

# Bing Liu

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## Research Interests

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

## Education

**Carnegie Mellon University** 2013.08 - 2018.07 (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%)

**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**, and Ian Lane, "*Iterative Policy Learning in End-To-End Trainable Task-Oriented Neural Dialog Models*", accepted at 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, "*Dialogue 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
- **Bing Liu**, Ping Shum, Jing Zhang, and Guo-Qiang Lo, "*Fabrication Tolerance Study on Mode-coupling-based Polarization Rotators*" In IEEE ICCS, 2010.
- **Bing Liu**, and Chinlon Lin, "*A Novel Side-Pumping Coupler for High-Power Fiber Laser*", in Proceedings of URECA (NTU), 2009.

## Honors and Awards

- ASRU Conference Travel Grant 2017.09
- 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 Task-Oriented Dialogue Systems** 2017.05 - 2017.08

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

**Carnegie Mellon University** Advisor: Ian Lane  
**Spoken Language Understanding and Dialog Management** 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.
- Designed neural dialog models that jointly optimize language understanding and dialog policy modules conditioning on long term dialog history.

**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 and Posters

- *An End-to-End Trainable Neural Network Model with Belief Tracking for Task-Oriented Dialog*
  - Presented at Interspeech, Stockholm, Sweden, Aug 20-24, 2017
- *Dialog Context Language Modeling with Recurrent Neural Networks*
  - Presented at ICASSP, New Orleans, USA, Mar 05-09, 2017
- *Joint Online Spoken Language Understanding and Language Modeling With Recurrent Neural Networks*
  - BayLearn Symposium, Sunnyvale, USA, Oct 06, 2016.
  - Young Researchers' Roundtable on Spoken Dialog Systems, Los Angeles, USA, Sep 16-18, 2016
  - Presented at SIGDIAL, Los Angeles, USA, Sep 13-15, 2016.
- *Attention-Based Recurrent Neural Network Models for Joint Intent Detection and Slot Filling*
  - Presented at Interspeech, San Francisco, USA, Sep 08-12, 2016
- *Recurrent Neural Network Structured Output Prediction for Spoken Language Understanding*
  - Presented at NIPS Workshop on Machine Learning for SLU, Montreal, Canada, Dec 07-12, 2015
- *Learning Drivers' Behaviour with Deep Neural Networks*
  - Demo at CMU Silicon Valley Annual Tech Showcase, Moffett Field, USA, Aug 09, 2014