

# Bing Liu

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## Research Interests

- Deep learning and its applications in natural language processing and understanding
- End-to-end learning of 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 natural language understanding and dialog state tracking
- Developed deep reinforcement learning based dialog policy optimization method that enables effective policy learning with user teaching and feedback in an interactive manner

**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**, Gokhan Tur, Dilek Hakkani-Tur, Pararth Shah, and Larry Heck, "*Dialogue Learning with Human Teaching and Feedback in End-To-End Trainable Task-Oriented Dialogue Systems*", in NAACL, 2018
- **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 Travel 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

## 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 Tür, Dilek Hakkani-Tür  
**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 - 2016.12

- 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

## 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

## **Service**

Reviewer (past and/or present) for:

- Neural Networks Journal (Elsevier)
- Conference of the North American Chapter of the Association for Computational Linguistics (NAACL)
- International Conference on Computational Linguistics (COLING)

## **References**

- Ian Lane (Carnegie Mellon University)
- John Paul Shen (Carnegie Mellon University)
- Alexander Rudnicky (Carnegie Mellon University)
- Dilek Hakkani-Tür (Google Research)
- Antoine Raux (b4.ai)

Last updated: Feb, 2018