Benjamin A. Cook, PhD

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EDUCATION

Harvard University   Cambridge, MA

Ph.D. Astronomy and Astrophysics   2019

Secondary Field: Computational Science and Engineering

Awards: National Science Foundation Graduate Research Fellow, Certificate of Teaching Excellence (2x)

M.A. Astronomy and Astrophysics   2016

Relevant Coursework: Extreme Scale Data and Computational Science; Stochastic Methods for Data Analysis, Inference and Optimization; Machine Learning; Data Science; Noise and Data Analysis in Astrophysics

Princeton University   Princeton, NJ

A.B. Astrophysical Sciences, with High Honors   2014

Awards: Magna cum laude, Sigma Xi Research Honor Society, American Astronomical Society Chambliss Medal

TECHNICAL SKILLS

Programming and Computation: Python, GPU-acceleration with CUDA, Tensorflow, Amazon Web Services, Docker, Bokeh, C, Java, JavaScript, MPI, HTML/CSS, Linux, Git, Make, Google Apps Script

Machine Learning and Statistics: Bayesian inference, neural networks and deep learning, Markov chain Monte Carlo (MCMC), reinforcement learning, collaborative filtering, classification, clustering

COMPUTATIONAL EXPERIENCE

Akuna Capital   Boston, MA

Junior Quantitative Researcher   August 2019 – Present

Harvard University   Cambridge, MA

Graduate Research Fellow, PhD. Thesis   2016 – 2019

- Developed Bayesian inference framework for analyzing galaxy images with nested sampling and MCMC
- Accelerated simulation code by 34x with GPU-acceleration
- Apply models to archived Hubble Space Telescope data and lead public code distribution via GitHub

D.E. Shaw & Co.   New York, NY

Quantitative Analysis Intern   Summer 2018

- Designed Tensorflow deep neural network models to predict mortgage prepayment risk
- Trained and evaluated models on database of over 200M records representing 12M loans
- Demonstrated potential of neural networks for identification of tradable insights and improved predictive power over linear models

Harvard University   Cambridge, MA

Team Member, Graduate course final project (*Extreme Scale Data and Computational Science*)   Spring 2018

- Developed gpu-accelerated, MPI-parallel N-body gravitation code for simulation of galaxies
- Implemented and executed on 587 core, 12 node architecture on Harvard super-computing cluster

Graduate Research Fellow, Master's thesis   2014 – 2016

- Built post-processing pipeline for large dataset from cosmological simulation of galaxies
- Discovered important consequence of galaxy collisional histories using results from post-processing pipeline
- Published results in 1st-author scientific journal article and presented work at 4 international scientific meetings

Team Member, Graduate course final project (*Machine Learning*)   Spring 2016

- Designed reinforcement learning model (Q-learner) to autonomously play *Flappy Bird*-inspired computer game
- Model surpassed human abilities after 50 games of training

Team Member, Graduate course final project (*Data Science*)   Fall 2015

- Scraped baseball reference websites to compile pitcher-batter matchup database
- Developed collaborative filtering models with team of 4 to predict pitcher-batter match-up success rates

Leadership Experience

ComSciCon National Workshop Cambridge, MA

Treasurer 2018 – present
- Managed expenses and revenues totaling over $150k for 10 annual workshops across the country

Member, National Leadership Team 2016 – present
- Advised in ongoing organizational transition to 501(c)(3) non-profit and raised funds for national workshop

Chair, Local Organizing Committee 2015 – 2018
- Supervised 12-person team to organize national STEM communication and outreach workshop
- Balanced $80k annual budget and coordinate venue, lodging, travel, and catering for 90 students and 30 panelists
- Directed review process for over 1000 applications each year

Harvard University Cambridge, MA

Graduate Teaching Fellow 2015, 2016
- Guided weekly review and homework sessions for groups of 15+ students and led occasional lectures
- Supervised group observational labs and graded problem sets and exams
- Twice awarded Certificate of Teaching Excellence by Bok Center for Teaching and Learning

West End House Boys and Girls Club Boston, MA

Homework Buddy 2017 – Present
- Tutor local elementary student weekly in reading and math

Banneker Institute Cambridge, MA

Mentor / Instructor 2016 – present
- Instruct undergraduate students of color in summer astronomy program
- Advise on graduate school application process and edit application materials

Selected Publications (3 of 6)

Cook, B.A., Conroy, C., van Dokkum, P., and Speagle, J.S. 2016, *ApJ*, 876, 78. [arXiv:1904.00011]

Measuring Star-Formation Histories, Distances, and Metallicities with Pixel Color-Magnitude Diagrams I: Model Definition and Mock Tests

Cook, B.A., Conroy, C., Pillepich, A., et al. 2016, *ApJ*, 833, 158. [arXiv:1610.00014]

The information content of stellar halos: Stellar population gradients and accretion histories in early-type Illustris galaxies

Cook, B.A., Williams, P.K.G., and Berger, E. 2014, *ApJ*, 785, 10 [arXiv:1310.6758]

Trends in Ultracool Dwarf Magnetism. II. The Inverse Correlation Between X-ray Activity and Rotation as Evidence for a Bimodal Dynamo

Selected Contributed and Public Talks (3 of 9)

Challenges in Panchromatic Galaxy Modelling with Next Generation Facilities – Osaka, Japan November 2018

Pixel Color-Magnitude Diagrams

.Astronomy 9 – Cape Town, South Africa November 2017

Tutorial: GPU-acceleration with Python

On the Origin (and Evolution) of Baryonic Galaxy Halos – Galapagos Islands, Ecuador March 2017

The Information Content of Stellar Halos: Accretion Histories and Stellar Population Gradients in Quiescent Illustris Galaxies