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Personal Information

Date of Birth: June 7th, 1990
Citizenship: South Korea

Undergraduate Studies:

B.A., Economics, Sogang University, Highest Distinction, 2014

Masters Level Work:

M.A., Economics, University of Pennsylvania, Highest Distinction, 2017

Graduate Studies:

University of Pennsylvania, 2016 to present.

Thesis Title: "Essays in Mechanism and Information Design"

Expected Completion Date: May 2022

Thesis Committee and References:

Rakesh V. Vohra (Advisor)
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Research Fields:

Microeconomic Theory, Mechanism and Information Design, Industrial Organization, Discrimination

Teaching Experience:

Teaching Assistant (TA) at University of Pennsylvania:

- Fall, 2021 *Introduction to Economics (Undergraduate)*, TA for Professor Anne Duchene
- Spring, 2019 *Game Theory and Applications (Graduate)*, TA for Professor Yuichi Yamamoto
- Fall, 2018 *Micro Economic Theory II (Graduate)*, TA for Professor Yuichi Yamamoto
- Spring, 2018 *Game Theory and Applications (Graduate)*, TA for Professor Yuichi Yamamoto
- Fall, 2017 *Micro Economic Theory II (Graduate)*, TA for Professor George Mailath

Teaching Assistant (TA) at Professional Graduate Schools, Sogang University

- 2014-2015 *Various Courses (Graduate)*, Head TA for Professor Hahn Shik Lee

Research Experience and Other Employment:

Research Assistant (RA) at University of Pennsylvania:

- 2019 RA for Professor Annie Liang
- 2019 RA for Professors Rakesh Vohra and Aaron Roth
- 2018 RA for Professors Ashley Swanson and Matthew Grennan
- 2018 RA for Professor George Mailath

Research Assistant (RA) at Sogang University:

- 2014-2015 RA for Professor Jungmin Lee

Professional Activities:

- Presentations NBER Decentralization: Mechanism Design for Vulnerable Populations (2021), ACM Conference on Economics and Computation (2020), Pennsylvania Economic Theory Conference (Poster, 2019), Economics Joint Conference of Korea (2016)

Honors, Scholarships, and Fellowships:

- 2021 Summers-Weintraub Fellowship in Economics for Outstanding Theory, Macroeconomics or International Economics Student, University of Pennsylvania
- 2020 Sidney Weintraub Memorial Fellowship in Economics for Outstanding Theory Student, University of Pennsylvania
- 2019 Excellence for Third Year Paper, University of Pennsylvania
- 2017 Lawrence Robbins Prize for Best First Year Student, University of Pennsylvania
- 2016-2021 Fellowship, University of Pennsylvania
- 2014 Summa Cum Laude (ranked first among graduates), Sogang University
- 2013-2014 Kwanjeong Foundation Scholarship, Kwanjeong Foundation

Papers in Refereed Conference Proceedings:

“*Fair Prediction with Endogenous Behavior*” (with Christopher Jung, Sampath Kannan, Mallesh Pai, Aaron Roth and Rakesh Vohra) EC 2020 (computer science conference with acceptance rate 27%)

There is increasing regulatory interest in whether machine learning algorithms deployed in consequential domains (e.g. in criminal justice) treat different demographic groups “fairly.” However, there are several proposed notions of fairness, typically mutually incompatible. Using criminal justice as an example, we study a model in which society chooses an incarceration rule. Agents of different demographic groups differ in their outside options (e.g. opportunity for legal employment) and decide whether to commit crimes. We show that equalizing type I and type II errors across groups is consistent with the goal of minimizing the overall crime rate; other popular notions of fairness are not.

“*Moment Multicalibration for Uncertainty Estimation*” (with Christopher Jung, Mallesh Pai, Aaron Roth, Rakesh Vohra) COLT 2021 (computer science conference with acceptance rate 30%)

We show how to achieve the notion of “multicalibration” from Hébert-Johnson et al. (2018) not just for means, but also for variances and other higher moments. Informally, it means that we can find regression functions which, given a data point, can make point predictions not just for the expectation of its label, but for higher moments of its label distribution as well—and those predictions match the true

distribution quantities when averaged not just over the population as a whole, but also when averaged over an enormous number of finely defined subgroups. It yields a principled way to estimate the uncertainty of predictions on many different subgroups-and to diagnose potential sources of unfairness in the predictive power of features across subgroups. As an application, we show that our moment estimates can be used to derive marginal prediction intervals that are simultaneously valid as averaged overall of the (sufficiently large) subgroups for which moment multicalibration has been obtained.

Research Papers:

“Optimal Recommender System Design” (Job Market Paper)

Intermediaries like Amazon and Google recommend products and services to consumers for which the intermediaries receive compensation from the recommended sellers. Nevertheless, consumers will find these recommendations useful if they are informative about the quality of the match between the sellers' offerings and consumers' needs. The intermediary would like the consumer to purchase the product from the seller who pays the most for a recommendation but is constrained because consumers will not follow the recommendation unless it is in their interest to do so. I frame the intermediary's problem as a mechanism design problem in which the mechanism designer cannot directly choose the outcome, but must encourage the consumer to choose the desired outcome. I show that in the optimal mechanism, the recommended seller has the largest non-negative virtual willingness to pay adjusted for the cost of persuasion. The optimal mechanism can be implemented via a handicap auction.

I use this model to examine the regulatory question of whether platforms should be allowed to use data reflecting sellers' private information, such as margins and bidding history. The use of data always benefits the intermediary, but can either benefit or harm the consumers and sellers. A special class of data is interpreted as the intermediary monopolizing a product market with private label products, and this is shown to benefit the consumer. I also examine a welfare-maximizing mechanism: relative to the revenue-maximizing mechanism, it reduces the intermediary's revenue but increases the consumer surplus and sellers' profits. An alternative interpretation of the model as a search engine is discussed.

“Outcome Test for Policies” (with Mallesh Pai and Rakesh Vohra)

The marginal outcomes test (Becker (1993)) has become one of the most popular test of taste-based discrimination in classification or allocation settings. We consider settings with two key properties: (1) the underlying attribute of the agent being classified is strategically chosen by the agent, and (2) the principal commits to a policy, taking the agent's strategic behavior into account. In this setting we show the outcome test is misspecified: the optimal rule will result in different marginal outcomes across demographics, even in the absence of any discriminatory motive for the principal. We derive a correctly specified test in such a setting. The test statistic requires estimation of both marginal and average outcomes---the latter portion captures the effect on agents' incentives. Under additional assumptions we identify the direction of misspecification for the classical marginal outcomes test.

Research Papers in Progress:

“Regulating Lobbyists” (with Rakesh Vohra)

“Fair Algorithms in the Hands of Unfair Humans: How a Fair Algorithm Can Make the Outcomes More Unfair”

Language: South Korean (native), English (fluent)

Computer Skills: MATLAB, STATA, R, Mathematica