Yawen Xiao

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Research Interests

My research focuses on integrating **Artificial Intelligence** with **Human-Computer Interaction** to create adaptive, human-centered systems. Building on my work in **VR interaction**, **digital twins**, and **LLM applications**, I aim to develop **machine learning** methods that model human behavior, predict discomfort and reconfigure virtual and physical environments. My goal is to design **AI-driven frameworks** that map and simulate industrial and collaborative spaces, enabling data-driven adaptation of workflows, tools, and interfaces. This research will advance more intuitive and effective **human AI integration**.

Education

University of Toronto, MS 2024.09 – 2025.12

- Electrical and Computer Engineering | Data Analytics and Machine Learning
- GPA: 4.0/4.0
- **Coursework:** Data Analytics and Machine Learning, Applications of Natural Language Processing, Special Topics in Software Engineering Artificial Intelligence, AI in Finance, Wearable AI

University of Toronto, BS 2019.09 – 2024.05

- Computer Science Specialist | Statistics Minor
- GPA: 3.6/4.0
- **Coursework:** Artificial Intelligence, The Design of Interactive Computational Media, Computer Graphics, Software Engineering, Databases, Operating Systems, Algorithm Design and Analysis

Experience

Research Assistant – Case Study AI Grading Platform (advised by Ruhai Wu), McMaster University 2025.05 – Present

- Developed a full-stack grading system with Ollama-powered AI service for rubric-based scoring.
- Designed professor workflows for course/assignment setup, rubric conversion, and AI-assisted grading with editable row-level feedback. Implemented student interface for submission, enabling streamlined AI-supported grading in case study assignments.

Teaching Assistant – Computer Organization (CSC258), University of Toronto 2025.01 - 2025.12

- Assisted students in weekly labs by demonstrating concepts, providing guidance, and validating their work on digital logic and microprogramming tasks.
- Evaluated assembly language project demonstrations and graded exams, ensuring comprehensive feedback and adherence to course standards.

Research in Human Computer Interaction (advised by Tovi Grossman), University of Toronto 2023.12 - 2024.06

Beating the Reality: Investigating the PinchLens Technique for Target Selection and Placement [Link]

- Selecting and operating small, densely packed objects in VR presents significant challenges, stemming from both technological limitations and human factors like perception and dexterity.
- Investigating the efficacy of the PinchLens technique, which greatly improves target selection in VR, in object placement and practical scenarios. Comparing its performance in simulated real-world tasks to determine if PinchLens can enhance user efficiency in VR, potentially surpassing real-world performance—a notable shift from the current trend where VR generally underperforms compared to real-life tasks.

Research in VR Wellness (advised by Mark Chignell), University of Toronto 2023.05 - Present

Forest Bathing [Link]

- Encapsulating diverse scenarios within an expansive virtual forest environment, offering participants the opportunity to freely explore the serene woodland setting using a VR headset, inducing relaxation and psychotherapy benefits. Social therapy mode facilitates conversations and interactions within built-in social scenarios, further reinforced by quizzes for user study.
- Creating a tranquil and relaxing space on one hand, and encouraging positive social interactions in varying situations, shedding light on social anxiety disorders and methods to overcome them on the other.

4VR Young

- Connecting VR headsets with stationary bicycle equipment, where the movement of the bicycle translates into signals that synchronized with 360-degree videos, creating the illusion of outdoor cycling.
- Promoting real indoor exercise and offering users a virtual experience of different outdoor settings.

Full-stack Developer, Environment and Climate Change Canada 2022.05 – 2023.08

Species at Risk Data Management System [Link]

- Focused on both frontend and backend development for the Species at Risk Data Management System.
- The project encompassed vital data management functionalities, including recording, posting, editing, and archiving data related to wildlife species.
- This platform was designed to empower scientists and environmentalists in their efforts to monitor and comprehend the evolving status of various species across the globe.

Software Developer, Nahdet el Mahrousa [Link] 2021.09 – 2021.12

- A chat-with-bot application that receives a message and sends the response. The application contains a login site and provides additional operations to the administrator accounts to manage the bot replies.
- Developed through JavaScript, React, and Heroku to deploy.

Executive in Application Development Association, University of Toronto 2021.09 – 2022.05

- Collaborated in teams to develop creative software projects, organize coding contests, and provide a platform for students to showcase and implement innovative ideas.
- Participated in weekly meetings covering diverse topics like Optical Virtual Reality (OVR) and motion detection, fostering technical skills and collaborative innovation.

Operating System Research Assistant, Beihang University 2020.09 – 2021.08

- Contributed to the design and implementation of the building management system by deploying the Digital Twins system. Involved in the research based on the intelligent hotel and investigated the interaction between the users and the system.

Publications

Are Virtual Forests Just for Relaxation, or Can They Enhance the Benefits of Therapy? 2025.03

10.3390/healthcare13060621

Projects

ColourSenseXR: Helping the Hearing-Impaired Perceive Sound Through Colour 2025.10 – 2025.11
[Link]

- Built an XR system that translates music into dynamic colour gradients, enabling hearing-impaired users to perceive emotional cues visually.
- Trained and compared three models: Static CNN, Dynamic CNN, and Dynamic CNN+LSTM for valence–arousal prediction, achieved the best real-time performance with the LSTM-based model.
- Implemented a Unity inference pipeline using ONNX and Barracuda, calibrated normalization to align Python-trained outputs with Unity's audio processing.

- Designed emotion-to-colour and note-to-colour mapping strategies for smooth real-time visual transitions on Meta Quest 2.
- Conducted a preliminary user study demonstrating 70% accuracy in visual emotion recognition.

Automated Event Booking Decision System [Link] 2025.05 – 2025.08

- Built a two-stage decision system that combined LLM-based policy compliance checks with a historical data set similarity analysis.
- Implemented custom feature weighting and precomputed embeddings for efficient similarity scoring, with threshold-based approval logic.
- Evaluated multiple weight configurations and tuned thresholds, finding LLM effective for complex policy interpretation but sensitive to prompt design.

Application of eXplainable AI (XAI) Methods [Link] 2025.03 – 2025.04

- Designed a machine learning pipeline to detect cyberattacks in electric vehicle charging systems, achieving 90.61% validation accuracy using Multilayer Perceptron models.
- Applied XAI techniques (SHAP, LIME) for feature importance analysis, enabling transparent and interpretable model predictions in cybersecurity applications.
- Balanced imbalanced data through undersampling, ensuring unbiased model training for anomaly detection tasks.

Feature-Optimized MLP for Breast Tumor Diagnosis [Link] 2025.02 – 2025.04

- Implemented MLP with two hidden layers, dropout for regularization, and optimized hyperparameters through grid search to achieve robust and efficient tumor classification.
- Applied neural network techniques for handling high-dimensional data, including feature standardization, loss weighting for imbalanced datasets, and early stopping to prevent overfitting.

Bitcoin Daily Trading Strategy [Link] 2025.02 – 2025.04

- Trained machine learning models to predict next-day Bitcoin price direction based on time-series data, integrating features like MACD and Rolling Volatility.
- Backtested the strategy, achieving a Sharpe Ratio of 2.22 and reduced drawdowns, demonstrating effective risk-adjusted returns compared to Buy & Hold.
- Applied SHAP for model interpretability, uncovering key time-series insights and enhancing transparency in trading decisions.

Sentiment Analysis on QQQ Investments Using Large Language Models [Link] 2025.01 – 2025.04

- Developed a predictive model using Large Language Models (LLMs) to analyze market sentiment and forecast QQQ's short-term performance.
- Integrated diverse data sources, including public news, technical indicators, and earnings reports, to enhance decision-making and optimize investment strategies.
- Designed a dual-mode system balancing independent decision-making and collaborative reasoning to improve accuracy and adaptability in stock market analysis.

InstaDiagnose [Link] [Video] 2024.10 – 2024.12

- Designed a multi-agent model incorporating task decomposition, including diagnosis, comparison, and inquiry agents, to deliver precise and interpretable primary care diagnostics.
- Enhanced the model with chain-of-thought prompting and Retrieval-Augmented Generation (RAG) using a medical database, improving retrieval accuracy with a helper translation agent.
- Achieved significant performance improvements by implementing Top-1 and Top-4 accuracy metrics and a score-based evaluation, ensuring reliable and accurate disease suggestions.

Data Analysis and Machine Learning [Link] 2024.09 – 2024.12

- Conducted data preprocessing and cleaning to prepare datasets for analysis, ensuring data quality and consistency for reliable results.
- Implemented machine learning techniques such as Gaussian Mixture Models for anomaly detection and PCA for clustering high-dimensional image datasets.

- Applied Singular Value Decomposition (SVD) and linear regression to solve real-world problems, gaining insights and optimizing predictive accuracy.
- Designed and evaluated machine learning models, employing rigorous training, testing, and validation processes to ensure performance and generalization.

Computer Network Interface [Link] 2023.09 – 2023.11

- Implementation of a network stack using C++ focused on the link layer, responsible for creating and sending Ethernet packets, also receives and processes the incoming Ethernet packets.
- Design is based on updating frames send/receive by using the IP addresses to access the ARP table periodically.

Computer Graphics and Animation [Link] 2022.09 – 2022.12

- Using Visual Studio and C++ to build 3D rendered objects by ray-casting and ray-tracing.
- Animations of solid objects, skeleton bones, mesh, and mass spring system are created by calculated vectors based on the kinematics theories.

Awards

Honors Bachelor of Science with High Distinction 2024

Natural Sciences and Engineering Research Council (NSERC) Undergraduate Student Research Award Program (USRA) Award 2023

Dean's List Scholar 2020-2024

Cayley Contest Certificate of Distinction 2018

Euclid Contest Certificate of Distinction 2019

Technologies

PROGRAMMING LANGUAGES: Python, Java, C, C++, C#, R, JavaScript, HTML, Flash, SQL, Vue, React, MIPS Assembly, Shell, LaTeX, Turing, Unity

VERSION CONTROL & PACKAGE: Git, Node Builder

OTHER TOOLS: Azure DevOps, Amazon Web Services, Postman, Visual Studio, Ubuntu Virtual Machine, Service Bus, Figma, Microsoft Offices, Photoshop

LANGUAGES: English, Mandarin, French (novice), Spanish (novice)

HOBBIES: Piano, Arts, Badminton, Table Tennis, Swimming, Reading