

Kewei Tu

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RESEARCH INTERESTS

My research interest is in machine learning, natural language processing, probabilistic knowledge representation, computer vision, and artificial intelligence in general. My current research focuses on the study of probabilistic/neural grammars and parsers for modeling different aspects of intelligence: (1) grammar-based representation, inference, and automatic learning; and (2) the application of grammar-based approaches in a variety of AI areas including natural language processing, probabilistic modeling, and computer vision.

EXPERIENCE

- Assistant Professor, School of Information Science and Technology, ShanghaiTech University, China, Feb. 2014 – Present
- Visiting Scholar, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, USA, Spring 2016
- Postdoctoral Researcher, Center for Vision, Cognition, Learning, and Art, Departments of Statistics and Computer Science, University of California, Los Angeles, USA, Jan. 2012 – Jan. 2014
- Research Assistant, Artificial Intelligence Research Laboratory, Computer Science Department, Iowa State University, USA, Spring & Fall 2009, Spring & Summer 2010, and Summer 2011
- Teaching Assistant, Computer Science Department, Iowa State University, USA, Fall 2005 – Fall 2011
- Intern, Microsoft Research Asia, Data Intelligence and Tools Group, Summer 2007 and Summer 2008
- Research Assistant, Apex Data & Knowledge Management Lab, Shanghai JiaoTong University, China, Fall 2001 – Spring 2005
- Teaching Assistant, Computer Science and Engineering Department, Shanghai JiaoTong University, China, Fall 2002 – Spring 2005

EDUCATION

- Ph.D. in Computer Science 2005-2012
Iowa State University, USA
Dissertation: Unsupervised Learning of Probabilistic Grammars

Adviser: Vasant Honavar

- Master in Computer Science and Engineering 2002-2005
Shanghai JiaoTong University, China
Thesis: Automatic Ontology Mapping by Combining Multiple Strategies
Adviser: Yong Yu
- Bachelor in Computer Science and Engineering 1998-2002
Shanghai JiaoTong University, China
Thesis: A Natural Language Understanding System Based on Conceptual Graph

GRANTS

- Joint research of brain mechanism of language processing and computational modeling in artificial intelligence, Kewei Tu (Project Co-PI; PI of the sub-project “cross-discipline research at the syntactic level”) (Project PI: Zheng Zhang), Major Program of Science and Technology Commission Shanghai Municipal (STCSM), 2017-2018.
- Domain specific syntactic parsing, Kewei Tu (PI), Le Yan Inc., 2017.
- Extending stochastic grammars as general-purpose statistical models, Kewei Tu (PI), National Natural Science Foundation of China, 2016 – 2018.

PUBLICATIONS

Conference Papers

- Yanpeng Zhao, Liwen Zhang and **Kewei Tu**, "Gaussian Mixture Latent Vector Grammars". In *the 56th Annual Meeting of the Association for Computational Linguistics (ACL 2018)*, Melbourne, Australia, July 15–20, 2018.
- Jun Mei, Yong Jiang and **Kewei Tu**, "Maximum A Posteriori Inference in Sum-Product Networks". In *the Thirty-Second AAAI Conference on Artificial Intelligence (AAAI 2018)*, New Orleans, Louisiana, USA, February 2–7, 2018.
- Chen Zhu, Yanpeng Zhao, Shuaiyi Huang, **Kewei Tu**, and Yi Ma, "Structured Attentions for Visual Question Answering". In *the International Conference on Computer Vision (ICCV 2017)*, Venice, Italy, October 22–29, 2017.
- Yong Jiang, Wenjuan Han, and **Kewei Tu**, "Combining Generative and Discriminative Approaches to Unsupervised Dependency Parsing via Dual Decomposition". In *the Conference on Empirical Methods in Natural Language Processing (EMNLP 2017)*, Copenhagen, Denmark, September 7–11, 2017.
- Wenjuan Han, Yong Jiang, and **Kewei Tu**, "Dependency Grammar Induction with Neural Lexicalization and Big Training Data". In *the Conference on Empirical Methods in Natural Language Processing (EMNLP 2017)*, Copenhagen, Denmark, September 7–11, 2017.
- Jiong Cai, Yong Jiang, and **Kewei Tu**, "CRF Autoencoder for Unsupervised Dependency Parsing". In *the Conference on Empirical Methods in Natural Language Processing (EMNLP 2017)*, Copenhagen, Denmark, September 7–11, 2017.
- Xiao Zhang, Yong Jiang, Hao Peng, **Kewei Tu**, and Dan Goldwasser, "Semi-supervised Structured Prediction with Neural CRF Autoencoder". In *the Conference*

on Empirical Methods in Natural Language Processing (EMNLP 2017), Copenhagen, Denmark, September 7–11, 2017.

- Shanbo Chu, Yong Jiang and **Kewei Tu**, "Latent Dependency Forest Models". In *the Thirty-First AAAI Conference on Artificial Intelligence (AAAI 2017)*, San Francisco, California, USA, February 4–9, 2017.
- Yanpeng Zhao, Shanbo Chu, Yang Zhou and **Kewei Tu**, "Sequence Prediction Using Neural Network Classifiers". In *the 13th International Conference on Grammatical Inference (ICGI 2016)*, Delft, the Netherlands, October 5-7, 2016.
- Lin Qiu, **Kewei Tu** and Yong Yu, "Context-Dependent Sense Embedding". In *the Conference on Empirical Methods in Natural Language Processing (EMNLP 2016)*, Austin, Texas, USA, November 1-5, 2016.
- Yong Jiang, Wenjuan Han and **Kewei Tu**, "Unsupervised Neural Dependency Parsing". In *the Conference on Empirical Methods in Natural Language Processing (EMNLP 2016)*, Austin, Texas, USA, November 1-5, 2016.
- **Kewei Tu**, "Modified Dirichlet Distribution: Allowing Negative Parameters to Induce Stronger Sparsity". In *the Conference on Empirical Methods in Natural Language Processing (EMNLP 2016)*, Austin, Texas, USA, November 1-5, 2016.
- **Kewei Tu**, "Stochastic And-Or Grammars: A Unified Framework and Logic Perspective". In *the 25th International Joint Conference on Artificial Intelligence (IJCAI 2016)*, New York City, USA, July 9-15, 2016. (Also accepted and presented at *the Sixth International Workshop on Statistical Relational AI (StarAI 2016)*, New York City, USA, July 11, 2016)
- Yanpeng Zhao, Yetian Chen, **Kewei Tu** and Jin Tian, "Curriculum Learning of Bayesian Network Structures". In *the 7th Asian Conference on Machine Learning (ACML 2015)*, Hong Kong, China, November 20-22, 2015.
- Maria Pavlovskaia, **Kewei Tu** and Song-Chun Zhu, "Mapping the Energy Landscape of Non-Convex Optimization Problems". In *the 10th International Conference on Energy Minimization Methods in Computer Vision and Pattern Recognition (EMMCVPR 2015)*, Hong Kong, China, January 13-16, 2015.
- **Kewei Tu**, Maria Pavlovskaia and Song-Chun Zhu, "Unsupervised Structure Learning of Stochastic And-Or Grammars". In *Advances in Neural Information Processing Systems 26 (NIPS 2013)*, Lake Tahoe, Nevada, USA, December 5-10, 2013.
- **Kewei Tu** and Vasant Honavar, "Unambiguity Regularization for Unsupervised Learning of Probabilistic Grammars". In *Proceedings of the 2012 Conference on Empirical Methods in Natural Language Processing and Natural Language Learning (EMNLP-CoNLL 2012)*, Jeju, Korea, July 12-14, 2012.
- **Kewei Tu** and Vasant Honavar, "On the Utility of Curricula in Unsupervised Learning of Probabilistic Grammars". In *Proceedings of the Twenty-second International Joint Conference on Artificial Intelligence (IJCAI 2011)*, Barcelona, Catalonia, Spain, July 16-22, 2011.
- **Kewei Tu**, Xixiu Ouyang, Dingyi Han, Yong Yu, and Vasant Honavar, "Exemplar-based Robust Coherent Biclustering". In *Proceedings of the 11th SIAM International Conference on Data Mining (SDM2011)*, Phoenix/Mesa, Arizona, USA, April 28-30, 2011.
- **Kewei Tu**, and Vasant Honavar, "Unsupervised Learning of Probabilistic Context-Free Grammar Using Iterative Biclustering". In *Proceedings of 9th International Colloquium on Grammatical Inference (ICGI 2008)*, LNCS 5278, St Malo, Brittany, France, September 22-24, 2008.

- **KeWei Tu**, Miao Xiong, Lei Zhang, HaiPing Zhu, Jie Zhang and Yong Yu, "Towards Imaging Large-Scale Ontologies for Quick Understanding and Analysis". In *Proceedings of the Fourth International Semantic Web Conference (ISWC2005)*, LNCS 3729/2005, Galway, Ireland, November 6-10, 2005.
- Jing Lu, Yong Yu, **Kewei Tu**, Chenxi Lin and Lei Zhang, "An Approach to RDF(S) Query, Manipulation and Inference on Databases". In *Proceedings of the 6th International Conference on Web-Age Information Management (WAIM2005)*, LNCS 3739/2005, Hangzhou, China, October 11-13, 2005.
- **KeWei Tu**, and Yong Yu, "CMC: Combining Multiple Schema-Matching Strategies based on Credibility Prediction". In *Proceedings of the 10th International Conference on Database Systems for Advanced Applications (DASFAA 2005)*, LNCS 3453, Beijing, China, April 17-20, 2005.
- Lei Zhang, Yong Yu, Jing Lu, Chenxi Lin, **KeWei Tu**, MingChuan Guo, Zhuo Zhang, GuoTong Xie, Zhong Su, and Yue Pan, "ORIENT: Integrate Ontology Engineering into Industry Tooling Environment". In *Proceedings of the 3rd International Semantic Web Conference (ISWC2004)*, LNCS 3298, Hiroshima, Japan, Nov.7-11, 2004.
- **Kewei Tu**, Jing Lu, Haiping Zhu, Guowei Liu, and Yong Yu, "A Semantic Search Approach by Graph Matching with Negations and Inferences". In *Proceedings of the 11th International Conference on Conceptual Structures (ICCS 2003)*, LNCS 2746, Dresden, Germany, July 21-25, 2003.

Journal Papers

- Yong Jiang, Yang Zhou, **Kewei Tu**, "Learning and Evaluation of Latent Dependency Forest Models". To appear in *Neural Computing and Applications*.
- Yanpeng Zhao, Yetian Chen, **Kewei Tu** and Jin Tian, "Learning Bayesian Network Structures Under Incremental Construction Curricula". In *Neurocomputing*, volume 258, pages 30–40, 2017.
- **Kewei Tu**, Meng Meng, Mun Wai Lee, Tae Eun Choe, and Song-Chun Zhu, "Joint Video and Text Parsing for Understanding Events and Answering Queries". In *IEEE MultiMedia*, vol. 21, no. 2, pp. 42-70, 2014.

Workshop Papers

- **Kewei Tu**, "Towards a Unified Logic Perspective of Stochastic And-Or Grammars". In *ICML Workshop of Learning Tractable Probabilistic Models*, Beijing, China, June 26, 2014.
- **Kewei Tu**, "Combining the Sparsity and Unambiguity Biases for Grammar Induction". In *PASCAL Challenge on Grammar Induction, NAACL-HLT 2012 Workshop on Inducing Linguistic Structure*, Montréal, Canada, June 7, 2012.
- **Kewei Tu**, and Vasant Honavar, "An Empirical Study of Hierarchical Dirichlet Process Priors for Grammar Induction". In *NIPS Workshop of Grammar Induction, Representation of Language and Language Learning*, Whistler, Canada, December 11, 2009.

Theses

- Kewei Tu, "Unsupervised Learning of Probabilistic Grammars". *Ph.D. Dissertation*, Iowa State University, January 2012.
- KeWei Tu, "Automatic Ontology Mapping by Combining Multiple Strategies" (in Chinese). *Master Thesis*, Shanghai JiaoTong University, January 2005.

- KeWei Tu, "A Natural Language Understanding System Based on Conceptual Graph" (in Chinese). *Bachelor's Thesis*, Shanghai JiaoTong University, June 2002. [Excellent Undergraduate Thesis Award]

Technical Reports

- Maria Pavlovskaia, **KeWei Tu** and Song-Chun Zhu, "Mapping Energy Landscapes of Non-Convex Learning Problems". *Technical report*, September 2014.
- **KeWei Tu**, ChenXi Lin, and Yong Yu, "Complex-Mapping Oriented Schema Mapping Composition". *Technical report*, Shanghai JiaoTong University, September 2004.

INVITED TALKS

- "Unsupervised Grammar Learning",
 - at Microsoft Research Asia, Beijing, China, November 2017;
 - at Shanghai University of Finance and Economics, Shanghai, China, September 2017.
- "Representation and Learning of Grammars Beyond the Language Domain",
 - at *Brain, Cognition and Computing Workshop*, Institute of Automation, Chinese Academy of Sciences, Beijing, China, November, 2017;
 - at ShanghaiTech Symposium on Information Science and Technology (SSIST), Shanghai, China, July 2017.
- "Theoretical Study of Stochastic And-Or Grammars", at *Vision, Learning, and Cognition Workshop*, Microsoft Research Asia, Beijing, China, September 2016.
- "Stochastic And-Or Grammars: Representation & Learning",
 - at *Workshop: Frontiers in Knowledge Graphs*, Shanghai, China, December 2015;
 - at School of Computer Science, Fudan University, Shanghai, China, May 2015;
 - at *Symposium on Knowledge Graphs*, China Computer Federation Young Computer Scientists & Engineers Forum (CCF YOCSEF), Shanghai, China, May 2015.
- "Tutorial on Semantic Web", at Shanghai Association of Information Sciences, Shanghai, China, November 2014.
- "Joint Inference of Video and Text", at *Conference: A Meeting of the Minds: Computational Social Science*, Gould School of Law, University of Southern California, Los Angeles, California, USA, May 15, 2012.

AWARDS AND HONORS

- Excellence in Research Award, School of Information Science and Technology, ShanghaiTech University, 2016.
- Yanpeng Zhao, Shanbo Chu, Yang Zhou, KeWei Tu, 2nd place, the Sequence Prediction Challenge (SPiCe), the 13th International Conference on Grammatical Inference (ICGI), 2016.
- 1st place, PASCAL Challenge on Grammar Induction, the Dependency Induction Track, 2012.

- Teaching Excellence Award, Iowa State University, 2012.
- Excellent Undergraduate Thesis, Shanghai JiaoTong University, 2002.
- "Exceptional Student" of Shanghai JiaoTong University (Awarded to top 1% students), 2001.
- Scholarships at Shanghai JiaoTong University: IBM Excellent Student Scholarship (2004), Scholarship of Chinese Academy of Sciences (2003), OOCL Scholarship (2001), Eaton Scholarship (2000), University Scholarship (1998-2001).

PROFESSIONAL SERVICES

- Conference/Workshop Organization Committee Member:
 - Program Chair, ShanghaiTech Symposium on Information Science and Technology (SSIST), 2017
 - ShanghaiTech Symposium on Information Science and Technology (SSIST), 2016
 - ShanghaiTech Symposium on Data Science (SSDS), 2015
- Conference/Workshop Program Committee Member / Reviewer:
 - Annual Meeting of the Association for Computational Linguistics (ACL), 2018
 - IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016, 2017
 - Conference on Neural Information Processing Systems (NIPS), 2016
 - European Conference on Computer Vision (ECCV), 2016
 - AAAI Conference on Artificial Intelligence (AAAI), 2014, 2015
 - Vision Meets Cognition Workshop at CVPR 2014
 - International Joint Conferences on Artificial Intelligence (IJCAI), 2011, 2013
 - Midwest Artificial Intelligence and Cognitive Science Conference (MAICS), 2012, 2013
- Journal Reviewer:
 - Computer Speech and Language
 - ACM Transactions on Asian and Low-Resource Language Information Processing
 - Artificial Intelligence
 - Frontiers of Computer Science
 - Computational Intelligence
 - Fundamenta Informaticae
 - ETRI Journal