

Jaejun Brandon Lee

COMPUTER VISION · NATURAL LANGUAGE PROCESSING · SPEECH RECOGNITION · ROBOTICS
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Introduction

Drawing from seven years of research experience across computer vision, speech recognition, natural language processing, and robotics, I believe that multimodal representation learning is not only effective in capturing knowledge about our world but also in controlling and interpreting a model's internal representations. Therefore, **I am particularly interested in building a vision system that leverages language for effective communication with the user and efficient adaptation to dynamic environments.**

Education

University of Waterloo

Waterloo, ON, Canada

MASTER OF MATHEMATICS IN COMPUTER SCIENCE, ADVISOR: DR. JIMMY LIN

Jun. 2020

- Thesis: Honkling: In-Browser Personalization for Ubiquitous Keyword Spotting
- Research area: Information retrieval and deep learning (natural language processing & speech recognition)
- Cumulative GPA : 88.75 % (3.90 / 4.00)

University of Waterloo

Toronto, ON, Canada

BACHELOR OF COMPUTER SCIENCE

Oct. 2018

- Completed co-operative program and graduated with distinction
- Recipient of President's Scholarship and Faculty of Mathematics Scholarship
- Cumulative GPA : 81.18 % (3.70 / 4.00)

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

Experience

Research Scientist

Markham, ON, Canada

EPSON CANADA - COMPUTER VISION & ROBOTICS LAB

Mar. 2023 - Present

- Leading research on agentic AI for 2D detection, aimed at efficiently and effectively learning complex, domain-specific concepts.
- Developed an **interpretable 2D object and attribute detection** system tailored for non-technical individuals.
 - Designed a two-stage adapter-based domain adaptation method that utilizes a contrastive loss focused on hard-negative samples.
 - Enabled effective verification of the model's understanding by organizing internal knowledge hierarchically through clustering of foundational concepts.
 - Developed a plug-and-play, training-free detection head for vision-language dual encoder models (a first-author paper under review for NeurIPS 2025 [15]).
- Proposed and developed a **prompt-based 2D keypoint detection** pipeline that eliminates keypoint-specific training needs while remaining robust in multi-instance scenarios (a first-author paper under review for TAI [14]).

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

- Implemented an intuitive vision-driven bin-picking solution 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, and 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 2020 workshop [4].
- Integrated Howl with Firefox Voice 🗣️ to provide a completely hands-free experience to over 8,000 users.

Research Scientist Intern

SAMSUNG RESEARCH AMERICA - VISUAL DISPLAY INTELLIGENCE LAB

Mountain View, CA, USA

Apr. 2019 - Aug. 2019

- Invented a novel co-clustering algorithm leveraging GANs, resulting in a first-author paper at ICME 2021 [3] and two patents [10, 11].
 - Proposed combining two modality-specific InfoGANs to maximize mutual information between the modalities, identifying unique clusters within dual-modal data that are challenging to detect from a single-modality perspective.
 - Integrated into a recommendation system that captures complex relationships between TV programs and viewers.

Graduate Student Researcher

UNIVERSITY OF WATERLOO - DATA SYSTEMS GROUP, ADVISOR: PROF. JIMMY LIN

Waterloo, ON, Canada

Sep. 2018 - Dec. 2019

- Honking: **Personalized Keyword Spotting** System 🐼 – two first-author papers at EMNLP 2019 [7] and IUI 2019 [9]
 - Implemented keyword spotting with convolutional neural networks in pure JavaScript that runs in any standards-compliant browser.
 - Applied on-device fine-tuning with network slimming for accent adaptation and evaluated its efficiency in a browser environment.
- Efficient Domain Adaptation of Language Models
 - Investigated the effects of freezing various BERT layers for multi-task and multilingual tasks – a first-author manuscript [12].
 - Developed memory- and latency-efficient inference techniques for BERT – a paper at ACL 2020 [6].

Undergraduate Research Assistant

UNIVERSITY OF WATERLOO - ADVISOR: PROF. JIMMY LIN

Waterloo, ON, Canada

May. 2018 - Aug. 2018

- Studied the suitability of JavaScript as an environment for deep learning execution – a first-author manuscript [13].

Software Engineer Intern

META (FACEBOOK) - DYNAMIC ADS INFRASTRUCTURE

Menlo Park, CA, USA

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

UNIVERSITY OF WATERLOO - ADVISOR: PROF. KEN SALEM

Waterloo, ON, Canada

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

UNIVERSITY OF WATERLOO - ADVISOR: PROF. KHUZAIMA DAUDJEE

Waterloo, ON, Canada

Sep. 2017 - Dec. 2017

- Analyzed latency and throughputs of Apache Storm and Spark Streaming; benchmarked against TPCx-IOT specifications.
 - Empirically validated the maximum throughput Apache Storm can handle: 500K tuples per second with a live connection to Redis.

Software Engineer Intern

UBER - COMPLEX DATA PROCESSING / SPARK TEAM

Palo Alto, CA, USA

May. 2017 - Aug. 2017

- Integrated TensorFlowOnSpark on Uber's 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

ZYNGA INC - CENTRAL TECHNOLOGY ORGANIZATION

Toronto, ON, Canada

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

SAP - EMERGING TECHNOLOGIES TEAM

Waterloo, ON, Canada

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

MOZZAZ CORPORATION

Waterloo, ON, Canada

May. 2015 - Aug. 2015

- Developed a cross-platform web application using Cordova and Angular.js; performed back-end development with C#.

Publications and Patents

* equal contribution

PUBLICATIONS

- [1] Hwayeon Danielle Shin*, **Jaejun Lee***, Imam Kassam, Federica Guccini. Mining Public Voices: Analyzing Suicide Related Thoughts and Behaviors in YouTube Videos and Comments Using Topic Modeling. **FHLIP**, 2025
- [2] Tomasz Palczewski*, **Jaejun Lee***, Lenin Mookiah*. Production-Ready Applied Deep Learning. **Packt Publishing**, ISBN: 9781803238050, 1803238054, 2022
- [3] **Jaejun Lee**, Hyun Chul Lee, Tomasz Palczewski. CI-GAN: Co-Clustering By Information Maximizing Generative Adversarial Networks. **ICME**, 2021
- [4] 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
- [5] Raphael Tang, **Jaejun Lee**, Ji Xin, Xinyu Liu, Yaoliang Yu, Jimmy Lin. Showing Your Work Doesn't Always Work. **ACL**, 2020
- [6] Ji Xin, Raphael Tang, **Jaejun Lee**, Yaoliang Yu, Jimmy Lin. DeeBERT: Dynamic Early Exiting for Accelerating BERT Inference. **ACL**, 2020

- [7] **Jaejun Lee**, Raphael Tang, Jimmy Lin. Honkling: In-Browser Personalization for Ubiquitous Keyword Spotting. *EMNLP-IJCNLP*, 2019
- [8] Ryan Clancy, **Jaejun Lee**, Zeynep Akkalyoncu Yilmaz, Jimmy Lin. Information Retrieval Meets Scalable Text Analytics: Solr Integration with Spark. *SIGIR*, 2019
- [9] **Jaejun Lee**, Raphael Tang, Jimmy Lin. Universal Voice-Enabled User Interfaces using JavaScript. *IUI*, 2019

PATENTS

- [10] **Jaejun Lee**, Hyun Chul Lee, Tomasz Palczewski. Co-Informatic Generative Adversarial Networks for Efficient Data Co-Clustering. *International Patent*, Pub. WO/2021/066530, 2021
- [11] **Jaejun Lee**, Hyun Chul Lee, Tomasz Palczewski. Co-Informatic Generative Adversarial Networks for Efficient Data Co-Clustering. *US Patent*, Pub. 20210097372, 2021

MANUSCRIPTS

- [12] **Jaejun Lee**, Raphael Tang, Jimmy Lin. What Would Elsa Do? Freezing Layers During Transformer Fine-Tuning. *arXiv*: 1911.03090, 2019
- [13] **Jaejun Lee**, Raphael Tang, Jimmy Lin. JavaScript Convolutional Neural Networks for Keyword Spotting in the Browser: An Experimental Analysis. *arXiv*: 1810.12859, 2018

UNDER REVIEW

- [14] **Jaejun Lee**, Aristide Tossou, Sandra Wang, Dibyendu Mukherjee. LAM: Few-Shot Random Keypoint Detection in Any Scene through Open-set Object Segmentation. *TAI*
- [15] **Jaejun Lee***, Shin Nishimura, Sahar Ghavidel, Allen Tao, Dibyendu Mukherjee. TIDES: Training-free Instance Detection from Semantics. *NeurIPS*, 2025

Presentation

Epson's Global Information Sharing Meeting

ORAL PRESENTATION

- Hierarchical Concept Learning for Semantic Learning.

Virtual
May., 2025

Epson's Canadian Information Sharing Meeting

ORAL PRESENTATION

- Hierarchical Concept Learning for Semantic Learning.

Markham, ON, Canada
Apr., 2025

2025 Future of Health Leadership, Informatics and Policy (FHLIP) Conference

ORAL PRESENTATION

- Mining Public Voices: Analyzing Suicide Related Thoughts and Behaviors in YouTube Videos and Comments Using Topic Modeling.

Toronto, ON, Canada
Feb., 2025

Epson's Global Information Sharing Meeting

ORAL PRESENTATION

- Leveraging Large Vision-Language Models for Explainable Semantic Concept Learning.

Virtual
Dec., 2024

2024 American Medical Informatics Association (AMIA) Annual Symposium

POSTER PRESENTATION

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

San Francisco, CA, USA
Nov., 2024

2024 Institute of Health Policy, Management and Evaluation (IHPME) Research & Impact Day

ORAL PRESENTATION

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

Toronto, ON, Canada
Apr., 2024

Epson's Global Information Sharing Meeting

ORAL PRESENTATION

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

Virtual
Apr., 2024

2024 Annual Meeting of the Society for Digital Mental Health

POSTER PRESENTATION

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

Virtual
Apr., 2024

Epson's Canadian Information Sharing Meeting

ORAL PRESENTATION

- Enhancing 2D Object Detection Efficiency through Prompt Engineering.

Markham, ON, Canada
Nov., 2023

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

ORAL PRESENTATION

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

Virtual
Nov., 2020

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.

Professional Development

TEACHING ASSISTANTSHIP

CS 452/652 – Real-time Programming

Waterloo, ON, Canada

UNIVERSITY OF WATERLOO, INSTRUCTED BY PROF. BILL COWAN

Fall 2019

CS 480/680 – Introduction to Machine Learning

Waterloo, ON, Canada

UNIVERSITY OF WATERLOO, INSTRUCTED BY PROF. EDITH LAW

Winter 2019

CS 451/651 – Data Intensive Distributed Computing

Waterloo, ON, Canada

UNIVERSITY OF WATERLOO, INSTRUCTED BY PROF. JIMMY LIN

Fall 2018

- Led weekly discussion sessions consisting of 10~20 students and held office hours each week to assist those who needed additional support.
- Graded assignments and exams, and conducted exam preparation sessions.

ACADEMIC & PROFESSIONAL MENTORSHIP

Aina Merchant

Markham, ON, Canada

RESEARCH INTERN

May, 2025 - Present

- Mentoring a research project on hierarchical concept learning for semantic learning.

Allen Tao

Markham, ON, Canada

RESEARCH INTERN

May, 2024 - May, 2025

- Mentoring a research project on few-shot object and attribute detection (one paper under review for NeurIPS 2025 [15]).

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 TAI [14]).

Xinyu (Mavis) Liu

Waterloo, ON, Canada

UNDERGRADUATE RESEARCH ASSISTANT

Jan, 2018 - Aug, 2018

- Mentored a research project on keyword spotting.