

Hoda Heidari

CONTACT INFORMATION	Gates Hillman Center, #8229 Pittsburgh, PA 15213	<i>E-mail:</i> hheidari@cmu.edu <i>Phone:</i> 412-268-6869
RESEARCH INTERESTS	<ul style="list-style-type: none">• Responsible AI• AI Governance and Policy• Fairness and Accountability for ML	
POSITIONS	<p>K&L Gates Career Development Assistant Professor in Ethics & Computational Technologies Carnegie Mellon University, Pittsburgh, PA Jul 2023–present</p> <p>Assistant Professor, Machine Learning Department, School of Computer Science Carnegie Mellon University, Pittsburgh, PA Jul 2020–Jul 2023</p> <ul style="list-style-type: none">• <i>Co-lead of the Responsible AI Initiative at CMU</i>• <i>CMU Affiliations:</i> Institute for Software, Systems, and Society (S3D), Human-Computer Interaction Institute (HCII), CyLab Security and Privacy Institute, Block Center for Technology and Society, <p>Post-doctoral Associate, Cornell University, Ithaca, NY Sep 2019–Jul 2020</p> <ul style="list-style-type: none">• <i>Supervisor:</i> Professors Jon Kleinberg, Karen Levy, and Solon Barocas• <i>Affiliation:</i> AI, Policy, and Practice initiative, Computer & Information Science Department <p>Post-doctoral Fellow, ETH Zürich, Switzerland Aug 2017–Aug 2019</p> <ul style="list-style-type: none">• <i>Supervisor:</i> Professor Andreas Krause• <i>Affiliation:</i> Learning and Adaptive Systems Group at the Machine Learning Institute	
EDUCATION	<p>University of Pennsylvania, Philadelphia, PA 2017</p> <p>Ph.D. in Computer and Information Science</p> <ul style="list-style-type: none">• <i>Thesis:</i> “Essays in Algorithmic Market Design under Social Constraints”• <i>Advisors:</i> Professors Michael Kearns and Ali Jadbabaie• <i>Committee:</i> Rakesh Vohra, Aaron Roth, Shivani Agrawal, Vahab S. Mirrokni• <i>Elective Coursework:</i> Microeconomics I (Decision Theory and General Equilibrium Theory), Microeconomics II (Game Theory and Mechanism Design), Market Design, Discrete Convexity & Submodularity, Convex Optimization, Computational Learning Theory <p>Wharton School of Business, Philadelphia, PA 2017</p> <p>M.Sc. in Statistics</p> <ul style="list-style-type: none">• <i>Thesis:</i> “What Can Machine Learning Teach Econometrics?”• <i>Supervisor:</i> Prof. Dylan Small• <i>Coursework:</i> Applied Econometrics I, Mathematical Statistics, Probability, Stochastic Processes, Statistical Learning Theory, Data Analysis, Statistical Computing <p>Sharif University of Technology, Tehran, Iran 2011</p> <p>B.Sc. in Computer Engineering</p> <ul style="list-style-type: none">• <i>Thesis:</i> “Toward Optimal Vaccination Strategies for Probabilistic Models” Joint work with Z. Abbassi, supervised by Prof. Mohammad Ghodsi.• <i>Elective Coursework:</i> Linear Algebra, Algorithmic Game Theory (graduate course)	

- INDUSTRY EXPERIENCE
- Summer Intern, **Google Research**, New York 2015
 • *Mentors:* Hossein Azari, Mohammad Mahdian, Umar Syed, Sergei Vassilvitskii
- Summer Intern, **Microsoft Research**, New York 2014
 • *Mentors:* Sebastien Lahaie, David Pennock, Jenn Wortman Vaughan
- PEER-REVIEWED PUBLICATIONS
- [1] *The AI Incident Database as an Educational Tool to Raise Awareness of Harms: A Classroom Exploration of Efficacy, Limitations, & Future Design Improvements.* Michael Feffer, Nikolas Martelaro, and Hoda Heidari. ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization (EAAMO), 2023.
- [2] *Towards Operationalizing A pipeline-centric view of Fairness for ML.* Emily Black, Rakshit Naidu, Rayid Ghani, Kit Rodolpha, and Hoda Heidari. ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization (EAAMO), 2023.
- [3] *Cognitive Diversity and Affinity Bias in Team Formation Dynamics.* Solon Barocas, Karen Levy, Jon Kleinberg, and Hoda Heidari. ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization (EAAMO), 2023.
- [4] *Perspectives on Incorporating Expert Feedback into Model Updates.* Valerie Chen, Umang Bhatt, Hoda Heidari, Adrian Weller, and Ameet Talwalkar. Pattern (Volume 4, Issue 7), 2023.
- [5] *From Preference Elicitation to Participatory ML: A Critical Survey & Guidelines for Future Research.* Michael Feffer, Michael Skirpan, Zachary Chase Lipton, and Hoda Heidari. AAAI /ACM Conference on Artificial Intelligence, Ethics, and Society (AIES), 2023.
- [6] *A Validity Perspective on Evaluating the Justified Use of Data-driven Decision-making Algorithms.* Amanda Coston, Anna Kawakami, Haiyi Zhu, Ken Holstein and Hoda Heidari. The IEEE Conference on Secure & Trustworthy Machine Learning (SAT-ML), 2023. Best paper award.
- [7] *Local Justice & ML: Modeling and Inferring Dynamic Ethical Judgments Around High-stakes Allocations.* Violet Chen, Joshua Williams, Derek Leben, and Hoda Heidari. The AAAI Conference on Artificial Intelligence (AAAI) , 2023.
- [8] *Moral Machine or Tyranny of the Majority?.* Michael Feffer, Hoda Heidari, Zachary Chase Lipton. AAAI, 2023.
- [9] *Bayesian Persuasion for Algorithmic Recourse.* Keegan Harris, Valerie Chen, Joon Sik Kim, Ameet Talwalkar, Hoda Heidari, and Steven Wu. NeurIPS, 2022.
- [10] *Four Years of FAccT: A Reflexive, Mixed-Methods Analysis of Research Contributions, Shortcomings, and Future Prospects.* Ben Laufer, Sameer Jain*, A. Feder Cooper*, Jon Kleinberg, and Hoda Heidari. ACM conference on Fairness, Accountability, and Transparency (FAccT), 2022.
- [11] *Strategic Instrumental Variable Regression: Recovering Causal Relationships From Strategic Responses.* K. Harris, D. Ngo, L. Stapleton, H. Heidari, and S. Wu. The International Conference on Machine Learning (ICML), 2022.

- [12] *Stateful Strategic Regression*. K. Harris, H. Heidari, and S. Wu. Neural and Information Processing Systems (NeurIPS), 2021.
- [13] *On Modeling Human Perceptions of Allocation Policies with Uncertain Outcomes*. H. Heidari, S. Barocas, J. Kleinberg, and K. Levy. The ACM Conference on Economics and Computation (EC), 2021. Exemplary track award.
- [14] *Addressing the Long-term Impact of ML Decisions via Policy Regret*. D. Lindner, H. Heidari, and A. Krause. The International Joint Conference on Artificial Intelligence (IJCAI), 2021.
- [15] *Fair equality of chances: fairness for statistical prediction-based decision-making*. M. Loi, A. Herlitz, and H. Heidari. AIES, 2021.
- [16] *A Human-in-the-loop Framework to Construct Context-aware Mathematical Notions of Outcome Fairness*. M. Yaghini, A. Krause, and H. Heidari. AIES, 2021.
- [17] *Allocating Opportunities in a Dynamic Model of Intergenerational Mobility*. Hoda Heidari and Jon Kleinberg. ACM conference on Fairness, Accountability, and Transparency (FAccT), 2021. Best paper award.
- [18] *On the Desiderata for Online Altruism: Nudging for Equitable Donations*. Nuno Mota, Abhijnan Chakraborty, Asia J. Biega, Krishna P. Gummadi, Hoda Heidari: Proceedings of the ACM on Human-Computer Interaction (CSCW), Volume 4, 2020.
- [19] *Algorithmic Notions vs. Human Perceptions of Fairness: A Descriptive Approach to Selecting a Suitable Fairness Metric*. Megha Srivastava, Hoda Heidari, and Andreas Krause. Proceedings of the SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), 2019.
- [20] *On the Long-term Impact of Algorithmic Decision Policies: Effort Unfairness and Feature Segregation through Social Learning*. Hoda Heidari, Vedant Nanda, and Krishna P. Gummadi. The International Conference on Machine Learning (ICML), 2019.
- [21] *On the Impact of Choice Architectures on Inequality in Online Donation Platforms*. Abhijnan Chakraborty, Nuno Mota, Asia J. Biega, Krishna P. Gummadi and Hoda Heidari. The Web Conference (WWW), 2019.
- [22] *A Moral Framework for Understanding of Fair ML through Economic Models of Equality of Opportunity*. Hoda Heidari, Michele Loi, Krishna P. Gummadi, and Andreas Krause. FAccT, 2019.
- [23] *Fairness Behind a Veil of Ignorance: A Welfare Analysis for Automated Decision Making*. Hoda Heidari, Claudio Ferrari, Krishna P. Gummadi, and Andreas Krause. NeurIPS, 2018.
- [24] *A Unified Approach to Quantifying Algorithmic Unfairness: Measuring Individual and Group Unfairness via Inequality Indices*. Till Speicher*, Hoda Heidari*, Nina Grgic-Hlaca, Krishna P. Gummadi, Adish Singla, Adrian Weller, Muhammad Bilal Zafar. KDD, 2018.

- [25] *Preventing Disparate Treatment in Sequential Decision Making*. Hoda Heidari and Andreas Krause. IJCAI, 2018.
- [26] *Fairness in Criminal Justice Risk Assessments: The State of the Art*. Richard Berk, Hoda Heidari, Shahin Jabbari, Michael Kearns, and Aaron Roth. Sociological Methods and Research, 2018.
- [27] *Pricing a Low-regret Seller*. Hoda Heidari, Mohammad Mahdian, Umar Syed, Sergei Vassilvistskii, and Sadra Yazdanbod. ICML, 2016.
- [28] *Tight Policy Regret Bounds for Improving and Decaying Bandits*. Hoda Heidari, Michael Kearns and Aaron Roth. IJCAI, 2016.
- [29] *Integrating Market Makers, Limit Orders, and Continuous Trade in Prediction Markets*. Hoda Heidari, Sebastien Lahaie, David Pennock, and Jenn Wortman Vaughan. EC, 2015.
Full version was invited for publication, and appeared in the ACM Transactions on Economics and Computation (TEAC).
- [30] *Learning from Contagion (Without Timestamps)*. Kareem Amin, Hoda Heidari, and Michael Kearns. ICML, 2014.
- [31] *New Models for Competitive Contagion*. With Moez Draief and Michael Kearns. AAAI, 2014.
- [32] *Competitive Contagion in Networks*. Sanjeev Goyal, Hoda Heidari, and Michael Kearns. Games and Economic Behavior Journal (GEB), 2014.
- [33] *Depth-Workload Tradeoffs for Workforce Organization*. Hoda Heidari and Michael Kearns. The Conference on Human Computation & Crowdsourcing (HCOMP), 2013.

PEER-REVIEWED
NON-ARCHIVAL
PUBLICATIONS

- *A Unifying Framework for Combining Complementary Strengths of Humans and ML toward Better Predictive Decision-Making*. Charvi Rastogi, Leqi Liu, Ken Holstein, and Hoda Heidari. Poster at EAAMO, 2022.
- *A Sandbox Tool to (Bias)Stress-Test Fairness Algorithms*. Nil-Jana Akpinar, Manish Nagireddy, Logan Stapleton, Hao-Fei Cheng, Haiyi Zhu, Steven Wu, and Hoda Heidari. Poster at EAAMO, 2022.

WORKING PAPERS

- *Beneficent Intelligence: A Capability Approach to Modeling Benefit, Assistance, and Associated Moral Failures through AI Systems*. Alex J. London* and Hoda Heidari*. 2023.
- *Fine-tuning Games: Bargaining and Adaptation for General-Purpose Models*. Ben Laufer, Jon Kleinberg*, and Hoda Heidari*. 2023.
- *Toward Generating Actionable Counterfactual Explanations via Posterior Inference*. Joshua Williams, Anurag Katakhar, Hoda Heidari, and Zico Kolter. 2022.

INVITED
ARTICLES

- Invited Book Chapter on “Fairness in AI” 2023
To be published by ACM as part of a textbook on “Artificial Intelligence and Society”
- *On Modeling Human Perceptions of Allocation Policies with Uncertain Outcomes*. 2023
Invited letter at SIGEcom Exchanges

- *Allocating Opportunities in a Dynamic Model of Intergenerational Mobility*. 2022
Invited for publication and presentation at the Sister Conference Best Paper Track of IJCAI

GRANTS/ AWARDS

- Senior Personnel, the **NSF AI Institute for Societal Decision-Making (AI-SDM)**. 2023
- Invited research member at the **Simons Laufer Mathematical Sciences Institute**. 2023
- **PwC Research Grant (300K)** for “*Robust and Fair AI Systems in Dynamic Environments*”.
With PI Z. Lipton and Co-PIs A. Risteski, and D. Childers 2022
- **Facebook Research Award (100K)** to build “*A Tool to Study the Efficacy of Fairness Algorithms on Specific Bias Types*”. With co-PIs S. Wu and H. Zhu 2021
- **NSF FAI grant (600K)** on “*Fair AI in Public Policy: Achieving Fair Societal Outcomes in ML Applications to Education, Criminal Justice, and Health and Human Services*”.
With co-PIs Chouldechova, Ghani, Lipton and Rodolfa. 2021
- **J. P. Morgan and Chase Individual Faculty Award (10K)** 2021
- **CMU CyLab grant (50K)** “*On the Impact of Algorithmic Fairness Metrics and Methods on Trust in Machine Learning Systems*”. 2021
- Winner of an **Exemplary Track Award** at The ACM Conference on Economics and Computation (EC) 2021
- Winner of a **Best Paper Award** at the ACM Conference on Fairness, Accountability, and Transparency (FAccT) 2021
- Selected to deliver a lecture through the *AAAI New Faculty Highlights Program* 2021
- Selected to participate in the *Rising Stars in EECS* workshop 2019
- *Travel Award*, Women in Machine Learning (WiML) workshop 2017
- *Travel Award*, Women in Theory (WiT) workshop 2016
- *Silver Medal* in the National Mathematical Olympiad, Iran 2006

ADVISING

CMU Students

- Nari Johnson, doctoral student at MLD. Summer 2023–present
- Rebecca Yu, doctoral student at MLD. Fall 2022–present
- Keegan Harris, doctoral student at MLD. Co-advised with S. Wu. Fall 2020–Fall 2022
- Michael Feffer, doctoral student at Societal Computing. Co-advised with Z. Lipton. Fall 2021–present
- Atishay Jain, master student at MLD. Fall 2022–Spring 2023
- Eric Liang, master student at MLD. Co-advised with R. Ghani. Spring 2022–Fall 2022
- Siqi Zeng, master student at MLD. Co-advised with F. Fang. Fall 2022–Spring 2023
- Qiqi Xu, master student at MLD. Co-advised with N. Shah. Fall 2021–Spring 2022
- Sameer Jain, master student at LTI. Spring–Fall 2021
- Anurag Katakhar, master student at LTI. Spring 2021
- Manish Nagireddy, bachelor student at SCS. Summer–Fall 2021

Graduate Thesis Committee

- Nil-Jana Akpınar, Doctoral student at MLD and Statistics, CMU.
- Emily Black, Doctoral student at CSD, CMU.
- Anthonia Carter, Doctoral student at Information Science, Cornell University.
- Violet Chen, Doctoral student at Tepper, CMU.
- Amanda Coston, Doctoral student at MLD and public policy, CMU.
- Leqi Liu, Doctoral student at MLD, CMU.
- Charvi Rastogi, Doctoral student at MLD, CMU.

TEACHING

Instructor, CMU

- Instructor, **Machine Learning, Ethics, and Society** (10-613/713) Fall'21, Spring'23
- Instructor, **Mathematical/Computational Foundations of ML** (10-606/7) Fall'22
- Co-instructor, **Probabilistic Graphical Models** (10-708) Spring'22

Instructor, ETH Zürich and CMU

- Designed and taught a new course on **Fairness, Explainability, and Accountability for Machine Learning** Spring 2019, Fall 2020

Guest Lecturer, CMU

- “*Fairness, Transparency, and Accountability in ML*” at 10-701. Spring'21, Spring'23
- “*Fairness, Transparency, and Accountability in ML*” at 10-315. Spring'22
- “*Formalizations of Fairness in ML*” at 17-200. Fall'21
- “*Societal Computing Practicum*” (17-994). Fall'20, Fall'21, Fall'22

Teaching Assistant, ETH Zürich

- *Introduction to Machine Learning* Prof. A. Krause Spring 2018
- *Probabilistic Artificial Intelligence*. Prof. A. Krause Fall 2017

SERVICE

Organizer

- Organizer of the CMU Workshop on “*Operationalizing the NIST AI Risk Management Framework*” Jul 2023
- Chair and organizer of the 2022 PI Meeting for the NSF Program on Fairness in AI in Collaboration with Amazon 2022
- Tutorial Co-chair for the ACM FAccT conference 2022
- NeurIPS Workshop on “*Learning and Decision-Making with Strategic Feedback*” 2022
- ICLR Workshop on “*Responsible AI*” 2021
- Workshop on “*Intersectionality in Fair Machine Learning: Where Are We and Where Should We Go from Here?*” 2020
At MOSAIC 2020: An Annual Conference on Intersectionality.
- NeurIPS Workshop on “*Human-centric Machine Learning*” 2019
- Tutorial on “*Economic Theories of Distributive Justice for Fair ML*” 2019
Presented at the 30th Web Conference
- Weekly reading group on the “*Societal Aspects of AI*”, ETHZ 2017, 2018

University Service

- Executive leadership of the *Responsible AI initiative* 2021-present
- Faculty hiring committee member for a joint SCS-Dietrich search. Fall'22-present
- *SCS council member* discussing school-wide topics with the dean, School of Computer Science at CMU 2021-present
- Admissions committee member for MLD 2020
- Admissions committee member for Societal Computing 2020, 2021, 2022

Senior Program Committee

- The Conference on Economics and Computation (EC) 2022
- ACM Conference on Fairness, Accountability, and Transparency (FAccT) 2022
- The AAI Conference on Artificial Intelligence (AAAI) 2022
- The Conference on Neural Information Processing Systems (NeurIPS) 2021
- The International Conference in Machine Learning (ICML) 2021

Program Committee

- ACM Conference on Fairness, Accountability, and Transparency (ACM FAT*) 2019-21
- The AAAI Conference on Human Computation and Crowdsourcing (HCOMP) 2019
- The International Conference in Machine Learning (ICML) 2016-2020
- The Conference on Economics and Computation (EC) 2015, 2018
- The Conference on Artificial Intelligence (AAAI) 2018, 2020

Ad Hoc Reviewer

- Serving on an *NSF Panel* to evaluate and discuss research grant proposals April 2021
- Journal of Machine Learning Research (JMLR)
- The Conference on Neural Information Processing Systems (NeurIPS)
- The Operations Research Journal (OR)
- Mathematics of Operations Research (MOR)
- The Network Science Journal
- Transactions on Economics and Computation (TEAC)
- Transactions on Signal Processing (TSP)
- Information Processing Letters (IPL)

External Reviewer

- Conference on Learning Theory (COLT)
- The Conference on Web and Internet Economics (WINE)
- The Symposium on Discrete Algorithms (SODA) (2013, 2017)
- The Symposium on Foundations of Computer Science (FOCS)
- The International Joint Conference on Artificial Intelligence (IJCAI)
- Conference on Decision and Control (CDC)

Outreach & Pipeline Building Activities

- Speaker at the Pittsburgh Women in Mathematics and Computing Symposium (WMCS) Feb 2023
- Team mentor, OurCS conference, CMU Oct 2022
- Group leader at the Undergraduate Research Mixer, SCS CMU 2021
- Member of the Wellness Network at MLD, SCS CMU 2020-2021
- Panelist at the MLD Admissions Workshop for prospective students, SCS CMU 2020
- Panelist at the Academic Job Market discussion, SCS CMU 2020
- Interviewee, Women@SCS Faculty Lunch Interview Series, SCS CMU 2020
- Scientific Body Representative at a *Faculty Recruiting Committee*. Mar 2019
Department of Computer Science, ETHZ
- Expert Feedback at *ETH Week: Manufacturing the Future*, ETHZ Sep 2017

PRESENTATIONS & DISCUSSIONS

- Invited speaker at the *Introduction to AI in Municipal Government* (A partnership of the National League of Cities and the AAAS Center for Scientific Evidence in Public Issues) Aug'23
- Invited panelist at AIES panel on *AI for society: Developing, Deploying, and Auditing Public-Facing AI* Aug'23
- Invited speaker at the *IDEAS Summer Program: "on human-AI collaboration"* Aug'23
- Invited discussant at the *the Cowles Foundation Annual Conference on Econometrics*, Yale University Jun 2023
- Invited panelist at TILOS (an NSF AI Institute) *Early Career Development Panel on AI Ethics* May 2023
- Invited keynote speaker at the *Responsible AI in the Natural Sciences* workshop hosted

- at CMU May 2023
- Invited participant at the *private discussion with Assistant Secretary of Commerce for Communications & Information & NTIA Administrator* on AI accountability Apr 2023
- Invited speaker at the *No Joke: we are talking about LLMs*, Pittsburgh Apr 2023
- Invited speaker at the *Women in Data Science, CMU*, Pittsburgh 2023
- Invited panelist at MIT's *Institute for Data, Systems, and Society (IDSS)* celebration, on Equity, justice, AI and automation Apr 2023
- Invited speaker at the *Human + AI Conference* at University of Chicago Oct 2022
- Invited panelist at the *64th National Association for Business Economics (NABE) Annual Meeting* Oct 2022
- Invited speaker at the *Workshop in AI+Economics*, ETH Zürich 2022
- Invited speaker at the *Workshop on Fairness and Machine Learning in Health*, Millan 2022
- Invited speaker at the *European Workshop on Algorithmic Fairness*, Zürich 2022
- Invited speaker at the *The Annual ACM SIGecom Winter Meeting* 2022
- Invited speaker at the *CROSSING Conference* organized by the German Science Foundation 2021
- Invited speaker at the *Trustworthy ML initiative* 2021
- Invited speaker at the *Humanising Machine Intelligence Research Seminar* organized by Prof. S. Lazar and Dr. C. Adamson at the Australian National University. 2021
- Invited panelist at the *“Roundtable on Data Privacy in Black Communities”* organized by the Joint Center for Political and Economic Studies 2021
- Invited speaker at the *“Foundations of Algorithmic Fairness”* workshop organized by ELLIS 2021
- Invited speaker at the *“Max Planck Symposium on Computing and Society”* organized by Max Planck Institute 2021
- Invited speaker at the *“Artificial Intelligence and Ethics”* conference organized by Duke-Kunshan University 2020
- Invited speaker at the workshop on *“Algorithmic Fairness through the Lens of Causality and Interpretability”*, co-located with NeurIPS 2020
- Invited discussant at the *“Philosophical Questions about AI, Law, & Governance”* 2018 Workshop organized by the *Faculty of Law, UZH* (Prof. Christoph Graber), and *Berkman Klein Center of Internet and Society, Harvard University*
- Invited discussant at the *“Governance of Decision-making Algorithms—How to Address Risks?”*. Expert Workshop organized by *Swiss Re* Jul 2018
- Invited discussant at the *“UZH Digital Forum: Can Algorithms be Fair?”* Dec 2018
The Digital Society Initiative & the Swiss Alliance for Data-Intensive Services
- Invited panel at the *“AI and Intellectual Property”* workshop Jun 2019
Organized by the *the Max Planck Institute for Innovation and Competition*
- Invited speaker at the *“Workshop on Ethical, Social and Governance Issues in AI”* 2018 co-located with NeurIPS

MEDIA
COVERAGE

- *“Our Region’s Business - Responsible AI Initiative”* by Bill Flanagan, WPXI Jun’23
- *“On Artificial Intelligence”* with Julie Mason at SiriusXM Feb’23
- *“Responsible AI: Heidari Applies Social Awareness to Developing Technologies”* by Susie Cribbs, The Link Aug’22
- *“Why CMU launched the Responsible AI initiative”* by Sophie Burkholder, Technical.ly Apr’22
- *“Responsible AI Initiative launches at Carnegie Mellon University following panel discussion”*

- including government, industry leaders” by Nate Doughty, PittsburghInno Apr’22
- “5 *Great Human-Centered AI Papers from 2018*” by Emma Brunskill, Medium 2018
 - “*Fair Algorithms*” in the ETH podcast series 2019