

Collin A. Politsch

Flatiron Institute, Center for Computational Astrophysics
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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- α 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: Umesh K. Gavaskar Memorial Award for Best Ph.D. Dissertation (2020-'21)

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

1. **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*.
2. **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](#). [Up-to-date 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*, Aug. 2021. [YouTube](#).
 - 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- α 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- α 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

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

Undergraduate student: Benjamin Leroy (now holds Ph.D. in Statistics and Data Science from CMU)
 Project: Dynamical Mass Measurements of Galaxy Clusters
 Award: National Science Foundation ([Award #1043903](#))

Professional Service

Referee	<i>Journal of the Royal Statistical Society: Series B</i> <i>Journal of Cosmology and Astroparticle Physics (JCAP)</i> <i>NASA Experimental Program to Stimulate Competitive Research</i> <i>Astronomy and Computing (A&C)</i> <i>CHANCE Magazine</i>
Session Organizer	<i>Statistical Challenges in Cosmology</i> , JSM 2021, Seattle, WA.
Session Chair	<i>Computing, Graphics, and Programming Statistics</i> , JSM 2017, Baltimore, MD.
Judging Panel	<i>Tartan Data Science Cup 2017</i> , Carnegie Mellon University.
Outreach Talks	<i>Astrostatistics</i> , Hillel Academy of Pittsburgh, AP Statistics class, 2017.

Professional Memberships

AAS	<i>American Astronomical Society</i>
ASA	<i>American Statistical Association</i>
COIN	<i>Cosmostatistics Initiative</i>
IAA	<i>International Astrostatistics Association</i>
IAIA	<i>International AstroInformatics Association</i>

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](#)