

Bing Liu

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Research Interests

- Deep learning and its applications in natural language processing and understanding
- End-to-end learning for spoken language understanding and dialog systems

Education

- Carnegie Mellon University** 2013.08 - 2018.08 (Expected)
- Ph.D., Electrical and Computer Engineering
 - *Machine Learning, Deep Learning, Natural Language Understanding, Spoken Dialog Systems*
- Nanyang Technological University, Singapore** 2011.07
- B.Eng., Electrical and Electronic Engineering
 - First Class Honors, GPA 4.87/5.0 (Top 2%)
 - Minor Degree in Business
- KTH Royal Institute of Technology, Sweden** 2010.01 - 2010.05
- Exchange student in school of Information and Communication Technology

Work Experience

- Google Research** Software Engineer Intern 2017.05 - 2017.08
- Designed and developed an end-to-end trainable neural network model for task-oriented dialog that shows robust performance in tracking dialog state and handling noisy user inputs
 - Designed deep reinforcement learning based dialog policy optimization methods in the end-to-end trainable framework
- Capio.ai** Software Engineer Intern 2015.05 - 2015.08
- Developed and integrated natural language understanding modules (intent identification & semantic tagging) with Capio's Automatic Speech Recognition (ASR) core engine
 - Designed contextual RNN language model in Capio's core engine for enhanced ASR performance
- Capio.ai** Software Engineer Intern 2014.05 - 2014.08
- Designed and developed the first version of Capio's cloud infrastructure and APIs for ASR
- Oracle** Technical Consultant / Data Engineer 2011.07 - 2013.07
- Designed and delivered Big Data solution to top tier telecommunication companies in Oracle APAC
 - Took full accountability for Big Data project delivery: gathering functional requirements, designing and developing applications, testing and trouble shooting, engaging and advising clients

Selected Publications

- **Bing Liu**, Tong Yu, Ian Lane, and Ole Mengshoel, "Customized Nonlinear Bandits for Online Response Selection in Neural Conversation Models", in AAAI, 2018
- **Bing Liu**, Gokhan Tur, Dilek Hakkani-Tur, Pararth Shah, and Larry Heck, "End-to-End Optimization of Task-Oriented Dialogue Model with Deep Reinforcement Learning", in NIPS Workshop, 2017
- **Bing Liu**, and Ian Lane, "Multi-Domain Adversarial Learning for Slot Filling in Spoken Language Understanding", in NIPS Workshop, 2017
- **Bing Liu**, and Ian Lane, "Iterative Policy Learning in End-To-End Trainable Task-Oriented Neural Dialog Models", in IEEE ASRU, 2017
- **Bing Liu**, and Ian Lane, "An End-to-End Trainable Neural Network Model with Belief Tracking for Task-Oriented Dialog", in INTERSPEECH, 2017
- **Bing Liu**, and Ian Lane, "Dialog Context Language Modeling with Recurrent Neural Networks", in IEEE ICASSP, 2017
- **Bing Liu**, and Ian Lane, "Joint Online Spoken Language Understanding and Language Modeling With Recurrent Neural Networks", in SIGDIAL, 2016
- **Bing Liu**, and Ian Lane, "Attention-Based Recurrent Neural Network Models for Joint Intent Detection and Slot Filling", in INTERSPEECH, 2016
- **Bing Liu**, and Ian Lane, "Recurrent Neural Network Structured Output Prediction for Spoken Language Understanding", in NIPS Workshop, 2015

Honors and Awards

- ASRU Google Student Grant 2017.10
- Outstanding Entry Award - CMU Silicon Valley Annual Tech Showcase 2014.08
- Carnegie Institute of Technology Dean's Fellowship 2013.08
- Oracle Consulting Services ASEAN - Consultant of the Month 2012.05
- NTU Industrial Attachment Book Prize (Best Overall Performance) 2010.12
- NTU EEE Dean's List and President Research Scholar 2008/09/10/11

Teaching Experience

- Project Sponsor. 11-751/18-781 Speech Recognition and Understanding, CMU. Fall 2016, 2017
- Teaching Assistant. 11-755/18-797 Machine Learning for Signal Processing, CMU. Fall 2015
- Teaching Assistant. 18-645 How to Write Fast Code, CMU. Spring 2015

Skills and Languages

- TensorFlow, Theano, Hadoop, Python, Java, Shell scripts, etc.
- Github: <https://github.com/hadoopit>
- Language: English, Mandarin Chinese

Research Projects

Google Research

Advisor: Gokhan Tur, Dilek Hakkani-Tur

End-to-End Learning of Task-Oriented Dialog

2017.05 - 2017.08

- Designed neural network models for task-oriented dialog that can be trained end-to-end
- Designed a novel dialog policy learning method with a combination of supervised learning, imitation learning, and reinforcement learning

Carnegie Mellon University

Advisor: Ian Lane

Task-Oriented Dialog Systems

2016.06 - Present

- Designed end-to-end trainable framework for task-oriented dialog with connected components for language understanding, belief tracking, and policy learning.
- Designed neural network based user simulator that can be co-trained with the dialog agent using reinforcement learning.

Carnegie Mellon University

Advisor: Ian Lane

Spoken Language Understanding

2015.08 - Present

- Designed neural network based models for joint intent detection and semantic slot filling in spoken language understanding that show robust performance with both text and noisy speech input.
- Designed incremental neural network based language understanding models that can be used in online settings for real time spoken language processing and understanding.

Carnegie Mellon University

Advisor: Ian Lane

Context-aware Language Modeling

2014.08 - Present

- Designed topic conditioned and speaker intent conditioned RNN language models that enable next word prediction in automatic speech recognition (ASR) to be context dependent.
- Designed dialog context language models that have special design in modeling dialog interactions and implicitly capture the context state in dialog.

Talks

- *Learning Dialog Policy in End-to-End Task-Oriented Neural Dialog Models*
 - Presented at BayLearn Symposium, Cupertino, USA, Oct 19, 2017.
- *Joint Online Spoken Language Understanding and Language Modeling With Recurrent Neural Networks*
 - Presented at BayLearn Symposium, Sunnyvale, USA, Oct 06, 2016.
 - Young Researchers' Roundtable on Spoken Dialog Systems, Los Angeles, USA, Sep 16-18, 2016
- *Learning Drivers' Behaviour with Deep Neural Networks*
 - Demo at CMU Silicon Valley Annual Tech Showcase, Moffett Field, USA, Aug 09, 2014