Hao Fang

Microsoft Semantic Machines
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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

University of Washington Seattle, WA, USA
Research Assistant

- Amazon Alexa Prize (Winner) *Oct. 2016 – Nov. 2017*
  - Leads the UW team for the Amazon Alexa Prize competition.
  - Our team is the winner of the 2017 Alexa Prize ($500K), competing with teams selected from over 100 applications across 22 countries.
  - Developed a socialbot that converses coherently and engagingly on popular topics with more than 100K users per month.
  - **Publication**: [C11], [C12], [R2]
- 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 Edmonton, AB, Canada
Research Assistant

- 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 Beijing, China
Research Assistant

- 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: 900+ h-index: 9 i10-index: 8

Journal Articles

[J4] Y. He, P. Baumann, **H. Fang**, B. Hutchinson, A. Jaech, M. Ostendorf, E. Fosler-Lussier, and J. Pierrehumbert, "Using Pronunication-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

[C11] **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.

[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)*, Libson, 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)*, Libson, 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

[R2] **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.

[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: ACL 2018, NAACL 2018, EMNLP 2017, RoboNLP 2017*, EMNLP 2016*, NAACL-HLT 2016, AAAI 2016*, IEEE Trans. Signal Processing, IEEE Signal Processing Letters, Elsevier Signal Processing Image Communications. (*: as secondary reviewer)

Computer Skills

Programming:	Python, C++, Javascript, Bash, Latex
Tools:	Git, Vim, AWS, Amazon Alexa SDK, HTCondor