

SUWEI MA

929-227-5971 • sm5011@columbia.edu • www.linkedin.com/in/suwei-ma
willma17.github.io

EDUCATION

Columbia University, BA in Computer Science

New York City, USA

GPA: 4.1852/4.00 (Top 2% of Class)

Sep 2021-May 2025

Related Courses: Artificial Intelligence, Machine Learning, Operating Systems, Advanced Systems Programming, Advanced Software Engineering, Natural Language Processing, Cloud Computing, Databases, Probability Theory, Blockchain, Linear Algebra, Analysis of Algorithms, Data Structures

RESEARCH AND PUBLICATIONS

CyberNYC REU (Google Funded)

Jun 2024-Present

- Advisors: Junfeng Yang, Baishakhi Ray
- **Develop a comprehensive benchmark** for testing LLM-generated patches and bug fixes in the Linux Kernel, assessing their effectiveness in real-world scenarios and their impact on kernel stability and performance
- **Design and integrate a pipeline** for collecting kernel coverage data during the execution of agent-produced kernel configurations
- **Develop Python scripts** to parse C and syz-fuzzing reproducer files, embedding custom coverage collection logic at strategic points
- **Create binary file analyzer** which compared the symbol table of two object files to determine whether or not LLM patches would result in function short-circuiting
- **Analyze the structure of existing benchmarks** and identified optimal approaches for adapting bug reproducers for coverage collection
- Publication:
 - In progress

Columbia University

Jun 2024-Nov 2024

- Advisor: Tony Dear
- **Explored the application of Large Language Models**, such as GPT-4, in the domain of credit scoring
- **Identified challenges in LLM adoption for finance**, including issues related to model interpretability, reliability, biases, and transparency
- **Proposed a hybrid approach** combining LLMs with the statistical rigor of **conformal inference** to analyze the reliability of credit scoring models
- **Integrated Split-Conformal Prediction and Jackknife+ with K-Fold Cross Validation** as methods for ensuring robust predictions in LLM-based credit scoring systems
- **Demonstrated the empirical performance of the proposed framework**, showing how LLMs can be used effectively in credit assessments
- Publication (First Author):
 - Chen, Y., Ma, S., & Dear, T. (2024). A conformal inference-based approach to credit score modeling with large language models. *The 1st Workshop on Large Language*

Models and Generative AI for Finance. Retrieved from
<https://openreview.net/forum?id=StLkHQi857>

Columbia University

Jan 2024-Nov 2024

- Advisor: Tony Dear
- **Investigated the emergence of internal representations in transformer models** trained on Markov Decision Processes (MDPs), with a focus on the game of ConnectFour
- **Developed and trained 12 transformer models** using game transcripts, analyzing both states (coordinates of played pieces) and actions (column selections) as input representations
- **Showed that transformer models can internally represent generative processes** governing game transitions, even with varying input representations and policies (Deep Q-Learning and Monte-Carlo Tree Search) by **probing internal activations**
- **Validated the robustness of model performance** across different representations of the game state and transition dynamics
- Accepted to EMNLP Conference, BlackboxNLP
- Publication (First Author):
 - Yuxi Chen, Suwei Ma, Tony Dear, and Xu Chen. 2024. Transformers Learn Transition Dynamics when Trained to Predict Markov Decision Processes. In *Proceedings of the 7th BlackboxNLP Workshop: Analyzing and Interpreting Neural Networks for NLP*, pages 207–216, Miami, Florida, US. Association for Computational Linguistics.

Columbia University

Jan 2024-May 2024

- Advisors: Suman Jana, Baishakhi Ray
- **Investigated Context Flow Graph recovery from LLM embeddings**
- **Designed linear probes** to predict relative distances between lines of code in a traditional CFG given their transformer embedding representations as input, showing statistically significant improvements in loss over predictions on random embeddings
- **Explored AST representations of code snippets** as precursor to CFG construction due to lack of optimally accurate resources for CFG generation
- **Curated labeled datasets** of code block/distance pairs using AST and graph parsing techniques

Columbia University

Jan 2024-May 2024

- Advisor: Junfeng Yang
- **Engineered attacks on LLMs** and their abilities to detect malicious code
- Investigated how LLM malicious code detection was affected by different presentations of a code snippet which preserved semantic meaning
- **Designed code transforming scripts** which used AST parsing techniques to rewrite code

Tsinghua Shenzhen International Graduate School

Jun 2023-Sept 2023

- Advisor: Yongzhe Chang
- **Contributed to a research team focused on training and evaluating the performance of large language models** using reinforcement learning (RL) techniques, with an emphasis on improving model robustness and accuracy

- **Assisted in the training and development of a large-scale language model** consisting of 1.3 billion parameters utilizing DeepSpeed
- Focused on evaluating robustness and accuracy of model when faced with adversarial attacks
- **Gained experience with a variety of reinforcement learning algorithms**, including Proximal Policy Optimization (PPO), Actor-Critic methods, Deep Q-Networks (DQN), and Policy Gradient techniques
- Publication:
 - Chang, Y., et al. (2024). Are large language models really robust to word-level perturbations? Submitted to Transactions on Machine Learning Research. Retrieved from <https://openreview.net/forum?id=BMKJEGNMcZ>

TEACHING EXPERIENCE

Columbia University

Columbia University

Head Teaching Assistant

Sep 2022-Present

- Head Teaching Assistant for **Discrete Mathematics and Artificial Intelligence**
- **Designed exams and assignments** in collaboration with course instructors, ensuring challenging and relevant content
- **Led weekly office hours** to assist students with coursework questions, assignments, and Python programming, ensuring they understood key concepts and improved problem-solving skills
- **Organized recitation sessions** to reinforce and expand on class material, addressing topics such as number theory, probability, reinforcement learning, and inference in hidden Markov models
- **Developed and tested programmatic test cases** for student assignments and designed autograders
- **Contributed to assignment grading and examination proctoring** on a weekly basis

WORK EXPERIENCE

Anidote Inc.

Albany, New York

Software Developer/Gameplay Engineer (Part-time)

Mar 2021-Jun 2024

- **Oversaw the programming aspects** of the 2D visual novel interactive game *Time Symmetry Broken* in C#, managing core gameplay mechanics and logic
- **Utilized Unity** to develop and (eventually) publish the game across iOS and Android platforms, ensuring cross-platform functionality and performance
- **Addressed memory optimization** by implementing fixes and refining resource allocation for smoother operation on lower-end devices
 - Reduced runtime memory usage **from approximately 8GB to 1.5GB**, optimizing the game for devices with limited resources
- **Created metadata** for all game modules and object classes for efficient asset management and documentation throughout development

SKILLS

Spoken Languages: English (Native), Mandarin Chinese (Native), French (Fluent), Spanish (Conversational), Japanese (Beginner)

Programming/Markup Languages: Python, Java, C#, C, C++, MIPS assembly, LaTeX, HTML, CSS, Go, SQL

Technical Skills: Linux Kernel, Operating Systems, PyTorch, TensorFlow, Jupyter Notebooks, Neural Networks, Large Language Models, Reinforcement Learning, React.js, SpringBoot, Flask, Accelerate, Unity

PRESENTATIONS

- Ma, S., and Chen, E. "A Conformal Inference-based Approach to Credit Score Modeling With Large Language Models." Poster presented at the *AI4F Workshop*, The Tillary Hotel Brooklyn, Brooklyn, NY, November 14, 2024.
- Ma, S., and Chen, E. "Transformers Learn Hidden Dynamics When Trained to Predict Markov Decision Processes." Poster presented at the *2024 Conference on Empirical Methods in Natural Language Processing*, Hyatt Regency Miami Hotel, Miami, FL, November 12–16, 2024.

HONORS

- Junior Phi Beta Kappa Honors Society Inductee (Columbia College Section)
- Upsilon Pi Epsilon International Computer Science Honors Society
- Dean's List (All Semesters)