

IRINA CRISTALI

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EDUCATION

University of Chicago, IL

PhD in Statistics

September 2019 - June 2024 (*Expected*)

- Research interests: causal inference on social networks, random graphs, theoretical foundations of machine 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

1. **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).
2. **Cristali, I.**, Junge, M., Durrett, R. Poisson percolation on the oriented square lattice. *Stochastic Processes and their Applications*, **130**, 488-502 (2020).
3. **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).
4. **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).

WORKING PAPERS

5. **Cristali, I.**, Veitch, V. Using Embeddings to Estimate Peer Influence on Social Networks.

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	2015-2019
Bronze & Silver Medal, The Romanian Mathematics Olympiad	2015 & 2012
Bronze Medal in Math, Tuymaada XIX Intl. Multidisc. Olympiad	2012
Bronze Medal, The Italian Mathematics Olympiad	2012

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, namely the causal influence that units of the network have on other units, 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.
- Currently implementing the method in TensorFlow 2.0 in order to illustrate its performance on real social network data.
- **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. Project resulted in a manuscript currently under review.
- **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 Estimating Causal Effects over Social Networks.* Gave a contributed "Speed" talk at JSM 2021, Section on Nonparametric Statistics.
- *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 - Present

Statistical Theory and Methods, Causal Inference and Machine Learning, UChicago *Chicago, IL*

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

Teaching Assistant*Real Analysis, Probability, Abstract Algebra, Duke U*

August 2017 - May 2019

Durham, NC

- Held problem sessions, graded homework, answered questions.

Tutor*Multivariable Calculus & Linear Algebra, Duke Math Help Room*

January 2016 - May 2017

Durham, NC

- Explained key concepts and problem-solving techniques.

SERVICE / OUTREACH / MENTORING

Statistics Dept. Representative, Graduate Recruitment Initiative*The University of Chicago*

2020-Present

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, addressed some of their concerns, answered their questions, and encouraged them to apply/attend.

Mathematics Mentor for Women*Duke University*

2016-2019

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*Duke University Summer Workshop in Mathematics*

2016-2018

Durham, NC

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

Volunteer*"Duke Math Meet" High School Contest*

2015-2016

Durham, NC

- Proposed contest problems, graded contest papers for the individual and the relay rounds, proctored the team round.

SKILLS

Programming: Experienced in Python (numpy, pandas, scikit-learn, Tensorflow 2.0/Keras), R (data wrangling & visualization, modeling, interactive web app. development in R Shiny), Matlab, LaTeX; familiar with Git/GitHub, Bash; beginner in SQL.

Languages: English (full proficiency), French (intermediate), Romanian (native).