

# Collin A. Politsch

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## Research Interests

**Machine Learning/Statistics:** 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- $\alpha$  forest, intergalactic medium, statistical cosmography, large-scale structure of the Universe, planetary transits

## Academic Positions

**Flatiron Institute**, Center for Computational Astrophysics  
*Guest Researcher*

New York, NY  
August 2021 - present

**Carnegie Mellon University**, Machine Learning Department  
*Postdoctoral Fellow*

Pittsburgh, PA  
July 2020 - July 2021

## Education

**Carnegie Mellon University**  
Joint Ph.D. in Statistics and Machine Learning

Pittsburgh, PA  
2020

Dissertation: *Statistical Astrophysics: From Extrasolar Planets to the Large-scale Structure of the Universe*

Award: 2020-'21 Umesh K. Gavaskar Memorial Award for Best Ph.D. Dissertation

Advisors: Larry Wasserman, Jessi Cisewski-Kehe, Rupert A.C. Croft

**Carnegie Mellon University**  
M.Sc. in Machine Learning

Pittsburgh, PA  
2017

Thesis: *Exploring the Intergalactic Medium*

Advisors: Larry Wasserman, Jessi Cisewski-Kehe, Rupert A.C. Croft

**University of Kansas**  
B.Sc. in Mathematics (With Honors)

Lawrence, KS  
2014

Honors Thesis: *On Discrete-Time Linear Quadratic Control*

Advisor: Tyrone E. Duncan

## Peer-Reviewed Publications

- Three-dimensional cosmography of the high redshift Universe using intergalactic absorption**  
[Collin A. Politsch](#), Jessi Cisewski-Kehe, Rupert A.C. Croft, Larry Wasserman  
In preparation. Pre-submission inquiry approved by *Nature*.
- Trend Filtering – I. A Modern Statistical Tool for Astronomical Spectroscopy and Time-Domain Astronomy**  
[Collin A. Politsch](#), Jessi Cisewski-Kehe, Rupert A.C. Croft, Larry Wasserman  
*Monthly Notices of the Royal Astronomical Society*, Volume 492, Issue 3, March 2020, Pages 4005-4018.  
[Publisher](#). [arXiv](#). [trendfiltering](#) R package.

\* **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**  
Collin A. Politsch, Jessi Cisewski-Kehe, Rupert A.C. Croft, Larry Wasserman  
*Monthly Notices of the Royal Astronomical Society*, Volume 492, Issue 3, March 2020, Pages 4019-4032.  
**Publisher.** [arXiv](#). [trendfiltering R package](#).

\* **Finalist for best paper in the 2020 ASA Astrostatistics Student Paper Competition**, sponsored by the Astrostatistics Interest Group.

4. **An Open Repository of Real-Time COVID-19 Indicators**  
Alex Reinhart, Logan Brooks, Maria Jahja, Aaron Rumack, Jingjing Tang, et al.  
*Proceedings of the National Academy of Sciences*, Volume 118, Issue 51, December 2021.  
**Publisher.** [medRxiv](#). [Supplement](#). [Data Access](#).
5. **Evaluation of individual and ensemble probabilistic forecasts of COVID-19 mortality in the US**  
Estee Y. Cramer, Evan L. Ray, Velma K. Lopez, et al.  
Submitted to *Proceedings of the National Academy of Sciences*.  
[medRxiv](#). [COVID-19 Forecast Hub](#).
6. **Augmenting Adjusted Plus-Minus in Soccer with FIFA Ratings**  
Francesca Matano, Lee F. Richardson, Taylor Pospisil, Collin A. Politsch, Jining Qin  
Submitted to *Journal of Quantitative Analysis in Sports*. [arXiv](#). [Current player ratings](#).

## Other Publications

1. **Mapping the Large-scale Universe through Intergalactic Silhouettes**  
Collin A. Politsch and Rupert A.C. Croft  
*CHANCE*, Volume 32, Issue 3, Sep. 2019, Pages 14-19. [Publisher](#).

## Awards and Honors

- 2020-'21 Umesh K. Gavaskar Memorial Award for Best Ph.D. Dissertation in Statistics and Data Science at Carnegie Mellon University.
- Finalist for best paper in the 2020 ASA Astrostatistics Student Paper Competition, sponsored by the Astrostatistics Interest Group.
- 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 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 CMU BrainHub NeuroHackathon, sponsored by Google.
  - 51 CMU graduate students selected to compete for free tuition and travel stipends

## Selected Talks

### Invited

- *Three-dimensional cosmography of the high redshift Universe using intergalactic absorption*
  - *Into the Impossible With Brian Keating*, [YouTube Link](#), Aug. 2021.
  - University of Chicago, Machine Learning in Complex Phenomena seminar series, Chicago, IL. Feb. 2021.
  - University of Maryland, Department of Mathematics, College Park, MD. Nov. 2020.
  - Duke University, Department of Statistical Science, Durham, NC. Nov. 2020.
  - The “Physics of the Future” NSF AI Planning Institute at Carnegie Mellon & the Statistical Methods for the Physical Sciences (STAMPS) Research Group at Carnegie Mellon. Oct. 2020.
  - The Flatiron Institute, Center for Computational Astrophysics & NYU. Oct. 2020.
  - Los Alamos National Laboratory, Los Alamos, NM. Oct. 2020.
- *Trend Filtering: A Modern Statistical Tool for Time-Domain Astronomy and Astronomical Spectroscopy*
  - Joint Statistical Meetings. Best Astrostatistics Student Paper Award Session. Aug. 2020.
  - The “Data-Driven Discovery in Physics” NSF AI Planning Institute at Carnegie Mellon. Oct. 2019.
- *From Mapping the Universe to Forecasting the Pandemic*
  - OnSolve Nexus 2021: Managing Uncertainty for Organizational Resiliency (Paid speaker). April 2021.
- *A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman- $\alpha$  Forest*
  - Uber Technologies, Inc., San Francisco, CA. Aug. 2018.
  - Statistical and Applied Mathematical Sciences Institute (SAMSI), Cosmology Working Group Seminar Series, Durham, NC. Nov. 2016.

### Contributed Conference Proceedings & Seminars

- *Three-dimensional cosmography of the high redshift Universe using intergalactic absorption*
  - Joint Statistical Meetings. Session: *Statistical Challenges in Cosmology*. Aug. 2021.
- *A Multi-Resolution 3D Map of the Intergalactic Medium via the Lyman- $\alpha$  Forest*
  - Statistical and Applied Mathematical Sciences Institute (SAMSI), Astronomy Transition Workshop, Durham, NC. May 2017.
- *Multi-resolution Regression, Divide and Conquer Risk Estimation, and the Large-scale Universe*
  - Department of Statistics & Data Science, Carnegie Mellon University, Pittsburgh, PA. May 2017.
  - Statistical and Applied Mathematical Sciences Institute (SAMSI), Durham, NC. April 2017.
- *Exploring the Intergalactic Medium*
  - Department of Statistics & Data Science, Carnegie Mellon University, Pittsburgh, PA. April 2017.

## Software

R package **trendfiltering**: *The state-of-the-art method for denoising 1D signals.*

Available at <https://capolitsch.github.io/trendfiltering>

R package **SALTdenoiseR**: *Statistical software for the SALT Observatory.*

Available at <https://capolitsch.github.io/SALTdenoiseR>

R package **aardvark**: *COVID-19 forecasters from Carnegie Mellon's Delphi research group.*

Available at <https://github.com/cmu-delphi/covid-19-forecast>

R package **trendfilteringSupp**: *Optimal one-dimensional data analysis with trend filtering.*

Available at <https://github.com/capolitsch/trendfilteringSupp>

## Experience

### Carnegie Mellon University

*Postdoctoral Fellow*

08/2020 - 08/2021

Lab: The Delphi Research Group

PI/co-PI(s): Roni Rosenfeld, Ryan J. Tibshirani

Personal role: Lead of COVID-19 forecasting development and evaluation team

Description:

I was a core member of the CMU-based Delphi Research Group and Lead of the forecasting development and evaluation team. Our research was devoted to developing statistical models for forecasting COVID-19 incidence in the United States in order to help inform a data-driven national response to the COVID-19 pandemic.

*Graduate Research Assistant, McWilliams Center for Cosmology*

01/2019 - 06/2020

Project: Intensity Mapping the Universe

Award: 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

Award: National Science Foundation ([Award #1521786](#))

PI/co-PI(s): Ann Lee, Chad Schafer, Shirley Ho

Project: Statistics and Machine Learning for Scientific Inference

Award: National Science Foundation ([Award #1043903](#))

PI: Larry Wasserman

### Uber Technologies, Inc.

*Data Scientist Intern*

San Francisco, CA

06/2018 - 08/2018

Team: UberEverything Data Science

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

Description:

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.

**Association of Universities for Research in Astronomy Observatory**  
*La Serena School for Data Science: Applied Tools for Astronomy*

La Serena, Chile  
08/2015

Project: Cosmology with the Cosmic Microwave Background Through Cross Correlations  
Funding: NSF ([Award #1637359](#)), MAS, CONICYT  
Mentors: Jeffrey McMahon, Chris Miller

**North Carolina State University**  
*Undergraduate Research Assistant*

Raleigh, NC  
05/2013 - 07/2013

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

**University of Kansas**  
*Undergraduate Research Assistant*

Lawrence, KS  
01/2013 - 05/2014

Project: Optimal Control of Stochastic Systems Driven by Fractional Brownian Motions  
Award: U.S. Army Research Office ([Contract W911NF-10-1-0248](#))  
PI/co-PI(s): Tyrone E. Duncan, Bozenna Pasik-Duncan  
  
Project: Optimal and Adaptive Control of Stochastic Systems  
Award: 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  
Award: National Science Foundation ([Award #1108884](#))  
PI/co-PI(s): Tyrone E. Duncan, Bozenna Pasik-Duncan

## Teaching and Advising

**Carnegie Mellon University**  
*Graduate Teaching Assistant*

01/2015 - 12/2018

- 10/36-702: *Statistical Machine Learning* Head TA, PhD course
- 10/36-705: *Intermediate Statistics* Head TA, PhD course
- 36-618: *Experimental Design & Time Series* Head TA, MS course
- 36-467/667: *Special Topics: Data over Space & Time* Head TA, MS course
- 36-401/607: *Modern Regression* Head TA, BS/MS course
- 36-402/608: *Advanced Methods for Data Analysis* BS/MS course
- 36-225: *Introduction to Probability Theory* Head TA, BS course
- 36-226: *Introduction to Statistical Inference* Head TA, BS course
- 36-217: *Probability Theory and Random Processes* Head TA, BS course

*Lecturer*

- **Summer Lecture Series**, Carnegie Mellon University, Summer Undergraduate Research Experience in Statistics, Pittsburgh, PA. *Introduction to Statistics in R*. June - July 2015.
- **Guest Lecture**, Carnegie Mellon University, STAT 217 (Probability Theory and Random Processes), Pittsburgh, PA. *Introduction to Markov Chains*. Nov. 2015.

- **Guest Lecture**, Carnegie Mellon University, STAT 401 (Modern Regression), Pittsburgh, PA. *Introduction to Programming in R and R Markdown*. Aug. 2017.

*Research Advisor*

*05/2015 - 08/2015*

Undergraduate student: Benjamin Leroy (UC Berkeley; now CMU PhD student)  
 Project: Dynamical Mass Measurements of Galaxy Clusters  
 Award: National Science Foundation ([Award #1043903](#))

## Professional Service

**Referee** *Journal of the Royal Statistical Society: Series B*  
*Journal of Cosmology and Astroparticle Physics (JCAP)*  
*NASA Experimental Program to Stimulate Competitive Research*  
*Astronomy and Computing (A&C)*  
*CHANCE Magazine*

**Session Organizer** *Statistical Challenges in Cosmology*, JSM 2021, Seattle, WA.

**Session Chair** *Computing, Graphics, and Programming Statistics*, JSM 2017, Baltimore, MD.

**Judging Panel** *Tartan Data Science Cup 2017*, Carnegie Mellon University.

**Outreach Talks** *Astrostatistics*, Hillel Academy of Pittsburgh, AP Statistics class, 2017.

## Professional Memberships

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

## In the News

- [CMU Statistics and Data Science Graduate Students Keep Winning Big](#)
- [Mr. Indispensable, from Lionel Messi to Virgil Van Dijk: Which player can your team not live without?](#) (Joint work with Francesca Matano, Lee Richardson, et al.)
- [NBA Hackathon 2017 Recap](#)