

## Yuqing Tang

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### Education

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- Ph.D. in Computer Science, the Graduate Center, City University of New York, February 2012;  
**Advisor:** Simon Parsons
- M.Phil. in Computer Science, the Graduate Center, City University of New York, September 2008
- B.Eng. in Computer Science, Shenzhen University, China, June 1999

### Selected appointments held

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- August 2016 – Present  
**Applied Scientist**, Bing Ads, Microsoft AI and Research
- May 2015 – August 2016  
**Project Scientist**, Robotics Institute, School of Computer Science, Carnegie Mellon University
- February 2012 – February 2014  
**Postdoctoral Fellow**, Robotics Institute, School of Computer Science, Carnegie Mellon University;  
**Advisor:** Katia Sycara
- September 2010 – December 2010  
**Adjunct Lecturer** (teaching graduate course: Expert Systems/Bayes Nets), Department of Computer and Information Science, Brooklyn College of the City University of New York.
- March 2001 – August 2002  
**Software Engineer** (initiated this startup company), Billion Online INT'LTD (China).
- January 2000 – January 2001  
**Senior Software Engineer** (initiated this startup company), Vinside Information Technology (China).

### Specialties

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- **Artificial intelligence:** Hybrid symbolic and probabilistic reasoning, probabilistic graphical models (e.g. Markov Random Fields, Bayesian nets), knowledge representation, symbolic model checking, defeasible reasoning, argumentation, social network/trust models, AI planning, Markov decision processes, Deep learning, agent-based simulation of social interactions
- **Programming Languages and Libraries:** C++ (boost and etc.), Java, Scala (Akka, Spay.io, and etc.); familiarity by periodically hacking: Matlab, Python (NumPy, pandas, matplotlib); CNTK, MXNET, Theano; Unix shell, node.js (socket.io) and JavaScript (jQuery, d3.js, webcola and etc.); currently exploring SPARK and Deeplearning4j for scalable Markov Random Fields for defeasible reasoning/argumentation engine; expiring old-day experiences: Pascal, Prolog, Lisp, 80x86 assembly, PHP, JSP, VBA, Oracle PL/SQL

### Interests

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I am interested in AI techniques that can support the establishment of social intelligence for a system of agents (e.g. machine agents, human, or hybrid human-machine agents). In particular, I am focusing on hybrid symbolic and probabilistic approaches: Markov Random Fields, integrating probabilistic and symbolic reasoning (e.g. probabilistic argumentation-based reasoning), probabilistic multi-agent planning for **applications**: making sense of inconsistent, uncertain and incomplete knowledge and data, single-robot, multi-robot and hybrid-human-robot task planning, hybrid human-machine dialogues (communication/interaction protocols), verifiable controllers for systems of software, hardware, and hybrid human-machine systems with inconsistent, uncertain and incomplete knowledge and data, and so on.

## Experience

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- **Bing Ads, Microsoft AI and Research** August 2016 – Present  
*Applied Scientist* Redmond, WA
  - Conducted research on deep learning on revenue prediction based on text and image understanding
- **Robotics Institute, School of Computer Science, Carnegie Mellon University** February 2012 – August 2016  
*Project Scientist / Postdoctoral Fellow* Pittsburgh, PA
  - Conducted and managed research projects on robotics, artificial intelligence, cognitive modeling, human-robot interaction
  - Coded the projects using Scala, Spark, and etc.
  - Instructed master students on cutting-edge research; Written funded research proposals

### *Selected Projects*

- Markov Argumentation Random Fields* February 2014 – Present
- Integrated formal theory of human argumentative dialogues with probabilistic graphical models to provide transparent reasoning on complex, inconsistent, uncertain, and noisy data
  - Enabled formally grounded and provably correct: 1) transparent formulation of hypotheses and their conflict analysis, 2) quantitative characterization of the reasoning process, 3) identification of the most probable explanations of the results
  - Implemented a prototype of the system in Scala (currently working on its improvement)
- Cognitive Social Simulation of Human Collective Sensemaking* February 2014 – Present
- Developing a computational cognitive model using the ACT-R framework which can automatically produce a step-by-step simulation of human behavior (i.e., attentional processing, mnemonic storage/retrieval and so on)
  - Investigated the interaction between cognitive, social and technological factors in team-based collaborative problem solving tasks
  - Fast-prototyped a Web-based platform to collect human data in collaborative problem solving tasks: Implemented the server component in JAVA using socket.io APIs to communicate with the client side which is implemented in HTML5, JavaScript using various libraries built on JQuery and D3.js
- Human plan/intention recognition from RGB-D video data* February 2013 – August 2013
- Co-initiated this project
  - Formalized a model of probabilistic hierarchical task networks (pHTNs) for human activity recognition
  - Instructed CMU master students on implementing the pHTNs algorithms along with other building blocks, e.g. feature extraction and SVM classifier using Matlab
- Any Time Cognition (ANTICO)* February 2012 – August 2013
- Developed an assistant agent architecture integrating plan recognition (using Hidden Markov Models), current and future user information needs, workload estimation and adaptive information presentation to aid a human user in making high quality decisions under time stress, while avoiding cognitive overload
  - Implemented a prototype of the system in Java

*Presenting Relevant Facts and Answers from Inconsistent and Uncertain Information* February 2012 – February 2014

- Created framework to link raw data (images, radar, voice, video and so on), human reports along with their probabilistic characterization to decision makings
- Integrated semantic-web reasoning, Dempster-Shafer probabilistic reasoning, and argumentation-based reasoning
- Created presentation model of relevant facts and answers to reduce human users' cognitive load
- Implemented a prototype of the system using JAVA

• **IBM Research (supervised by US Army Research Lab)** June 2009–August 2009  
*Research Intern* Hawthorne, NY & Adelphi, MD

- Developed ontology based data conversion for sensors in ISR (Intelligence, Surveillance, and Reconnaissance) systems

• **Brooklyn College, City University of New York** Summer 2006 & Fall 2010  
*Adjunct Lecturer* New York, NY

- Lectured graduate course CIS 7414x (graduate level) – Expert Systems  
With a focus on Bayesian networks in expert systems.  
<http://www.cs.cmu.edu/~yuqingt/teachings/cis7414x/index.html>
- Given lectures, designed and graded homework, midterm and final examinations
- Covered rule-based inferences, Bayesian Networks, Dempster-Shafer theory, and etc.
- Lectured undergraduate course CIS 1.0 – Computing: Its Nature, Power, and Limits  
<http://www.cs.cmu.edu/~yuqingt/teachings/cis10/cis10.html>

• **The Graduate Center, City University New York** 2002 - 2012

*Selected Projects*

*Argumentation-based Reasoning about Trusts on Inconsistent and Uncertain Information* August 2010 – February 2012

- Created a model of argumentation-based reasoning about trust
- Created a model of probabilistic evidences (in terms of Dempster-Shafer theory) propagation in argumentation for trusts
- Implemented a prototype of the system in JAVA

*Models of Hybrid Human Agent Teams: Agent support for ad hoc adaptive collaboration* August 2007– 2011

- Created formal models of multiagent (machine) dialogues for aiding human collaborative planning and plan execution
- Developed non-deterministic state transition and Markov decision process models for machine team dialogues
- Developed argumentation-based reasoning for resolving inconsistent information
- Applied symbolic model checking techniques (implicit set and relation manipulations using Binary Decision Diagrams) to reduce the computation complexity
- Implemented the dialogue model in C++
- Analyzed data collected from human dialogues during team plan executions

*Agent-based Modeling Simulation of Education, Human Capital and Economics* August 2004–August 2007

- Translated equation-based models of education, human capital and economics into agent-based models
- Demonstrated the possibility of simulating the interaction effects of non-equational social dynamics (drawn from data) and non-equational social policies
- Simulated both the micro behaviors at level of individual agent and the macro behaviors at the level of the agent society
- Implemented and analyzed the models in Java with RePast (a Java based agent simulation platform)
- Replicated the results of the equation based models
- Discovered new model behaviors beyond the equation based models

*Matrix Eigen Problems and Polynomial Root-finding*

August 2003–August 2005

- Implemented matrix eigen solving algorithms using C++ and Matlab
- Implemented polynomial root-finding algorithms using C++ and Matlab

• **New York State Banking Department**

June 2005–August 2005

Graduate Assistant

New York, NY

- Designed and developed a computer program to collect and process banking data into a data warehouse

• **Billion Online INT'LTD**

March 2001–August 2002

*Software Engineer*

Shenzhen, China

- Initiated this startup company
- Integrated email systems (include webmail, mailing list, etc.) with qmail, ezmlm and sqwebmail, etc; rewrote part of them with C++
- Co-led the first phase development of the EIM (Enterprise Instant Messenger) and ETALK (a Voice-over-Internet Protocol system which was launched about one year before Skype) with OpenH323, C++ and pwlib

• **Vinside Information Technology INC.**

January 2000–January 2001

*Senior Software Engineer*

Shenzhen, China

- Initiated this startup company: the 2nd member in the engineering team; created the server-side architecture/infrastructure
- Participated in fund raising to start up the company
- Designed a software architecture which later had more than 50 programmers work on it
- Implemented the core of a multi-server instant messaging system targeting a huge number of users with C++, OpenLDAP, MYSQL on hybrid FreeBSD and Linux systems which later had about 0.5 million registered users
- Led a team to integrate instant messaging technology into office automation systems

## Professional Activities

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- Program committee member:
  - Program committee member of International Conference on Autonomous Agents and Multi-Agent Systems, 2017
  - Program committee member of AAI-17
  - Program committee member of International Conference on Autonomous Agents and Multi-Agent Systems, 2016

- Program committee member of AAAI-16
- Program committee member of COMMA 2016 (Sixth International Conference on Computational Models of Argument)
- Program committee member of 1st International Workshop on Understanding Situations Through Multimodal Sensing, 2016
- Program committee member of the 2015 IEEE/WIC/ACM International Conference on Intelligent Agent Technology (IAT'15)
- Program committee member of International Conference on Autonomous Agents and Multi-Agent Systems, 2015
- Program committee member of WIT-EC 2015 (4th Workshop on Incentive and Trust in Electronic Communities)
- Program committee member of ISC2014 (1st Workshop on Intelligent Service Clouds)
- Program committee member of the Special Issue on the Ubiquitous Semantic Web, International Journal On Semantic Web and Information Systems
- Program committee member of International Conference on Autonomous Agents and Multi-Agent Systems, 2014
- Program committee member of COMMA 2014 (Fifth International Conference on Computational Models of Argument)
- Second International Workshop on Theory and Applications of Formal Argumentation, IJCAI 2013 workshops
- Program committee member of the Tenth International Workshop on Argumentation in Multi-Agent Systems (ArgMAS), 2013
- Program committee member of International Conference on Autonomous Agents and Multi-Agent Systems, 2013
- Program committee member of the Ninth International Conference on Autonomic and Autonomous Systems (ICAS), 2013
- Program committee member of the Ninth International Workshop on Argumentation in Multi-Agent Systems (ArgMAS), 2012
- Journal reviewer:
  - International Journal of Approximate Reasoning, 2013
  - ACM Transactions on Intelligent Systems and Technology, 2013
  - Artificial Intelligence (AIJ), 2009
  - Journal of Computation and Logic, 2009
  - IEEE Intelligent Systems, 2007
- Conference and workshop reviewer:
  - 2016 American Control Conference
  - International Workshop on Uncertainty Reasoning for the Semantic Web (URSW), 2012
  - International Conference on Autonomous Agents and Multi-Agent Systems, 2013
  - International Conference on Autonomous Agents and Multi-Agent Systems, 2012
  - International Conference on Autonomous Agents and Multi-Agent Systems, 2011
  - International Symposium on Logical Formalizations of Commonsense Reasoning, 2011
- University and Departmental service:
  - Computer Science Curriculum Committee, 2006 - 2012

## Publications

### Journal Articles

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- Yuqing Tang, Federico Cerutti, Nir Oren, and Chatschik Bisdikian. Reasoning about the impacts of information sharing. *Information Systems Frontiers*, 2014
- Yuqing Tang, Kai Cai, Peter McBurney, Elizabeth Sklar, and Simon Parsons. Using argumentation to reason about trust and belief. *Journal of Logic and Computation*, 22(5):979–1018, 2012
- Victor Y. Pan, Dmitriy Ivolgin, Brian Murphy, Rhys Eric Rosholt, Islam Taj-Eddin, Yuqing Tang, and Xiaodong Yan. Additive preconditioning and aggregation in matrix computations. *Computers and Mathematics with Applications*, 55(8):1870–1886, 2008
- Victor Y. Pan, Brian Murphy, Rhys Eric Rosholt, Yuqing Tang, Xinmao Wang, and Ailong Zheng. Eigen-solving via reduction to DPR1 matrices. *Computers and Mathematics with Applications*, 56(1):166–171, 2008
- Victor Y. Pan, Mikhail Kunin, Brian Murphy, Rhys Eric Rosholt, Yuqing Tang, Xiaodong Yan, and Wenbo Cao. Linking the TPR1, DPR1 and Arrow-head Matrix Structures. *Computers and Mathematics with Applications*, 52(10-11):1603–1608, November-December 2006

### Refereed Major Conference Papers

- Abraham Vinod, Yuqing Tang, Meeko Oishi, Katia Sycara, Christian Lebiere, and Michael Lewis. Validation of cognitive models for collaborative hybrid systems with discrete human input. In *Intelligent Robots and Systems (IROS)*, 2016
- Yuqing Tang, Nir Oren, and Katia Sycara. Markov argumentation random fields. In *Proceedings of AAAI Conference on Artificial Intelligence*, 2016. (demonstration track)
- Y. Tang, C. Lebiere, K. Sycara, D. Morrison, M. Lewis, and P. Smart. Information sharing for collective sensemaking. In *2016 49th Hawaii International Conference on System Sciences (HICSS)*, pages 377–385, Jan 2016
- Yuqing Tang, Christian Lebiere, Katia Sycara, Don Morrison, and Paul Smart. Cognitive and probabilistic models of group decision making. In *Proceedings of the 24th Behavior Representation in Modeling and Simulation Conference*. The BRIMS Society, 2015
- Katia Sycara, Christian Lebiere, Yulong Pei, Don Morrison, Yuqing Tang, and Michael Lewis. Abstraction of analytical models from cognitive models of human control of robotic swarms. In *Proceedings of the International Conference on Cognitive Modelling, ICCM 2015*, 2015
- Paul Smart, Katia Sycara, and Yuqing Tang. Using cognitive architectures to study issues in team cognition in a complex task environment. In *SPIE Defense, Security, and Sensing: Next Generation Analyst II*, May 2014
- Chatschik Bisdikian, Yuqing Tang, Federico Cerutti, and Nir Oren. A framework for using trust to assess risk in information sharing. In *Proceedings of the 2nd International Conference on Agreement Technologies*, 2013
- Lance M. Kaplan, Murat Sensoy, Yuqing Tang, Supriyo Chakraborty, Chatschik Bisdikian, and Geeth de Mel. Reasoning under uncertainty: Variations of subjective logic deduction. In *Proceedings of the 16th International Conference on Information Fusion (FUSION)*, 2013
- Murat Sensoy, Achille Fokoue, Jeff Z. Pan, Timothy J. Norman, Yuqing Tang, Nir Oren, and Katia Sycara. Reasoning about uncertain information and conflict resolution through trust revision. In *Proceedings of the 2013 International Conference on Autonomous Agents and Multi-agent Systems, AAMAS '13*, pages 837–844, Richland, SC, 2013. International Foundation for Autonomous Agents and Multiagent Systems. (22% acceptance rate)

- Yuqing Tang, Chung-Wei Hang, Simon Parsons, and Munindar P. Singh. Towards argumentation with symbolic dempster-shafer evidence. In *Computational Models of Argument - Proceedings of COMMA 2012*, pages 462–469, 2012
- Yuqing Tang, Felipe Meneguzzi, Simon Parsons, and Katia Sycara. Probabilistic hierarchical planning over mdps. In *Proceedings of the Tenth International Joint Conference on Autonomous Agents and Multiagent Systems*, 2011. (extended abstract), (22% acceptance rate, additional 23% for extended abstracts)
- Simon Parsons, Yuqing Tang, Elizabeth Sklar, Kai Cai, and Peter McBurney. Argumentation-based reasoning in agents with varying degrees of trust. In *Proceedings of the Tenth International Joint Conference on Autonomous Agents and Multiagent Systems*, 2011. (22% acceptance rate)
- Yuqing Tang, Timothy J. Norman, and Simon Parsons. A model for integrating dialogue and the execution of joint plans. In *Proceedings of the Eighth International Joint Conference on Autonomous Agents and Multiagent Systems*, Budapest, Hungary, May 10-15 2009. (22% acceptance rate)
- Yuqing Tang and Simon Parsons. A dialogue mechanism for public argumentation using conversation policies. In *Proceedings of the Seventh International Joint Conference on Autonomous Agents and Multiagent Systems*, pages 445–452, Estoril, Portugal, May 12-16 2008. (22% acceptance rate)
- Yuqing Tang, Simon Parsons, and Elizabeth Sklar. An agent-based model that relates investment in education to economic prosperity. In *Proceedings of the 6th International Conference on Autonomous Agents and Multi-Agent Systems*, Honolulu, 2007. (poster), (22% acceptance rate, additional 25% for posters)
- Yuqing Tang, Simon Parsons, and Elizabeth Sklar. Agent-based modeling of human education data. In *Proceedings of the 5th International Conference on Autonomous Agents and Multi-Agent Systems*, Hakodate, Japan, 2006. (short paper), (23% acceptance rate, additional 25% for short papers)
- Yuqing Tang and Simon Parsons. Argumentation-based dialogues for deliberation. In *Proceedings of the Fourth International Joint Conference on Autonomous Agents and Multiagent Systems*, pages 552–559, New York, NY, USA, 2005. ACM Press. (25% acceptance rate)

#### Other Refereed Conference Papers

- Yuqing Tang, Felipe Meneguzzi, Katia Sycara, Murat Sensoy, Jeff Z. Pan, Achille Fokoue, and Mudhakar Srivatsa. Towards presenting relevant facts and answers on inconsistent and uncertain knowledge. In *Proceedings of 2012 ACITA Conference*, Southampton, UK, 2012
- Yuqing Tang, David C. Emele, Timothy J. Norman, and Simon Parsons. Learning to communicate more efficiently in human-agent teams. In *Proceedings of the Third Annual Conference of the ITA*, Imperial College, London, 2010
- Felipe Meneguzzi, Yuqing Tang, Katia Sycara, and Simon Parsons. On representing planning domains under uncertainty. In *Proceedings of the Third Annual Conference of the ITA*, Imperial College, London, 2010
- Yuqing Tang, Timothy J. Norman, and Simon Parsons. Towards the implementation of a system for planning team activities. In *Proceedings of the Second Annual Conference of the ITA*, University of Maryland University College, Maryland, 2009
- Yuqing Tang, Timothy J. Norman, and Simon Parsons. Agent-based dialogues to support plan execution by human teams. In *Proceedings of the Second Annual Conference of the ITA*, Imperial College, London, 2008
- Simon Parsons, Steven Poltrock, Helen Bowyer, and Yuqing Tang. Analysis of a recorded team coordination dialogue. In *Proceedings of the Second Annual Conference of the ITA*, Imperial College, London, 2008

## Refereed Workshop and Symposium Papers

- Yuqing Tang, Alice Toniolo, Katia Sycara, and Nir Oren. Argumentation random field. In *Eleventh International Workshop on Argumentation in Multi-Agent Systems*, 2014
- Paul R Smart, Darren P. Richardson, Katia Sycara, and Yuqing Tang. Towards a cognitively realistic computational model of team problem solving using act-r agents and the elicit experimentation framework. In *19th International Command and Control Research Technology Symposium (ICCRTS'14)*, June 2014
- Yuqing Tang, Nir Oren, Simon Parsons, and Katia Sycara. Dempster-shafer argument schemes. In *Tenth International Workshop on Argumentation in Multi-Agent Systems*, 2013
- Yuqing Tang, Elizabeth Sklar, and Simon Parsons. An argumentation engine: Argtrust. In *Ninth International Workshop on Argumentation in Multiagent Systems*, 2012
- Yuqing Tang, Felipe Meneguzzi, Katia Sycara, and Simon Parsons. Planning over MDPs through probabilistic HTNs. In *AAAI 2011 Workshop on Generalized Planning*, San Francisco, August 2011
- Felipe Meneguzzi, Yuqing Tang, Katia Sycara, and Simon Parsons. An approach to generate MDPs using HTN representations. In *IJCAI Workshop on Decision Making in Partially Observable Uncertain Worlds: Exploring Insights from Multiple Communities*, Barcelona, Spain, July 2011
- Simon Parsons, Yuqing Tang, Kai Cai, Elizabeth Sklar, and Peter McBurney. Some thoughts on using argumentation to handle trust. In *Proceedings of the 12th International Workshop on Computational Logic in Multi-Agent Systems*, Barcelona, 2011
- Yuqing Tang. Integrating multiagent dialogues, planning and plan execution. In *20th International Conference on Automated Planning and Scheduling Doctoral Consortium*, Toronto, Canada, 2010
- Yuqing Tang, Kai Cai, Elizabeth Sklar, Peter McBurney, and Simon Parsons. A system of argumentation for reasoning about trust. In *Proceedings of the 8th European Workshop on Multi-Agent Systems*, Paris, France, December 2010
- Yuqing Tang, Timothy J. Norman, and Simon Parsons. Computing argumentation in polynomial number of BDD operations: A preliminary report. In *Seventh International Workshop on Argumentation in Multiagent Systems*, 2010
- Victor Y. Pan, Dmitriy Ivolgin, Brian Murphy, Rhys Eric Rosholt, Islam Taj-Eddin, Yuqing Tang, and Xiaodong Yan. Additive preconditioning in matrix computations. In *Proceedings of the Third International Computer Science Symposium*, 2008
- Yuqing Tang, Simon Parsons, and Elizabeth Sklar. An agent-based model that relates investment in education to economic prosperity. In *Proceedings of the Workshop on Multiagent-based Simulation*, Honolulu, 2007
- Victor Y. Pan, Dmitriy Ivolgin, Brian Murphy, Rhys Eric Rosholt, Yuqing Tang, Xinmao Wang, and Xiaodong Yan. Real root-finding. In Stephen M. Watt and Jan Verschelde, editors, *Proceedings of the International Workshop on Symbolic-Numeric Computation*, pages 161–169. ACM, July 2007
- Yuqing Tang, Simon Parsons, and Elizabeth Sklar. Modeling human education data: From equation-based modeling to agent-based modeling. In *Proceedings of the Workshop on Multiagent-based Simulation*, Hakodate, Japan, 2006
- Yuqing Tang and Simon Parsons. Using argumentation-based dialogues for distributed plan management. In *Proceedings of the AAAI Spring Symposium on Distributed Plan and Schedule Management*, Stanford, 2006. (position paper)
- Yuqing Tang and Simon Parsons. Argumentation-based multi-agent dialogues for deliberation. In Simon Parsons, Nicolas Maudet, Pavlos Moraitis, and Iyad Rahwan, editors, *Second International Workshop on Argumentation in Multiagent Systems*, pages 229–244, 2005. (invited paper)



## Book Chapter

- Victor Y. Pan, Brian Murphy, Rhys Eric Rosholt, Guoliang Qian, and Yuqing Tang. Root-finding with Eigen-solving. In Dongming Wang and Lihong Zhi, editors, *Symbolic-Numeric Computation*, pages 185–210. 2007