YANG XU

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EDUCATION

University of Southern California — Los Angeles, CA
Master of Science in Applied Data Science — Aug 2025 – Present

Nanjing University of Information Science and Technology — Nanjing, China
Bachelor of Engineering in Artificial Intelligence — Sep 2020 – Jun 2024

- **GPA:** 3.62 | **Ranking:** Top 15% (14/96)
- **Honors:** Outstanding Graduate (2024), Merit Student (4 consecutive years), First Class Scholarship (2022-2023).

PUBLICATIONS

- **T. Liu, R. Huang, Y. Xu, et al.**, "Multivalued and Cascaded Chaotic Sequence based Sensing Matrix for Compressed Sensing," *Journal of Computational and Applied Mathematics*, Aug. 2024.
- **Y. Xu, C. Li, et al.**, "A Compact Multiplier-Oriented Chaotic Oscillator for Free Control," *IEEE Transactions on Circuits and Systems II: Express Briefs*, vol. 70, no. 6, pp. 2276-2280, June 2023.
- **J. Wu, C. Li, Y. Xu, et al.**, "A Triode-Based Analog Gate and Its Application in Chaotic Circuits," *IEEE Transactions on Circuits and Systems I: Regular Papers*, vol. 70, no. 1, pp. 378-387, Jan. 2023.

RESEARCH EXPERIENCE

GenBinder: Flow Matching with Optimal Transport for TCR Binder Design — Sep 2025 – Present
Project Lead, USC Viterbi School of Engineering `[AI4Science]` `[Generative AI]` `[Geometric Deep Learning]`
Developed an end-to-end generative framework for protein binder design that casts the generation process as an Optimal Transport problem, in contrast to conventional noise-based diffusion approaches.

- **Motivation:** Standard diffusion models often rely on noise distributions lacking biological priors; sought to model generation as a structured transport process between real biological distributions.
- **Idea:** Utilized Flow Matching to map existing TCRs/natural binders to target binder distributions, integrating physically motivated structural losses.
- **Contribution:** Implemented a sequence-structure coupled training framework with modular loss components (including helicity constraints) to encourage biologically plausible conformations.
- **Result:** Established **a fully runnable training and evaluation pipeline**; currently focusing on dataset integration and benchmarking.

ConVis: Interactive Large-scale Neuron Network Visualization — Jan 2025 – Nov 2025
Project Lead, NYU Tandon School of Engineering `[Data Visualization]` `[Web Development]` `[Neuroscience]`
Led system design for a Web-based 3D visualization tool capable of rendering 140,000 neurons with semantic zooming capabilities.

- **Motivation:** Large-scale neuron files (SWC) are difficult to explore interactively in browser environments due to rendering bottlenecks.
- **Idea:** Designed a framework integrating Three.js/WebGL with buffer mechanisms and chunked loading strategies to handle massive datasets without lag.
- **Contribution:** Architected data loading algorithms to maintain real-time performance and coordinated a 5-person team across frontend development and visualization algorithms.

Exploration of 3D Gaussian Splatting and Geometry-Aware SLAM — Apr 2024 – Present
Independent Researcher, USC `[Computer Vision]` `[SLAM]` `[3D Reconstruction]`
Conducting independent research into Gaussian-based scene representations to unify rendering, mapping, and geometry reasoning.

- **Motivation:** Addressing the gap between efficient neural rendering and precise geometry-aware mapping in robotic perception.
- **Idea:** Investigating the progression from 3D Gaussian Splatting (3DGS) to SLAM systems (like HI-SLAM2) to emphasize geometry-aware mapping under monocular constraints.
- **Contribution:** Proposed conceptual extensions for dynamic, large-scale Gaussian-based SLAM systems to bridge neural rendering and robot perception.

Distributed Vision Transformer Implementation — Sep 2023 – Jul 2025
Supervised by Prof. Chunbiao Li `[Computer Vision]` `[HPC]` `[Distributed Systems]`
Architected and implemented a distributed Vision Transformer (ViT) model using PyTorch to solve computational bottlenecks in training large-scale models.

- **Motivation:** Training complex ViT architectures on single nodes is inefficient; aimed to optimize convergence rates and stability across distributed environments.
- **Idea:** Leveraged data parallelism to scale training while conducting rigorous mathematical analysis to ensure the algorithm's convergence stability.
- **Result:** Reduced training time by 40% while maintaining 95%+ accuracy on complex image classification tasks and implemented attention visualization tools for interpretability.

Information Security System based on Chaotic Encryption Jul 2021 – Sep 2022

Supervised by Prof. Chunbiao Li `[Cybersecurity] [Chaos Theory] [Full Stack]`

Engineered an end-to-end secure data transmission system integrating novel chaotic encryption algorithms with embedded hardware and web dashboards.

- **Motivation:** Enhancing digital image protection and data transmission security by leveraging the unpredictability of advanced mathematical chaotic models.
- **Contribution:** Designed chaotic encryption algorithms (SL2 oscillators) achieving 128-bit security and implemented a robust RESTful API (Flask) for STM32 microcontroller communication.
- **Result:** Achieved 99.9% uptime and increased data interpretation efficiency by 40% through custom Echarts visualization dashboards.

Compact Multiplier-Oriented Chaotic Oscillator Mar 2021 – Sep 2022

Supervised by Prof. Chunbiao Li & Prof. Guanrong Chen `[Chaos Theory] [Hardware Design] [Math]`

Developed a new type of chaotic oscillator for cryptographic applications, validating the design through both numerical analysis and hardware prototyping.

- **Motivation:** To create a compact, controllable chaotic source easily implemented in hardware for free control applications.
- **Contribution:** Conducted numerical analysis using Lyapunov stability theory and designed hardware prototypes using AD633 multipliers.
- **Result:** Validated mathematical models through empirical testing and published findings in *IEEE Transactions on Circuits and Systems II*.

Crop Protection Unmanned Aerial Vehicle (UAV) Apr 2021 – Nov 2021

Supervised by Zhongyuan Zhao `[Robotics] [Computer Vision] [Embedded Systems]`

Engineered an autonomous UAV system combining computer vision and custom flight control for precision agriculture applications.

- **Motivation:** Automating crop anomaly detection to improve agricultural monitoring efficiency.
- **Contribution:** Implemented sensor fusion algorithms (T265 odometry + PX4) and designed a custom PID control system for precise trajectory following.
- **Result:** Achieved 95% accuracy in crop anomaly detection and <5cm positional error, with real-time recognition running at 15 FPS on embedded hardware.

COURSE PROJECTS

Image Generation with High-Speed Inference (ControlNet) Sep 2022

`[Generative AI] [Model Optimization] [Computer Vision]`

Optimized state-of-the-art generative AI models to achieve faster inference speeds and lower memory usage on consumer hardware.

- **Idea:** Leveraged transfer learning from pre-trained diffusion models and applied advanced fine-tuning strategies like DreamBooth and LoRA.
- **Result:** Achieved 3x faster inference than baselines and reduced VRAM usage by 40% through memory-efficient pipelines.

Metaheuristic Algorithms in Continuous Optimization Jun 2022

`[Optimization] [Algorithm Design]`

Designed and benchmarked three metaheuristic optimization algorithms (RIWPSO, GA, PSO) from scratch to analyze convergence behavior.

- **Idea:** Proposed a novel "Random Inertia Weight" mechanism for PSO to enhance the balance between exploration and exploitation.
- **Result:** Conducted rigorous statistical analysis across 13 benchmark functions, maximizing algorithm performance via hyperparameter grid search.

Electronic Album with Raspberry Pi PICO Jul 2021 – Sep 2021

`[Embedded Systems] [IoT]`

Architected an integrated hardware-software solution for media playback and sensor fusion on a memory-constrained microcontroller.

- **Contribution:** Developed efficient embedded algorithms for real-time processing and a multi-modal user interface.
- **Result:** Reduced signal noise by 30% through applied signal processing techniques and ensured reliable sensor data performance.

PATENTS & SOFTWARE COPYRIGHTS

- **China Patent:** “A Non-Operational Amplifier Chaotic Waveform Generator...” (CN116155242B), Granted 2023.
- **China Patent:** “A Pressure Stability Monitoring Circuit...” (CN115979471A), Published 2023.
- **Software Copyright:** “Artificial Intelligence Detection and Recognition System V1.0” (No. 2022SR0859053).
- *(3 Additional Patents in Circuit Design and Hardware)*

TECHNICAL SKILLS

- **AI & Machine Learning:** PyTorch, TensorFlow, Transformers (Hugging Face), Diffusion Models, ControlNet, Scikit-learn.
- **Computer Vision:** OpenCV, OpenMV, YOLO, 3D Gaussian Splatting, NeRF, SLAM.
- **Programming:** Python, C/C++, MATLAB, JavaScript, PHP, SQL.
- **Hardware & Embedded:** Raspberry Pi, STM32, PX4, Circuit Design, Verilog.
- **Tools:** Linux, Git, Docker, LaTeX, Jupyter.