Panyu Chen

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EDUCATION

Duke University **Durham, NC** **Fall 2023–Present**

Master of Science, Computer Science

– Cumulative GPA: 4.0/4.0

New York University Shanghai **Shanghai, China** **Fall 2019–May 2023**

Bachelor of Science, Computer Science, Honors Mathematics (Double Major)

– Counting from Sophomore Year – Cumulative GPA: 3.895/4.0; Computer Science GPA: 3.93/4.0; Honors Mathematics GPA: 3.917/4.0
– Cumulative GPA: 3.779/4.0; Computer Science GPA: 3.917/4.0; Honors Mathematics GPA: 3.711/4.0

RESEARCH POSITIONS

New York University Shanghai **Shanghai, China** **September 2023–December 2023**

Position: Research Assistant: Work on the differential network verification project
Advisor: Dr. Guyue Liu, currently an Assistant Professor at Peking University, Department of Computer Science

New York University Shanghai **Shanghai, China** **October 2022–November 2022**

Position: Student Research Associate of Mathematics
Advisor: Dr. Laurent Mertz, currently an Assistant Professor at City University of Hong Kong, Department of Mathematics

New York University Shanghai **Shanghai, China** **December 2021–January 2022**

Position: Student Research Associate of Heimdall Project
Advisor: Dr. Guyue Liu, currently an Assistant Professor at Peking University, Department of Computer Science

RESEARCH EXPERIENCE

Duke University **Durham, NC** **Jan 2024–May 2024**

Project: Models That Are Interpretable But Not Transparent
Advisor: Dr. Cynthia Rudin, Departments of Computer Science, Electrical and Computer Engineering, Statistical Science, Mathematics, and Biostatistics & Bioinformatics

– **Outcome**: Paper submitted to *AISTATS 2025*.
– The project focused on interpreting logical models in banking systems to decide whether to refuse a loan application. It addressed the trade-off between providing an informative explanation (e.g., a loan is refused and explained with "age $<$ 25 and income $<$ 5k") and revealing the logical model (e.g., refusing any applicant who meets only the "income $<$ 5k" condition) to the applicant.
– Collected algorithmic attack strategies for an attacker to make cumulative queries to extract the model, based upon explanations provided to it. Meanwhile, also collected algorithmic defense strategies for the banking system (defender) to post-process explanations and minimize the information leak, while preserving faithfulness.
– Implemented in Python the explanation-extraction game – the attacker chose a strategy to make sequential queries and the defender chose a strategy to respond to each query with an explanation. Conducted experiments to assess the power of our proposed "FaithfulDefense" strategy, which cost the attacker 4-9 times more queries to extract the model, regardless of its choose of attack strategy.

Duke University **Durham, NC** **September 2023–July 2024**

Project: Neuron Synchronization Analyzed through Spatial-Temporal Attention
Advisor: Dr. Vahid Tarokh, Department of Electrical and Computer Engineering

- **Outcome**: Paper submitted to *PLOS Computational Biology*, available through: `https://www.biorxiv.org/content/10.1101/2024.07.10.602834v1`.
- The project examined synchronization across a neuron population of the moth *Manduca sexta*, according to neuron spiking activities. A spatial attention module extracted latent information from neuron spikes. A normalizing flow architecture then took the latent representation to model the likelihood of (and generate synthetic data for) spike occurrences.
- Conducted the experiment to differentiate behavioral stimuli from non-behavioral stimuli, according to attention weights from the previous training which expressed the moth's olfactory response to different stimuli types. An accuracy of 80% was achieved and outperformed previous studies, which achieved 60% accuracy.
- Led an experiment to classify neurons into projection neurons (PNs) and inter-local neurons (LNs) based upon burst-related spiking characteristics. Subsequently explored interactions between the two neuron types according to attention weights from the previous training.

Duke University **Durham, NC** **September 2023–September 2024**

Project: Predicting Erroneous Patient Identity in MIMIC-III with Large Language Models: A Comparative Study
Advisor: Dr. Anru Zhang, Departments of Biostatistics & Bioinformatics, and Computer Science

- **Outcome**: First-Author Paper submitted to *AMIA 2025*.
- The project addressed errors in electronic health records (EHRs), focusing on the "wrong patient error" in the MIMIC-III dataset of clinical texts, where a discharge summary and a physician note under the same patient ID didn't actually describe the same patient. The work paved the way for subsequent studies on real unpruned EHR data in hospitals.
- Formulated an unbalanced synthetic dataset of [discharge summary, physician note] pairs from MIMIC-III, where text pairs describing different patients were hidden in the majority of pairs, each pair describing the same patient. Implemented and compared performances of various deep learning structures (CNN, Bi-RNN, cross-attention, *etc.*) in consistency-checking: deciding whether or not the two texts described the same patient. The best model achieved a recall of 98% and 98.6% AUC, which proved its power in discovering errors from the majority of correct data.
- Applied the integrated gradients technique to explain the predicted conflicts between texts, such as the drug use recorded in the physician note conflicted with the patient diagnosis in the discharge summary. It set the foundations for subsequent studies, addressing interpretability by attentions between text segments and patient demographics/diagnoses.

New York University Shanghai **Shanghai, China** **September 2022–June 2024**

Project: An elementary approach based on variational inequalities for modeling a friction-based locomotion problem
Advisor: Dr. Laurent Mertz, currently an Assistant Professor at City University of Hong Kong, Department of Mathematics

- **Outcome**: Paper published in *Applied Mathematics Letters*, available through: `https://www.sciencedirect.com/science/article/abs/pii/S0893965924003252`.
- The project focused on a two-body system moving on a flat surface with Coulomb friction. A linkage connected the two bodies and imposed pushing/pulling force on each of them as the two bodies contracted or extended.
- Helped construct a system of equations describing the motion of the two bodies. Variational inequalities were introduced to represent Coulomb friction force on each body, a discontinuous function of its velocity.
- Validated the condition for the the system to hold a unique solution, which described how the motion of the whole system was uniquely determined by a pre-designated function of time $l(t)$, which represented the contracting/extending distance between the two bodies. The case of 2 bodies was also extended to that of n bodies ($n \geq 3$).

New York University Shanghai **Shanghai, China** **September 2021–September 2024**

Project: DYNASIM: Efficient Network Simulation with Dynamic Single-Source Shortest Path Algorithms
Advisor: Dr. Guyue Liu, currently an Assistant Professor at Peking University, Department of Computer Science

- **Outcome**: First-Author Paper submitted to *NSDI 2025*.
- The project proposed DynaSim, a control plane simulator that computed the control plane of dynamic networks, under topology/configuration changes such as the addition and removal of routers and changing local preferences, filters, and aggregations. It exploited the power of dynamic Single-Source Shortest Path (SSSP) algorithms to improve efficiency by eliminating redundant operations in former control plane verifiers, when handling the network changes.
- Proposed generalized dynamic SSSP algorithms for the computation. The numeric graph algorithms were generalized to incorporate complicated network configurations. The algorithms eliminated redundant operations – analyzing dispreferred routes or routers unaffected by changes – performed in existing dynamic control plane verifiers.
- Theoretically proved that the generalized algorithms correctly compute the control plane after incrementing the changes, with efficiency outperforming the state-of-the-art dynamic control plane verifier (named "DNA").
- Implemented the dynamic SSSP algorithms in C++. Then co-implemented the control plane simulator "DynaSim". Evaluation results showed DynaSim achieved a 30x-160x efficiency boost, compared to DNA, when handling subnet additions and deletions. DynaSim also accelerated other network changes such as updated local preference values and aggregation rules.

New York University Shanghai **Shanghai, China** **September 2022–May 2023**

Project: Thermal Convection in a Tilted Cell
Advisor: Assistant Dr. Jinzi Mac Huang, Department of Mathematics

- **Outcome**: Written thesis and 15-minute oral presentation for the NYU Shanghai Honors Mathematics Independent Studies project, a graduation requirement for students in the Honors Mathematics major. Available through:
  `https://ocelottamer.github.io/papers/Thermal_Convection_in_a_Tilted_Cell.pdf`.
- The project focused on computing thermodynamic circulation in a 2D Rayleigh-Béynard convection cell – a water container heated from its bottom – being tilted at different angles.
- Solved the Navier-Stokes-Boussinesq equations, which described velocities and vorticities of all flows in the container, by discretizing it and converting it into Helmholtz equations and then applying the Chebyshev-Chebyshev method.
- Simulated the solutions in Matlab. Red and blue colors in a tilted rectangular block, along with long and short arrows pointed to different directions, displayed the fluid dynamics when the container is tilted at different angles.

GRANTS & AWARDS

- NYU Shanghai Global Quintessence Scholarship — September 2019
- NYU Founders Day Award — April 2023

SKILLS & LANGUAGES

Technical Skills: SQL, Python, C/C++, MATLAB, Java
Languages: English (TOEFL 110 – Reading 30, Listening 26, Speaking 25, Writing 29; GRE 331 + 4.5), Mandarin (Native)