Davis Catherman

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Education

Worcester Polytechnic Institute (WPI) — Worcester, MA
Ph.D. in Robotics Engineering (Software) - GPA: 4.00/4.00 — Jan. 2020 – May 2023
M.S. in Robotics Engineering (Software) - GPA: 3.88/4.00 — Aug. 2018 – Dec. 2019

Christopher Newport University (CNU) — Newport News, VA
B.S. in Computer Engineering & minor in Leadership Studies - GPA: 3.53/4.00 — Aug. 2014 – May 2018

Related Work Experience

Roboticist / SWE, Waymo — May 2021 – Aug. 2021
Intern - Behavior Planner, Prediction, & Controls — *Remote - MA*
- Developed an online framework for graph sampling and path planning enabling a non-uniform graph structure
- Produced comparable results to existing motion planning algorithm while adding necessary functionality
- Evaluated findings and developed plots with the Dremel SQL engine and presented results to the search team

Software Developer, Kuva Systems — Aug. 2019 – May 2021
Engineering Intern Rotation Program — *Cambridge, MA*
- Developed supervised machine learning model detecting methane at a 5% greater accuracy that statistical methods
- Created production ready systems with Yocto board support package resulting in a 300% deployment speedup
- Calculated kinematics for translating camera sight to the world frame enabling accurate 3D geometry modeling
- Increased efficiency by designing software systems with UML then deployed across the company & internationally

Roboticist / SWE, Canon Inc. — Jan. 2018 – Dec. 2018
Advanced Manufacturing Technology Intern — *Newport News, VA*
- Predicted manufacturing defects using Python and Tensorflow reducing wasted time and material
- Implemented object detection system to location items in robot camera for grasping using deep neural network
- Proposed solutions to prevent millions in government fines by analyzing the problem and potential technologies

Software Engineer, NASA — Aug. 2016 – Dec. 2017
Safety Critical Avionic Systems Intern — *Hampton, VA*
- Enabled simulation testing by modifying the software sim environment, saving thousands of dollars in hardware
- Augmented safety critical testing with bash scripts and Bamboo unit tests producing strong code verification

Related Projects

Taxi Driver Classification | *TensorFlow, LSTM, Ensemble learning, Activation functions* — Oct. 2020 – May 2021
- Designed a multi-faceted model that classified 10 taxi drivers based on 1 day's GPS coordinates for a company
- Increased accuracy by 24% to a total of 97% by implementing custom activation functions and feature engineering

Behavior Planner | *Python, TensorFlow, Reinforcement Learning, ROS, Gazebo, MoveIt!* — Sep. 2020 – May 2021
- Created model to select the optimum action sequence in a game environment resulting in 10% higher scores
- Implemented the system using ROS and Gazebo with hierarchical state machines producing verifiable results

TurtleBot Trajectory Controllers | *Python, ROS, Controls, Gazebo, Git* — Aug. 2018 – Dec. 2018
- Implemented multiple trajectory controllers on a Turtlebot with a VICON system and in simulation using Gazebo
- Provided analytics of results and explanation for emergent behaviors resulting in a conference publication

Capstone: RoboTender | *Python, C++, ROS, MoveIt!, Kinova, Angular, Controls, Git* — Aug. 2017 – Apr. 2018
- Poured beverages without foam tested by completing 20 orders accomplished by implementing trajectory planning
- Produced repeatable serving with a python server queuing system completing 15 consecutive autonomous servings

Technical Skills

Languages: Python, C/C++, Java, Bash, Buzz, MATLAB, JavaScript, Verilog HDL
Tools: ROS (Robot Operating System), Make, Git, Docker, Singularity, Slurm, Continuous Integration (CI)
Simulation & CAD: Gazebo, MoveIt!, ModelSim, Multisim, Logisim, JSBSim, CAD
Libraries: TensorFlow (1.x & 2.x), PyTorch, Pandas, NumPy, Matplotlib, Requests, PyQt5, OpenCV, Keras, Theano
Other: AWS, UML, Agile, HPC, REST, Atlas humanoids, Kinova Robot Arm, AI, UAVs, 3D Printers, Microcontrollers

Publications

Catherman, Neville, Bloom, & White, "Reinforcement Learning Adversarial Swarm Dynamics," *Proceedings of IEEE SoutheastCon*, March, 2020, Raleigh, NC, USA.

Catherman, Kaminski, & Jagetia, "Atlas Humanoid Robot control with Flexible Finite State Machines for Playing Soccer," *Proceedings of IEEE SoutheastCon*, March, 2020, Raleigh, NC, USA.

White & Catherman, "Mobile Robot Controller Performance over Unexpected Terrain Disturbances," *Proceedings of IEEE SoutheastCon*, April, 2019, Huntsville, AL, USA.

Conner, Catherman, Enders, Gates, & Gu, "Flexible Manipulation: Finite State Machine-based Collaborative Manipulation," *Proceedings of IEEE SoutheastCon*, April, 2018, St. Petersburg, FL, USA.

Additional Projects

Projecting Growth of COVID-19 | *Python, RNN, LSTM, Tensorflow, Git* Mar. 2020 – Dec. 2020
- Researched factors contributing to growth and expansion of COVID-19 during the height of the pandemic
- Predicted the following two weeks of cases by developing LSTM time distributed models with Tensorflow

Multi-agent Learning | *Python, DDQN, Reinforcement Learning, TensorFlow, Git* Aug. 2019 – Dec. 2019
- Developed system for multiple agents to make in through a maze without collision, achieving 95% optimality
- Used a POMDP process in a grid-world to limit agent knowledge, instead using intelligent reward shaping

Adversarial Swarm Games | *Python, Reinforcement Learning, TensorFlow, ARGoS, C++* Jan. 2019 – Apr. 2019
- Created a swarm game with agents using reinforcement learning to perform task allocation
- Provided analytics of results and explanation for emergent behaviors resulting in a conference publication

Swarm Information Propagation Decision Making | *ARGoS, Buzz, C++, Git* Jan. 2019 – Apr. 2019
- Researched the effects of information propagation on collective swarm decision making
- Analyzed the use of decaying resource qualities as the quantifiable metric to activate a decision

Humanoid Playing Soccer | *Python, C++, ROS, Gazebo, MoveIt!, Atlas, Docker, Lidar* Jan. 2019 – Apr. 2019
- Developed vision, walking, and control components necessary for a humanoid atlas to compete in a game of soccer

Additional Work Experience

Team Lead Software Developer, SICdrone Jan. 2019 – Jul. 2019
Engineering Intern Program *Cambridge, MA*
- Developed UAV control algorithm to adjust thrust proportions per rotor based on tilt angle of extra rotors
- Optimized team efficiency through formalization of agile development workflow saving 10 hours each week
- Introduced dynamic modeling of drone saving thousands of dollars of hardware by simulating the control systems

Engineering Tutor, Center for Academic Success, CNU Aug. 2016 – Dec. 2016
Student Worker, Information Technology Services, CNU Apr. 2015 – May 2016
Employee (Seasonal), Information Technology, Trinity Episcopal School Jun. 2012 – Aug. 2017

Research & Leadership Experience

Vice President, Graduate Student Government, WPI June 2021 – Present
Student Representative, Rho Beta Epsilon (Honors Society), WPI Mar. 2021 – Present
Ph.D. Researcher, NEST Lab (Robotics Lab), WPI Jan. 2021 – Present
Research Student, CHRISLab (Robotics Lab), CNU Aug. 2016 – Jul. 2018
Team Mission Commander (Leader), Unmanned Aerial Systems, CNU Aug. 2015 – Jul. 2018
Mentor, FIRST Robotics Team 539, Trinity Episcopal School Aug. 2014 – Jul. 2018

Certificates, Honors, & Awards

Amateur Radio Operator – General Class, FCC HAM Radio License Exp. July 2030
FAA Part 107 Certificate Holder, FAA Commercial UAS Pilot Exp. Aug. 2023
Forbes 30 Under 30 Scholar, Forbes in Boston, MA Oct. 2018
Collegiate Cyber Defense Competition (CCDC), CNU Mar. 2018
PCSE Community Scholarship, Department of Engineering, CNU Apr. 2017
1st Place, Ethical Hacking Competition, CNU Feb. 2016