

## Christopher Sprague Hazard

Cell Phone: (301) 803-9939 Personal Website: <https://christopherhazard.com/>

E-mail: chazard@andrew.cmu.edu, chazard@comcast.net

### Experience and Interests

AI, machine learning & statistics, natural language processing, visual learning, deep learning, control systems & simulation, mathematical finance

### Education

**Carnegie Mellon University** Pittsburgh, Pennsylvania August, 2018

M.S. in Robotics, Dept. of Computer Science: research advised by Profs. Nancy Pollard and Stelian Coros

- Courses in machine learning, deep learning, computer vision, control systems and dynamics, optimization, robotic manipulation, and ML for combined language and vision

**California Institute of Technology (Caltech)** Pasadena, California June, 2016

B.S. in Computer Science, graduated with honors. GPA 3.7

- Courses in Computer Science, Machine Learning/Data Mining, Statistics, Mathematical Finance, and Physics. Member of the Robotics Team. Participated in the Putnam Mathematics Competition.

### Work Experience

**National Robotics Engineering Center (NREC)-Carnegie Mellon** Pittsburgh, Pennsylvania 2019-  
**Robotics Engineer**

- Developed software for robotics projects, responsible for several successful client demos
- Designed/implemented software for robot arm inspection and cleaning of aircraft wing: responsible for controls, vision, and planning components
- Researched/proposed novel ideas in adversarial learning and neural network verification for image classification (member of project in robustness of image classifiers on mobile vehicles)

**Carnegie Mellon University** Pittsburgh, Pennsylvania 2018

**Visiting Research Assistant (Robotics Institute)**

**Carnegie Mellon University** Pittsburgh, Pennsylvania 2016-2018

**Robotics Researcher (Master's Program)**

- Masters Thesis: "Automated Design of Manipulators for In-Hand Tasks"
- Experience in optimization, manipulation, deep learning, simulation & control systems, motion planning, and reinforcement learning

**California Institute of Technology** Pasadena, California 2015-summer  
2016

**Researcher- Machine Learning and Finance**

- Independent research supervised by Prof. Ben Gillen under the Summer Undergraduate Research Funding (SURF) program and continued research through 2015-2016 school year
- Developed and back-tested machine learning based stock market trading strategies utilizing technical indicators, Bayesian analysis, and time series analysis techniques
- Developed market micro-structure models for short term market dynamics and market bubble prediction

**Northrop Grumman Corporation** Annapolis Junction, Maryland Summer 2014

**Software Engineer- Cybersecurity**

- Worked on the BluVector project, a machine learning based malware detection system
- Analyzed machine learning algorithms to improve system performance and verify correctness/novelty in detecting malware.

**H Capital Management LLC** Rockville, Maryland Summer 2013

**Programmer**

- Developed, programmed, and tested models for trading stocks and commodities

## **Selected Academic and Independent Projects**

- Visual Question Answering: human verifiable reasoning over scene graphs (ongoing)
- Multi-agent RL for learning social navigation in basketball games (ongoing)
- State Space Simulation and Prediction of Football Games with Bayesian ML methods (ongoing)
- ML with Language & Vision: visual question answering using an external knowledge base
- Deep Learning: task and motion planning with deep reinforcement learning on a robotic gripper
- Dynamics & Optimization: optimization of library of robotic hand designs for robust manipulation
- Manipulation: evolutionary grasp optimization for grasping under uncertainty
- Robotic Boxing Dummy: built 3D printed robot arm to attach to punching dummy to create a vision-enabled boxing robot with ML-based prediction of user's punches
- Estimating informed vs uninformed trader composition in Kyle-type market microstructure environments with extrapolative traders
- Machine learned based stock market timing models: construction of stock market trading strategies via genetic programming over learned trend indicators

## **Publications**

- "Automated Design of Simple and Robust Manipulators for Dexterous In-Hand Manipulation Tasks using Evolutionary Strategies" *Humanoids 2019*  
Andre Meixner, Christopher Hazard, Nancy Pollard
- "Automated Design of Robotic Hands for In-Hand Manipulation Tasks"  
*International Journal of Humanoid Robotics 2019*  
Christopher Hazard, Stelian Coros, Nancy Pollard
- "Automated Design of Manipulators For In-Hand Tasks" *Humanoids 2018* (best oral paper finalist)  
Christopher Hazard, Stelian Coros, Nancy Pollard

## **Academic Competitions & Awards**

**Humanoids 2018 Conference: Best Paper Finalist (Top 5)** 2018  
**USA Math Olympiad Qualifier (USAMO)** 2012  
**American Regions Mathematics League (ARML) National Competition-Top 10 Team** 2010-2012

## **Programming Languages and Packages**

- C++, Python, Java, Matlab, SQL, C, and Microsoft Excel
- PyTorch, Scikit-learn, ROS, OpenCV, OpenGL, TensorFlow, Weka, V-REP, Open Dynamics Engine, Mujoco