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Personal Information
Date of Birth: June 7th, 1990
Citizenship: South Korea
Language: South Korean (native), English (fluent)

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:

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Research Fields:

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

Teaching Experience:

Fall, 2021	*Introduction to Economics (Undergraduate)*, University of Pennsylvania, Teaching Assistant for Professor Anne Duchene
Spring, 2019	*Game Theory and Applications (Graduate)*, University of Pennsylvania, Teaching Assistant for Professor Yuichi Yamamoto
Fall, 2018	*Micro Economic Theory II (Graduate)*, University of Pennsylvania, Teaching Assistant for Professor Yuichi Yamamoto
Spring, 2018	*Game Theory and Applications (Graduate)*, University of Pennsylvania, Teaching Assistant for Professor Yuichi Yamamoto
Fall, 2017	*Micro Economic Theory II (Graduate)*, University of Pennsylvania, Teaching Assistant for Professor George Mailath
Spring, 2015	*Various Courses for Professional Graduate Schools (Graduate)*, Sogang University, Head Teaching Assistant for Professor Hahn Shik Lee

Research Experience and Other Employment:

2019	University of Pennsylvania, Research Assistant for Professor Annie Liang
2019	University of Pennsylvania, Research Assistant for Professors Rakesh Vohra and Aaron Roth
2018	University of Pennsylvania, Research Assistant for Professors Ashley Swanson and Matthew Grennan
2018	University of Pennsylvania, Research Assistant for Professor George Mailath
2014-2015	Sogang University, Research Assistant 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**)

An intermediary knows a consumer's preference over options, but the consumer and sellers do not. The intermediary recommends options to the consumer, but collects payments from sellers in exchange for recommending their products. I study the intermediary's problem of maximizing its revenue raised from sellers while persuading the consumer to follow recommendations. The optimal recommendations rule is characterized by recommending the seller with the largest non-negative virtual willingness to pay adjusted for the *cost of persuasion*. The optimal recommender system can be implemented via a handicap auction.

Using this characterization, I explore economically relevant implications. Allowing the intermediary to use additional information about sellers' private information always benefits the intermediary, but can both benefit and harm the consumer and sellers. Sufficient conditions for the consumer and sellers to benefit or get harmed from additional information are provided. Welfare-maximizing recommender system redistributes the intermediary's revenue to consumer surplus and sellers' profits. An alternative interpretation of the model as search engine is discussed.

"*Outcome Test for Policies*" (with Mallesh Pai and Rakesh Vohra)

The marginal outcomes test (Becker (2010)) has become a 'go-to test' of (un-)fairness/ disparate impact 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 adjudicator/ institution commits to a rule/policy, taking into account strategizing by the agent. 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 Unfairer*"

Computer Skills: MATLAB, STATA, R, Mathematica