Philip M. Carr

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GitHub: https://github.com/pmc1gh LeetCode: https://leetcode.com/philipmcarr1/

Education

California Institute of Technology (Caltech) **Graduated 2020**
Major: BS, Computer Science
GPA: 3.6

Thomas Jefferson High School for Science and Technology (TJHSST) **Graduated 2016**
Newsweek's Number 1 Ranked High School in the U.S. in 2016
Alexandria, Virginia

Computer Science Fields of Interest

Graphics, Animation, and Simulation
Artificial Intelligence and Machine Learning

Programming Languages: C++, Python, C, OCaml, Haskell, Java, x86-64 Assembly

Project/Research Experience

Projects in Computer Science Class
Class/Project Mentor: Dr. Alan Barr **October 2, 2019 – June 12, 2020**

Project Title: Illustrative Rendering and 2D Heightmap Animation Program

Project Description:

- Developed a program (in C++) that renders 3D triangle mesh models (.obj files) in the art style of the video game Team Fortress 2 as detailed by Mitchell, J., Francke, M., and Eng, D. 2007. This program utilizes a variety of techniques such as texture-mapped diffuse lighting and rim lighting.
- Additionally, animates a 2-dimensional heightmap (triangle mesh sheet oriented along the xy-plane) with any given time-dependent function of 2 variables (e.g. h = f(t; x, y)).

Caltech/Mitsubishi Electric Advanced Technology Research and Development Center – Hyogo, Japan
Project Mentor: Dr. Kenzo Makino **July 1, 2019 – September 8, 2019**

Project Title: Research and development to speed up machine learning by using a quantum computer

Project Description:

- Developed a software pipeline (in Python) to investigate the feasibility of using the D-Wave quantum computer to accelerate the pre-training process (QPU-based pre-training) of a deep neural network. This system compares the performances of the fully trained (pre-training followed by post-training) deep-neural network models using QPU-based pre-training against equivalent models pre-trained using the traditional CPU-based method.
- Experimental procedure replicated that of Adachi & Henderson 2015, which found that QPU-based pre-training results in higher deep neural network accuracy with fewer pre-training iterations than does the CPU-based pre-training, although results of this project differed from Adachi & Henderson 2015 (possibly due to replication error).

Caltech Summer Undergraduate Research Fellowship
Project Mentor: Dr. Lynne Hillenbrand **July 16, 2018 - September 21, 2018**

Project Title: Application of Supervised Machine Learning to Classification of Variable Young Stars

Project Description:

- Developed software in Python with Jupyter Notebooks to implement the application of supervised machine learning models to the classification of variable young stars using labelled data derived from light curves of different variability types.
- Developed programs to read in the labelled light curve data, extract features from the data, train and optimize a variety of classifiers on the data (using scikit-learn) and evaluate the classification accuracy of each model. The most accurate model was the random forest algorithm with an average classification accuracy of 75 ± 5 % and a balanced accuracy of 75 ± 6 %.

Caltech Summer Undergraduate Research Fellowship
Project Mentor: Dr. Lynne Hillenbrand **July 10, 2017 - September 15, 2017**

Project Title: Development of a T Tauri star spectral analysis infrastructure

Project Description:

- Developed software in Python in a Jupyter Notebook to perform data analysis methods on the spectra of T Tauri (young) stars. Designed data analysis infrastructure to study both properties of stars (spectrum plotting, stellar chemical composition, radial velocity, etc.) and interactions between a star and its circumstellar disk (disk accretion veiling, emission line profiles, and velocity spectrum plotting).

Caltech Freshman Summer Research Institute
Project Mentor: Dr, Adric Riedel **July 10, 2016 - August 13, 2016**

Project Description:

- Helped retrieve data of Young Stellar Objects (YSOs) from various research papers and populate the Caltech YSOC database with the retrieved data. Determined the relative ages of several star-forming regions (using a color-color plot distinguishing infrared excess stars from non-infrared excess stars) using the data in the database (Python used for the data analysis).

Summer Science Program 2015 (SSP)
Hosted by University of Colorado Boulder

Sponsored by Caltech and MIT **June 28, 2015 - August 5, 2015**

Project Description:

- On a team of three people, selected a near-earth asteroid (2005 JF21) to observe and measure throughout the course of the program, using ground-based optical telescopes. Wrote software to determine the size, shape, and orientation of the asteroid's orbit around the Sun using Python, with determined orbital elements of the asteroid submitted to the Minor Planet Center of the International Astronomical Union.

Honors and Awards

USA Astronomy and Astrophysics Olympiad Grades 11, 12
National Astronomy Olympiad (NAO) Semifinalist 2015, 2016

Science Olympiad Grades 7, 8, 11

2nd Place Astronomy, 5th Place Geologic Mapping
1st Place Team Trophy 2015
Virginia Science Olympiad Division C Regional Tournament
Marshall HS, Falls Church, Virginia

5th Place Astronomy, 5th Place Geologic Mapping
2nd Place Team Trophy 2015
Fairfax Div. C Science Olympiad Invitational (40 teams, 5 states)
Fairfax HS, Fairfax, Virginia

1st Place Reach for the Stars, 1st Place Meteorology
1st Place Team 2012
Virginia Science Olympiad State Finals
Westfield High School, Chantilly, Virginia

Member of 8th Place Team National Finals 2012
University of Central Florida, Orlando, Florida

2nd Place Reach for the Stars, 2nd Place Water Quality, 3rd Place Meteorology 2012
Virginia Science Olympiad Regional Finals
Kilmer MS, Vienna, Virginia

1st Place Meteorology, 2nd Place Reach for the Stars 2012
Virginia Science Olympiad Division B Invitational Tournament
Fairfax HS, Fairfax, Virginia

1st Place Ecology, 3rd Place Solar System 2011
Virginia Science Olympiad Division B State Finals
Randolph Macon College, Ashland, Virginia

1st Place Ecology, 1st Place Dynamic Planet, 1st Place Solar System 2011
Virginia Science Olympiad Division B Regional Finals
Langley HS, McLean, Virginia

National Merit Commended Student Grade 12 2016

National AP Scholar Award Grade 12 2016

AP Scholar with Distinction Award Grades 11, 12 2015, 2016

Center for Talented Youth (CTY) Summer Program
Astrophysics Grade 8 2011
Johns Hopkins University, Baltimore, MD

Botball Robotics Grade 11, 12-Dead Robot Society, Botball Robotics Team Awards

1st Place Overall
1st Place Double Elimination
Overall Judges Choice Trophy
2016 Greater DC Regional Botball Tournament
Rockville, Maryland

2nd Place Overall
1st Place Head to Head
Overall Judges Choice Trophy
2015 Greater DC Botball Tournament
Alexandria, Virginia

2nd Place Alliance Match Team Trophy
Spirit of Botball Team Trophy
Youth Advisory Council People's Choice Award
2014 International Botball Tournament
Los Angeles, California