Collin Politsch, Ph.D.

Born: Shawnee, Kansas
Citizenship: American
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Kavli Institute for Cosmology
University of Cambridge
Madingley Road
Cambridge, CB3 0HA, U.K.

Research Interests

Data Science, Statistics, Machine Learning: Massive spatial datasets, spatial modeling, distributed spatial models, time series analysis, signal processing, forecasting, data mining, nonparametric statistics, uncertainty quantification, high-dimensional statistics, statistical machine learning

Astrophysics: Astrostatistics and astroinformatics, cosmostatistics, nonparametric and data-driven astrophysics, Lyman-α forest, intergalactic medium, statistical cosmography, large-scale structure of the Universe

Positions and Affiliations

University of Cambridge — Cambridge, U.K.
Postdoc Research Associate, Kavli Institute for Cosmology & Institute of Astronomy — Sep 2022 – pres
Adjunct Lecturer in Data Science, Dept. of Applied Mathematics and Theoretical Physics — Jan 2023 – pres

Carnegie Mellon University — Pittsburgh, PA
Postdoctoral Fellow, Machine Learning Department — July 2020 – Aug 2021
Head of COVID-19 Forecasting, The Delphi Group

Uber Technologies, Inc. — San Francisco, CA
Data Scientist Intern, UberEverything Data Science — June 2018 – Aug 2018

Education

Carnegie Mellon University — Pittsburgh, PA
Joint Ph.D. in Statistics and Machine Learning — 2020

Dissertation: *Statistical Astrophysics*
Advisors: Larry Wasserman, Jessi J. Cisewski-Kehe, Rupert A.C. Croft
Award: Umesh K. Gavaskar Memorial Best Dissertation Award (faculty vote)

Carnegie Mellon University — Pittsburgh, PA
M.Sc. in Machine Learning — 2017

Thesis: *Exploring the Intergalactic Medium*
Advisors: Larry Wasserman, Jessi J. Cisewski-Kehe, Rupert A.C. Croft

University of Kansas — Lawrence, KS
B.Sc. in Mathematics (With Honors), Minor in Latin — 2014

Honors Thesis: *On Discrete-Time Linear Quadratic Control*
Advisor: Tyrone E. Duncan

Awards and Honors

- 2020-'21 Umesh K. Gavaskar Memorial Award for Best Ph.D. Dissertation in Statistics and Data Science at Carnegie Mellon University.
- 2021 Statistical Partnerships Among Academe, Industry, and Government (SPAIG) Award [Link]
  - Awarded to the Delphi group (in conjunction with our government and corporate partners: the U.S. Centers for Disease Control and Prevention, Google, Facebook, Amazon, Change Healthcare, Optum, and Quidel Inc.) by the American Statistical Association "for commitment to the theory and practice of epidemic tracking and forecasting through building and modeling unique public health data streams," for our partnership on COVIDcast.
- 2021 Allen Newell Award for Research Excellence [Link]
  - Awarded to the Delphi Group by the Carnegie Mellon University School of Computer Science, "for advancing the theory and practice of epidemic tracking and forecasting, and enabling national collaborative scientific response."
- Finalist for best paper in the 2020 ASA Astrostatistics Student Paper Competition, sponsored by the Astrostatistics Interest Group. [Link]
- 2nd Place: The Data Open 2018 at CMU, presented by Citadel and Correlation One.
  - 300+ applications, ∼125 selected to compete for $25,000 in prizes
- 2nd Place: 2017 NBA Basketball Analytics Hackathon, New York, NY, hosted by the NBA.
  - 900+ applications, ∼200 selected to compete for ∼$20,000 equivalent in game tickets, etc.
- 2nd Place: The Data Open 2017 at CMU, presented by Citadel and Correlation One.
  - 550+ applications, ∼125 selected to compete for $25,000 in prizes
- 3rd Place: 2017 Carnegie Mellon University BrainHub NeuroHackathon, sponsored by Google.
  - 51 CMU graduate students selected to compete for free tuition and travel stipends

Peer-Reviewed Publications

1. **Three-dimensional cosmography of the high redshift Universe using intergalactic absorption**
   C. A. Politsch, J. Cisewski-Kehe, R. A. C. Croft, L. Wasserman
   Pre-submission inquiry approved by *Nature*. Preparing to submit in full.

2. **Trend Filtering – I. A Modern Statistical Tool for Astronomical Spectroscopy and Time-Domain Astronomy**
   C. A. Politsch, J. Cisewski-Kehe, R. A. C. Croft, L. Wasserman
   Monthly Notices of the Royal Astronomical Society, Volume 492, Issue 3, March 2020.
   [Publisher] [arXiv] [Software]
   - ∗ **Finalist for best paper in the 2020 ASA Astrostatistics Student Paper Competition**, sponsored by the Astrostatistics Interest Group.

3. **Trend Filtering – II. Denoising Astronomical Signals with Varying Degrees of Smoothness**
   C. A. Politsch, J. Cisewski-Kehe, R. A. C. Croft, L. Wasserman
   Monthly Notices of the Royal Astronomical Society, Volume 492, Issue 3, March 2020.
   [Publisher] [arXiv] [Software]
   - ∗ **Finalist for best paper in the 2020 ASA Astrostatistics Student Paper Competition**, sponsored by the Astrostatistics Interest Group.

4. **Evaluation of individual and ensemble probabilistic forecasts of COVID-19 mortality in the United States**
   E. Y. Cramer, E. L. Ray, V. K. Lopez, et al.
   Proceedings of the National Academy of Sciences, Volume 119, Issue 15, April 2022.
   [Publisher] [medRxiv] [Data Access]

5. **The United States COVID-19 Forecast Hub dataset**
   E. Y. Cramer, Y. Huang, Y. Wang, et al.
   Scientific Data, Volume 9, Issue 462, August 2022.
   [Publisher] [Data Access]

6. **An Open Repository of Real-Time COVID-19 Indicators**
   A. Reinhart, L. Brooks, M. Jahja, A. Rumack, J. Tang, et al.
   Proceedings of the National Academy of Sciences, Volume 118, Issue 51, December 2021.
   [Publisher] [medRxiv] [Data Access]

7. **The Young Supernova Experiment Data Release 1 (YSE DR1): Light Curves and Photometric Classification of 1978 Supernovae**
   P. D. Aleo, K. Malanchev, S. Sharief, D. O. Jones, et al.
   The Astrophysical Journal Supplement Series, Volume 266, Issue 1, May 2023.
   [Publisher] [arXiv] [Data Access]

8. **Flight of the Bumblebee: the Early Excess Flux of Type Ia Supernova 2023bee revealed by TESS, Swift and Young Supernova Experiment Observations**
   Q. Wang, A. Rest, G. Dimitriadis, R. Ridden-Harper, et al.
   Submitted to *The Astrophysical Journal*.
   [arXiv]

9. **Photometric and Spectroscopic Analysis of SN 2022oqm: Closing The Gap Between SNe-Iax and Ic-like Calcium-Rich Transients**
   S.K. Yadavalli et al.
   Preparing to submit to *The Astrophysical Journal*.

10. **Mapping the Large-scale Universe through Intergalactic Silhouettes** [*Lightly-refereed]
    C. A. Politsch and R. A. C. Croft
    CHANCE, Volume 32, Issue 3, September 2019.
    [Publisher]

11. **Augmenting Adjusted Plus-Minus in Soccer with FIFA Ratings**
    F. Matano, L. F. Richardson, T. Pospisil, C. A. Politsch, J. Qin
    Journal of Quantitative Analysis in Sports, Volume 19, Issue 1, March 2023.
    [Publisher] [arXiv] [Data Access]

Industry Experience

Uber Technologies, Inc. — San Francisco, CA
Data Scientist Intern — 06/2018 – 08/2018

Team: UberEverything Data Science

Project: A Holistic Approach to Uber Eats Home Feed Ranking Optimization

Role: I completed an end-to-end project which culminated in a new personalized ranking and recommendation algorithm for the Uber Eats iOS/Android home feed that showed significant improvement over the current ranking algorithm in both offline evaluation and online A/B testing, and was subsequently launched.

Software

R packages

- trendfiltering: *The state-of-the-art method for denoising 1D signals* [Link]
- SALTdenoiseR: *Statistical software for the SALT Observatory* [Link]
- aardvark: *COVID-19 forecasters from Carnegie Mellon University's Delphi Group* [Link]

Teaching

University of Cambridge
Instructor
Department of Applied Mathematics and Theoretical Physics

- *Mathematical Foundations of Data-Intensive Science* 01/2023 – pres
  - £1 million contract (in the first instance) to construct and deliver a corporate data science training course for a very large tech company partner. Expected to be renewed for 3+ additional years.

Teaching Committee
Institute of Astronomy

- Postdoc representative on the IoA Teaching Committee 10/2022 – pres

Carnegie Mellon University
Instructor
Department of Statistics and Data Science

- 36-202: *Methods for Statistics & Data Science* Summer 2015
  - Intensive 8-week course for students in the summer REU program [Link]

Guest Lecturer
Department of Statistics and Data Science

- 36-401: *Modern Regression* 08/2017
- 36-217: *Probability Theory and Random Processes* 11/2015

Head Graduate Teaching Assistant 06/2015 – 12/2018
Department of Statistics and Data Science (36-) & Machine Learning Department (10-)
Course levels: B.Sc. (2XX – 4XX), M.Sc. (6XX), Ph.D. (7XX)

- 10-702: *Statistical Machine Learning*
- 10-705: *Intermediate Statistics*
- 36-618: *Experimental Design & Time Series*
- 36-467/667: *Special Topics: Data over Space & Time*
- 36-401/607: *Modern Regression*

- 36-402/608: *Advanced Methods for Data Analysis*
- 36-225: *Introduction to Probability Theory*
- 36-226: *Introduction to Statistical Inference*
- 36-217: *Probability Theory and Random Processes*

Graduate Teaching Assistant
Department of Statistics and Data Science

- 36-402/608: *Advanced Methods for Data Analysis* Spring 2015

Selected Talks

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, University of Cambridge, Department of Applied Mathematics and Theoretical Physics. 10/2022

(Invited) Machine Learning for Astronomy, Into the Impossible With Brian Keating. 08/2021

Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, Joint Statistical Meetings. *Statistical Challenges in Cosmology* session. 08/2021

(Invited) From Mapping the Universe to Forecasting the Pandemic, OnSolve Nexus 2021: Managing Uncertainty for Organizational Resiliency. 04/2021

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, University of Chicago, Machine Learning in Complex Phenomena seminar series. 02/2021

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, University of Maryland, Department of Mathematics. 11/2020

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, Duke University, Department of Statistical Science. 11/2020

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, "Physics of the Future" NSF AI Planning Institute at Carnegie Mellon University. 10/2020

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, The Flatiron Institute, Center for Computational Astrophysics & NYU. 10/2020

(Invited) Three-dimensional cosmography of the high redshift Universe using intergalactic absorption, Los Alamos National Laboratory. 10/2020

(Award) Trend Filtering: A Modern Statistical Tool for Time-Domain Astronomy and Astronomical Spectroscopy, Joint Statistical Meetings, Best Astrostatistics Student Paper Award Session. 08/2020

(Invited) Trend Filtering: A Modern Statistical Tool for Time-Domain Astronomy and Astronomical Spectroscopy, "Data-Driven Discovery in Physics" NSF AI Planning Institute at Carnegie Mellon University. 10/2019

(Invited) A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman-α Forest, Uber Technologies Data Science. 08/2018

(Invited) A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman-α Forest, Joint Statistical Meetings. 07/2017

A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman-α Forest, Statistical and Applied Mathematical Sciences Institute. 05/2017

Multi-resolution Regression, Divide and Conquer Risk Estimation, and the Large-scale Universe, Carnegie Mellon University, Department of Statistics and Data Science & Machine Learning Department. 05/2017

Multi-resolution Regression, Divide and Conquer Risk Estimation, and the Large-scale Universe, Statistical and Applied Mathematical Sciences Institute. 04/2017

(Invited) A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman-α Forest, Carnegie Mellon University, McWilliams Center for Cosmology. 03/2017

(Invited) A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman-α Forest, Statistical and Applied Mathematical Sciences Institute, Cosmology Working Group. 11/2016

(Poster) Exploring the Intergalactic Medium, Statistical and Applied Mathematical Sciences Institute, Astronomy Opening Workshop. 08/2016

Diversity, Equity, and Inclusion

- Postdoc representative on the Equality, Diversity & Inclusion Committee [Link] 10/2022 – pres
  Institute of Astronomy, University of Cambridge.
- Co-Chair of the EDI Work-Life Balance focus group 10/2022 – pres
  Institute of Astronomy, University of Cambridge.
- Postdoc representative on the Institute of Physics Project Juno Self-Assessment Team 10/2022 – pres
  Institute of Astronomy, University of Cambridge.

Scientific Collaborations

Delphi Delphi Group [Link] 08/2020 – 08/2021

I was a core member of the CMU-based Delphi Group and Team Lead of our forecasting development and evaluation initiative. The team I personally led devoted our work to developing statistical models for forecasting COVID-19 incidence in the United States in order to support and advise the COVID-19 pandemic responses of the U.S. Centers for Disease Control and Prevention (CDC) and the White House. The Delphi Group received numerous awards for our collective work. Particularly relevant to my team's work was the *2021 Statistical Partnerships Among Academe, Industry, and Government Award*[1] by the American Statistical Association and the *2021 Allen Newell Award for Research Excellence*[2] by the Carnegie Mellon University School of Computer Science.

LSST *Large Synoptic Survey Telescope (Vera C. Rubin Observatory)* [Link] 01/2023 – pres

WEAVE *William Herschel Telescope Enhanced Area Velocity Explorer* [Link] 01/2023 – pres

YSE *Young Supernova Experiment* [Link] 10/2022 – pres

Advising

Undergraduate students

- Benjamin LeRoy (UC Berkeley), Summer Undergraduate Research Experience in Statistics [Link], Carnegie Mellon University, Summer 2015. "Dynamical Mass Measurements of Galaxy Clusters." (Received Ph.D. in Statistics & Data Science from CMU in 2021).

Academic Service

- Postdoc representative on the Teaching Committee 10/2022 – pres
  Institute of Astronomy, University of Cambridge.
- Member of the Postdoc Committee 01/2023 – pres
  Institute of Astronomy, University of Cambridge.

Referee	*Astronomy and Computing (A&C)* *Journal of Cosmology and Astroparticle Physics (JCAP)* *NASA Experimental Program to Stimulate Competitive Research (EPSCoR)* *CHANCE Magazine*
Judging Panel	ASA Astrostatistics Student Paper Competition 2023 Tartan Data Science Cup 2017, Carnegie Mellon University.
Program Chair	Program Chair-Elect for the ASA Astrostatistics Interest Group during the 2022-'23 academic year and Program Chair during the 2023-'24 year. Responsible for organizing the full Astrostatistics program at the Joint Statistical Meetings 2024.
Session Organizer	*Statistical Challenges in Cosmology*, Joint Statistical Meetings 2021, Seattle, WA.
Session Chair	*Computing, Graphics, and Programming Statistics*, Joint Statistical Meetings 2017, Baltimore, MD.

Professional Memberships

AAS	*American Astronomical Society*
ASA	*American Statistical Association*
COIN	*Cosmostatistics Initiative*
IAA	*International Astrostatistics Association*
IAIA	*International AstroInformatics Association*
RAS	*Royal Astronomical Society*

Research Funding

University of Cambridge Cambridge, U.K.
Postdoctoral Research Associate 09/2022 – pres
Kavli Institute for Cosmology and the Institute of Astronomy

Project: Next-Generation Data-Driven Probabilistic Modelling of Type Ia Supernova SEDs in the Optical to Near-Infrared for Robust Cosmological Inference – BayeSN
Funding: ERC Grant #101002652
PI: Kaisey S. Mandel

Carnegie Mellon University Pittsburgh, PA
Postdoctoral Fellow 07/2020 – 08/2021
Machine Learning Department

Project: COVIDcast
Funding: Unrestricted Gift from Google.org [Link]
PI: Ryan J. Tibshirani

Graduate Research Assistant
McWilliams Center for Cosmology 01/2019 – 06/2020

Project: Intensity Mapping the Universe
Funding: NASA Grant #NNX17AK56G
PI: Rupert A.C. Croft

Graduate Research Assistant
Department of Statistics & Data Science 01/2015 – 08/2016

Project: Nonparametric Procedures that Exploit Structured Data and Models
Funding: NSF Grant #1521786
PI/co-PI(s): Ann Lee, Chad Schafer, Shirley Ho

Project: Statistics and Machine Learning for Scientific Inference
Funding: NSF Grant #1043903
PI: Larry Wasserman

Association of Universities for Research in Astronomy Observatory La Serena, Chile
La Serena School for Data Science: Applied Tools for Astronomy [Link] 08/2015

Project: Cosmology with the Cosmic Microwave Background Through Cross Correlations
Funding: NSF Grant #1637359, MAS, CONICYT

North Carolina State University Raleigh, NC
Undergraduate Research Assistant 05/2013 – 07/2013
Department of Mathematics

Project: Portfolio Optimization with Conditional Value-at-Risk (CVaR)
Funding: NSF Grant #1461148, NSA
PI: Tao Pang

University of Kansas Lawrence, KS
Undergraduate Research Assistant 01/2013 – 05/2014
Department of Mathematics

Project: Optimal Control of Stochastic Systems Driven by Fractional Brownian Motions
Funding: U.S. Army Research Contract #W911NF-10-1-0248
PI/co-PI(s): Tyrone E. Duncan, Bozenna Pasik-Duncan

Project: Optimal and Adaptive Control of Stochastic Systems
Funding: Air Force Office of Scientific Research Grant #FA9550-09-1-0554
PI/co-PI(s): Tyrone E. Duncan, Bozenna Pasik-Duncan

Project: Control of Stochastic Systems
Funding: NSF Grant #1108884
PI/co-PI(s): Tyrone E. Duncan, Bozenna Pasik-Duncan

References

- Prof. Larry Wasserman
  Department of Statistics & Data Science
  Machine Learning Department
  Carnegie Mellon University

- Prof. Jessi J. Cisewski-Kehe
  Department of Statistics
  University of Wisconsin-Madison

- Prof. Rupert A.C. Croft
  Department of Physics
  McWilliams Center for Cosmology
  Carnegie Mellon University