

# Nathan Van Utrecht

563-528-4488 | [nvanutrecht@gmail.com](mailto:nvanutrecht@gmail.com) | [linkedin.com/in/nathan-van-utrecht](https://www.linkedin.com/in/nathan-van-utrecht) | [github.com/nvan21](https://github.com/nvan21)

## EDUCATION

### University of California San Diego

*Masters of Science in Intelligent Systems, Controls, and Robotics*

San Diego, CA

*Expected June 2027*

### Iowa State University

*Bachelor of Science in Mechanical Engineering, Minor in Cyber Physical Systems*

Ames, IA

*Aug 2021 – May 2025*

- **GPA:** 3.98/4.00
- **Honors:** University honors program graduate, summa cum laude, Tau Beta Pi inductee

## RESEARCH EXPERIENCE

### Iowa State University Honors Program

*Capstone Researcher*

Ames, IA

*Jan 2025 – May 2025*

- Empirically benchmarked Adversarial Inverse Reinforcement Learning (AIRL), GAIL, and Behavioral Cloning across four MuJoCo environments to evaluate policy robustness and reward function transferability.
- Demonstrated that AIRL policies exhibit superior zero-shot robustness, outperforming direct imitation methods by over 140% on transfer tasks with significant dynamics changes.
- Validated the transferability of AIRL's reward function by enabling a new agent to achieve 98% of oracle performance in a modified Hopper environment.
- Identified critical failure modes of learned reward functions when faced with out-of-distribution changes, such as morphological alterations or shifted goal locations.
- Authored a comprehensive research paper and published all code on GitHub for reproducibility.

### Coordinated Systems Lab

*Undergraduate Research Assistant*

Ames, IA

*Nov 2023 – May 2025*

- Accelerated research readiness by mastering foundational machine learning and reinforcement learning concepts through a self-directed study of contemporary literature.
- Applied theoretical knowledge by implementing and validating core RL algorithms using Python and PyTorch.

### Translational Artificial Intelligence Center

*REU Researcher*

Ames, IA

*May 2024 – Aug 2024*

- Investigated the sim-to-real gap by benchmarking model-free (SAC, PPO) and model-based (SHAC) RL algorithms on the Pendulum environment.
- Discovered that SAC policies converged 5x faster and showed greater robustness to system noise, a contradiction to the original SHAC publication.
- Published a public-facing repository and presented key findings at the Summer Undergraduate Research Symposium to disseminate results to the academic community.

## PROFESSIONAL EXPERIENCE

### John Deere

*Product Design Engineer*

Augusta, GA

*May 2023 – Aug 2023*

- Engineered and prototyped a functional lawnmower tool storage bracket using Creo Parametric, seeing the project through from concept to physical validation.
- Optimized the bracket's structural integrity via Finite Element Analysis (FEA), reducing component weight by 15% and lowering material costs without compromising strength.
- Spearheaded market and homologation research to establish baseline design requirements for next-generation tractor cabs.
- Formulated four distinct CAD concepts for new cab features, influencing the subsequent design cycle for the commercial product portfolio.

### Grace Technologies

*HoT Engineer*

Davenport, IA

*May 2022 – May 2023*

- Architected a Python field debugger application with an SQL backend to streamline diagnostics for predictive maintenance equipment, cutting customer callbacks by 40%.
- Constructed custom test fixtures for hardware validation in collaboration with senior engineers.
- Automated hardware validation by scripting six Python test suites, which reduced manual testing time by over 80% and expanded test coverage.

## PROJECTS

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- Traffic Sign Recognition** | *Computer Vision, CNN, ResNet, ViT, Scikit-learn* Nov 2024 - Dec 2024
- Engineered a custom CNN balancing high accuracy (95.93%) and fast inference (0.98 ms), making it ideal for real-time robotic applications.
  - Achieved 98.18% peak accuracy on the German Traffic Sign Recognition Benchmark by fine-tuning pre-trained ResNet-50 and Vision Transformer (ViT) models.
  - Improved model robustness against real-world conditions by implementing a custom data augmentation pipeline featuring random occlusions.
- Basketball Shot Detection** | *OpenCV, Image Segmentation, YOLOv8* July 2024 – Aug 2024
- Built a basketball shot analysis tool that achieved 87% accuracy in predicting shot outcomes using YOLOv8 for detection and parabolic trajectory analysis.
  - Integrated computer vision and physics-based models to provide actionable performance insights from video footage.
- PPO Algorithm Implementation** | *Reinforcement Learning, PyTorch, Gymnasium* May 2024 – June 2024
- Constructed the Proximal Policy Optimization (PPO) algorithm from scratch in PyTorch to master modern reinforcement learning techniques.
  - Validated the implementation by training agents to solve multiple Gymnasium environments with both discrete and continuous action spaces, such as CartPole and BipedalWalker.
- Autonomous Racing Simulation** | *SLAM, RRT\*, LiDAR, Path Planning, ROS* Nov 2023 – Dec 2023
- Deployed and evaluated multiple path-planning algorithms, including SLAM with RRT\* and Follow the Gap, in a high-speed autonomous racing simulation.
  - Selected the computationally efficient Follow the Gap algorithm for its superior real-time performance and smooth trajectory generation in dynamic environments.

## PRESENTATIONS

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- Iowa State Honors Research Symposium** May 2025
- Showcased research on direct policy transfer versus learned reward transfer in bridging the demonstration to adaptation gap for imitation learning algorithms.
- Iowa State University Summer Undergraduate Research Symposium** Aug 2024
- Presented my findings on model-free versus model-based reinforcement learning algorithms in bridging the simulation-to-real gap.

## TECHNICAL SKILLS

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**Languages & Tools:** Python, C/C++, SQL, JavaScript, HTML/CSS, Git  
**Technologies:** Computer Vision, Reinforcement Learning, Robotics, CNNs, Vision Transformers, Transfer Learning, SLAM, RRT\*, LiDAR  
**Libraries:** PyTorch, Scikit-learn, OpenCV, Gymnasium, ROS, pandas, NumPy, Matplotlib