Yanbo Cheng

yanbocheng01234@gmail.com | 647-831-3135 | LinkedIn | GitHub

Research Interests

Machine Learning, Deep Learning, Computer Vision, Pattern Recognition, Reinforcement Learning, Dynamical Systems, Optimization, Image Processing.

Education

University of Toronto Aug 2021 – June 2025
Computer Science Specialist + Mathematics Major, Honours *GPA: 3.5*

- **Relevant Coursework:** Machine Learning, Deep Learning, Neural Networks, Reinforcement Learning, Linear Algebra, Probability, Statistics, Algorithms, Data Structures, Operating Systems, Database Systems, Optimization, Numerical Methods.

Research Experience

Robust 3D Perception via Point Cloud Painting 2025 – Present
(UncertaintyPainting & DifficultyPainting)

- Developed a family of multi-modal sensor fusion frameworks that "paint" camera-derived semantics onto LiDAR point clouds to improve 3D detection.
- **UncertaintyPainting:** Integrated **Evidential Deep Learning** to quantify aleatoric uncertainty, filtering **200k+** false positives and enabling safety-critical background suppression.
- **DifficultyPainting (Novel):** Advanced the architecture by projecting **learned detection difficulty** scores onto LiDAR points, effectively creating a 3D attention mechanism for hard-to-detect objects.
- Surpassed the previous best (UncertaintyPainting) performance, achieving new state-of-the-art results on the KITTI benchmark **80.03% AP**.
- GitHub (Difficulty) | GitHub (Uncertainty)

Data-Driven Discovery of Governing Equations via Reservoir Computing + SINDy 2024 – Present
Independent Research Project (Scientific Machine Learning)

- Designed a hybrid framework combining **Reservoir Computing (RC)** with **SINDy** to uncover governing ODEs and PDEs from time-series and trajectory data.
- Reconstructed nonlinear dynamical systems (Lorenz, Van der Pol, Duffing) under noise, limited samples, and perturbed initial conditions.
- Developed augmentation techniques (trajectory perturbations, noise injection, resampling) to improve SINDy robustness.
- Analyzed stability of recovered coefficients, sparsity structure, reconstruction error, and feature-space conditioning.
- Produced a research-style technical report discussing theory, methodology, and empirical findings.
- GitHub Repository

Recurrent Evolutionary Neural Network for MNIST 2025 – Present
Ongoing Research Project

- Developing a biologically-inspired recurrent neural architecture that evolves its structure and weights to perform **image classification** on the 8×8 MNIST dataset.
- Designing a constrained connectivity scheme—Input $\rightarrow$ Recurrent $\leftrightarrow$ Recurrent $\rightarrow$ Output—prohibiting self-loops, output-to-output, and bypass connections to study structured recurrent dynamics.
- Implementing a population-based evolutionary training process using elite selection, tournament selection, crossover, and both structural and weight mutations.
- Modeling recurrent activation dynamics that iterate until convergence, with fallback averaging for unstable trajectories.
- Evaluating networks on classification accuracy, convergence behavior, evolutionary stability, and structural complexity across generations.

Industry Experience

CUSP Sep 2024 – Present
Full Stack Developer
- Delivered B2B platform features enabling scalable vendor-client matching and workflow automation.
- Led development of user onboarding pipelines, multi-role dashboards, and backend services.
- Optimized AWS-hosted services to reduce manual processing time across multiple stakeholder groups.

BalanceAI May 2024 – Sep 2024
Full Stack Developer
- Partnered with cross-functional teams to deliver cloud-native SaaS for education clients.
- Enhanced customer retention through AI-based grading and feedback loops (cut response time by 90%).
- Ensured compliance and trust by implementing secure APIs with JWT and GDPR protocols.

RBC May 2023 – Sep 2023
Software Engineer Intern
- Built client reporting dashboard (Power BI + React) for 500+ users, boosting visibility and executive insights.
- Developed resilient Python pipelines processing 10M+ financial records per day with 99.9% uptime.
- Collaborated across departments to streamline data-driven decision-making workflows.

Projects

Froupie – Social Restaurant Finder | *Node.js, Express, MySQL, React, TypeScript*
- Full-stack web app recommending optimal meetup restaurants via Google Maps API.
- Built REST API backend (Node.js, Express, MySQL) and React + TypeScript frontend.
- Integrated AWS-hosted SQL for persistence, reducing redundant API calls by 40%.
- GitHub

Yanbot – Discord Automation Bot | *Python, Discord API, Heroku*
- Developed multipurpose Discord bot in Python, deployed on Heroku across 10+ servers.
- Implemented music playback, role management, and chat moderation features.
- Added unit testing and uptime monitoring to ensure high reliability.
- GitHub

Hypertrophy App – Mobile Workout Tracker | *React Native, Expo*
- Built a mobile-first hypertrophy tracking app using React Native Expo with support for 2–6 day splits, auto progression, and editable plans.
- Implemented scrollable stats dashboard and last-cycle comparison to visualize workout trends over time.
- Developed searchable exercise library and calendar-based logging for persistent and flexible scheduling.
- GitHub

ChaosNet – Chaos-Based Reinforcement Learning | *Python, PyTorch, RL*
- Extended ChaosNet neural architecture to reinforcement learning, introducing chaotic neurons to drive sample-efficient exploration and policy learning.
- Achieved competitive performance on CartPole, Blackjack, and LunarLander using as few as 10 training episodes.
- Designed TT-SS feature extraction and prediction algorithms leveraging chaotic dynamics to outperform Q-learning in early-stage learning.
- GitHub

Feynman Chatbot – AI-Powered Learning Assistant | *Streamlit, LLaMA, Python*
- Built an interactive education chatbot using Streamlit and LLaMA that simplifies complex topics using the Feynman Technique.
- Enabled guided QA sessions with LLM-powered feedback and explanation scaffolding to support effective concept learning.
- Implemented folder-based saving and export of conversation threads to support long-term study and review.
- GitHub

SKILLS

Languages: Python, Java, JavaScript/TypeScript, SQL, C++, C#, Go, R
ML & Data: PyTorch, TensorFlow, Pandas, NumPy, Scikit-learn, PySpark, Neural Networks, RL, Scientific ML, Image Processing, Pattern Recognition
Cloud/DevOps: AWS, Docker, Kubernetes, Terraform, CI/CD, Azure
Other: Algorithms, Data Structures, REST, Agile/Scrum, English/Mandarin