# Nicholas Di

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## RESEARCH INTERESTS

Numerical Optimization • Machine Learning Theory • Uncertainty Quantification • Causal Inference

## EDUCATION

**Rice University** **Houston, TX, USA**
*PhD Statistics GPA: 3.95* *Aug 2023 - May 2028 (Expected)*

**Macalester College** **Saint Paul, MN, USA**
*BA Economics (Honors), BA Applied Mathematics/Statistics GPA: 3.96* *Aug 2018 - Dec 2022*

## PUBLICATIONS

- **Di N**, Chi E, Wu Fung S. (2025). A Monte Carlo Approach for Nonsmooth Convex Optimization via Proximal Splitting Algorithms. *Submitted*
- Artman C, **Di N**. (2025). IFlowNets: Extending Generative Samplers to Learn Strategies in Incomplete Information Games. *Submitted*
- Shaw C, Williams C, Tan T, Illera, D, **Di N**, Shulman J, Belmont J. (2025). The Causal Pivot: A Structural Approach to Genetic Heterogeneity and Variant Discovery in Complex Diseases. *The American Journal of Human Genetics*
- **Di N.** (2023). Gendered Labor Market Outcomes During COVID-19: Evidence from Early Withdrawal of Federal Pandemic Unemployment Compensation. *The Developing Economist*.**(Won Best Undergraduate Paper Award)**
  Paper Link News Link

## RESEARCH EXPERIENCE

### AI Applications in Game Theory

*Advised by Dr. Conor Artman and Dr. Scott Perkins (Lawrence Livermore National Lab)* *May 2025 - Aug 2025*

- Extended Generative Flow Networks (GFlowNets) to handle incomplete information games, implementing novel applications for strategy learning in stochastic environments like Kuhn Poker
- Designed and executed large-scale experimental batches using SLURM workload manager on high-performance computing clusters, optimizing computational efficiency
- Developed theoretical framework connecting generative sampling methodologies with established results in counterfactual regret minimization, bridging probability theory and game theory

### Stochastic Methods for Non-Smooth Optimization

*Advised by Dr. Eric Chi (Rice University)* *Sep 2024 - Current*

- Developed Monte Carlo proximal gradient algorithms for non-smooth convex optimization problems with intractable proximal operators, enabling efficient computation through inexact/stochastic approximations
- Established convergence guarantees for stochastic proximal splitting methods under various noise models, proving O(1/k) convergence rates for the ergodic iterate in non-smooth settings
- Applied methodology to large-scale statistical learning problems including LASSO, elastic net, and fused LASSO, demonstrating computational advantages over exact methods while maintaining solution quality

### PRS-RV Causal Pivot: A Segmentation Approach to Complex Disease Genetics

*Advised by Dr. Chad Shaw (Baylor College of Medicine)* *May 2024 - Aug 2024*

- Developed a structural equation model categorizing diseases into four types using Polygenic Risk Scores (PRS) and rare variants (RV), showing that RV-PRS exclusion can aid in disease discovery
- Tested the model on UK Biobank data for hypercholesterolemia, breast cancer, and Alzheimer's disease, finding significant negative correlation between RV and PRS in affected individuals

### Gendered Labor Market Outcomes During COVID-19

*Advised by Dr. Amy Damon (Macalester College)* *Jun 2022 - Aug 2022*

- Conducted independent research on the gender-specific effects of the cessation of Federal Pandemic Unemployment Compensation during the COVID-19 pandemic
- Collected and analyzed data from the U.S. Census Bureau; collaborated with a Federal Reserve researcher to gain deeper insights and validate findings

### Causal Inference

*Advised by Dr. Leslie Myint (Macalester College)* *May 2019 - Aug 2019*

- Developed a causal diagram using R and Tetrad's search algorithms, gaining experience in applying causal inference techniques to enhance the reliability of biological research findings
- Conducted a meta-research study of cancer biological research using PLoS and Semantic MEDLINE abstract outputs

## INDUSTRY EXPERIENCE

**Analyst**
*Ernst and Young, Quantitative Economics and Statistics, Washington D.C, USA* *Jan 2023 - June 2023*
- Collaborated with major environmental ESG (Environmental, Social, and Governance) consulting firms to evaluate, optimize, and elevate ESG scores for numerous corporate clients
- Performed econometric and statistical, predictive forecasting, and fiscal impact modeling for business and government clients on a broad range of topics including relocation decisions, federal and state policy, tax, and vaccine distributions

**Research Assistant Intern**
*Brattle Group, Boston, USA* *Jun 2022 - Aug 2022*
- Supported leading academics in applying sophisticated econometric and statistical models to legal, regulatory, and policy issues
- Utilized mathematical software to model and solve linear, nonlinear and mixed-integer optimization problems related to electricity demand

**Analyst Intern**
*Ernst and Young, Quantitative Economics and Statistics, Washington D.C, USA* *Jun 2021 - Aug 2021*
- Developed and maintained comprehensive databases on Medicare cases and compliance with healthcare standards and regulations
- Worked on various projects related to economic policy analysis, impact analysis, survey design, and statistical sampling and analysis

**Business Development Manager**
*NutriKarma, New York NY, USA* *Aug 2020 - May 2021*
- Expanded the NutriKarma team by 11 employees and worked in project management, specifically with app-wire flow, data sets, and marketing
- Led meetings with potential angel investors, securing interest and building strategic partnerships with business leaders, dietitians, and personal trainers to advance market presence

**Business Analyst Intern**
*U.S. Bank, Minneapolis MN, USA* *Jun 2020 - Aug 2020*
- Facilitated projects regarding classification of product types for document custody services and preformed in-depth data and business analysis for automation of loan certification process

**Business Data Analyst**
*Minnesota Association of Volunteer Administration, Minneapolis MN, USA* *Oct 2018 - May 2019*
- Wrote R-scripts to compute regression models regarding membership recruitment data for over 500 clients
- Developed outreach plans regarding local organizations and sponsorship, and updated internal resources for manager to keep information and schedules up to date

## AWARDS

- **AAAS Annual Conference Statistics Travel Award** in AAAS - 2024
- **Dean's Prize** in Rice University - 2023-2025
- **3M Scholar Award** in Macalester College Economics Department - 2022
- **Best Undergraduate Paper Award** in Midwest Economics Association Conference - 2022
- **Summa Cum Laude** in Macalester College - 2022
- **Phi Beta Kappa** in Macalester College - 2022
- **Deans List All Semesters** in Macalester College - 2018 - 2022

## TEACHING ACTIVITIES

- **Rice University**
- Teaching Assistant, STAT 413: Statistical Machine Learning
- Teaching Assistant, STAT 425: Introduction to Bayesian Inference
- Teaching Assistant, STAT 405/605: Data Science in R
- **Macalester College**
- Teaching Assistant, COMP 123: Introduction to Computer Science
- Teaching Assistant, STAT 155: Introduction to Statistical Modeling
- Teaching Assistant, ECON 194: Calculus Based Principles of Economics
- Teaching Assistant, STAT 253: Statistical Machine Learning
- Supplemental Instructor, ECON 381: Econometrics

## PRESENTATIONS

- **IFlowNets: Extending Generative Samplers to Learn Strategies in Incomplete Information Games** SIAM TX-LA - 2025
- **The Polygenic Score Rare Variant Causal Pivot** American Society of Human Genetics - 2024
- **American Statistical Association Panel** American Association for the Advancement of Science - 2024
- **Spatial Analysis of Lead Levels in Twin Cities Metro Area** Capstone Seminar in Macalester College - 2022
- **Economics Independent Research** Midwest Economics Association - 2022
- **Causal Inference Research** Jr. Faculty-Hub Summer Research Fund Meeting, Macalester College - 2019

## UNIVERSITY SERVICES

- **Statistics Student Seminar Organizer** Rice University - 2024
- **STAT 450 Project Judge** Rice University - 2022
- **Graduate Student Representative** Rice University - 2023