Luoning (Roger) Zhang

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EDUCATION

University of California, Irvine

B.S. in Applied and Computational Mathematics, Expected Dec.2025

- Data Science Concentration, GPA: 3.85 (Upper-div GPA: 4.00)
- Dean's Honor List (5 Quarters)
- Cum Laude Honor (Top 16%)
- UROP Fellow for Summer 2025, July 2025

RESEARCH EXPERIENCE

Optimizing LLM and RL Methods to Explore Open Problems in Combinatorics:
A Case Study on the "No-Three-in-Line" Problem Mar.2025–Present

- Implementing MCTS and Neural Networks to explore the largest and smallest complete sets, and optimized the algorithm's time complexity through algorithmic improvements and Numba acceleration, boosting performance from 7 to 15,000+ iter/s.
- For n=59……72, the algorithm finds 1.8n±2 points, which outperforms the previous best lower bound: ((1.5-ε)n).
- Optimizing an AlphaZero-based reinforcement learning framework, focusing on state encoding, network architecture (such as ResNet), hyperparameter tuning, and data augmentation.
- Exploring the smallest geometric dominating set and complete set; developing graph search algorithms.
- Investigating LLM-based methods for code optimization to explore open problems in combinatorics.

Optimizing Large Language Models (LLM) for Academic Support:
A Framework for Knowledge Graph (KG) Embedding and Cheat Sheet Generation Sep.2024–Present

- Designed a benchmark to evaluate the performance of LLM on college-level academic problems.
- Integrate KG for Retrieval-augmented Generation into LLM and assess the accuracy improvement on the benchmark.

Instantaneous Electromagnetic Water Heater Design & Multiphysics Field Finite Element Optimization Aug. 2016 – Oct.2017

- Designed the structure and circuitry of the induction water heater with better energy efficiency and temperature stability; coded a program for temperature control and user interaction on Arduino; optimized the energy efficiency by applying thermodynamic and electromagnetic models and conducting multi-physics field finite element simulations on ANSYS.
- Successfully filed and granted as Patent No. ZL201621267831.6

PROJECT EXPERIENCE

Regret Analysis of the Upper Confidence Bound Algorithm for Multi-Armed Bandits Nov.2025-Present

Objective: Authored a self-contained expository paper analyzing the exploration-exploitation tradeoff in multi-armed bandits.

- Presented formal definitions of the MAB framework including policies, regret metrics, and the Explore-Then-Commit baseline; derived UCB1's confidence radius from the Chernoff-Hoeffding bound.
- Provided a complete proof of UCB1's O(ln n) regret upper bound, demonstrating how optimism under uncertainty limits suboptimal arm pulls.
- Built an interactive web demo allowing users to manually explore the bandit problem and compare ETC vs UCB1 policies through Monte Carlo simulations with real-time regret visualization.

NASDAQ Index Prediction and Investment Simulation Mar.2025

Objective: Developed machine learning and neural network models to forecast the NASDAQ Index.

- Preprocessed the dataset (1984 samples and 84 features, including technical indicators, futures contracts, etc.) by feature augmentation, conversion, filling and dropping null values, and time-series train-test split.
- Trained four machine learning models (Linear Regression, Decision Tree, Random Forest, and XGBoost) and four deep learning models (MLP, LSTM, 1DCNN, CNN-LSTM); and used Grid Search to optimize hyperparameters.
- Implemented Recursive Feature Elimination and Time-Series Cross-Validation to select features.
- Evaluated and compared the models and implemented an investment simulation with these models.

CNN and Vision Transformer Pre-trained Models for Facial Emotion Recognition May 2024

Objective: Built convolutional and Vision Transformer-based neural networks to detect facial emotions from raw data.

- Preprocessed the FER-2013 dataset with 35,887 grayscale images (48x48 pixels) of 7 categories, addressed class imbalance by resampling, and implemented data augmentation by rotating and resizing the images.
- Designed and optimized the architecture of CNN and Vision Transformer networks, optimized the learning rate, increased the number of layers and used gradual unfreezing to solve underfitting, and incorporated max pooling (for CNN), batch normalizations, dropout layers, and weight decay to overcome overfitting.
- Achieved 66% accuracy with Vision Transformer and 62% with CNN; the 'happy' class showed highest precision (83%). Models generalized well to external images.

Market Data Analysis for Airbnb in Dublin Apr.2024

Objective: Enhanced booking conversion rates through in-depth user segmentation and funnel analysis.

Tools used: Tableau, Python (Pandas, NumPy, Sklearn, XGBoost, Matplotlib, Seaborn)

- Preprocessed the raw dataset (2 tables, 43k rows, and 24 columns) by dropping or filling null values and outliers, converting data types, merging tables and rows, and engineering features.
- Used Plotly, Geopandas, Matplotlib, etc. to depict users' demographics, visualizing insights into the booking process.
- Trained 4 predictive tree models including XGBoost, combined them with the voting classifier, and used cross-validation to optimize parameters; tested the model to predict users' stages in the conversion process (searched, inquired, accepted, and booked), getting an accuracy score of 0.82, 228% higher than guessing randomly.
- Suggested business strategies with a higher potential return on investment.

Analysis on Airline Dataset Sep.2023

Objective: Analyzed flight data to extract passenger demographics trends and build predictive models for flight status outcomes.

Tools used: Python (Pandas, Sklearn, Altair)

- Preprocessed the raw data (98k rows, 15 columns) using pandas, and encoded categorical data with the label encoder.
- Visualized passengers' profiles using Altair to gain insights into their characteristics including nationalities, ages, etc.
- Predicted the flight status ("on time", "delayed", or "canceled") using logistic regression and random forest models.

WORK EXPERIENCE

EasyTransfer, Beijing, China Feb.2023–May 2023

Marketing Project Leader and User Growth Analyst *40hrs/week*

- Optimized marketing strategy by using funnel model and analyzing user data, and initiated the entire process of WeChat user acquisition SOP from scratch, increasing users by 25%.
- Came up with monthly planning and task allocation strategies across diverse social media channels, compiled weekly data reports of social media projects, and analyzed content and user data through social media analytics platforms, achieving a 50% overall subscription growth rate; 3 accounts grew from 0 to over 100 subscriptions with "hit" posts in a week.
- Supported live broadcast backend operations and live room setup, collected viewer feedback; reviewed and analyzed live broadcast data to improve live performance, achieving the highest view of over 1,000 and GMV of over 1,200 CNY.

Yiche, Beijing, China Oct.2022–Jan.2023

User Growth Analyst Intern *40hrs/week*

- Collected user behavior data from the SCRM system and conducted data analysis and A/B tests to optimize the creator growth process, achieving a peak of 50 new creators per day and a conversion rate of over 50%.
- Expanded user acquisition channels across various social media platforms to foster the growth of UGC creators' base.
- Managed 50 WeChat groups (about 5,000 people) in the Yiche community, conducted group message writing, pushing, and optimizing, and answered user inquiries on the mobile app and website, achieving over 70% community engagement rate and 30% weekly growth rate.

SKILLS

Programming: Python, R, MATLAB, C

Machine Learning: PyTorch, Keras, Scikit-learn; familiar with deep learning, reinforcement learning, and hyperparameter optimization

Data Analysis & Scientific Computing: Pandas, NumPy, SciPy, Numba, Matplotlib, Seaborn, SQL, Tableau, ANSYS, Excel

Embedded Systems: Analog & Digital Circuits, 8051 MCU Development, Arduino

Tools: Git, Slurm, LaTeX

Design & Media Production: SolidWorks, CorelDRAW, Photoshop, Canva, CapCut, VideoStudio, OBS

STUDENT CLUB EXPERIENCE

UCI Math Student Federation Sep.2023–Jun.2025

President

- Communicated with sponsors to keep the club well-funded.
- Initiated the "Club Alumni Directory" program to foster networking opportunities among current members and ex-members.
- Managed recruitment and social media operations.