

Yao (Justin) Liu

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EDUCATION BACKGROUND

University of Southern California, Los Angeles, CA

Aug. 2021 – May 2025

B.S. in Electrical Engineering(Honors Degree) | B.S. in Applied and Computational Mathematics | CGPA: 3.819/4.0 |Major GPA:3.84

Coursework(Mathematics & Software): Data Structure, Algorithm & OOP, Calculus I&II&III, Linear Algebra, Probability Theory, Statistics, Mathematics of Machine Learning, IoT, ODE&PDE, Fourier Analysis, Number Theory

Coursework(Hardware): Electromagnetics, Optics, Embedded Systems, Linear Circuit, Analog/Digital Electronics, Signals&Systems

SKILLS

Programming Languages: C/C++, Python, Pytorch, Jupyter, MATLAB, MySQL, Verilog&HDL, Assembly

Software/Hardware: FPGA, Zemax, Timing-Design, Altium Designer, SolidWorks, AutoCAD, TensorFlow, Arduino, ARM, Linux

Data Science Libraries: NumPy, SciPy, Panda, Scikit-Learn, TensorFlow, Scrapy, Matplotlib, Seaborn, Selenium, Cvx-Python

PUBLICATIONS

- Yue Hu, Gourav Datta, Kira Beerel, **Yao Liu**, Peter Beerel. “*Let’s Roll: Synthetic Dataset Analysis for Pedestrian Detection Across Different Shutter Types*”, IEEE SiPS 2024
- Yue Ma, Lucia Liu, **Yao Liu**, Xiyuan Jia, Cindy Feng, Anton Xia. “*Exploring the associations between teacher and student depression: evidence from rural primary school students in China*”, Social Psychology of Education 2024

PROJECT EXPERIENCE

Distributed Inference & Malicious Device Detection Via Dynamic Redundancy—USC

Los Angeles, CA

Advisor: Prof. Peter Beerel

Aug. 2024-Present

- Contributed to validating the probabilistic framework for detecting attacks on single and multiple devices with redundancy computation that guarantees confidence interval
- Substantiated the detection difference bound, proving that the detection probability gap between independent and centralized RNG methods remains minimal across varying redundancy ratios

Arrow-Debreu Equilibrium: Adaptive Online Stochastic Optimization—Stanford University

remote

Advisor: Prof. Yinyu Ye

- Co-developed and simulated an adaptive online optimization algorithm under revealed parameters, and known distribution settings respectively to determine equilibrium-optimal prices and allocations for the Arrow-Debreu Market
- Improved regret $O(\log(n))$ and constraint violation $O(1)$ respectively with both the online adaptive certainty equivalent algorithm, and Sample Averaged Approximation, outperforming the static pricing model benchmarked against the offline oracle
- Empirically and analytically proved the price convergence in the revealed parameter setting with Sampled Averaged Approximation

Optimized Computing for Training Object Detection Models—USC

Los Angeles, CA

Advisor: Prof. Peter Beerel

Oct. 2023-July 2024

- Developed an algorithm to create Rolling Shutter (RS) effects by amalgamating successive rows from sequences of high frame rate Global Shutter (GS) images, which were generated using Unreal Engine 5 (UE5)
- **Assisted in training and object detection models (YOLOv8 & DETR):** Utilized a combination of real and synthetic data to enhance pedestrian detection accuracy, achieving comparable performance under Rolling Shutter (RS) and Global Shutter (GS) conditions without requiring RS correction.
- Validated the proposed pipeline on the corresponding real-world datasets, demonstrating substantial improvements in precision (13.1%), recall (53.1%), and mean Average Precision (30.3%)

Safe Inverse Reinforcement Learning with Stochastic Variational Delays

remote

Advisor: Prof. Qi Zhu

Dec. 2023- June.2024

- Studied Markov Decision Processes under augmented state spaces with time delays, and temporal-difference learning for behavior cloning
- Explored the inference of reward functions from observed behavior and implemented the Soft Actor-Critic (SAC) algorithm to optimize policies based on the inferred reward function

USC Khajavikhan Acoustic Lens Research Lab.

Los Angeles, CA

Team Leader | Advisor: Prof. Mercedeh Khajavikhan.

Aug. 2022-May 2023

- Coupled laser beam into optical fiber and designed precise housing for fiber-transducer alignment, utilizing techniques in

Gaussian beam propagation (beam waist optimization and mode matching) which has contributed to:

- Efficient light propagation through the acousto-optic system, enhancing the interaction between optical and acoustic
- Tunable lensing power range with an inverse focal length variation from 1.88 1/m to 2.55 1/m, based on duty cycle adjustments.
- Built a temperature detector with Arduino-embedded drone to detect real-time temperature within the water tank through which the laser beam penetrates

Tsinghua University Department of Electronic—MetaCam Labs

Beijing, China

Team Leader | Advisor: Prof. Hongwei Chen & Dr. Chengyang Hu

May 2023-Aug. 2023

- Assisted to implement a spatial-adaptive CNN architecture that significantly improved imaging quality by effectively mitigating optical aberrations through the precise removal of Point Spread Functions (PSFs).
- Simulated a raytracing and superposition algorithm to create PSF-convoluted images, simulating real-world optical aberrations for generating synthetic data to train a CNN, enhancing image restoration.
- Enhanced a spatial-adaptive CNN by using PSF-convoluted synthetic data, significantly improving correction of spatially variant blur and chromatic dispersion; This approach reduced artificial textures, preserved image details, and lowered computational overhead, achieving a 1.7% improvement in restoration over state-of-the-art methods.

WORK EXPERIENCE

SBS Science & Technology Co., Ltd.

Shenzhen, China

Hardware Engineering Intern, Hardware Service

May 2022-July 2022

- Conducted testing on newly manufactured products, including boards used in automotive vehicles and high-speed rail
- Created a user manual with video & step-by-step instruction for testing the malfunctioning of embedded computer CAD 1410 & CDM 2855
- Assisted in developing a hardware testing program to identify & help resolve malfunctions in newly developed TSN NetTimeLogic products

University of Southern California

Los Angeles, CA

Course Producer & Grader Positions

Aug. 2023-Present

- **EE202 Linear Circuit**--Fall 2023: Assist students with lab including op-amp and band-pass filter design; Held office hours to help students reinforce lecture concepts
- **MATH 245**--Spring 2024: Graded assignments and supported students with MATLAB labs on Ordinary Differential Equations
- **EE 301 Linear System**--Fall 2024: Graded assignments and helped on labs concept in Convolution and Fourier Transform

EXTRACURRICULAR ACTIVITIES

USC Rocket Propulsion Laboratory

Los Angeles, CA

Avionics Team Member

Jan. 2022-May 2024

- Led PCB routing with Altium for the Rangefinder transponder board, enhancing signal processing efficiency
- Coached new members to perform battery protector PCB bring-up and surface mount device assembly
- Designed a GNSS receiver using a MAX2769 front end GNSS receiver for altitude tracking, rocket tracking, and potential reference usage for parachute deployment

USC Inspire Creativity Initiative 501(c)(3)

Los Angeles, CA

President

Feb. 2022-Present

- Founded ICI as a student organization at USC and dedicated to enhancing education for underprivileged students
- Comprehensively documented high school STEM course curriculum encompassing Calculus and Physics
- Conducted outreach services in downtown Los Angeles and taught 30+ interactive lessons to inspire students' creativity

Stanford FSI—Center on China's Economy

Palo Alto, CA(remote)

Student Researcher, Advised by Dr. Ma Yue

May 2020-Mar. 2023

- Cataloged and revamped the App UI of TaoLi Online & carried out user experience surveys in rural China
- **Conducted Pearson correlation, t-statistics, and multivariate regression with fixed effects** to analyze data from 105 rural schools (9,000+ students in 305 classes), examining the relationships between teacher and student mental health.
- **Implemented regression models with clustered errors** for inferences on the impact of teacher depression on student subgroups

PROJECTS

LMSYS - Chatbot Arena Human Preference Prediction – Kaggle Competition

Aug 2024

- Fine-tuned the *Gemma-2 9b* and *Llama-3.1-8B* LLMs via QLoRA (Quantized Low-Rank Adaptation), to significantly reduce memory footprint and accelerating training processes
- Adjusted key hyperparameters such as learning rate, sequence length, dropout rates, and layer freezing to optimize model performance and computational efficiency across different training and inference scenarios

- Conducted comprehensive model evaluations by logistic loss to assess model accuracy and probability calibration to ensure the models' predictions alignment with user preferences and optimized chatbot-human interaction quality

Model-Based Advancement in Submersible Navigation--TDOA and Kalman Filtering Techniques

International Mathematical Contest in Modeling

Feb 2024

- Led a team of three to design, implement and simulate Time Difference of Arrival and Kalman Filtering Algorithms to compute the precise location of the submarine and predict its future projectile in scenarios involving loss of communication.
- Simulated Kalman Filter transitioning states based on the previous step of trilateral localization.
- Modeled the maximum likelihood estimator for search and rescue of the submersible conditioned on the predicted trajectory.

Automated Grocery Management: A Perspective On Sustainability

Los Angeles, CA

Electrical Engineering Capstone Course Project | *Advisor: Prof. A. Weber*

Jan. 2024-May 2024

- Coordinated a team of three to design and implement an embedded fridge management system, featuring both local and remote iOS app UIs for recording details such as expiration dates and storage locations, allowing users to check, store or remove items from either interface.
 - Hardware: Established communication protocols such as SPI, UART, I2C, and parallel between devices such as temperature sensor, keypad, and barcode scanner with Atmega328p microcontroller
 - Software: Developed an application to allow real-time synchronization of grocery items via an information query mechanism implemented in a JSON-like format in Firebase, covering: 1) Items information entered on either UI and transmitted via Raspberry; 2) Temperature monitoring in the local fridge; 3) Prediction algorithm implemented via Bayesian inference on consumption behavior: designed to guide users on how much food to buy to avoid spoilage.
- Final presentation and technical report well received by the course instructors; garnered the topmost score in the class (out of 20 teams).
- Fostered a collaborative environment in the team; organized discussions for brainstorming, alignment, timing-analysis, etc.

AWARDS AND HONORS

Gold Medalist , Kaggle--Chatbot Arena Human Preference Predictions.....	August 2024
Honorable Mention , Mathematical Contest in Modeling, COMAP.....	May 2024
Ming Hsieh Institute Undergraduate Scholar (<i>Awarded to 5 undergraduates in Electrical Engineering</i>).....	May 2024
Academic Achievement Award , USC.....	2023-2024
Provost Research Scholarship , USC.....	Nov 2023
W.V.T. Rusch Engineering Honors Degree , USC.....	Nov 2023
Dean's List , USC.....	Every Semester since Spring 2022
Life Membership , California Scholarship Federation.....	May 2021