

# MELISSA ZHIYANG PAN

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## RESEARCH INTERESTS

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I aspire to build next-generation systems that embody responsibility in the core of computing stacks. To this end, I am passionate about systems and infrastructure tailored for machine learning and data-intensive tasks at large scale, that prioritize sustainability alongside efficiency, performance, and reliability.

## EDUCATION

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**Carnegie Mellon University**, Pittsburgh, PA

Expected Graduation: Jun 2024

Master of Science in Electrical and Computer Engineering – Applied Study with Research Track

GPA: 4.0/4.0

**University of Toronto**, Toronto, Canada

Graduation: Jun 2020

Bachelor of Applied Science in Electrical and Computer Engineering, High Distinction

Engineering Business Minor, AI Engineering Certificate, Core GPA 3.83/4.0

## PUBLICATIONS & INDUSTRIAL PATENT PUBLICATIONS

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“EcoScale: Giving Old Servers New Life at Hyperscale”, Jaylen Wang\*, **Zhiyang Pan\***, Udit Gupta, Akshitha Sriraman. *IEEE Computer Architecture Letters July-Dec. 2023*. (Under submission)

“Method and Apparatus of Rank Based Setup and Execution of Federated Learning Workflow”, **Zhiyang Pan**, Derek Roy, Kairui Dong, Nazim Uddin Bhuiyanr, Rafiur Rashid, Shaikh Quader, Petr Novotny, [IPCOM000270087D](#), Jun. 02, 2022, IBM LLC.

“Method and System of Redaction of Sensitive Enterprise-Wide Data”, **Zhiyang Pan**, Derek Roy, Kairui Dong, Nazim Uddin Bhuiyanr, Shaikh Quader, Petr Novotny, [IPCOM000270088D](#), Jun. 02, 2022, IBM LLC.

“Face Recognition and Rehabilitation: A Wearable Assistive and Training System for Prosopagnosia”, Steve Mann, **Zhiyang Pan**, Yi Tao, Anqi Gao, Xingchen Tao, Danson Evan Garcia, Dawei Shi, Georges Kannan. *IEEE International Conference on Systems, Man and Cybernetics 2020*, Toronto, Canada. [[Presentation](#), [Conference Paper](#)]

## RESEARCH EXPERIENCE

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**Graduate Researcher**, Carnegie Mellon University

Aug 2023 – Present

Advised By: **Prof. Akshitha Sriraman** and **Prof. Udit Gupta**

*Pittsburgh, PA*

- *Research topic*: introducing sustainability as a first-order objective in hyper-scale data center systems via distributed microservice scheduling on heterogeneous hardware to promote hardware lifetime extension
- Designed and conducted profiling experiments to identify correlation between microservice performance and hardware generations to construct scaling policy in combination with carbon intensity for online scheduling
- Developed the heterogeneous auto-scaling online scheduler using Docker Swarm to execute workload generated from real-world application traces, ensuring latency service level objectives while reducing carbon footprint

**Graduate Researcher**, Carnegie Mellon University, TEEL Lab

Sept 2023 – Present

Advised By: **Dr. Jaromir Savelka**

*Pittsburgh, PA*

- *Research topics*: investigating the application of GPT models for creating structured, university-level course materials in specialized, research-focused disciplines, particularly in areas with limited online resources.
- Developed Python infrastructure to pipeline the generation of learning objectives and corresponding multiple choice questions with prompt templates designated to each type of questions
- Designed rubrics to evaluate the quality of the generated multiple choice questions based on Bloom’s taxonomy and curated input learning objectives iteratively based on the evaluation results

**Software Engineer**, IBM (system design & research group – side project)

Jan 2021 – Jun 2022

Mentored By: **Dr. Petr Novotny** and **Shaikh Quader**

Markham, Canada

- *Research topics*: innovating the combination of database systems with machine learning and machine learning systems using relational databases for enterprise-level data and applications.
- Developed and integrated a scripting interface to streamline the transfer of Db2 data from `ibm_db` framework into IBM Cloud Pak for Data's federated learning client API, and automated the setup process for local environments.
- Authored two full system design proposals, delivered presentations to the IP stakeholder review board and successfully submitted them for publication

**Undergraduate Researcher**, University of Toronto, Mann Lab

Aug 2019 – Oct 2020

Advised By: **Prof. Steve Mann**

Toronto, Canada

- *Research topic*: addressing social challenges faced by individuals with prosopagnosia through the development of assistive devices for immediate support and long-term rehabilitative training
- Designed and implemented a full system architecture with two modes being real-time face recognition implemented with asynchronous on-device training on BlazeNet and FaceNet in Python, alongside a self-training mode designed to emulate clinical treatment, developed within an Android mobile application using Java and Android Studio
- Programmed a customized eye tracker for pupil detection that translates pupil image from inward raspberry pi infrared camera to coordinates on image region of the outward facing camera, achieving a recognition accuracy of 96% within a 0.5-meter range for real-time application

## SELECTED PROFESSIONAL EXPERIENCE

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**Software Engineering Intern** (Research-Oriented, [github link](#))

May 2023 – Aug 2023

Google, CoreML

Sunnyvale, CA

- Designed and implemented NCCL GPU collective clustering optimizations end-to-end using C++ in Tensorflow DTensor API enabling up to 5% reduction in step time and 78% reduction in device idle time for BERT and T5
- Formulated and conducted 180 training experiments on 5 types of transformers and or models in Python to profile and evaluate optimization performance; Crafted comprehensive performance study report from analysis of the experiment result
- Authored design documentation independently from extensive research on state-of-the-art literatures in distributed computing, previous design documentation and proactive engagement in design discussions with technical leads

**Software Engineer**

May 2020 – Dec 2022

IBM, Data Analytics and AI

Markham, Canada

- Spearheaded end-to-end development of two new features to handle tablespace failure during backup and recovery in Db2 v11.5.7, and to optimize storage of recovery objects in Db2 v12.1; presented in montely stakeholder meeting
- Maintained C++ code for Db2 core engine in Backup, Restore and Recovery (BAR) components across six Db2 releases, core features include: availability, data replication in distributed database systems, log space management
- Represented BAR domain end-to-end in a project involving 7 teams from design to implementations; facilitated PM to drive progress by providing technical consultations on code migration and infrastructure for other teams
- Refactored and migrated 488 full domain test sets to GIT, and developed standardized Perl APIs for modernization
- Built a full-scale monitoring system for distributed infrastructure from scratch, reducing manual effort by 75%

**Backend Developer** (& Technical Product Manager)

Jun 2020 – Sept 2020

BeenThere – Harvard Innovation Lab

Remote

- Developed web backend using Spring, Spring MVC, and MySQL for a seamless integration with existing frontends
- Designed relational database in MySQL with optimized schemas to streamline ML training in psychology research
- Led migration of the domain from WordPress to Amazon AWS and conducted analysis on various cloud providers

**Software Engineer** (Professional Experience “Co-op” Year)

May 2018 – Sept 2019

IBM, Data Analytics and AI

Markham, Canada

- Participated in redesign of VARCHAR data structure for Db2 blu acceleration leading up to 66% runtime memory reduction; Implemented major APIs in C++ integrated with 200+ referencing functions in the source code

- Developed and managed a new testing framework with primary functional verification tests in Perl for a new feature in Db2 led to a 10% total speed enhancement and covered SQL commands in 12 categories with 25 data types

## TEACHING & MENTORSHIP

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<b>CMU:</b> 18-847, Data Center Computing: Teaching Assistant	Fall 2023
<b>IBM:</b> Intern Mentor: Catherine Mo Zhou (UofT, undergraduate student)	2021 – 2022
<b>IBM:</b> STEM For Girls, Introduction to Coding: Course Designer & Instructor	Summer 2022
<b>IBM:</b> STEM For Girls, Design Thinking: Course Instructor	Summer 2021
<b>IBM:</b> STEM For Girls, Logical Thinking: Course Designer & Instructor	Summer 2019
<b>BitTiger:</b> Teaching Assistant Volunteer	2017 – 2018
<b>Toronto District School Board:</b> Homework Peer Mentor	2014 – 2015
<b>Toronto District School Board:</b> K-12 After School Education Volunteer	2013 – 2015

## AWARDS AND HONORS

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Members of IEEE Eta Kappa Nu	2023
IBM Jumpstart Judges's Choice Best Project Award	2021
IBM DB2 Manager's Recognition Award	2020
University of Toronto ECE Distinction Capstone Project Award	2020
University of Toronto Faculty of Engineering Dean's Honored List	2015 – 2020
University of Toronto Entrance Scholarship	2015

## TECHNICAL SKILLS

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<b>Programming Languages</b>	C++/C, Python, Java, Perl, Scala, Bash, x86 Assembly, HTML, Javascript
<b>AI &amp; Big Data</b>	SQL, NoSQL, Tensorflow, JAX, NumPy, Pandas, MapReduce, Spark, Jupyter
<b>Databases &amp; Servers</b>	DB2, MySQL, PostgreSQL, MongoDB, Neo4j, Kubernetes, Docker, Google Cloud, Azure, AWS EC2, Drogon, Python Flask
<b>Tools</b>	Git, Linux perf, Vim, Xcode, Android Studio

## ACTIVITIES AND OTHER EXPERIENCES

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<b>CMU</b> Carnegie AI Safety Initiative, Graduate Member, facilitated by: <b>Dr. Vojta Kovarik</b>	Sep 2023 – Present
<b>CMU</b> ECE Diversity and Inclusion Committee	Oct 2023 – Present
<b>CMU</b> ECE Grad Organization, General Member, Volunteer	Jan 2023 – Present
<b>Hack the North:</b> Participant <a href="#">[project link]</a>	2018
<b>UofT</b> Chinese Scholars and Students Association, VP of Media & IT	2015 – 2016
<b>Toronto Science Fair:</b> Marine Ecosystem COWEB Agent-Based Modelling, Advised By: <b>Dr. Brad Bass</b>	2015