Neo Lee

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EDUCATION

University of California, Berkeley   **GPA: 4.0/4.0**

Bachelor of Arts, Applied Mathematics, Computer Science   *Graduation: Spring 2025*

Cal Alumni Leadership Scholarship

Relevant Coursework: Machine Learning, Time Series Analysis, Stochastic Processes, Probability Theory, Linear Algebra, Discrete Mathematics, Graph Theory, Real Analysis, Numerical Analysis, Cryptography, Data Structures and Algorithms, Functional Programming, Object Oriented Programming, Dynamic Programming

EXPERIENCE

UC Berkeley Department of Mathematics   **Berkeley, CA**

Undergraduate Researcher - Stake-governed Random Turn Games   *August 2023 - Present*

- Built a finite integer line tug-of-war game simulator with **Python, Numpy, and Pandas** to solve for Markov perfect equilibria with dynamic programming, and visualized the results with **Matplotlib**.
- Constructed a computer assisted proof for the sufficient and necessary condition for the existence of a Markov perfect equilibrium in infinite integer line tug-of-war games, being that the reward ratio is bounded within a 1×10^{-4} interval from a symmetric game: paper is currently under review.
- Reduced the run-time of the computer-assisted proof by 60% through the implementation of dynamic programming optimization techniques.

Undergraduate Researcher - Mechanistic Interpretability   *September 2023 - Present*

- Reverse engineered Stockfish's efficiently updatable neural network's learned algorithm using **Pytorch, Sklearn, and Seaborn**, achieving MSE of 1.8 compared to a simple linear regression model with MSE of 126.
- Applied dimension reduction techniques such as SVD, neuron pruning, and feature projection onto ReLU privileged basis to reverse engineer the embedding layer, showing that each neuron's activation space is 95%+ correlated.
- Aggregated 38GB training dataset with Sqlite and used Git for version control.
- Built an Alpha-beta pruning algorithm & NN based chess engine with **C++** to study the effect of neural network based evaluation functions on the performance of the algorithm.

UC Berkeley Department of EECS   **Berkeley, CA**

Academic Tutor - CS61A   *August 2023 - Present*

- Tutored students in Functional Programming, Object Oriented Programming, and Dynamic Programming with Python in lab sessions.
- Held weekly office hours to help students with homework and projects, and tutored other tutors.

PROJECTS

Mathematical Error Analysis Library   *December 2023 - Present*

- Building a Numpy-like Python library to perform arithmetic operations object-orientedly with associated error bounds factoring in floating point error.
- Can be used in rigorous computer assisted proofs to bound the error of the results of mathematical expressions.

2D Tile-based World Exploration Engine   *November 2023 (2 days)*

- Built a 2D tile-based world exploration engine with **Java** that generates a random world with rooms and corridors, which allows the user to explore the world with a character, and was showcased for class project demo with an A+.
- Implemented the A* search algorithm to find the shortest path between two points in the world and a snake game.

Trading Bot   *June 2023 - August 2023*

- Implemented machine learning models with **Pytorch, Statsmodels, and XGBoost** for crypto price forecasting, e.g. LSTM, ARIMA, ETS Smoothing, Multi-linear Regression, GBRF, Sentiment Analysis, Transformer.
- Built a trading bot with Python to trade cryptocurrency on Bybit using the Bybit API, achieving 2.68 Sharpe Ratio on the past 3 years of data by performing time series cross validation and leading factors engineering.

Interview Questions Scraper   *April 2023 (1 hour)*

- Built a web scraper with **Selenium** to scrape interview questions from Glassdoor.