

CHENWEI ZHANG

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EDUCATION

University of British Columbia

Doctor of Philosophy in Computer Science, GPA: 91.4/100 | TOP 1%

Vancouver, BC, Canada

Sept. 2021 – Present

University of Waterloo

Master of Science in Chemistry (Nanoscience), GPA: 4.0/4.0 | TOP 1%

Waterloo, ON, Canada

Sept. 2018 – Feb. 2021

University of Waterloo

Bachelor of Science in Nanoscience (Dean's Honours List), GPA: 3.90/4.0 | TOP 5%

Waterloo, ON, Canada

Sept. 2017 – Aug. 2018

Beijing Jiaotong University

Bachelor of Engineering in Nanotechnology, GPA: 3.90/4.0 | TOP 5%

Beijing, China

Sept. 2015 – Aug. 2017

RESEARCH EXPERIENCE

Research Assistant | Co-Supervisors: Prof. Anne Condon & Prof. Khanh Dao Duc

From Sept. 2021

University of British Columbia

Vancouver, BC, Canada

- Developed *CryoSAMU*, a novel structure-aware multimodal 3D U-Net for enhancing intermediate-resolution cryo-EM density maps. Introduced a self-attention-based post-processing module to generate fixed-size structural representations. By integrating both density and structure modalities, CryoSAMU overcomes limitations of existing map-only methods and outperforms prior approaches across key metrics while significantly reducing inference time, offering a practical solution for accelerating protein structure modeling. Open-sourced on [Github](#).
- Proposed *struc2mapGAN*, a GAN-based framework for generating high-fidelity cryo-EM 3D density maps from protein structures. Utilized a nested U-Net generator architecture and an additional L1 reconstruction loss to enhance learning efficiency and mitigate mode collapse. Struc2mapGAN captures complex structural features more effectively than traditional simulation-based methods and enables rapid, scalable inference for structural biology workflows. Open-sourced on [Github](#).
- Conducted a comprehensive survey and benchmark of deep learning (DL) methods for automated atomic protein structure building from cryo-EM density maps. Distinguished between direct density-based approaches and those incorporating AlphaFold-derived predictions. Refined standard evaluation metrics and benchmarked representative DL and physics-based methods across varying resolutions, demonstrating that DL-based approaches consistently outperform traditional ones, with AlphaFold integration improving both completeness and accuracy. Open-sourced on [Github](#).
- Developed *ViDa*, a novel deep learning framework for extracting DNA secondary structure features and visualizing reaction trajectories modeled via continuous-time Markov chains. ViDa integrates scattering transforms on secondary structure graphs with a variational autoencoder (VAE), semi-supervised by physics-informed constraints. The training objective incorporates domain-specific losses capturing both thermodynamic and kinetic properties. This work introduces a new paradigm that leverages graph-based representations of DNA secondary structures and imposes physical priors to guide VAEs in interpreting complex reaction mechanisms. Open-sourced on [Github](#).

Research Assistant | Supervisor: Prof. Pavle Radovanovic

Sept. 2018 – Feb. 2021

University of Waterloo

Waterloo, ON, Canada

- Highlighted the challenges in assigning absorption bands of complex semiconductor nanocrystals to localized surface plasmon resonance. Demonstrated magnetic circular dichroism spectroscopy as an invaluable tool for characterization of semiconductor nanocrystals.
- Reported a variable-temperature-variable-field magnetic circular dichroism study of ZnO and SnO₂ nanocrystals prepared under oxidizing and reducing conditions. Demonstrated the ability to tune carrier polarization in metal oxide nanocrystals by in situ control of the native defect formation and attest to the anomalous Zeeman splitting of the band states.
- Investigated the role of synthesis methods and post-synthesis processing on plasmonic properties of antimony-doped SnO₂ nanocrystals. Designed semiconductor nanocrystals with targeted plasmonic properties by proposed synthesis methodology and post-synthesis treatment.

Undergraduate Research Assistant | Supervisor: Prof. Pu Chen

Dec. 2017 – Aug. 2018

University of Waterloo

Waterloo, ON, Canada

- Developed a novel method to enhance charge/discharge performance in zinc-ion aqueous rechargeable batteries by leveraging zinc ions as electrolyte and vanadium oxide as the cathode.

Undergraduate Research Assistant | Supervisor: Prof. Yuliang Zhao

Jun. 2016 – Aug. 2017

National Center for Nanoscience and Technology, Chinese Academy of Science

Beijing, China

- Led a one-year project on studying nanomedicine for cancer treatment. Focused on developing drug-loaded nanoparticles and improved the targeting ability of docetaxel to a certain extent.

WORK EXPERIENCE**Machine Learning Intern**

From Jan. 2025

Prenuvo

Vancouver, BC, Canada

- Developed multimodal foundation models for medical image analysis, with a focus on MRI interpretation.
- Designed and trained transformer-based and ResNet-based vision encoders alongside text encoders using contrastive learning objectives (e.g., CLIP-style pretraining).
- Applied LoRA and instruction fine-tuning techniques to adapt large-scale multimodal vision-language models for domain-specific tasks in healthcare.
- Integrated vision-language alignment strategies to enhance zero-shot and few-shot performance on downstream medical imaging benchmarks.

Machine Learning Intern

Jun. 2023 – Jun. 2024

Amgen

Burnaby, BC, Canada

- Designed an automated pipeline to accelerate cryo-EM 3D density map analysis and streamline protein structure modeling workflows.
- Optimized traditional machine learning methods for enhancing cryo-EM density maps and improving protein structure prediction.
- Deployed state-of-the-art deep learning techniques into internal platforms for large-scale and high-throughput cryo-EM data processing.

TEACHING EXPERIENCE**Teaching Assistant**

Sept. 2021 – Apr. 2023

University of British Columbia

Vancouver, BC, Canada

- **CPSC 340/532M**: Machine Learning and Data Mining
- **CPSC 330**: Applied Machine Learning
- **CPSC 322**: Introduction to Artificial Intelligence

Teaching Assistant

Sept. 2018 – Dec. 2020

University of Waterloo

Waterloo, ON, Canada

- **CHE 102**: Chemistry for Engineers
- **CHEM 120L/123L**: General Chemistry Laboratory I/II

PUBLICATIONS**CryoSAMU: Enhancing 3D Cryo-EM Density Maps of Protein Structures at Intermediate Resolution with Structure-Aware Multimodal U-Nets**

Mar. 2025

Submitted to ICCV 2025

[Download](#)

- [Chenwei Zhang](#), [Anne Condon](#), [Khanh Dao Duc](#)

Struc2mapGAN: improving synthetic cryo-EM density maps with generative adversarial networks

Mar. 2025

Submitted to Bioinformatics Advances

[Download](#)

- [Chenwei Zhang](#), [Anne Condon](#), [Khanh Dao Duc](#)

A comprehensive survey and benchmark of deep learning-based methods for atomic model building from cryo-EM density maps

Jan. 2025

Submitted to Briefings in Bioinformatics

[Download](#)

- [Chenwei Zhang](#), [Anne Condon](#), [Khanh Dao Duc](#)

ViDa: Visualizing DNA hybridization trajectories with biophysics-informed deep graph embeddings

Mar. 2024

Machine Learning in Computational Biology (oral). PMLR 240:148-162, 2024

[Download](#)

<ul style="list-style-type: none"> Chenwei Zhang, Jordan Lovrod, Boyan Beronov, Khanh Dao Duc, Anne Condon EMPOT: partial alignment of density maps and atomic model fitting using unbalanced Gromov-Wasserstein divergence <i>Workshop Paper accepted at NeurIPS 2023</i>	Oct. 2023
<ul style="list-style-type: none"> Aryan Tajmir Riahi, Chenwei Zhang, James Chen, Anne Condon, Khanh Dao Duc Revisiting Hybridization Kinetics with Improved Elementary Step Simulation <i>Conference Paper accepted at DNA29</i>	Aug. 2023
<ul style="list-style-type: none"> Jordan Lovrod, Boyan Beronov, Chenwei Zhang, Erik Winfree, Anne Condon Revisiting Plasmonic Properties of Complex Semiconductor Nanocrystals Using Magnetic Circular Dichroism Spectroscopy: A Cautionary Tale <i>Journal Paper accepted at J. Phys. Chem. C</i>	Jan. 2023
<ul style="list-style-type: none"> Aaron Kenny-Wilby, Gyorgy Jaics, Chenwei Zhang, Penghui Yin, Pavle V. Radovanovic Visualizing DNA Reaction Trajectories with Deep Graph Embedding Approaches <i>Workshop Paper accepted at NeurIPS 2022</i>	Oct. 2022
<ul style="list-style-type: none"> Chenwei Zhang, Khanh Dao Duc, Anne Condon On the Origin of d⁰ Magnetism in Transparent Metal Oxide Nanocrystals <i>Journal Paper accepted at J. Phys. Chem. C</i>	Dec. 2021
<ul style="list-style-type: none"> Chenwei Zhang, Penghui Yin, Wenhuan Lu, Victor Galievsky, Pavle V. Radovanovic Manipulating Carrier Polarization in Pure and Doped Metal Oxide Semiconductor Nanocrystals <i>M.Sc. Thesis at UWaterloo</i>	Feb. 2021
<ul style="list-style-type: none"> Chenwei Zhang Manipulating Plasmonic Properties of Sb-Doped SnO₂ Nanocrystals by Controlling Dopant Oxidation State via Synthesis Method and Processing Conditions <i>Conference Paper accepted at ECS Trans.</i>	Sept. 2020
<ul style="list-style-type: none"> Chenwei Zhang, Penghui Yin, Pavle V. Radovanovic 	

PERSONAL/COURSE PROJECTS

VideoCLIP-based Evaluation Metrics for Text-to-Video Generative Tasks <i>University of British Columbia</i>	Sept. 2022 – Dec. 2022 Vancouver, BC, Canada
<ul style="list-style-type: none"> Proposed VCLIP-Metric, a VideoCLIP-based metric for text-to-video generators, achieving a score nearly twice that of CLIP frame-based metrics. View the report. Open-sourced on Github. 	
i-ViDa: Visualizing Energy Landscapes and Trajectories of DNA Reactions <i>University of British Columbia</i>	Sept. 2022 – Dec. 2022 Vancouver, BC, Canada
<ul style="list-style-type: none"> Designed i-ViDa, an interactive visualization tool using D3.js, enabling users to plot and manipulate latent space, energy landscapes, and trajectories. View the report. Open-sourced on Github. 	
Approximating and visualizing path spaces in large CTMCs <i>University of British Columbia</i>	Mar. 2022 – Apr. 2022 Vancouver, BC, Canada
<ul style="list-style-type: none"> Implemented Pathway Elaboration algorithm in Julia for arbitrary CTMCs with explicit rate matrices, using Julia's plotting packages to visualize state distributions and trajectory samples in large CTMCs. View the report 	
VASLA: Visually Assisted Sound-Localization and Amplification <i>University of British Columbia</i>	Nov. 2021 – Dec. 2021 Vancouver, BC, Canada
<ul style="list-style-type: none"> Developed VASLA, a tool to help alleviate machines' difficulty in separating sounds of interest from background sounds in noisy environments. View the report. Open-sourced on GitHub. 	
Quantum Valley Investments Problem Pitch Competition <i>University of Waterloo</i>	May 2020 – Jul. 2020 Waterloo, ON, Canada
<ul style="list-style-type: none"> Competed in a pitch competition for funding to address training data quality challenges in AI, focusing on the healthcare AI market. 	
Kaggle Competitions – COVID-19 Study <i>University of Waterloo</i>	Mar. 2020 – Apr. 2020 Waterloo, ON, Canada
<ul style="list-style-type: none"> Won the bronze medal for the COVID-19 competition. 	

ACTIVITIES

- Sept. 2024: [Poster presentation](#) at 30th International Conference on DNA Computing and Molecular Programming (DNA30), Johns Hopkins University, Baltimore, USA.
- Jul. 2024: Attended Oxford Machine Learning Summer School ([OxML 2024](#)) at University of Oxford, Oxford, UK.
- Mar. 2024: Attended [Mitacs Roundtable Discussion](#) with the new BC Minister of Post-Secondary Education and Future Skills at Vancouver, Canada.
- Dec. 2023: [Poster presentation](#) at Machine Learning in Structural Biology (MLSB2023) at NeurIPS 2023, New Orleans, USA.
- Dec. 2023: [Oral presentation](#) at 18th Machine Learning in Computational Biology Conference (MLCB2023), University of Washington, Seattle, USA.
- Sept. 2023: [Poster presentation](#) at 29th International Conference on DNA Computing and Molecular Programming (DNA29), Tohoku University, Sendai, Japan.
- Sept. 2023: [15-minute talk](#) at Workshop - Mathematical Methods for Exploring and Analyzing Morphological Shapes across Biological Scales, BIRS, Banff, Canada.
- Dec. 2022: [Poster presentation](#) at Machine Learning in Structural Biology (MLSB2022) at NeurIPS 2022, New Orleans, USA.
- Aug. 2022: [Poster presentation](#) as coauthor at 28th International Conference on DNA Computing and Molecular Programming (DNA28), University of New Mexico, Albuquerque, USA.
- Spring 2018: **Mentor** of junior undergraduate students from 2+2 program at UWaterloo.
- Winter 2017, Spring 2018: **Member** of International Peer Community & Conversation Partner Program at UWaterloo.
- Winter 2017: **Member** of UW Photo Club, skilled at digital SLR camera photography, photo editing and video clipping.
- Jul. 2016 – Aug. 2016: **Volunteer** in the “Explore China” project held by AIESEC in Beijing.
- Winter 2015: **Head** of the Enrollment Association Shanxi Province Group at BJTU.

HONOURS, AWARDS, GRANTS AND SCHOLARSHIPS

- Jun. 2023 – Jun. 2024: **Mitacs Accelerate Fellowship**, Amgen Canada & University of British Columbia
- From Sept. 2021: **International Tuition Award, Faculty of Science PhD Tuition Award, President’s Academic Excellence Initiative PhD Award, Research Assistant Scholarship**, University of British Columbia
- Sept. 2018 – Feb. 2021: **International Master’s Student Award (IMSA), Science Graduate Award (SGA), Research Graduate Scholarship**, University of Waterloo
- May 2018, Sept. 2018: **Dean’s Honours List**, University of Waterloo
- 2017 – 2018: **International Tuition Grant**, University of Waterloo
- Oct. 2016, Oct. 2017, Oct. 2018: **Academic Scholarships (Top 5%)**, Beijing Jiaotong University
- Nov. 2017: **Scholarship of Student’s Innovation**, Chinese Academy of Science

ACADEMIC REVIEWERS

- Annual Conference on Neural Information Processing Systems (NeurIPS) 2024
- International Conference on Machine Learning (ICML) 2024
- Machine Learning in Computational Biology (MLCB) 2024

SKILLS

- **Languages:** English, Mandarin
- **Programming Languages:** Python, Julia, MATLAB, Markdown, Bash, \LaTeX
- **Frameworks:** PyTorch, Scikit-learn, HuggingFace, TensorFlow, Keras
- **Developer Tools:** AWS, Nvidia DGX, Slurm, Git, Docker, Apptainer (Singularity), Linux, CUDA, HPC
- **Libraries:** PyTorch Lightning, NumPy, SciPy, Pandas, Transformers, Matplotlib, Plotly, NetworkX