

# FRANK YANG

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## EDUCATION

### Northwestern University

Bachelor of Science in Computer Science and Mathematics

Master of Science in Computer Science

Evanston, IL

Sep 2020 – Jun 2024

Expected, Jun 2025

- **B.S. GPA:** 3.98/4.00 | **M.S. GPA:** 4.00/4.00 | **Honors & Awards:** Bachelor's degree with *summa cum laude*
- **Relevant coursework:** Probability and Stochastic Processes, Foundations of Optimization, Cyber-physical System Design, Computer Vision, Embedded Systems, Deep Learning, Linear Algebra, Quadrotor Design and Control

## RESEARCH INTEREST

I have a broad interest in robotic control and learning. I'm fascinated by the challenge of building autonomous robots that navigate complex environments and perform long-horizon tasks efficiently and safely. I am currently researching on equipping robots with safe learning and runtime decision-making capabilities within uncertain environments subject to disturbances or observation delays. This interest extends from common applications like self-driving vehicles to manipulation robotics.

## PUBLICATION (\* Stands for equal contribution)

### Inverse Delayed Reinforcement Learning (In submission)

- Authors: S. Zhan, Q. Wu, Z. Ruan, **F. Yang**, P. Wang, Y. Wang, R. Jiao, C. Huang, Q. Zhu
- Conference: Learning for Dynamics and Control, 2025
- Summary: introduces an inverse reinforcement learning framework that employs off-policy adversarial training to extract reward features from expert trajectories affected by delayed disturbances

### Case Study: Runtime Safety Verification of Neural Network Controlled System

- Authors: **F. Yang**, S. Zhan, Y. Wang, C. Huang, Q. Zhu
- Conference: International Conference on Runtime Verification, 2024
- Link: <https://arxiv.org/abs/2408.08592>
- Summary: presents a runtime safety verification approach for neural-network-controlled systems, demonstrating a safe online controller switching strategy based on reachability analysis results from POLAR-express

### Efficient Encoding of Graphics Primitives with Simplex-based Structures

- Authors: **F. Yang\***, Y. Wen\*
- Conference: Midwest Machine Learning Symposium, 2023
- Link: <https://arxiv.org/abs/2311.15439>
- Summary: proposes a simplex-based approach for encoding graphics primitives, offering a more efficient alternative to traditional encoding methods using grid-based structures, especially in higher-dimensional spaces

## RESEARCH EXPERIENCE

### Stanford Vision and Learning Lab

Research Assistant Intern

Stanford, CA

Jun 2024 – Present

- Advised by: Fei-Fei Li, Sequoia Professor of Computer Science at Stanford University
- Focused on building BEHAVIOR-1K, a 3D simulation and benchmark for robots to perform tasks in indoor scenes, built upon NVIDIA's Isaacsim; developed novel skill-based learning algorithms to perform long-horizon manipulation tasks
- Decomposed complex, long-horizon tasks into learnable action primitives, such as grasping, placing, and point-to-point navigation, for manipulation robots; implemented an efficient and collision-free action primitives execution pipeline using curobo, enabling robots to solve challenging behavior benchmarks (e.g., picking up trash)
- Prototyped the first evaluation metrics that balance task completion and path planning efficiency during task executions
- Streamlined the manipulation of in-simulation objects by unifying position and orientation getters and setters, with reference to global, scene, and prim joint parent coordinate systems

### Design Automation of Intelligent Systems Lab

Research Assistant

Evanston, IL

Oct 2023 – Present

- Advised by: Qi Zhu, Associate Professor of Electrical and Computer Engineering at Northwestern University  
Chao Huang, Associate Professor of Electronics and Computer Science at University of Southampton
- Researched on efficient and precise formal reachability analysis for neural network-controlled systems (NNCS)

- Performed the first runtime safety verification on NN-controlled Turtlebot with reachability analysis tool, [POLAR-express](#)
- Developed safety-guaranteed switching strategy between NN and obstacle avoidance controls for robot navigation, using online Monte-Carlo localization and POLAR-express reachability analysis verification result; work submitted to RV2024
- Designed a novel inverse reinforcement learning (IRL) framework that employs off-policy adversarial training to extract reward features from expert trajectories affected by delayed disturbances; work submitted to L4DC2025
- Currently implementing efficient offline RL strategies that provide safety guarantees in the presence of observation delays

## Computational 3D Imaging and Measurement Lab

Evanston, IL

Research Assistant

May 2021 – June 2022

- Advised by: [Florian Willomitzer](#), Associate Professor of Optical Sciences at University of Arizona
- Created a 3D imaging framework that facilitates non-technical users to discover micro-painting degradation in glass tiles
- Streamlined and packaged a 3-step calibration sequence (intrinsic, radiometric, and geometric) for FLIR cameras, allowing  $\mu\text{m}$ -level precision prior to starting Phase Measuring Deflectometry
- Field-tested reconstruction on specular objects; decreased reprojection error and calibration time

## TALK

**POLAR-Express: Efficient and Precise Formal Reachability Analysis of Neural-Network Controlled Systems**, *tool presentation; Embedded System Software Competition Winner at Embedded Systems Week (ESWEEK)*

**Case Study: Runtime Safety Verification of Neural Network Controlled System**, *conference talk at International Conference of Runtime Verification 2024*

## TEACHING EXPERIENCE

CS340 Networking, Graduate TA

Winter 2023

CS310 Scalable Software Architectures, Graduate TA

Fall 2023

CS396 Web Development, Undergraduate TA

Spring 2022

Institute of Electrical and Electronics Engineers, Project Manager

Spring 2023

## RESEARCH PROJECT

**Simplex-based Structure Encoding**, Advised by [Prof. Ying Wu](#)

Dec 2022 – May 2023

- Adapted NVIDIA's "Instant NGP with Hash Encoding" simplex-based encodings for data compression and rendering
- Established mapping functions for simplex-grids in high dimensions; accelerated GPU gigapixel image fitting speed by 9.4% and improved NeRF rendering speed by 41.2% as compared to hash-encoding baseline; paper submitted to MMLS 2023

**Transformer-based Lie Detection**, Advised by [Prof. Zach Wood-Doughty](#)

Feb 2022 – Jan 2023

- Conceptualized a ViT-based detection model that detects lies from micro-facial, audio, and textual features with PyTorch
- Trained a transformer encoder and a LSTM binary classifier from fine-tuning Inceptionv3 with 121 clips of trial testimonies
- Pinpointed 20 micro-gestures and AUs that contributes to lying; achieved an out-of-sample classification accuracy of 76%

## PROFESSIONAL EXPERIENCE

Target

Minneapolis, MN

Software Engineering Intern

Jun 2023 – Aug 2023

- Developed a Golang application within a Vela pipeline to enforce security standards for internal applications deployment
- Integrated Postgres and Target API-based database with RestAPI for build lifecycle and versioning information retrieval
- Incorporated 90% coverage on unit and integration testing with sqlmock and httptest, achieved Target-specific SLOs

Amazon Web Services

Seattle, WA

Software Developer Engineer Intern

Jun 2022 – Sep 2022

- Implemented a Sagemaker webpage that provides benchmarked architecture evaluations for machine learning models
- Challenged and simplified frontend implementation of S3 resource selector; presented an end-to-end demo to 150+ Sagemaker engineers and received candidacy to beta-launch Sagemaker model cards on AWS Re:Invent

## OTHER PROJECT

Quadrotor Design and Control

Feb 2024 – Jun 2024

- Developed a WiFi-enabled quadrotor using Raspberry Pi and IMU; implemented PID control, safety measures, and joystick interfacing in C that allows stable manual flight control; integrated Vive Lighthouse with IR sensors to enable autonomous flight control with precise 3D positioning

## Convoice

Sep 2023 – May 2024

- Launched an AI calling startup to provide businesses with context-aware voicebots with human-like voices
- Configured a serverless file processing pipeline with AWS and Pinecone to extract knowledge base from file uploads
- Enabled smart question querying utilizing client knowledge base and conversation context using Azure GPT-4 API; enabled voice interruptions using Google Cloud Voices and realistic text2speech generation with ElevenLabs

## Skuy, Lead Tech Engineer

Apr 2022 – Jun 2024

- Managed a cross-platform campus community network app using React Native; led a 2-months database migration from Heroku to Firebase for service growth and stability; set up RestAPI checkpoints for data verification
- Managed pull requests for 8 tech engineers and configured CI/CD pipeline on Expo for application deployments

## LANGUAGES & SKILLS

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**Languages:** Python, Go, TypeScript, C/C++, SwiftUI, HTML/CSS/JavaScript

**Robotic Learning:** CUDA, Torch, TensorFlow, OpenCV, ROS2, Gazebo, RViz, MATLAB

**Web/Mobile Frameworks:** React, React Native, Redux, Node JS, Flask, ESLint, Cypress

**DevOps:** RestAPI, AWS, Firebase, Heroku, Elastic Beanstalk, Git, Vela, Docker, MySQL, PostgreSQL

## INTERESTS

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**Photography & Film:** Majored in Radio Television Video and Film ([Portfolio](#)). Participated as gaffer in 70-student feature film “NECRO 101” and “Clark”. 2AC in feature film “Voicemail to My Son”; Proficient in cinematography and color correction

**Piano:** 3 years of volunteer teacher in Academy of Music and Arts for Special Education (AMASE); Composed music sheets most comprehensible to students with visual impairment; Co-founder & Pianist for a 3-member school band “Allison Trio”