

# Jaejun Brandon Lee

RESEARCH SCIENTIST AT EPSON · COMPUTER VISION · NATURAL LANGUAGE PROCESSING · SPEECH RECOGNITION

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## Introduction

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.** 🦾

## Education

### University of Waterloo

Waterloo, ON, Canada

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

2019

- 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

2018

- 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

## 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 AAAI 2025).

### 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, 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

UNIVERSITY OF WATERLOO - DATA SYSTEMS GROUP

Waterloo, ON, Canada

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 language models (BERT).

## Undergraduate Research Assistant

UNIVERSITY OF WATERLOO

Waterloo, ON, Canada

May. 2018 - Aug. 2018

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

## 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

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

Waterloo, ON, Canada

Sep. 2017 - Dec. 2017

- Analyzed latency and throughputs of Apache Storm and Spark Streaming; benchmarked against TPCx-IOT specifications.

## Software Engineer Intern

UBER - COMPLEX DATA PROCESSING / SPARK TEAM

Palo Alto, CA, USA

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

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 SQA 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

Toronto, ON, Canada

May. 2017 - Aug. 2017

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

# Publications and Patents

\* equal contribution

## PUBLICATIONS

- [ 1 ] Tomasz Palczewski\*, **Jaejun Lee\***, Lenin Mookiah\*. Production-Ready Applied Deep Learning. **Packt Publishing**, ISBN: 9781803238050, 1803238054, 2022
- [ 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, 2021

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

## MANUSCRIPTS

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

## Presentation

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### 2024 American Medical Informatics Association (AMIA) Annual Symposium

*San Francisco, CA, USA*

POSTER PRESENTATION

*November, 2024*

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

### 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.

## Professional Development

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### 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 sections consisting of 10~20 students and held weekly office hours and help sessions.
- Facilitated exams, graded problem sets and exams, and held exam preparation sessions.

## ACADEMIC MENTORSHIP

### Allen Tao

RESEARCH INTERN

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

*Markham, ON, Canada*

*May, 2024 - Present*

### Sandra Wang

RESEARCH INTERN

- Mentored research projects on 3D scene understanding and few-shot keypoint detection (one paper under review for AAAI 2025).

*Markham, ON, Canada*

*Mar. 2023 - May, 2024*

### Xinyu (Mavis) Liu

UNDERGRADUATE RESEARCH ASSISTANT

- Mentored an undergraduate research project on keyword spotting.

*Waterloo, ON, Canada*

*Jan. 2018 - Aug. 2018*