PAN CHEN

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RESEARCH INTERESTS

Large language models; in-context learning and reasoning; multimodal learning; AI for science; human–AI interaction.

EDUCATION

University of Toronto 2022 – Present
PhD in Computer Science; Vector Institute affiliation Expected graduation: 06/2028
Supervisor: Alán Aspuru-Guzik. Committee: Nicholas Papernot and Michael Liut.

University of Toronto 2018 – 2022
BSc in Computer Science and Statistics. Research advisor: Joseph Jay Williams.

RESEARCH & INDUSTRY EXPERIENCE

Applied Scientist II (Intern), Amazon 2026

- Led a research project in the Alexa+ team to improve the visual capabilities of multimodal large language models (MLLMs) through supervised fine-tuning (SFT) and GRPO, improving accuracy by **6.5 percentage points** while maintaining inference latency.
- Research manuscript in preparation.

Doctoral Research, University of Toronto & Vector Institute 2022 – Present

- Research in-context learning and scientific reasoning with large language models.
- Developed Schema-Activated In-Context Learning (SA-ICL) to transfer structured reasoning templates to new questions, achieving performance gains of up to **36.19%** on GPQA chemistry and physics questions with a single high-quality demonstration.
- Co-authored research on language model-assisted reading and writing (TreeReader, TreeWriter) and computer vision for high-throughput materials synthesis.
- Contributed to the review paper *Molecular Knowledge Representations in the Era of Artificial Intelligence*, covering molecular and chemical knowledge representations for AI.

Research Engineer, Dynamic Graphics Project Lab, University of Toronto 2022 – 2023

- Led software development and machine learning design for an adaptive experimentation platform deployed in more than **25 courses**, in collaboration with CMU and UNC; our team won the **XPRIZE Digital Learning Challenge**.

Research Scholar, Data Sciences Institute, University of Toronto 2022

- Built a platform for collecting data from third-party websites and running data analysis through a web interface. Advisor: Michael Liut.

Software Developer Co-op, Infrastructures for Information (i4i) 2020 – 2021

TEACHING EXPERIENCE

University of Toronto, Computer Science & Statistics 2021 – Present
Instructor (2025 – Present); Teaching Assistant (2021 – 2024)

- Instructor for CSC148 (Introduction to Computer Science), CSC207 (Software Design), and CSC309 (Programming on the Web).
- Developed peer-feedback and grading-consistency tools for Software Design and a software-vulnerability assignment for Programming on the Web.
- Received the inaugural **DCS Graduate Teaching Award (2026)**, recognizing exemplary teaching.

SELECTED PUBLICATIONS & MANUSCRIPTS

When Should A Model Trust Its Own Examples? Asymmetry in Self-Generated In-Context Learning
P. Chen, M. Wang, S. Chen, et al.
Manuscript; planned submission to ACL Rolling Review (October 2026).

Schema for In-Context Learning
P. Chen, S. Chen, M. Wang, et al.
arXiv:2510.13905, 2025 (revised 2026).

Molecular Knowledge Representations in the Era of Artificial Intelligence
Z. Zhang, J. Bai, Y. Nakamura, A. Wang, S. X. Leong, S. Zhang, **P. Chen**, et al.
Accepted; forthcoming. Preprint: ChemRxiv, 2026.

Computer Vision for High-Throughput Materials Synthesis: A Tutorial for Experimentalists
M. A. Gaidimas, A. Mandal, **P. Chen**, et al.
Digital Discovery, 5(2), 510–522, 2026.

TreeWriter: AI-Assisted Hierarchical Planning and Writing for Long-Form Documents
Z. Zhang, F. Du, X. Liu, **P. Chen**, et al.
arXiv:2601.12740, 2026.

TreeReader: A Hierarchical Academic Paper Reader Powered by Language Models
Z. Zhang, **P. Chen**, F. Du, et al.
IEEE VL/HCC, 2025.

Platform-based Adaptive Experimental Research in Education: Lessons Learned from The Digital Learning Challenge
I. Musabirov, M. Reza, H. Song, S. Moore, **P. Chen**, et al.
International Learning Analytics and Knowledge Conference (LAK), 2025.

Does the Medium Matter? An Exploration of Voice-Interaction for Self-Explanations
A. Zavaleta Bernuy, N. Sibia, **P. Chen**, et al.
ACM Designing Interactive Systems (DIS), 86–101, 2024.

Opportunities for Adaptive Experiments to Enable Continuous Improvement in Computer Science Education
I. Musabirov, A. Zavaleta Bernuy, **P. Chen**, et al.
Western Canadian Conference on Computing Education (WCCCE), 2024.

Behavioral Consequences of Reminder Emails on Students' Academic Performance: A Real-World Deployment
R. Ye, **P. Chen**, Y. Mao, et al.
ACM SIGITE, 16–22, 2022.

Parameter Efficient Dendritic-Tree Neurons Outperform Perceptrons
Z. Han, E. Gorobets, **P. Chen**.
arXiv:2207.00708; presented at the ICML Dynamic Neural Networks Workshop, 2022.

Statistical Consequences of Dueling Bandits
N. Saxena, **P. Chen**, E. Liu.
EDM Workshop on Reinforcement Learning for Education; arXiv:2111.00870, 2021.

TECHNICAL SKILLS

Research engineering: Python, PyTorch, TensorFlow, Hugging Face Transformers.
LLM training & evaluation: Multimodal post-training (SFT, GRPO), in-context learning, benchmarking.
Agentic coding & harness engineering: Codex/Claude Code workflows, repository instructions, tool integration, and automated validation.

AWARDS, RESEARCH FUNDING & TRAINING

- Vector Research Grant; Department of Computer Science Graduate Program Award.
- Doctoral research supported by the Google–NSERC Industrial Research Chair.
- Carnegie Mellon University Summer School, full scholarship (2023); mentors and collaborators: John Stamper and Steven Moore.