Esther Rolf

✉ esther.rolf@colorado.edu | ⌂ www.estherrolf.com | ⌂ estherrolf

Research

I study statistical and geospatial machine learning. My research blends methodological and applied techniques to design and analyze machine learning algorithms and systems with an emphasis on usability, data-efficiency and fairness. My current research directions include developing algorithms and infrastructure for reliable environmental monitoring using machine learning, and understanding the multifaceted nature of representation in data and how that affects our ability to train fair and effective machine learning systems.

Academic Positions

Harvard University   *Cambridge MA, USA*
POSTDOCTORAL FELLOW   *2022 — present*
Joint fellowships from the Center for Research on Computation and Society & the Harvard Data Science Initiative

University of Colorado Boulder   *Boulder, Colorado*
ASSISTANT PROFESSOR   *starting 2024*
VISITING PROFESSOR   *2022 — 2024*

Education

University of California, Berkeley   *Berkeley, CA, USA*
PH.D., COMPUTER SCIENCE, ADVISED BY MICHAEL I. JORDAN AND BENJAMIN RECHT   *2016 - 2022*
- Thesis: *Incorporating Intent, Impact, and Context for Beneficial Machine Learning*

Princeton University   *Princeton NJ, US*
B.S.E. IN COMPUTER SCIENCE AND ENGINEERING   *2012 - 2016*
- Graduated summa cum laude. Department GPA: 4.0, Overall GPA: 3.83
- Senior Thesis: *Information Complexity Analysis of Topological Communication Bounds*, advised by Mark Braverman
- Junior Thesis: *Probabilistic Prediction of Metadata for Sparse Datasets*, advised by Elad Hazan

Selected Awards and Fellowships

2023	**SDG Digital Gamechangers award** UNDP and ITU	*Ney York, NY*
2021	**Rising Star in AI for Social Good** Harvard Center for Research on Computation and Society	*Cambridge, MA*
2020	**Google PhD Fellowship**	*Berkeley, CA*
2019	**Best Paper Award** NeurIPS Joint Workshop on AI for Social Good	*Vancouver, Canada*
2019	**Global Policy Lab Doctoral Fellow**	*Berkeley, CA*
2018	**Best Paper Award** International Conference of Machine Learning (ICML)	*Stockholm, Sweden*
2016	**National Science Foundation (NSF) Graduate Fellowship**	*Berkeley, CA*
2016	**Berkeley Stonebraker Fellowship**	*Berkeley, CA*

Publications

Conference Papers

- **Geographic location encoding with spherical harmonics and sinusoidal representation networks**.
  Marc Rußwurm, Konstantin Klemmer, **Esther Rolf**, Robin Zbinden, and Devis Tuia. *International Conference on Learning Representations (ICLR)*. 2024. **Spotlight presentation.**

- **Fairness and representation in satellite-based poverty maps: Evidence of urban-rural disparities and their impacts on downstream policy**.
  Emily Aiken*, **Esther Rolf***, Joshua Blumenstock. *International Joint Conference on Artificial Intelligence (IJCAI)*. 2023.

- **Resolving label uncertainty with implicit posterior models**.
  Esther Rolf*, Nikolay Malkin*, Alexandros Graikos, Ana Jojic, Caleb Robinson, Nebojsa Jojic. *Conference on Uncertainty in Artificial Intelligence (UAI)*. 2022. **Oral presentation.**

- **Representation matters: Assessing the importance of subgroup allocations in training data**.
  Esther Rolf, Theodora Worledge, Benjamin Recht, Michael I. Jordan. *International Conference on Machine Learning*

(ICML). 2021.

- **Balancing competing objectives with noisy data: Score-based classifiers for welfare-aware machine learning**.
  Esther Rolf, Max Simchowitz, Lydia T. Liu, Sarah Dean, Daniel Björkegren, Moritz Hardt, Joshua Blumenstock. *International Conference on Machine Learning (ICML)*. 2020.

- **Post-estimation smoothing: a Simple baseline for learning with side information**.
  Esther Rolf, Michael I. Jordan, Benjamin Recht. *International Conference on Artificial Intelligence and Statistics (AISTATS)*. 2020.

- **Delayed impact of fair machine learning**.
  Lydia T. Liu, Sarah Dean, **Esther Rolf**, Max Simchowitz, Moritz Hardt. *International Conference on Machine Learning (ICML)*. 2018. **Best paper award.**

- **Enhancing Wi-Fi signal strength of a dynamic heterogeneous system using a mobile robot provider**.
  Esther Rolf, Matt Whitlock, Byung-Cheol Min, Eric T Matson. *Robot Intelligence Technology and Applications (RiTA)*. 2014.

Journal Papers

- **A generalizable and accessible approach to machine learning with global satellite imagery**.
  Esther Rolf*, Jonathan Proctor*, Tamma Carleton*, Ian Bolliger*, Vaishaal Shankar*, Miyabi Ishihara, Benjamin Recht, Solomon Hsiang. *Nature Communications*. 2021.

- **A successive-elimination approach to adaptive robotic source seeking**.
  Esther Rolf*, David Fridovich-Keil*, Max Simchowitz, Benjamin Recht, Claire Tomlin. *IEEE Transactions on Robotics (TRO)*. 2020.

- **The effect of large-scale anti-contagion policies on the coronavirus (COVID-19) pandemic**.
  Solomon Hsiang, Daniel Allen, Sebastien Annan-Phan, Kendon Bell, Ian Bolliger, Trinetta Chong, Hannah Druckenmiller, Andrew Hultgren, Luna Yue Huang, Emma Krasovich, Peiley Lau, Jaecheol Lee, **Esther Rolf**, Jeanette Tseng, Tiffany Wu. *Nature*. 2020.

Workshop Papers

- **Evaluation challenges for geospatial ML**.
  Esther Rolf. *Workshop on Machine Learning for Remote Sensing (ICLR)*. 2023.

- **Striving for data-model efficiency: Identifying data externalities on group performance**.
  Esther Rolf, Ben Packer, Alex Beutel, Fernando Diaz. *Workshop on Trustworthy and Socially Responsible Machine Learning, Neural Information Processing Symposium (NeurIPS)*. 2022.

- **Can strategic data collection improve the performance of poverty prediction models?**.
  Satej Soman, Emily Aiken, **Esther Rolf**, Joshua Blumenstock. *Artificial Intelligence for Humanitarian Assistance and Disaster Response Workshop (NeurIPS)*. 2022.

- **Balancing competing objectives for welfare-aware machine learning with imperfect data**.
  Esther Rolf, Max Simchowitz, Lydia T. Liu, Sarah Dean, Daniel Björkegren, Moritz Hardt, Joshua Blumenstock. *Joint Workshop on AI for Social Good Workshop, Neural Information Processing Symposium (NeurIPS)*. 2019. **Best paper award.**

- **Ground control to Major Tom: the Importance of field surveys in remotely sensed data analysis**.
  Ian Bolliger, Tamma Carleton, Solomon Hsiang, Jonathan Kadish, Jonathon Proctor, Benjamin Recht, **Esther Rolf**, Vaishaal Shankar. *Data for Good Exchange*. 2017.

Other

- **Satellite images reveal untracked human activity on the oceans**.
  Konstantin Klemmer and **Esther Rolf**. *Nature Publishing Group UK London*. 2024.

* denotes equal contribution

Talks

Geospatial machine learning: Data-focused algorithm design, development, and evaluation

University of Colorado Boulder Earth Lab Seminar	Feb. 2024
Boston University Center for Computing and Data Sciences	Nov. 2023

Toward data focused machine learning: Efficiency, responsibility, and beyond

Google Research Seminar	July 2023
Microsoft New England Machine Learning Ideas Seminar	October 2022

A generalizable and accessible approach to machine learning with global satellite imagery

Summer at Census (virtual) Workshop	July 2022
United States Census Bureau	Nov. 2021
Berkeley School of Information Data Science Immersion Experience	Nov. 2021
Harvard Center for Research on Computation and Society Rising Star Speaker Series	Apr. 2021
CGIAR Big Data in Agriculture: Digital Dynamism for Adaptive Food Systems	Oct. 2020
American Geophysical Union	Dec. 2019
ImageXD Conference at Berkeley Institute of Data Science	Sep. 2019

Balancing competing objectives for welfare-aware ML with imperfect data

NeurIPS Joint Workshop on AI for Social Good	Dec. 2019

Delayed impact of fair machine learning

Sigmetrics Conference	June 2019

Teaching

Guest Lectures

Harvard CS 96: System Design Projects: Machine Learning for Social Impact *Spring 2023*
- Data and ML: Historical, academic, and practical perspectives.

Graduate Student Instructor

UC Berkeley DS 102, Data, Inference, and Decisions *Fall 2019*
- Developed curriculum and materials for the inaugural semester of the capstone data science course at UC Berkeley.
- Taught weekly discussion sections and code-based lab sections.

UC Berkeley CS 189/289A, Introduction to Machine Learning *Fall 2018*
- Developed and tailored course materials and exams at mixed undergraduate/graduate level machine learning.
- Taught weekly sections, prepared and delivered exam review sessions.

Undergraduate TA and Grader

Princeton CS 340: Reasoning About Computation *Fall 2015-Spring 2016*
- Held Lab TA office hours with a mix of lecture-style review content and one-on-one problem-based discussions. Graded.

Princeton CS 126, 226: Intro to Programming, Algorithms and Data Structures *Fall 2013-Spring 2015*
- Graded undergraduate programming assignments and exams. Both courses are taught in java.

Workshop and Seminar Organization

Workshop Organization

Co-organizer
- Harvard CRCS Workshop on AI-Assisted Decision-Making for Conservation: 2022
- NeurIPS Workshop on Artificial Intelligence for Humanitarian Assistance and Disaster Response Workshop: 2021

Good Data Seminar *UC Berkeley*

Organizer *September 2018 - Spring 2020*

In 2018 I initiated this cross-disciplinary seminar spanning members from Computer Science, Public Policy and the Information School, with regular guests from Statistics and Economics. For several years I organized the weekly meetings during which graduate students and postdocs presented research in progress, workshopped new ideas, and gave tutorials on fundamentals cross-cutting these fields.

Service

AGU Position Statement Panel: Data *San Francisco, CF*

Panel Member *Fall 2023*
- Served on panel to update the Data position statement of the American Geophysical Union.

Reviewing

- Conferences: EAAMO, AISTATS, NeurIPS, ICML
- Journals: Environmental Data Science, IEEE Robotics and Automation Letters
- Workshops: ICLR Workshop on Remote Sensing with Machine Learning, NeurIPS Workshop on AI + Humanitarian Assistance and Disaster Relief, NeurIPS Workshop on Consequential Decision Making in Dynamic Environments

Mentoring

Students Mentored (Individual Research)

- Theodora Worledge, UC Berkeley, Undergraduate.

Berkeley AI Research (BAIR) Undergraduate Mentoring Program *2017, 2019*

- Mentored undergraduate students from underrepresented groups who are considering a career in research.

Professional Positions

Research Intern *Virtual*
GOOGLE RESEARCH *November 2021- January 2022*
Hosted by Ben Packer, Alex Beutel, and Fernando Diaz.

Research Intern *Redmond, WA (virtual)*
MICROSOFT RESEARCH *May - July 2021*
Hosted by Nebojsa Jojic.