Tianyi Xu

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Education

- **University of Wisconsin-Madison** Madison, WI
  Bachelor of Science in Computer Science, Data Science, Math; GPA: 3.948 *Sept. 2021 – May 2025 (Expected)*
  Coursework: Learning-based CV (graduate level), Algorithms, Artificial Intelligence, Databases, Data Structures, Deep Learning, Machine Learning, Learning Theory, Optimization, AI/Data Ethics, Real Analysis, Probability, Statistics, Linear Algebra.

Research Experience

- **UW-Madison Electrical and Computer Engineering** Madison, WI
  Research Assisstant, Advisor: Pedro Morgado *Jan 2024 - Present*
  - Conducting research on audio-visual event separation using Diffusion Models, including training and implementing a conditioned latent diffusion model with PyTorch and latest open-source implementations.
  - Experimented with CLAP (Contrastive Language-Audio Pretraining) embeddings for generating audio events conditioned on text input.
  - Generated and cleaned audio data using Torchaudio, Python, Pandas, and Librosa.
- **Wisconsin Institute for Discovery** Madison, WI
  Research Assistant, Advisor: Claudia Solís-Lemus, Zuzana Burivalova *Jan 2023 - Present*
  - Analyzed large, high-dimensional microbiome datasets to identify patterns, employing visualization tools, dimension-reduction techniques, statistical analysis, and regression models in R.
  - Built and analyzed various graphical networks (e.g., Glasso, CARlasso) to understand the effects of fumigation on different predictors.
  - Actively developing a pipeline for processing audio data and feature engineering using Librosa, h5py, and Pandas. Developing a Faster-RCNN in PyTorch and experimenting audio detection with Detr using HuggingFace API.
  - Implementing an acoustic event detection baseline model using the monitoR package.
- **UW-Madison Biostats/Wisconsin Alzheimer's Disease Research Center** Madison, WI
  Research Assisstant, Advisor: Vikas Singh, Jea Woo Kang *Oct 2023 - Aug 2024*
  - Implemented machine learning models (Logistic Regression, Random Forest, XGBoost) for diagnostic prediction, using PCA and SMOTE for data analysis in Python.
  - Developed and trained a Variational Autoencoder(VAE) for data generation, improving positive class prediction accuracy by over 40%.
  - Designed and trained deep residual networks, exploring CNNs and Vision Transformers (ViT) for phenotype prediction. Improved diagnostic group prediction accuracy by over 10-20% overall.
  - Currently implementing deep image generation models (e.g., VAE) for phylogenetic tree embedding data.
- **UW-Madison Material Sciences** Madison, WI
  Machine Learning Researcher, Advisor: Dane Morgan *Feb 2023 - May 2023*
  - Implemented learning-based CV methods, using Python, to identify aggressive tumor traits in kidney CT scans.
  - Developed a deep convolutional neural network (CNN) with PyTorch, and optimized its performance to achieve an impressive improvement in accuracy from 60 % to 95 % during testing.
  - Assessed the robustness of the CNN model through permutation tests, confusion matrix, etc.

Talks/Presentation

- **Undergraduate Reseach Symposium**Poster Presentation at the 26th Annual Undergraduate Symposium: "Biodiversity Detection Using Acoustic Signals with Deep Learning." Abstract Link (Page 139)

Awards

- **Holstrom Environmental Research Fellowship**Awarded $3,000 + $1,000 (for advisor) research funding for a proposal on Acoustic Event Detection in tropical rainforests using deep learning.
- **UW-Madison Summer Scholarship**Selected to receive a $1,000 scholarship for Summer 2024 studies in recognition of top academic achievements.
- **Dean's List**Achieved Dean's List recognition for maintaining a semester GPA greater than 3.85 in Fall 2021, Spring 2022, Fall 2022, Fall 2023, and Spring 2024.

Work Experience

- **UW-Madison Computer Sciences** Madison, WI
  Undergraduate Teaching Assistant *Aug 2022 - May 2024*
  - Selected as teaching assistant for CS220, CS320 (Data Science Programming) and CS 540 (Intro to AI).
  - Held over 400 hours of office hours, guiding 400+ students through Python programming skills and AI/Data Science concepts, spanning topics from object-oriented programming to data visualization and machine learning.
  - Collaborated with the instructional team to design and oversee exams for over 1500 students.
- **UW-Madison, Division of Information Technology** Madison, WI
  Student Developer *Apr 2022 - Sept 2022*
  - Refined the UI by enhancing dark mode readability and ensuring user preferences were stored effectively.
  - Developed and documented new APIs, integrating with a MySQL server to streamline data storage/retrieval.
  - Developed a staff filtering system using React.js, facilitating efficient searches among the 1000 employees.

Selected Projects

- **ImageEditNet - Text based Image Editing** Madison, WI
  Graduate Level Course Project *Oct 2023 - Dec 2023*
  - Graduate level course project at UW-Madison, developed a text-prompt-based image editing model.
  - Combined GPT's in-context learning with GAN for dataset generation, improved upon InstructPix2Pix for face and real image editing tasks. Achieving higher CLIP and directional similarity scores.
- **Style Transfer with Diffusion Model** Madison, WI
  Course Project *February 2024 - May 2024*
  - Developed a pipeline of using diffusion models to perform style transfers using text prompts.
  - Finetuned Stable Diffusion and Instruct Pix2Pix models utilizing HuggingFace API, Python and Pytorch.
  - Improved upon present text-based foundation models on performing style transfers on real images, achieved higher CLIP and directional similarity scores.
- **ASL Sign Language Detection** Madison, WI
  Course Project *Oct 2023 - Dec 2023*
  - Developed in a team a real-time ASL detection and classification webcam application.
  - Using Python, PyTorch, and CUDA to implement and trained two Faster R-CNN models. Used openCV to and visualization to compared performances of them.
- **Teeko AI Player** Madison, WI
  Course/Individual Project *Nov 2022 - Dec 2022*
  - Developed an AI player for the Teeko game using Python and Pygame.
  - Incorporated efficient algorithms to explore all game states and utilized the minimax algorithm with depth cutoff, along with an authentic heuristic function based on Euclidean distance, allowing for a guaranteed victory against random players.
- **Money Laundering Activity Prediction Model** Madison, WI
  Individual Project with A Peer Partner *December 2023*
  - Built, trained, and optimized a Graph Neural Network (GNN) with Graph Attention Networks (GAT) to incorporate both edge and node features to predict money laundering activities using IBM Transactions for Anti Money Laundering data.
- **Minirel Database** Madison, WI
  Course Group Project *Feb 2023 - Apr 2023*
  - Conceptualized and executed a relational database structure. Used C++ to implement core database functions, including a buffer manager, a heapfile system, and various database operators..

Skills

- **Programming Languages** Python, R, Java, C/C++, JavaScript, HTML, CSS, SQL
- **ML/DS** PyTorch, TensorFlow, Scikit-Learn, Huggingface-hub, Transformers, Diffusers, PyTorch Geometric, Pandas, Docker, Spark, HDFS, BigQuery, Cassandra, Kafka, Cuda, Flask, Selenium, MySQL, Sqlite3
- **Other Tools** React, Node.js, Git, Linux, GCP, Junit, Vim, VS Code, PyCharm
- **Natural Languages** Chinese Mandarin (native), English (fluent), Japense (familiar)