Lei Xu

PHD Student at MIT EECS

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Research Interests: Automated Data Science, Natural Language Generation, Deep Learning

Education

Ph.D, Dept of Electronical Engineering and Computer Science(EECS), MIT

Cambridge, MA, USA

Supervised by Dr. Kalyan Veeramachaneni

Sept. 2017 - Present

- GPA: 5.0.
- Working on automated data science.

B.E, Dept of Computer Science and Technology, Tsinghua University

Beijing, China

Supervised by Prof. Zhiyuan Liu

Sept. 2013 - Jul. 2017

- Average Score: 92; Rank: 5/127; Excellent Graduation of Beijing City.
- Working on natural language processing.
- Thesis: Neural Abstractive Summarization with Keyword Reinforcement.

Exchange, Computer Science Department, Carnegie Mellon University

Pittsburgh, PA, USA

Supervised by Prof. J. Zico Kolter

Jun. 2016 - Sept. 2016

- Working on deep reinforcement learning and convex optimization.

Research Experiences

Trane, Automated Prediction Problems Generation

Cambridge, MA, USA

Supervised by Dr. Kalyan Veeramachaneni

Nov. 2017 - Present

- Data science is challenging because people don't know what problem to solve when they get some new data.
- Our goal is to propose and solve potentially interesting predictive problems on any relational database.
- We design a language to represent predictive problems so we can easily generate problems on a relational database.
- We build an end-to-end system which generates predictive problems and labels for supervised learning.

ICNN, A Neural Network for Reinforcement Learning and Image Completion

Pittsburgh, PA, USA

Supervised by Prof. J. Zico Kolter

Jun. 2016 - Sept. 2016

- By designing ICNN, the scalar output of the network is a convex function of the input.
- We use ICNN to model Q-function in reinforcement learning so that we can easily optimize actions over a continuous space.
- We compare ICNN with other methods on a robot simulation software and show the advantages of our model.

CWE, Joint Learning of Character and Word Embeddings

Beijing, China

Supervised by Dr. Zhiyuan Liu

Sept. 2014 - Feb. 2015

- The challenge of word representation lies on how to represent the meaning of low-frequency words accurately.
- Taking advantage of Chinese characters, we propose to jointly learn the meaning of characters and words.
- Our model can infer the meaning of a new word by its characters.

Abstractive Summarization with Keyword Reinforcement

Beijing, China

Supervised by Dr. Zhiyuan Liu

Feb. 2017 - May. 2017

- We focus on how to help the model generate correct keywords in the summary.
- We add supervision to the attention mechanism so the model focuses on the correct context and learns faster.
- We also reward the model when it generates correct keywords which do not appear in the ground truth.

Publications

2017

- Brandon Amos, Lei Xu, J. Zico Kolter, *Input Convex Neural Networks*, ICML-2017.

2016

- Lei Xu, Ziyun Wang, Ayana, Zhiyuan Liu, Maosong Sun, *Topic Sensitive Neural Headline Generation*, ArXiv.

2015

- Xinxiong Chen*, Lei Xu*, Zhiyuan Liu, Maosong Sun, Huanbo Luan. *Joint Learning of Character and Word Embeddings*, IJCAI-2015. (* equal contribution)

Skills

Program Language C/C++, Java, Python, Tensorflow, Latex.

Teaching Experiences

2017 **Teaching Assistant** Media Programing (Tsinghua University)

Interesting Projects

Reconstruct Functions from Contour *Cambridge, MA, USA*

Supervised by Prof. William T. Freeman, Antonio Torralba *Oct. 2017 - Dec. 2017*

- Human have strong ability to reconstruct 3D objects by looking at contour curves. We want to build a CV system with similar ability.
- We generate contour plots of 2-variable functions and design neural models to reconstruct the functions and depth maps.
- We show that models trained on 2-variable functions have strong generality and can be used on real objects.

Clothing Perception by GelSight Touch Sensors *Cambridge, MA, USA*

Supervised by Prof. Devavrat Shah, David Sontag, Suvrit Sra *Oct. 2017 - Dec. 2017*

- We collect clothes material data using a touch sensor.
- We design neural models to classify clothes materials and washing methods.
- This model can be applied to automatic laundry in the future.

Real-time Digit Recognition on FPGA *Beijing, China*

Supervised by Prof. Youjian Zhao *Mar. 2015 - Jun. 2015*

- We train a CNN on a computer and deploy the model on a low-end FPGA chip.
- We overcome the challenge of limited computing capability on FPGA and get acceptable accuracy.

Weibo Keywords Web App *Beijing, China*

Supervised by Prof. Zhiyuan Liu *Feb. 2014 - Sept. 2014*

- We use keyword extraction technology to visualize Weibo user's keywords.
- We reach millions of uses.

Honors & Awards

2017 **Excellect Graduation of Beijing City**
2016 **Scholarship** Excellent Student, Tsinghua University
2016 **Scholarship** Tsinghua Top Open Program for Overseas Visiting
2015 **Second Prize** Tsinghua University Mathematical Contest in Modeling
2015 **Scholarship** Excellent Student, Tsinghua University
2014 **Scholarship** Excellent Student, Tsinghua University