IRINA CRISTALI

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EDUCATION

University of Chicago, IL

PhD in Statistics *September 2019 - June 2024 (Expected)*

- Research interests: causal inference, network embedding methods, representation learning, differential privacy. Advisor: Prof. Victor Veitch.
- The University of Chicago Neubauer Family Distinguished Doctoral Fellowship.

M.S. in Statistics *September 2019 - June 2021*

Duke University, Durham, NC

B.S. in Mathematics & B.S. in Statistical Science *August 2015 - May 2019*

- Graduation with Distinction in Mathematics. Honors thesis: *Poisson Percolation on the Squared Lattice*. Advisor: Prof. Richard Durrett.
- Mathematics Department Excellence in Research Award.

PUBLICATIONS / PREPRINTS

1. **Cristali, I.**, Veitch, V. Using embeddings for causal estimation of peer influence in social networks (2022). *Accepted at NeurIPS 2022*. ArXiv.

2. Wu, X., Wang, L., **Cristali, I.**, Gu, Q., Willett, R. Adaptive differentially private empirical risk minimization (2021). ArXiv.

3. **Cristali, I.**, Jiang, Y., Junge, M., Kassem, R., Sivakoff, D., York, G. Two-type annihilating systems on the complete and star graph. *Stochastic Processes and their Applications*, **139**, 321-342 (2021). ArXiv.

4. **Cristali, I.**, Junge, M., Durrett, R. Poisson percolation on the oriented square lattice. *Stochastic Processes and their Applications*, **130**, 488-502 (2020). ArXiv.

5. **Cristali, I.**, Junge, M., Durrett, R. Poisson percolation on the square lattice. *ALEA Latin American Journal of Probability and Mathematical Statistics*, **16**, 429-437 (2019). ArXiv.

6. **Cristali, I.**, Ranjan, V., Steinberg, J., Beckman, E., Durrett, R., Junge, M., Nolen, J. Block size in Geometric(p)-biased permutations. *Electronic Communications in Probability*, **23**, Paper 80 (2018). ArXiv.

AWARDS & HONORS

The University of Chicago Neubauer Distinguished Doctoral Fellowship	2019
Duke University Excellence in Research Award	2019
Duke University Julia Dale Senior Prize in Mathematics	2019
Duke University Faculty Scholar Award Nomination	2019
Julia Dale Freshman Prize in Mathematics (Honorable Mention)	2016
Duke University Karsh International Scholar (Full merit-based scholarship)	2015–2019
Bronze & Silver Medal, The Romanian Mathematics Olympiad	2015 & 2012
Bronze Medal in Math, Tuymaada XIX International Multidisciplinary Olympiad	2012
Bronze Medal, The Italian Mathematics Olympiad	2012

SELECTED RESEARCH PROJECTS

Estimating Peer Influence on Networks March 2021 - Present
Research Assistant, UChicago, Advisor: Prof. Victor Veitch *Chicago, IL*

- Developed a method of using network embeddings to perform estimation and inference of peer contagion effects over a social network, given unobserved confounders. This has historically represented a challenging problem since contagion is generally confounded with homophily, the tendency of connected units to share common (latent) traits.
- Implemented the method in TensorFlow 2.0 and showed its performance on real social network data exhibits significant improvement over baselines.
- Project resulted in a manuscript accepted at NeurIPS 2022.
- **Skills:** causal inference, deep learning, empirical risk minimization on relational data, semi-supervised node embedding algorithms, TensorFlow.

Adaptive Differentially Private Optimization February 2021 - June 2021
Research Assistant, UChicago, Advisor: Prof. Rebecca Willett *Chicago, IL*

- Investigated a new stochastic gradient descent method for performing empirical risk minimization, while preserving the users' data privacy. Contributed to theoretically proving that the proposed method's privacy and convergence guarantees are better than those of standard differential methods, such as the differentially-private stochastic gradient descent (DP-SGD) algorithm.
- **Skills:** optimization, differential privacy, deep learning, PyTorch, numerically quantifying the level of differential privacy via the moments accountant method.

Poisson Percolation and Random Graphs August 2017 - May 2019
Research Independent Study, Duke U, Advisor: Prof. Richard Durrett *Durham, NC*

- Studied non-oriented and oriented inhomogeneous percolation on the 2D lattice, where open edges are sampled according to a Poisson process. Obtained new results on the asymptotic shape of the open cluster around the origin and on the density of open sites.
- Project resulted in two published papers.
- **Skills:** probability theory research, random graphs, asymptotic analysis of stochastic processes.

Random Fragmentation Processes May 2017 - August 2017
Math REU, Duke U, Advisor: Prof. Richard Durrett, Prof. Matthew Junge, Prof. James Nolen Durham, NC

- Studied a random process on the positive integers line, where each point is sampled with a geometric probability. Proved asymptotics on the size of the first continuous sequence of integers starting from 1 and on the time elapsed until such a sequence is obtained. Project resulted in a published paper.
- **Skills:** probability theory research, interacting particle systems, asymptotic analysis of stochastic processes.

TALKS & POSTER PRESENTATIONS

- *Using Embeddings for Causal Estimation of Peer Influence in Social Networks.* Presented a poster at the American Causal Inference Conference, Berkeley, CA, 2022.
- *Using Embeddings to Estimate Peer Influence on Social Networks.* Presented a poster at the NeurIPS 2021 workshop titled "Causal Inference & Machine Learning: Why now?" (Virtual).
- *Using Embeddings for Estimating Causal Effects over Social Networks.* Gave a contributed *"Speed"* talk at JSM 2021, Section on Nonparametric Statistics (Virtual).
- *Feedback Analysis in the Kidney.* Presented a poster at the Society for Mathematical Biology Annual Meeting, Salt Lake City, Utah, 2017.

- *A Mathematical Model of Blood Flow Control in the Kidney.* Presented a poster at the Society for Industrial and Applied Mathematics Conference, Boston, MA, 2016.

TEACHING EXPERIENCE

Teaching Assistant January 2020 - March 2022
Statistical Theory and Methods, Causal Inference and Machine Learning, UChicago *Chicago, IL*

· Held problem sessions, graded homework and exams, answered questions, composed homework and exam problems, prepared homework and final exam solutions.

Teaching Assistant August 2017 - May 2019
Real Analysis, Probability, Abstract Algebra, Duke U *Durham, NC*

· Held problem sessions, graded homework, answered questions.

Tutor January 2016 - May 2017
Multivariable Calculus & Linear Algebra, Duke Math Help Room *Durham, NC*

· Explained key concepts and problem-solving techniques.

SERVICE / OUTREACH / MENTORING

Summer Lab Coordinator and Mentor, Data Science Institute Summer 2022
The University of Chicago *Chicago, IL*

· As part of the "Data Science Institute Summer Lab" program, I mentored teams of masters, undergraduate, and high school students, by holding hands-on lab sessions aimed at teaching data science skills (Python, Git & Github and Unix), providing guidance on their research projects, and answering code-related questions.

Statistics Department Representative, Graduate Recruitment Initiative 2020-2021
The University of Chicago *Chicago, IL*

· As part of the "Graduate Recruitment Initiative Team" (GRIT), a student organization which seeks to enhance diversity, inclusion, and equity across UChicago STEM graduate programs, I discussed with prospective graduate students about the Statistics program, answered their questions, and encouraged them to apply / attend.

Mathematics Mentor for Women 2016-2019
Duke University *Durham, NC*

· Advised younger women interested in mathematics on selecting a rigorous course of study, undergraduate research opportunities, participating in competitions, and establishing career goals.

Mentor 2016-2018
Duke University Summer Workshop in Mathematics (SWiM) *Durham, NC*

· Mentored rising-senior high school girls interested in pursuing a mathematics major in college.

SKILLS

Programming: Experienced in Python (numpy, pandas, scikit-learn, Tensorflow 2.0/Keras), R (data wrangling & visualization, modeling, interactive web application development in R Shiny), Matlab, LaTex; familiar with Git/GitHub, Bash.
Languages: English (full proficiency), French (intermediate), Romanian (native).