

# Patrick Huang

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## EDUCATION / SKILLS

**University of Illinois Urbana-Champaign. B.S. Electrical Engineering**, 2024 to 2027 (expected).

Select classes: Abstract Linear Algebra, Digital Signal Processing, Intro to Optimization, Programming Methods for ML, Computer Systems and Programming (Honors), Electronic Circuits, Dynamical Systems and Differential Equations.

GPA: 3.87. Technical GPA: 3.92. James Scholar Honors Program.

**USA Physics Olympiad**: 2023 and 2024 Bronze medal.

**USA Computing Olympiad**: Gold division since 2023.

**American Invitational Mathematics Examination**: Qualifier since 2020.

**Skills**: Python, C++, and CUDA programming, integration, and optimization. Linux, Git.

Convolutional NNs, Transformers, Neural Radiance Fields, MAST3R (NN based SLAM).

PyTorch, Numpy, OpenCV, data visualization, NN distributed training. Image and audio processing.

Circuit design, analysis with oscilloscopes, simulation with LTSpice, soldering.

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## PROJECTS

**Discam: Automated sports film camera**. 2025 (ongoing). <https://github.com/phuang1024/Discam>

- Developed *reinforcement learning environment* to train Convolutional NN to track a sports game.
- Used optical flow and YOLO person tracking to generate ground truth training data.
- Controlled PTZ camera using USB Video Class API and control loop.

**Gradient compression for distributed LLM training**. 2025 (ongoing).

- Integrated *gradient compression algorithms* with PyTorch *Distributed Data Parallel* training, to reduce data transfer usage between GPUs in multiple device training.
- Implemented compression with *Exponential-Golomb coding*. Compared performance to the NVComp CUDA compression library.
- Benchmark compression ratio and speed on large language models including Llama, BERT.

**WaggleNet: Computer vision tools for beekeepers**. 2025-2026. <https://github.com/WaggleNet/BeeSee>

- Researched *Vision Transformer DINOv2* and *U-Net* to detect bee thoraxes. Trained Convolutional NN head to process the latent space output of DINO.
- Researched model quantization using PyTorch *Dynamic Quantization* for inference on edge devices. Benchmarked on Raspberry Pi.

**Boost converter circuit**. 2024. <https://github.com/phuang1024/BoostConverter>

- Designed and soldered a DC-DC step up switching power supply. Used Schmitt Inverter to create variable frequency square wave to drive MOSFET gate.
- Optimized efficiency by adjusting the operating frequency, benchmarking with an oscilloscope.

**Starst3r: Transformer based photogrammetry**. 2024. <https://github.com/phuang1024/Starst3r>

- Developed a Python API for the *Vision Transformer MAST3R*. Performs Multi View Stereo, computing camera poses and sparse reconstruction.
- Integrate MAST3R with *Gaussian Splatting*, a gradient descent dense 3D reconstruction method.
- Wrote a Python library and Blender add-on to improve accessibility of the technology.

**Autocar: Self driving robot car**. 2024. <https://github.com/phuang1024/Autocar>

- Used DepthAI OAK-D color and stereo depth camera. Trained end to end Resnet18 model.
- Designed and soldered high current DC motor drivers with H-Bridge polarity and MOSFET power control via PWM. Designed BJT gate driver for maximum efficiency.
- Used Raspberry Pi for neural network inference in a Linux and Python environment. Used Arduino for motor control. Wrote PID loop to control vehicle orientation.