Efrén Cruz Cortés, PhD

Data Science Fellow

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Summary

I am currently a [Data Science fellow](#) at the [Michigan institute of Data Science](#) and the [Center for the Study of Complex Systems](#) at the University of Michigan. I work on machine learning research, focused on algorithmic fairness and ethical and responsible artificial intelligence. I design and analyze algorithms and sociotechnical interventions mostly in the financial lending and criminal justice systems. I work in a very interdisciplinary environment, collaborating with social scientists and in conversation with policy makers and community stakeholders. I got my PhD from the University of Michigan in Electrical Engineering. Subsequently I worked at a medical facility implementing machine learning for cancer classification and Parkinson's early onset detection, after which I decided to return to academia proper for a statistics fellowship at Penn State before returning to U of M.

Keywords: *ethical AI, algorithmic impact, complexity, causal inference, category theory, kernel methods, dynamical systems.*

Education and Experience

PhD Electrical Engineering	University of Michigan, Ann Arbor, MI	2017
Eberly Fellowship in Statistics	Penn State University	2019-2021
[DISI Summer Institute](#)	St Andrews, Scotland	Summers 2018 - 2020
Research Scientist	Anschutz Medical Campus	2017-2019
MS Electrical Engineering	University of Michigan, Ann Arbor, MI	2014
BS Mathematics / Electrical Eng.	Brigham Young University	2012

Relevant Publications

- **ECC**, S. Rajtmajer, D. Ghosh, Locality of Technical Objects and Structural Interventions, *FAccT* 2022.
- R. Barbe, JP Caron, **ECC**, et al., Working Through Political Organization, *Crisis and Critique*, Vol. 9 Iss. 2, 2022.
- **ECC** and S. Rajtmajer, Structural interventions on automated decision making systems, *AFCR NeurIPS* 2021.
- **ECC** and D. Ghosh, An invitation to system-wide algorithmic fairness, *AIES*, 2020.

Skills

Programming: Python, R, Matlab. **Frameworks**: Machine Learning, Agent Based Modeling, Complex Systems. **Mathematical**: Fair machine learning, kernel methods, dynamical systems, statistics, causal inference. **Work**: Leadership, Organization, Interdisciplinarity, Community Involvement. **Teaching**: Computational Statistics, Complex Systems. **Fun**: Modern Dance, Capoeira, Art collaborations.

Leadership and Networks

- Organizer - [Datatopia: The Future of Scientific Discovery Through a Data Lens](#).
- Organizer - [Building Ethical and Trustworthy AI](#).
- Mentoring - Six students for research on fair algorithmic design. Two got an award for the project.
- **Networks** - [Tierra Común](#); [Subset of Theoretical Practice](#), [Future Leaders Summit](#)

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Publications

Technology and Society

- R. Barbe, JP Caron, **E. Cruz Cortés**, et al., Working Through Political Organization, *Crisis and Critique*, Vol. 9 Iss. 2, 2022.

- **E. Cruz Cortés**, S. Rajtmajer, D. Ghosh, Locality of Technical Objects and the Role of Structural Interventions for Systemic Change, *FAccT* 2022.

- **E. Cruz Cortés** and S. Rajtmajer, Structural interventions on automated decision making systems, *Workshop on Algorithmic Fairness, Causality and Robustness at NeurIPS* 2021.

- **E. Cruz Cortés** and D. Ghosh, An invitation to system-wide algorithmic fairness, *Artificial Intelligence, Ethics, and Society*, 2020.

Other

- **E. Cruz Cortés**, K. Josey, F. Yang, D. Ghosh, An Empirical process framework for covariate balance in causal inference, *arxiv.org/abs/2301.00889*, 2023.

- **E. Cruz Cortés**, F. Yang, E. Juárez-Colunga, T. Warsavage, D. Ghosh, Comment on "Statistical Modeling: the Two Cultures" by Leo Breiman, *Journal of Observational Studies*, 2021.

- P. Rudra, **E. Cruz Cortés**, X. Zhang and D. Ghosh, Multiple testing approaches for hypothesis in integrative genomics, *Wiley Interdisciplinary Reviews Computational Statistics*, 2019.

- D. Ghosh and **E. Cruz Cortés**, A Note on Strict Functional Overlap in Causal Inference Problems with High-dimensional Covariates. *Journal of Causal Inference,* 2019.

- **E. Cruz Cortés** and C. Scott, Consistent Kernel Density Estimation with Non-Vanishing Bandwidth. *arxiv.org/abs/1705.08921*.

- C. Croft, **E. Cruz Cortés**, J. Harge and L. Tawil, "A Provocation Towards Moving", *QED: A Journal of GLBTQ Worldmaking - queer resistance*, vol.4, iss. 2, pg. 71, 2017.

- **E. Cruz Cortés** and C. Scott, Sparse Approximation of a Kernel Mean, *IEEE Transaction in Signal Processing* 65, pp. 1310-1323, 2017.

- **E. Cruz Cortés** and C. Scott, Scalable sparse approximation of a sample mean. *Proc. 2014 IEEE Int. Conf. on Acoustic, Speech and Signal Processing (ICASSP)*, pp. 5274-5278, 2014.

- B. L. Mellor, **E. Cruz Cortés**, S. Khadka, and B. A. Mazzeo. Increased bandwidth for dielectric spectroscopy of proteins through electrode surface preparation. *Review of Scientific Instruments* 83, 015110 (2012).

- B. L. Mellor, **E. Cruz Cortés**, D. D. Busath, and B. A. Mazzeo. Method for estimating the internal permittivity of proteins using dielectric spectroscopy. *Journal of Physical Chemistry B* 115, 2205 (2011).

Working Papers

Algorithmic Harms

- Epistemic transfer in data science.
- The cognitive and cultural basis of algorithm design, with Devaux, Masewari et al.
- "Noise" in machine learning - error or possibility? with Roy.

Other Projects

- Cultural evolution of music, with Han Veiga et al.
- "From Chemistry to History Via Kernel Embedding", with Aronowitz et al.
- "The Aesthetics of Balance", with deYoung and Zaferiou.

Teaching and Service

Networks

- [Tierra Común](#)
- [Subset of Theoretical Practice](#)

Teaching

- Complex Systems / Political Science 391 - Modeling Political Processes. University of Michigan, Winter 2023, Winter 2022.
- Complex Systems 270 - Agent Based Modeling. University of Michigan, Fall 2022.
- Statistics 440 - Computational Statistics. Pennsylvania State University, Spring 2021, Fall 2020.
- Electrical Engineering 564 - Estimation, Filtering and Detection (GS Instructor). Graduate Course at University of Michigan, Winter 2017.
- Electrical Engineering 545 - Machine Learning (GS Instructor). Graduate Course at University of Michigan, Fall 2015.

Supervised Students (* indicates I'm the main advisor)

- * Cerella Zhuang (B.S.) - Feminicides.
- * Glenn Brye (B.S.) - Ontology logs as scientific representations.
- * Alex Tecum-Ramos (B.S.) - Industry funding influence on AI research.
- * Jonathon Rosevelt (B.S.) - Detection of biases by AI students/experts.
- * Elija Weinberg (B.S.) - Detection of biases by AI students/experts.
- * Esha Maheswari (B.S.) - Mental Representations and mechanisms of assimilation.
- * AJ deVaux (B.S.) - Mental Representations.
- Qisen Cheng (M.S.) – Human Movement Stability.
- Mayank Garg (M.S.) – Human Movement Stability.
- Sharath Sridhar (M.S.) – Discriminative Kernels.
- Huang Jian (B.S.) – Fixed Bandwidth KDE.
- Kevin Ong (B.S.-M.S.) – Sparse Kernel Means.

Service

- Datatopia: The Future of Scientific Discovery Through a Data Lens, organizer, University of Michigan 2022
- Data Science for Public Good planning committee, University of Michigan 2021 - 2022
- MIDAS Hackathon, organizer, University of Michigan 2022
- HEART-STEAM, "(un)ethical history of science" working group, organizer, University of Colorado Anschutz Medical Campus - 2019
- Liaison for campus wide Machine Learning Reading Group, UC Anschutz - 2017-2019

- Committee for new Data Science Graduate Certificate, UC Anschutz - 2017-2018
- American Mathematical Society, reviewer - 2017
- IEEE Transactions on Information Theory, reviewer - 2017
- International Symposium on Biomedical Imaging, reviewer - 2015-2016

Talks and ongoing research

Ongoing Research Projects

- Datafication of social categories
- Cognitive and cultural basis of algorithmic design
- System-wide algorithmic fairness and policy interventions through a categorical perspective

Talks and Simile

- "Radical Cybernetics: The activist's guide to data science", NxtGEN Workshop, Online, 2022.
- "Systemic harms in automated societies", *Future Leaders Summit*, Ann Arbor, 2022.
- "Designing Fair Machine Learning: ditch the fair and ditch the machine learning", *Center for the Study of Complex Systems*, University of Michigan, 2021.
- "Systemic Deficiencies in Algorithmic Decision Making", *Data Studies*, Pennsylvania State University, 2020.
- "Sowing against Proprietary Systems", *Society for Literature, Science, and the Arts*, Irvine, California, 2019.
- "A Simulation Based Dynamical Evaluation Framework for System-wide Algorithmic Fairness", International Biometric Society ENAR, Philadelphia, Pennsylvania, 2019.
- "Algorithmic fairness - a systemic perspective", *Diverse Intelligences Summit,* University of St Andrews, 2019.
- "Emergent Choreographies", master class, University of Michigan Department of Dance, 2018. With P. Solórzano.
- "Automatic Diagnosis of Parkinson's Disease Using Deep Learning", UC Anschutz, 2018.
- "Variable Weight Kernel Estimators", Flatiron Institute, NYC, New York, 2017.
- "Machine Learning for the Perplexed", Complex Systems Advanced Academic Workshop, University of Michigan, 2016.
- "Ecodance Improvisations and Complex Systems", Invited workshop for International Dance and Movement Arts Forum Performática 2016. With P. Solórzano.
- "Fixed Bandwidth Kernel Density Estimators", Statistical Learning Theory Summer Workshop, University of Michigan, 2016.
- "Scalable Sparse Representation of Kernel Means", Michigan Symposium for Interdisciplinary Statistical Sciences, University of Michigan, 2015.

ART

Selected Art Exhibitions and Performances

- Prologues and Protocols for the Coven Intelligence Program, *International Symposium of Electronic Arts*, Paris, France, 2023.
- Insurgent Ecologies (Machine Chronicles I-III), *Pixelache-BURN*, Helsinki, Finland, 2021.
- Arising from the underground: cyphers and prophecies. *The Witch Institute*, Queen's University, 2021.
- One two three potions a secret word/ and soon you'll see a freer world, *AFTER LIFE (we survive)*, Yerba Buena Center for the Arts, San Francisco, California, 2020-2021.
- APRIORI, *Ars Electronica*, Linz, Austria, 2019.
- Field Studies for Haunting Properties, *Queer Paranormal*, Bennington, Vermont, 2019.
- The Imprudent Cartography of Thought, by Paty Solórzano. Triskelion Arts (New York City), 2017. Detroit Dance City Festival and International Dance Forum Performática (México), 2016
- Frontera Blues, by Paty Solórzano. Detroit Sidewalk Festival, 2016.
- Goodbye to Wayward Flesh, by Amy Chavasse. Momentum, Power Center for the Arts, 2015.
- Space, by Anthony Alterio. Duderstadt Center, 2015.
- There are no People Here, by Jennifer Harge. Detroit Sidewalk Festival, 2015.
- Memory Loser, by Anna Martine Whitehead. Meanings and Makings of Queer Dance, 2015.
- Unending, with A. Yang, S. Hoskins, P. Solórzano and Steelworks, The Yellow Barn, 2015.

Current Art Projects

- Coven Intelligence Program: On rhizomes, witches, and machines - with Haughwout.
- Mirror Sky: networks, identity, and Mayan astronomy - with Navarrete and Solórzano.
- Imprudent Cartography of Thought: Borders, cognition and dance - with Solórzano.