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**, Perkins S. (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 convergence 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