

Hao Fang

Microsoft Semantic Machines
One Microsoft Way, Redmond, WA 98052-6399, USA

Email: hao.fang@microsoft.com
<https://hao-fang.github.io>

Research Interests Conversational AI, Natural Language Processing, Deep Learning

Education **University of Washington** Seattle, WA, USA
Ph.D. Electrical Engineering Sept. 2013 – Mar. 2019

- Thesis: Building A User-Centric and Content-Driven Socialbot
- Advisor: Dr. Mari Ostendorf
- Committee: Yejin Choi, Hannaneh Hajishirzi, Geoffrey Zweig

University of Alberta Edmonton, AB, Canada
M.Sc. Electrical and Computer Engineering Sept. 2011 – Jun. 2013

- Thesis: Parallel Sampling and Reconstruction with Permutation in Multidimensional Compressed Sensing
- Advisors: Dr. Sergiy A. Vorobyov, Dr. Hai Jiang

Beijing University of Posts and Telecommunications Beijing, China
B.Eng. Information Engineering Sept. 2007 – Jun. 2011

Research Experience **Microsoft Semantic Machines** Bellevue, WA, USA
Senior Researcher Mar. 2019 – Present

- Develop next generation conversational AI systems.

University of Washington Seattle, WA, USA
Research Assistant

- Social Chat Conversational Agent Oct. 2016 – Mar. 2019
 - Developed a social chatbot that converses coherently and engagingly on popular topics with more than 100K users per month. Our bot Sounding Board is the winner of the 2017 Amazon Alexa Prize (\$500K), competing with teams selected from over 100 applications across 22 countries.
 - Carried out in-depth analyses on socialbot conversations, proposed a hierarchical dialog structure model for segmenting social chat conversations, and developed two multi-level scoring methods for automatically predicting scores at both conversation and segment levels.
 - Proposed a novel approach for socialbot to carry out conversations grounded on unstructured documents using dialog moves on a graph-based document representation.
 - **Publication:** [C11], [C12], [C13]
- Neural Dependency Parsing Jan. 2016 – July 2016
 - Proposed a bi-directional attention mechanism for dependency parsing.
 - Achieved state-of-the-art error performance on 6 out of 14 languages.
 - **Publication:** [C9]
- Community Reaction in Online Discussion Forums Sept. 2014 – July 2016
 - Contributed to the defining of a new problem in social media analysis: predicting community endorsement.
 - Investigated how different types of language features affect community endorsement of an author's comment in Reddit discussions, and how language feature importance varies across communities.

- Proposed to use stacked SVMs to alleviate the data imbalance in training classifiers for identifying community-endorsed person in Reddit.
- Investigated discrete and continuous language features to improve the classifiers that use a set of graph and timing features.
- Proposed a novel neural network structure that performs as well as deep neural networks in predicting community endorsement but are more interpretable by learning latent conversation modes.
- **Publications:** [C7], [C8], [C10]
- Open-domain Name Error Detection *Apr. 2015 – June 2015*
 - Proposed a multi-task recurrent neural network model for sentence-level name detection in a two-stage name error detection system.
 - Achieved 20% improvement in F-score over a system using n-gram lexical features.
 - Using external training text from discussion forums to address the domain mismatch issue, leading to 6% further improvement in F-score.
 - **Publications:** [C6]
- Low Resource Language Modeling *Oct. 2013 – Sept. 2014*
 - Investigated the keyword spotting performance on a variety of languages using language models with a mixed word/subword vocabulary.
 - Investigated the use of morphological features in three types of exponential language models and achieved 7–18% perplexity reduction by introducing regularization through multi-task training.
 - **Publications:** [J3], [J4]

Microsoft Research

Cambridge, UK

Research Intern

- Dialogue-based Restaurant Recommendation *Sept. 2016 – Dec. 2016*
 - Worked on a neural network model to automatically generate both natural language responses (questions and recommendations) to customers and SQL queries to a restaurant database.

Microsoft Research

Redmond, WA, USA

Research Intern

- Intent Classification and Entity Recognition *June 2015 – Sept. 2015*
 - Investigated methods of using predictions from existing models for a variety of applications as features to improve the models for a target application.
 - When a user provides only 10 samples per intent/entity, the prediction accuracy can be as good as a model trained on 100 samples per intent and 40 samples per entity without using additional features.
 - With feature pruning, 40% applications deployed on the Language Understanding Intelligence Service (LUIS) benefit from the current collection of intent classification models.
- Automatic Caption Generation for Images *June 2014 – Sept. 2014*
 - Proposed a log-bilinear plus maximum-entropy language model to generate captions from a set of detected words for images.
 - Designed a ranking sub-system to pick the final caption from a list of generated candidates.
 - Ranked 1st (tie) in the 2015 COCO captioning challenge, with 32% of the generated captions passed the Turing test.

- **Publications:** [C4], [C5], [R1]

University of Alberta
Research Assistant

Edmonton, AB, Canada

- Performance Limits on Segmented CS *Jan. 2013 – Oct. 2013*
 - Analyzed the performance limits of segmented compressive sampling (CS) where the measurements are correlated.
 - **Publications:** [J2]
- Permutation and Parallel CS *Dec. 2012 – Aug. 2013*
 - Proposed to use permutation for improving the error performance of parallel compressive sampling (CS).
 - Designed a practical permutation for image reconstruction.
 - Reduced the reconstruction time by 90% while achieving similar error performance compared to the centralized CS reconstruction.
 - **Publications:** [J1], [C2], [C3]

Beijing University of Posts and Telecommunications
Research Assistant

Beijing, China

- CS in Distributed Video Coding *Mar. 2010 – June 2011*
 - Proposed a model to exploit the correlation between video frames for using compressive sampling (CS) in distributed video coding.
 - Achieved 2–5% improvement on average peak signal-to-noise ratio.
 - **Publications:** [C1]

Publications

Google Scholar Metrics

Citations: 1700+ h-index: 11 i10-index: 12

Journal Articles

- [J4] Y. He, P. Baumann, **H. Fang**, B. Hutchinson, A. Jaech, M. Ostendorf, E. Fosler-Lussier, and J. Pierrehumbert, “Using Pronunciation-based morphological subword units to improve OOV handling in keyword search”, *IEEE/ACM Trans. Audio, Speech and Language Process.*, vol. 24, no. 1, pp. 72–92, Jan. 2016.
- [J3] **H. Fang**, M. Ostendorf, P. Baumann, and J. Pierrehumbert, “Exponential language modeling using morphological features and multi-task learning”, *IEEE/ACM Trans. Audio, Speech and Language Processing*, vol. 23, no. 12, pp. 2410–2421, Dec. 2015.
- [J2] **H. Fang**, S. A. Vorobyov, and H. Jiang, “Performance limits of segmented compressive sampling: Correlated samples versus bits”, *IEEE Trans. Signal Processing*, vol. 62, no. 1, pp. 6061–6073, Nov. 2015.
- [J1] **H. Fang**, S. A. Vorobyov, H. Jiang and O. Taheri, “Permutation meets parallel compressed sensing: How to relax restricted isometry property for 2D sparse signals”, *IEEE Trans. Signal Processing*, vol. 62, no. 1, pp. 196–210, Jan. 2014.

Conference Articles

- [C13] H. Cheng, **H. Fang**, and M. Ostendorf, “A Dynamic Speaker Model for Conversational Interactions”, in *Proc. North American Chapter Assoc. for Computational Linguistics (NAACL)*, 2019.

- [C12] **H. Fang**, H. Cheng, M. Sap, E. Clark, A. Holtzman, Y. Choi, N. A. Smith, and M. Ostendorf, “Sounding Board – A User-centric and Content-driven Social Chatbot”, in *Proc. North American Chapter Assoc. for Computational Linguistics (NAACL): System Demonstrations*, 2018.
- [C11] **H. Fang**, H. Cheng, E. Clark, A. Holtzman, M. Sap, M. Ostendorf, Y. Choi, and N. A. Smith, “Sounding Board – University of Washington’s Alexa Prize Submission”, in *Proc. Alexa Prize*, 2017.
- [C10] H. Cheng, **H. Fang**, and M. Ostendorf, “A factored neural network model for characterizing online discussions in vector space”, in *Proc. Conf. Empirical Methods Natural Language Process. (EMNLP)*, Copenhagen, Denmark, Sept. 7–11, 2017.
- [C9] H. Cheng, **H. Fang**, X. He, J. Gao, and L. Deng, “Bi-directional attention with agreement for dependency parsing”, in *Proc. Conf. Empirical Methods Natural Language Process. (EMNLP)*, Austin, Texas, Nov. 1–5, 2016, pp. 2286–2296.
- [C8] **H. Fang**, H. Cheng, and M. Ostendorf, “Learning latent local conversation modes for predicting community endorsement in online discussions”, in *Proc. Int. Workshop Natural Language Process. for Social Media*, 2016.
- [C7] A. Jaech, V. Zayats, **H. Fang**, M. Ostendorf, and H. Hajishirzi, “Talking to the crowd: What do people react to in online discussions?”, in *Proc. Conf. Empirical Methods Natural Language Process. (EMNLP)*, Lisbon, Portugal, Sept. 17–21, 2015, pp. 2026–2031.
- [C6] H. Cheng, **H. Fang**, and M. Ostendorf, “Open-domain name error detection using a multi-task RNN”, in *Proc. Conf. Empirical Methods Natural Language Process. (EMNLP)*, Lisbon, Portugal, Sept. 17–21, 2015, pp. 737–746.
- [C5] J. Devlin, H. Cheng, **H. Fang**, S. Gupta, L. Deng, X. He, G. Zweig, and M. Mitchell, “Language models for image captioning: The quirks and what works”, in *Proc. Assoc. for Computational Linguistics (ACL)*, Beijing, China, July 26–31, 2015, pp. 100–105.
- [C4] **H. Fang**, S. Gupta, F. Iandola, R. Srivastava, L. Deng, P. Dollar, J. Gao, X. He, M. Mitchell, J. Platt, C. L. Zitnick, and G. Zweig, “From captions to visual concepts and back”, in *Proc. Computer Vision and Pattern Recognition (CVPR)*, Boston, USA, June 7–12, 2015, pp. 1473–1482. **1st Prize (tied) at the Microsoft COCO Captioning Challenge 2015.**
- [C3] **H. Fang**, S. A. Vorobyov, and H. Jiang, “Permutation enhanced parallel reconstruction for compressive sampling”, in *Proc. Int. Workshop Computational Advances in Multi-Sensor Adaptive Process. (CAMSAP)*, 2015. **Finalist of the Best Student Paper Contest.**
- [C2] **H. Fang**, S. A. Vorobyov, H. Jiang, and O. Taheri, “2D signal compression via parallel compressed sensing with permutations”, in *Proc. 46th Annual Asilomar Conf. Signals, Systems, and Computers*, Pacific Grove, California, USA, Nov. 4–7, 2012, pp. 1925–1929.
- [C1] X. Wang, **H. Fang**, X. Zhu, B. Li, and Y. Liu, “Sparse filter correlation model based joint reconstruction in distributed compressive video sensing”, in *Proc. IEEE Int. Conf. on Network Infrastructure and Digital Content*, Beijing, China, Sept. 24–26, 2010, pp. 483–487.

Patents

- [P2] J. Gao, X. He, S. Gupta, G. Zweig, F. Iandola, L. Deng, **H. Fang**, M. Mitchell, J. Platt, R. Srivastava, “Discovery of semantic similarities between images and text”, US20170061250 A1.
- [P1] H. Hu, **H. Fang**, Q. Liu, “CAPTCHA method and system”, US8572756 B2.

Technical Reports

[R1] X. Chen, **H. Fang**, T.-Y. Lin, R. Vedantam, S. Gupta, P. Dollar, and C. L. Zitnick, “Microsoft COCO Captions: Data Collection and Evaluation Server”, *arXiv[cs.CV]:1504.00325*, 2015.

Invited Talks “Sounding Board – A user-centric and content-driven social chatbot”, **Amazon Machine Learning Conference**, Seattle, WA 04/2018
“Sounding Board – A user-centric and content-driven social chatbot”, **Madrona Venture Group**, Seattle, WA 03/2018
“Sounding Board – UW’s Alexa Prize Submission”, **Mobvoi**, Redmond, WA 12/2017

Campus Talks “Conversational artificial intelligence”, UW NLP retreat 10/2017
“Conversational artificial intelligence”, UW EE299 Science Fiction 09/2017
“Conversational artificial intelligence”, UW Math Academy Seminar 07/2017

Honors & Awards 2018 UW College of Engineering Student Research Award 2018
2017 Alexa Prize Winner (\$500K award) 2017
Finalist of the Best Student Paper Contest in IEEE CAMSAP (12/134) 2015
NSF Travel Award for IEEE CAMSAP 2015
Finalist of the MSR PhD Fellowship (29/169) 2014
GSA Professional Development Grant, University of Alberta 2012
Exhibitor, Expo 2010 Shanghai China 2010
Worldwide #7, Ericsson Application Awards 2010
Excellent Students Awards, Beijing Univ. of Posts & Telecom. 2010
Academic Excellence Scholarship, Beijing Univ. of Posts & Telecom. 2008–2010
3rd Prize, Beijing College Student Physics Competition 2009
Excellent Member, Student Union of Beijing Univ. of Posts & Telecom. 2008

Professional Service Reviewer: EMNLP 2019, ACL 2019, NAACL 2019, ACL 2018, NAACL 2018, EMNLP 2017, RoboNLP 2017*, NAACL-HLT 2016, AACL 2016*, Journal of Artificial Intelligence Research, IEEE Trans. Signal Processing, IEEE Signal Processing Letters, Elsevier Signal Processing Image Communications. (*: as secondary reviewer)

Organizing Committee: ACL 2020, user2agent 2020.