASP/2006/79412.
4. Jingrui He, Mingjing Li, Hong-Jiang Zhang, **Hanghang Tong** and Changshui zhang. Generalized Manifold-Ranking Based Image Retrieval. IEEE Transaction on Image Processing. volume 15, issue 10: pp.3170-3177, 2006

Refereed Conference Publications

1. **Hanghang Tong**, Jingrui He, Zhen Wen, and Ching-Yung Lin. Diversified Ranking on Large Graphs: An Optimization Viewpoint. ACM SIGKDD conference on Knowledge Discovery and Data Mining (KDD-11) 2011
2. U Kang, **Hanghang Tong**, Jimeng Sun, Ching-Yung Lin and Christos Faloutsos. GBASE: A Scalable and General Graph Management System. ACM SIGKDD conference on Knowledge Discovery and Data Mining (KDD-11) 2011
3. Keith Henderson, Brian Gallagher, Lei Li, Leman Akoglu, Tina Eliassi-Rad, **Hanghang Tong** and Christos Faloutsos. It's Who You Know: Graph Mining Using Recursive Structural Features. ACM SIGKDD conference on Knowledge Discovery and Data Mining (KDD-11) 2011
4. Fei Wang, **Hanghang Tong** and Ching-Yung Lin. Towards Evolutionary Nonnegative Matrix Factorization. Twenty-Fifth Conference on Artificial Intelligence (AAAI-11) 2011
5. **Hanghang Tong** and Ching-Yung Lin. Non-Negative Residual Matrix Factorization with Application to Graph Anomaly Detection. SIAM Data Mining Coference (SDM) 2011
6. U Kang, Spiros Papadimitriou, Jimeng Sun, and **Hanghang Tong**. Centralities in Large Networks: Algorithms and Observations. SIAM Data Mining Coference (SDM) 2011
7. Dashun Wang, Zhen Wen, **Hanghang Tong**, Ching-Yung Lin, Chaoming Song,

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- Albert-László Barabási. Information Spreading in Context. International World Wide Web Conference (WWW) 2011
8. Nicholas C. Valler, B. Aditya Prakash, **Hanghang Tong**, Michalis Faloutsos, and Christos Faloutsos. Epidemic Spread in Mobile Ad Hoc Networks: Determining the Tipping Point. IFIP/TC6 NETWORKING 2011
 9. B. Aditya Prakash, **Hanghang Tong**, Nicholas Valler, Michalis Faloutsos, Christos Faloutsos: Virus Propagation on Time-Varying Networks: Theory and Immunization Algorithms. ECML/PKDD (3) 2010: 99-114
 10. **Hanghang Tong**, B. Aditya Prakash, Charalampos E. Tsourakakis, Tina Eliassi-Rad, Christos Faloutsos, Duen Horng Chau: On the Vulnerability of Large Graphs. ICDM 2010: 1091-1096
 11. Jingrui He, **Hanghang Tong**, Jaime G. Carbonell: Rare Category Characterization. ICDM 2010: 226-235
 12. Keith Henderson, Tina Eliassi-Rad, Christos Faloutsos, Leman Akoglu, Lei Li, Koji Maruhashi, B. Aditya Prakash, **Hanghang Tong**: Metric forensics: a multi-level approach for mining volatile graphs. KDD 2010: 163-172
 13. **Hanghang Tong**, Spiros Papadimitriou, Christos Faloutsos, Philip S. Yu, Tina Eliassi-Rad: BASSET: Scalable Gateway Finder in Large Graphs. PAKDD (2) 2010: 449-463
 14. **Hanghang Tong**, Huiming Qu, Hani Jamjoom, and Christos Faloutsos. iPoG: Fast Interactive Querying on Graphs. CIKM 2009
 15. Kensuke Onuma, **Hanghang Tong**, Christos Faloutsos: TANGENT: a novel, 'Surprise me', recommendation algorithm. KDD 2009: 657-666 (*research track, short paper; Acceptance Rate: 20%*)
 16. **Hanghang Tong**, Huiming Qu, and Hani Jamjoom. Measuring Proximity on Graphs with Side Information. ICDM 2008 (*full paper; Acceptance Rate: 10%*)
 17. **Hanghang Tong**, Yasushi Sakurai, Tina Eliassi-Rad, Christos Faloutsos. Fast Mining of Complex Time-Stamped Events. CIKM 2008 (*full paper; Acceptance Rate: 17%*)
 18. **Hanghang Tong**, Spiros Papadimitriou, Jimeng Sun, Philip Yu, and Christos Faloutsos. Colibri: Fast Mining of Large Static and Dynamic Graphs. KDD 2008 (*research track, short presentation*)
 19. Brian Gallagher, **Hanghang Tong**, Tina Eliassi-Rad, Christos Faloutsos. Using Ghost Edges for Classification in Sparsely Labeled Networks. KDD 2008 (*research track, full presentation, Acceptance Rate: 10%*)
 20. **Hanghang Tong**, Spiros Papadimitriou, Philip S. Yu and Christos Faloutsos. Proximity Tracking on Time-Evolving Bipartite Graphs. SDM 2008 (*full paper; Acceptance Rate: 14%*) **[Best Paper Award]**
 21. **Hanghang Tong** Yehude Koren, and Christos Faloutsos. Fast Direction-Aware Proximity for Graph Mining. KDD2007 (*research track, full paper; Acceptance Rate: <8%*)
 22. **Hanghang Tong** Brian Gallagher, Christos Faloutsos, and Tina Eliassi-Rad. Fast Best-Effort Pattern Match in Large Attributed Graphs. KDD2007 (*research track, short paper; Acceptance Rate: 19%*)
 23. **Hanghang Tong** and Christos Faloutsos. Center-Piece Subgraphs: Problem Definition and Fast Solutions. KDD 2006 (*Full paper; Acceptance Rate: 11%*)

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24. **Hanghang Tong**, Christos Faloutsos and Jia-Yu Pan. Fast Random Walk with Restarts and Its Applications. ICDM 2006 (*Full paper, Acceptance Rate: 10%*) [**Best Research Paper Award**]
25. **Hanghang Tong**, Jingrui He, Mingjing Li, Changshui Zhang, Wei-Ying Ma. Graph based multi-modality learning. ACM Multimedia 2005: 862-871 (*Full paper, Acceptance Rate: 16%*)
26. **Hanghang Tong**, Jingrui He, Mingjing Li, Hong-Jiang Zhang, Changshui Zhang. A Unified Optimization Based Learning Method for Image Retrieval, CVPR2005 (*Acceptance Rate: 22%*)
27. **Hanghang Tong**, Mingjing Li, Hong-Jiang Zhang, Changshui Zhang, Jingrui He. Learning No-Reference Quality Metric by Examples. The 11th International Multi-Media Modelling Conferene (MMM 2005).
28. Jingrui He, Changshui Zhang, Nanyuan Zhao and **Hanghang Tong**. Boosting Web Image Search by Co-Ranking. International Conference on Acoustics, Speech, and Signal Processing 2005 (ICASSP 2005)
29. **Hanghang Tong**, Chongrong Li, Jingrui He. Internet Traffic Prediction by W-Boost: Classification and Regression Proc. ISNN (3) 2005: 397-402
30. **Hanghang Tong**, Chongrong Li, Jingrui He, Jiajian Chen, Quang-Anh Tran, Hai-Xin Duan, Xing Li: Anomaly Internet Network Traffic Detection by Kernel Principle Component Classifier. ISNN (3) 2005: 476-481
31. **Hanghang Tong**, Mingjing Li, Hong-Jiang Zhang, Jingrui He and Changshui Zhang. Classification of Digital Photos Taken by Photographers or Home Users. 2004 Pacific-Rim Conference on Multimedia (PCM2004).
32. **Hanghang Tong**, Mingjing Li, Hong-Jiang Zhang, Changshui Zhang. No Reference Quality Assessment for JPEG2000 Compressed Images. International Conference on Image Processing 2004 (ICIP 2004).
33. **Hanghang Tong**, Mingjing Li, Hong-Jiang Zhang, Changshui Zhang. Blur Detection for Digital Images Using Wavelet Transform. International Conference on Multimedia and Expo 2004 (ICME 2004).
34. **Hanghang Tong**, Chongrong Li, Jingrui He. Boosting Feed-Forward Neural Network for Internet Traffic Prediction. The Third International Conference on Machine Learning and Cybernetics (ICMLC 2004).
35. **Hanghang Tong**, Chongrong Li, Jingrui He. A Boosting-based Framework for Self-similar and Non-linear Internet Traffic Prediction. International Symposium on Neural Network 2004 (ISNN2004).
36. Jingrui He, Mingjing Li, Hong-Jiang Zhang, **Hanghang Tong**, Changshui Zhang. Manifold-Ranking Based Image Retrieval. ACM Int. Conf. on Multimedia 2004 (*Full paper, Acceptance Rate: 17%*)
37. Jingrui He, Mingjing Li, Hong-Jiang Zhang, **Hanghang Tong**, and Changshui Zhang. Pseudo Relevance Feedback Based on Iterative Probabilistic One-Class SVMs in Web Image Retrieval. Proc. Pacific-Rim Conference on Multimedia (PCM), 2004.
38. Jingrui He, Mingjing Li, Hong-Jiang Zhang, **Hanghang Tong**, and Changshui Zhang. Automatic Peak Number Detection in Image Symmetry Analysis. Proc. Pacific-Rim Conference on Multimedia (PCM), 2004

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Tutorials

1. Christos Faloutsos, **Hanghang Tong**. Large Graph Mining: Patterns, Tools, and Case Studies. CIKM 2008, full day tutorial.
2. Christos Faloutsos, **Hanghang Tong**. Large Graph Mining: Patterns, Tools, and Case Studies. ICDE 2008.

Demos in Conferences

1. Duen Horng Chau, Aniket Kittur, **Hanghang Tong**, Christos Faloutsos, and Jason I. Hong. SHIFTR: A Fast and Scalable System for Ad Hoc Sensemaking of Large Graphs. KDD 2009
2. Duen Horng Chau, Christos Faloutsos, **Hanghang Tong**, Jason Hong, Brian Gallagher, and Tina Eliassi-Rad. GRAPHITE: A Visual Query System for Large Graphs. ICDM 2008
3. José Fernando Rodrigues Jr., **Hanghang Tong**, Agma J. M. Traina, Christos Faloutsos, Jure Leskovec: Gmine: A System for Scalable, Interactive Graph Visualization and Mining. VLDB 2006: 1195-1198

Tech Reports

1. **Hanghang Tong**, B. Aditya Prakash, Charalampos Tsourakakis, Tina Eliassi-Rad, Christos Faloutsos, and Duen Horng Chau. BridgeFind: Fast Detection of Top-k Bridges in Large Graphs. Lawrence Livermore Technical Report, LLNL-TR-414449, July 2009.
2. **Hanghang Tong**, Christos Faloutsos, and Jia-Yu Pan. Fast Random Walk with Restart and Its Application. CMU-ML-06-109
3. **Hanghang Tong** and Christos Faloutsos. Center-Piece Subgraphs: Problem Definition and Fast Solutions. CMU-ML-06-102

Workshop Publications

1. Jingrui He, **Hanghang Tong**, Spiros Papadimitriou, Tina Eliassi-Rad, Christos Faloutsos, and Jaime Carbonell. PaCK: Scalable Parameter-Free Clustering on K-Partite Graphs. SDM 2009 Workshop on Link Analysis, Counterterrorism and Security, Reno, NV, May 2009.
2. Jingrui He, **Hanghang Tong**, Mingjing Li, Wei-Ying Ma and Changshui Zhang. Multiple random walk and its application in content-based image retrieval. ACM Multimedia 2005 workshop on Multimedia information retrieval: 151-158.

Publications in Chinese

1. Nan Zhu, Chongrong Li, Yalei Wang and **Hanghang Tong**. Hierarchical Periodic Broadcasting Stratagem and Resource Allocation. Journal of Huangzhong University of Science and Technology (Nature Science), vol 31, 2003.10.
2. Rongrong Tong and **Hanghang Tong**. Tele-Immersion and its Application to Distance Learning. Global Chinese Conference on Computer in Education (GCCCE2003).
3. **Hanghang Tong**, Ling Wang, and Jingrui He. Reference Point-Based Near Insertion Approach and Its Improvement for Traveling Salesman Problem. Computers Engineering and Applications.

Funding Experience

- | | |
|---------------|--|
| 5/2011-4/2013 | Co-PI in a DARPA grant, DARPA-BAA-11-04. Multi-Aspect Abnormal Behavior Detection. \$4,789,938. (PI: Ching-Yung Lin) |
| 6/2010-5/2012 | Co-PI in a NSF grant, Proposal No. 1017415: <i>III:Small: Influence and Virus</i> |

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- Propagation in Large Graphs - Theory and Algorithms*, \$499K. (PI: Christos Faloutsos)
- 2/2009-9/2009 Helped in a successful proposal for a Lawrence Livermore National Laboratory, Contract No. B580840: *Trend and Anomaly Detection in Network Traffic*, \$100K.
- 2/2008-9/2009 Helped in a successful proposal Lawrence Livermore National Laboratory (LLNL) grant, Contract No. B579447: *Mining Large Time-Evolving Graphs*, \$50K
- 3/2007-9/2008 Helped in a successful proposal for Lawrence Livermore National Laboratory (LLNL), Contract No. B573265: *Mining Large Time-Evolving Graphs*, \$90K
- 2006-2007 Helped in a successful proposal for a Yahoo! Research Alliance gift: *Analysis and Mining of the Query and Answer System of Yahoo*, \$75K

Teaching Experience (TA)

- Fall, 2008 Machine Learning
- Spring, 2008 Multimedia Databases and Data Mining

Service Experience

- 2011 PC Member of KDD 2011 (both Research track and Industry track)
- 2010 PC Member of KDD 2010; PC Member of WWW 2011
- 2009 PC Member of PKDD 2009; PC Member of CNIKM'09.
- 2009 Admission Committee, Machine Learning Department, CMU.
- 2008 Admission Committee, Machine Learning Department, CMU.