Jaejun Brandon **Lee**

Research Scientist at Epson · Computer Vision · Natural Language Processing · Speech Recognition

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Summary

As a research scientist at Epson's computer vision & robotics lab, I am dedicated to crafting intelligent 2D and 3D detection systems tailored specifically for non-expert users. I take full advantage of large language models to enrich usability and interpretability while leveraging parameter-efficient fine-tuning techniques to streamline domain adaptation. Drawing from my hands-on expertise in natural language processing, speech recognition, robotics, and computer vision, I am passionate about harnessing multimodality to enhance the interpretability of AI systems, making these systems more user-friendly.

Experience

Research Scientist
Markham, ON, Canada

Epson Canada - Computer Vision & Robotics Lab — *Mar. 2023 - Present*

- Developing a customizable and interpretable 2D detection system for non-expert users by leveraging a large language model.
- Utilizing a novel open-set object segmentation method, developed a prompt-based keypoint detection pipeline that remains robust in multi-instance scenarios (one first-author paper under review for ECCV 2024).

Lead Research Scientist
Toronto, ON, Canada

Roboeye.ai — *Jul. 2021 - Mar. 2023*

- Developed a real-time (<1 sec) 6D pose estimation pipeline integrating latest computer vision techniques.
  - Point cloud reconstruction + instance segmentation (Mask R-CNN & DetectoRS) + pose estimation (FCGF-based RANSAC & PVN3D) + pose refinement (ICP) + detection filtering (3D NMS).
- Led a team of 20+ engineers in deploying and maintaining 50+ bin-picking systems for continuous operation without failure.

Research Scientist
Toronto, ON, Canada

Roboeye.ai — *Mar. 2020 - Jul. 2021*

- Developed an intuitive vision-driven bin-picking solution by leveraging a 6D pose estimation pipeline.
  - Fully automated online model training system using PyTorch, NVIDIA Isaac Sim, OpenCV, and AWS.
  - C++ application designed for bin-picking tasks using ROS, Qt5, Protobuf, OpenCV, and PCL.
  - Online object detection performance tracking system using AWS, Docker, W&B, Django.

Research Scientist
Remote

Mozilla - Emerging Technologies Team — *Mar. 2020 - Oct. 2020*

- Developed a wake-word detection system for Firefox, Howl, publishing a first-author paper at an EMNLP workshop [3].
- Integrated Howl with Firefox Voice to provide a completely hands-free experience to over 8,000 users.

Research Scientist
Mountain View, CA, USA

Samsung Research America - Visual Display Intelligence Lab — *Apr. 2019 - Mar. 2020*

- Developed a novel co-clustering algorithm leveraging GANs, resulting in a first-author paper at ICME 2021 [2] and the filing of two related patents [9, 10].
  - Jointly learns disentangled representations of dual data dimensions and their underlying interrelation in the correlation space.
- Implemented user-centric TV program recommendation by analyzing watch history.

Graduate Student Researcher
Waterloo, ON, Canada

University of Waterloo - Data Systems Group — *Sep. 2018 - Dec. 2019*

- Personalized Keyword Spotting System – two first-author papers at EMNLP 2019 [6] and IUI 2019 [8].
  - Implemented keyword spotting with convolutional neural networks in pure JavaScript that runs in any standards-compliant browser.
  - Applied fine-tuning based accent adaptation and studied its efficiency in the browser.
- PEfficient Parameter Fine-Tuning of Large Language Models – two papers at ACL 2020 [4, 5].
  - Developed memory/latency reduction techniques and investigated the effects of freezing various layers for large language models (BERT).

Undergraduate Research Assistant
Waterloo, ON, Canada

University of Waterloo — *May. 2018 - Aug. 2018*

- Studied the suitability of JavaScript as an environment for deep learning execution.

Software Engineer Intern
Menlo Park, CA, USA

Meta - Dynamic Ads Infrastructure — *Jan. 2018 - Apr. 2018*

- Applied KNN algorithms on product-level and user-level embeddings to enhance the quality of personalized advertisements.
- Redesigned the advertisements selection pipeline to retrieve user embeddings at an earlier stage, reducing loading time by 7%.

Undergraduate Research Assistant — *Waterloo, ON, Canada*
University of Waterloo — *Sep. 2017 - Dec. 2017*
- Implemented an RDD usage report generator for Spark and analyzed the impact of caching replacement policies on performance.

Undergraduate Research Assistant — *Waterloo, ON, Canada*
University of Waterloo — *Sep. 2017 - Dec. 2017*
- Analyzed latency and throughputs of Apache Storm and Spark Streaming; benchmarked against TPCx-IoT specifications.

Software Engineer Intern — *Palo Alto, CA, USA*
Uber - Complex Data Processing / Spark Team — *May. 2017 - Aug. 2017*
- Integrated TensorFlowOnSpark on Uber infrastructure and evaluated its stability.
- Transformed MLlib pipeline into a Spark job with TensorFlow; reduced training time from 33 to 3 hours.

Software Engineer Intern — *Toronto, ON, Canada*
Zynga Inc - Central Technology Organization — *Aug. 2016 - Dec. 2016*
- Developed a new architecture for the internal search system.
  - Improved data integrity led to 30% increase in search usage (Amazon Elasticsearch, Amazon Kinesis Streams and Amazon SQS).

Software Engineer Intern — *Waterloo, ON, Canada*
SAP - Emerging Technologies Team — *Jan. 2016 - Apr. 2016*
- Designed and developed a distributed SQLA back-end system with support for the OData protocol.
- Integrated Robot framework, an automated testing tool, to reduce QA cycle from 3 days to 4 hours.

Software Engineer Intern — *Toronto, ON, Canada*
Mozzaz Corporation — *May. 2017 - Aug. 2017*
- Developed a cross-platform web application using Cordova and Angular.js; performed back-end development with C#.

Education

University of Waterloo — *Waterloo, ON, Canada*
Master of Mathematics in Computer Science, Advisor: Dr. Jimmy Lin
- Thesis title: In-Browser Personalization for Ubiquitous Keyword Spotting
- Research area: Information retrieval and deep learning (natural language processing & speech recognition)

University of Waterloo — *Toronto, ON, Canada*
Bachelor of Computer Science
- Completed co-operative program and graduated with distinction – GPA : 3.80 / 4.00
- Recipient of President's Scholarship and Faculty of Mathematics Scholarship

Scholarships

2013-2018	**Scholarship**, Faculty of Mathematics Scholarship, University of Waterloo	*value of CAD 25,000*
2013	**Scholarship**, President's Scholarship, University of Waterloo	*value of CAD 2,000*
2013	**Scholarship**, Winnipeg North Rotary Club Scholarship	*value of CAD 5,000*
2013	**Scholarship**, Loblaw Scholarship	*value of CAD 1,500*

Publications and Patents

* equal contribution

Publications

[1] Tomasz Palczewski*, **Jaejun Lee***, Lenin Mookiah*. Production-Ready Applied Deep Learning. ***Packt Publishing***, 2022, ISBN: 9781803238050, 1803238054

[2] **Jaejun Lee**, Hyun Chul Lee, Tomasz Palczewski. CI-GAN: Co-Clustering By Information Maximizing Generative Adversarial Networks. ***ICME***, 2021

[3] Raphael Tang*, **Jaejun Lee***, Afsaneh Razi, Julia Cambre, Ian Bicking, Jofish Kaye, Jimmy Lin. Howl: A Deployed, Open-Source Wake Word Detection System. ***EMNLP-NLPOSS***, 2020

[4] Raphael Tang, **Jaejun Lee**, Ji Xin, Xinyu Liu, Yaoliang Yu, Jimmy Lin. Showing Your Work Doesn't Always Work. ***ACL***, 2020

[5] Ji Xin, Raphael Tang, **Jaejun Lee**, Yaoliang Yu, Jimmy Lin. DeeBERT: Dynamic Early Exiting for Accelerating BERT Inference. ***ACL***, 2020

[6] **Jaejun Lee**, Raphael Tang, Jimmy Lin. Honkling: In-Browser Personalization for Ubiquitous Keyword Spotting. ***EMNLP-IJCNLP***, 2019

[7] Ryan Clancy, **Jaejun Lee**, Zeynep Akkalyoncu Yilmaz, Jimmy Lin. Information Retrieval Meets Scalable Text Analytics: Solr Integration with Spark. ***SIGIR***, 2019

[8] **Jaejun Lee**, Raphael Tang, Jimmy Lin. Universal Voice-Enabled User Interfaces using JavaScript. ***IUI***, 2019

Patents

[9] **Jaejun Lee**, Hyun Chul Lee, Tomasz Palczewski. Co-Informatic Generative Adversarial Networks for Efficient Data Co-Clustering. International Patent Pub. WO/2021/066530

[10] **Jaejun Lee**, Hyun Chul Lee, Tomasz Palczewski. Co-Informatic Generative Adversarial Networks for Efficient Data Co-Clustering. US Patent Pub. 20210097372

Manuscripts

[11] **Jaejun Lee**, Raphael Tang, Jimmy Lin. What Would Elsa Do? Freezing Layers During Transformer Fine-Tuning. *arXiv*, 2019, arXiv: 1911.03090

[12] **Jaejun Lee**, Raphael Tang, Jimmy Lin. JavaScript Convolutional Neural Networks for Keyword Spotting in the Browser: An Experimental Analysis. *arXiv*, 2018, arXiv: 1810.12859

Presentation

2024 IHPME Research and Impact Day — *Toronto, ON, Canada*

Oral Presentation — *April, 2024*

- Analyzing YouTube Videos on Suicide-Related Thoughts and Behaviours: A Study Using Topic Modeling and Discourse Analysis.

Epson's Global Information Sharing Meeting — *Virtual*

Oral Presentation — *April, 2024*

- Advances in Large Vision and Language Models Driven by Prompt Engineering for Efficient Domain Adaptation.

2024 Annual Meeting of the Society for Digital Mental Health — *Virtual*

Poster Presentation — *April, 2024*

- Analyzing YouTube Videos on Suicide-Related Thoughts and Behaviours: A Study Using Topic Modeling and Discourse Analysis.

Epson's Canadian Information Sharing Meeting — *Markham, ON, Canada*

Oral Presentation — *Nov, 2023*

- Enhancing 2D Object Detection Efficiency through Prompt Engineering.

2nd Workshop for Natural Language Processing Open Source Software (NLP-OSS) — *Virtual*

Poster Presentation — *Nov, 2020*

- Howl: A Deployed, Open-Source Wake Word Detection System.

2019 Conference on Empirical Methods in Natural Language Processing (EMNLP) and 9th International Joint Conference on Natural Language Processing (IJCNLP) — *Hong Kong, China*

Poster Presentation — *Nov, 2019*

- Honkling: In-Browser Personalization for Ubiquitous Keyword Spotting.

24th International Conference on Intelligent User Interfaces (IUI) — *Los Angeles, CA, USA*

Poster Presentation — *Mar, 2019*

- Universal Voice-Enabled User Interfaces using JavaScript.

Teaching Experience

Teaching Assistant

CS 452/652	**Real-time Programming**, Fall 2019, University of Waterloo	*Waterloo, ON, Canada*
CS 480/680	**Machine Learning**, Winter 2019, University of Waterloo	*Waterloo, ON, Canada*
CS 451/651	**Data Intensive Distributed Computing**, Fall 2018, University of Waterloo	*Waterloo, ON, Canada*

Academic Mentorship

Allen Tao — *Markham, ON, Canada*

Research Intern — *May. 2024 - Present*

- Mentoring a research project on few-shot object detection.

Sandra Wang — *Markham, ON, Canada*

Research Intern — *Mar. 2023 - May. 2024*

- Mentored research projects on 3D scene understanding and few-shot keypoint detection (one paper under review for ECCV 2024).

Xinyu (Mavis) Liu — *Waterloo, ON, Canada*

Undergraduate Research Assistant — *Jan. 2018 - Aug. 2018*

- Mentored an undergraduate research project on keyword spotting.