

# Luwei Zhou

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## RESEARCH INTERESTS

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Computer vision and its relations to natural language and deep learning, with a focus on problems in video understanding such as video captioning, grounding, question answering, retrieval, activity recognition, and multi-modal unsupervised representation learning.

## WORK EXPERIENCE

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<b>Microsoft, Full-time</b> <i>Researcher in Multimodal AI Team</i>	Bellevue, WA May 2020 – Present
<b>University of Michigan, Department of EECS, Full-time</b> <i>Graduate Student Research Assistant (GSRA) with Dr. Jason J. Corso</i> <i>Graduate Student Instructor (GSI) with Dr. Justin Johnson's deep vision class</i>	Ann Arbor, MI May 2016 – April 2020 Sept. 2019 – Dec. 2019
<b>Microsoft Research</b> <i>Research Intern with Dr. Hamid Palangi and Dr. Jianfeng Gao</i>	Redmond, WA May 2019 – Aug. 2019
<b>Facebook AI Research</b> <i>Research Intern with Dr. Marcus Rohrbach</i>	Menlo Park, CA May 2018 – Aug. 2018
<b>Salesforce Research</b> <i>Deep Learning Research Intern with Dr. Caiming Xiong</i>	Palo Alto, CA May 2017 – Aug. 2017

## EDUCATION

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<b>University of Michigan</b> <i>Ph.D. Degree in Robotics (Computer Vision)</i> <i>Master's Degree in Robotics (Computer Vision)</i> <ul style="list-style-type: none"><li><b>Courses:</b> Advanced Computer Vision, Natural Language Processing, Machine Learning, Optimization</li><li><b>Academics:</b> Curriculum GPA: <b>4.00/4.00</b></li></ul>	Ann Arbor, MI Sept. 2015 – April 2020 Sept. 2015 – April 2017
<b>Nanjing University</b> <i>Bachelor's Degree in Automation</i> <ul style="list-style-type: none"><li><b>Courses:</b> Computer Vision, Artificial Intelligence, Advanced Programming Language, Data Structure</li><li><b>Academics:</b> Overall GPA: <b>91.8/100</b>, Major GPA: <b>93.0/100</b></li></ul>	Nanjing, Jiangsu, China Sept. 2011 – June 2015

## DOCTORAL DISSERTATION

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**L. Zhou**, “Language-Driven Video Understanding”, University of Michigan Deep Blue 2020.

## PATENTS

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Y. Zhou, **L. Zhou**, C. Xiong, and R. Socher, “Dense Video Captioning”, US10542270B2.

## SELECTED PUBLICATIONS AND TALKS (see all at [Google Scholar](#))

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**L. Zhou**, H. Palangi, L. Zhang, H. Hu, J. J. Corso, and J. Gao, “Unified Vision-Language Pre-Training for Image Captioning and VQA”, AAAI 2020. (**spotlight**)

Media coverages: [MSR](#), [VentureBeat](#), and [Medium](#). [Code](#). AR: 20%; h5: 95

**L. Zhou**, Y. Kalantidis, X. Chen, J. J. Corso, and M. Rohrbach, “Grounded Video Description”, CVPR 2019. (**oral**) [Code](#). [Dataset](#). AR: 5.6%; h5: 188

**L. Zhou**, **Y. Zhou**, J. J. Corso, R. Socher, and C. Xiong, “End-to-End Dense Video Captioning with Masked Transformer”, CVPR 2018. (**spotlight**) [Code](#). AR: 9%; h5: 158

**L. Zhou**, C. Xu, and J. J. Corso, “Towards Automatic Learning of Procedures from Web Instructional Videos”, AAAI 2018. (**oral**) [Code](#). [Dataset](#). AR: 11%; h5: 56

H. Huang, **L. Zhou**, W. Zhang, J. J. Corso, and C. Xu, “Dynamic Graph Modules for Modeling Object-Object Interactions in Activity Recognition”, BMVC 2019. AR: 30%; h5: 42

**L. Zhou**, N. Louis, and J. J. Corso, “Weakly-Supervised Video Object Grounding from Text by Loss Weighting and Object Interaction”, BMVC 2018. [Code](#). [Dataset](#). AR: 30%; h5: 42

**L. Zhou** et al, “Multi-agent Reinforcement Learning with Sparse Interactions by Negotiation and Knowledge Transfer”, IEEE Transactions on Cybernetics 2017, 47 (5): 1238 - 1250. SCI IF: 7.38; h5: 73

## WORKSHOP PRESENTATIONS

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**L. Zhou**, Y. Kalantidis, X. Chen, J. J. Corso, and M. Rohrbach, “Grounded Video Description”, ICML (How2 Workshop) 2019. (**pitch**)

**L. Zhou**, C. Xu, P. Koch, and J. J. Corso, “Watch What You Just Said: Image Captioning with Text-Conditional Attention”, ACM Multimedia (Thematic Workshops) 2017: 305-313. (**pitch**) [Code](#).

**L. Zhou**, P. Yang and C. Chen, "Multi-agent Reinforcement Learning with Sparse Interactions by Negotiation and Knowledge Transfer", IJCAI (Workshops) 2016. (**oral**)

## HONORS AND AWARDS

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Outstanding Winner Awards (0.2%), Mathematical Contest in Modeling (MCM)	2014
Sienhua New and Tsu Way Shen Memorial Award (Top 1), of University of Michigan	2015
Best Undergrad Thesis (Top 1), of Nanjing University and Jiangsu Province	2015
National Scholarship (1%), of Nanjing University	2012
Red Sun Scholarship, of Nanjing University	2014

## OTHER INVITED TALKS

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### CVPR 2020 [Tutorial](#) on Vision and Language

*Hosted by Dr. Zhe Gan*

Online (formerly Seattle, WA)

*June 2020*

### Microsoft

*Hosted by Dr. Jingjing Liu*

Bellevue, WA

*Oct. 2019*

### Facebook AI

*Hosted by Dr. Yatharth Saraf*

Menlo Park, CA

*Nov. 2019*

### NVIDIA Research

*Hosted by Dr. Jan Kautz*

Santa Clara, CA

*Nov. 2019*

### Salesforce Research

*Hosted by Dr. Caiming Xiong*

Palo Alto, CA

*Nov. 2019*

### Amazon AI

*Hosted by Dr. Joseph Tighe*

Seattle, WA

*Nov. 2019*

### Waymo

*Hosted by Dr. Dragomir Anguelov*

Mountain View, CA

*Nov. 2019*

### Tencent AI Lab

*Hosted by Dr. Tong Zhang*

Bellevue, WA

*Oct. 2019*

### NVIDIA AI Lab

*Hosted by Dr. Sanja Fidler*

Toronto, Ontario, Canada

*Dec. 2018*

### SAMSUNG AI Centre

*Hosted by Dr. Afsaneh Fazly and Dr. Allan Jepson*

Toronto, Ontario, Canada

*Dec. 2018*

## PROFESSIONAL ACTIVITIES

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*Organizer*, CVPR 2020 Challenge on ActivityNet-Entities Object Localization ([AEOL](#)), a guest task in the annual ActivityNet Workshop

*Co-organizer*, CVPR 2018 Workshop on Fine-grained Instructional Video Understanding ([FIVER](#)), with Jason Corso, Josef Sivic, and Ivan Laptev

*Co-organizer*, UMich Computer Vision Reading Group

*Program Committee Member / Reviewer:*

- Computer Vision: CVPR 2020/2019, ECCV 2020, ICCV 2019, TPAMI 2019/2018, IJCV 2019, ACM MM 2020/2019, and CVIU 2017
- Language Understanding: ACL 2020, EMNLP 2020, and NAACL (Workshops) 2018
- Machine Learning: NeurIPS 2020, ICML 2020, AAAI 2020, IJCAI 2020, and NIPS 2016
- Robotics: ICRA 2018 and ITS 2019/2018/2017

*Volunteer*, RSS 2016

## RESEARCH EXPERIENCE (open-source projects on [Github](#))

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### Large-Scale Unified Vision-Language Pre-training

Microsoft Research

*Supervisors: Dr. Jianfeng Gao, Dr. Lei Zhang, and Dr. Hamid Palangi*

*May 2019 – Nov. 2019*

- Introduced a generic and unified framework for Vision-Language Pre-training (VLP). VLP is pre-trained on millions of image-text pairs automatically mined from the web and fine-tuned for disparate downstream tasks including image captioning and VQA.
- Proposed to use two unsupervised learning objectives for VLP: bidirectional and sequence-to-sequence (seq2seq) masked vision-language prediction.
- Thanks to our vision-language pre-training, both training speed and overall accuracy have been significantly improved on the downstream tasks compared to other model initialization methods.
- Set new SotA on COCO Captions (CIDEr 129), VQA 2.0 (overall 71) and Flickr30k Captions (CIDEr 67 vs previous SotA 62), all from a single model architecture.
- Current focuses: VLP on videos by leveraging a large amount of instructional video data and the associated ASR scripts. Multi-task learning of captioning, QA, and event proposal.

### Grounded Video Description

Facebook AI Research

*Supervisors: Dr. Marcus Rohrbach, Dr. Yannis Kalantidis, and Dr. Xinlei Chen*

*May 2018 – Dec. 2018*

- Introduced a large-scale video description and grounding dataset, called [ActivityNet-Entities](#), where we annotated noun phrases (& objects) from sentence descriptions in videos as spatial bounding boxes. ActivityNet-Entities contains over 158k labeled boxes for 52k video clips.
- Proposed a unified framework for video and image description, where a supervised grounding module dynamically detects objects in the scene and provides visual clues to the captioning module.
- Set new SotA performance on video description and image description and demonstrated that our generated sentences are more explainable through grounding.

### Fine-grained Instructional Video Understanding

University of Michigan

*Supervisor: Prof. Jason Corso*

*Sept. 2016 – April 2020*

- Introduced [YouCook2](#) dataset, which contains temporally localized recipe sentence annotations and bounding boxes for 2000 YouTube cooking videos.
- Tackled a series of problems related to instructional video understanding: i) event proposal (AAAI 2018), ii) dense video captioning (CVPR 2018), iii) weakly supervised object grounding from language description (BMVC 2018).
- *Event proposal*: Proposed an event proposal and sequential modeling network that can temporally localize procedure steps in web instructional videos and capture the temporal structure of the video.
- *Dense video captioning*: Caption generation for event proposals. See Page 4 for more details.
- *Weakly supervised object grounding*: Given a video and the corresponding description, localize the objects mentioned from the description in the video as bounding boxes. No box is given for training.
- Current focuses: Graph-based procedure structure learning.

### **Dense-Captioning Events in Video and Temporal Action Proposal**

*Supervisors: Dr. Caiming Xiong and Dr. Richard Socher*

Salesforce Research

*May 2017 – Aug. 2017*

- Introduced a self-attention-based video captioning model and improved our previously proposed action/event proposal network with carefully-designed Temporal Convolutional Networks.
- Proposed to bridge event proposal and captioning by a differentiable visual mask and achieved state-of-the-art results on dense video captioning.

### **Text-conditional Visual Captioning with Guiding LSTM**

*Supervisor: Prof. Jason Corso*

University of Michigan

*Mar. 2016 – Nov. 2016*

- Proposed an encoder-decoder image captioner though explicit text-conditional image guidance.
- Extended the work to video captioning by leveraging audio features for the extra guidance.

### **End-to-End Grasping with Deep Reinforcement Learning**

*Supervisor: Prof. Satinder Singh*

University of Michigan

*Sept. 2015 – Apr. 2016*

- Applied state-of-the-art Deep RL algorithm named Deep Q-network (DQN) to robot grasping tasks.
- Built an API between physics engine MuJoCo and the DQN module.

### **Research on Multi-Agent Reinforcement Learning with Sparse Interactions**

*Supervisors: Prof. Chunlin Chen, Dr. Pei Yang, and Prof. Yang Gao*

Nanjing University

*Dec. 2014 – Jul. 2015*

- Introduced the concept of equilibrium into traditional sparse-interaction-based MARL algorithms and proposed a knowledge transfer approach to initialize the joint-state Q table.
- Applied the proposed algorithm in a real-world setting, i.e., our intelligent warehouse simulator.

### **Multi-Robot Task Allocation and Path Planning in Dynamic Environments**

*Supervisor: Dr. Pei Yang*

Nanjing University

*Nov. 2013 – Jul. 2014*

- Proposed a Balanced Heuristic Mechanism to balance task allocation in multi-robot systems.
- Built an intelligent warehouse simulator from scratch using C/OpenGL for the experiments.

## **PROFICIENCY AND SKILLS**

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*Technical Skills:* PyTorch/Torch, Python, C/C++, Linux, Git, LaTeX, Matlab, Caffe, HTML, CSS, JS etc.

*Languages:* English (proficient) and Mandarin (native)

## **REFERENCES**

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**Dr. Jingjing Liu**, Senior Principle Research Manager, Microsoft, [jingjl@microsoft.com](mailto:jingjl@microsoft.com)

**Dr. Marcus Rohrbach**, Research Scientist, Facebook AI, [mrf@fb.com](mailto:mrf@fb.com)

**Dr. Yannis Kalantidis**, Research Scientist, Naver Labs Europe, [yannis.kalantidis@naverlabs.com](mailto:yannis.kalantidis@naverlabs.com)

**Prof. Jason Corso**, Professor, University of Michigan, [jjcorso@umich.edu](mailto:jjcorso@umich.edu)

**Prof. Chenliang Xu**, Assistant Professor, University of Rochester, [chenliang.xu@rochester.edu](mailto:chenliang.xu@rochester.edu)