

Education

Bachelor of Science

University of Illinois at Urbana-Champaign

2020–2023 (expected)

- Triple-Major: *Mathematics, Statistics, Economics*; Minor: *Computational Science & Engineering*
- GPA – 3.97/4.00; Dean's list for all semesters; Phi Beta Kappa
- Spring 2021: *Visiting Research Student at HKUST Business School (Advisor: Song Lin)*

Undergraduate coursework

Zhejiang University

2018–2020

- Experimental Class of Social Science (Major Economics)
- Spring 2020: *GEM Trailblazer Exchange Student at Nanyang Technological University*

Research Projects

Writing Sample

Privacy-protected Online Advertising: Information Design in Auctions with Flexible Information Acquisition

Solo-authored working paper, submitted as my writing sample

Ongoing

- Keywords: *Game Theory, Rational Inattention, Bayesian Persuasion*
- Supervised by Prof. Yunchuan (Frank) Liu (UIUC) and Prof. Song Lin (HKUST)
- Presented at *ISMS Marketing Science Conference 2022*
- **Abstract:** In auctions, bidders learn information about products in two ways: provided by the seller and acquired by themselves. We consider a model where bidders' information about a product is obtained in both ways. We build a second-price auction model that sells one online advertising slot with one platform (seller) and two bidders. We set the platform lacks precise information about advertising slots because of the trend of banning third-party cookies, which prevents the platform from using users' data to help bidders target customers. The platform conveys information about the slot by setting keywords. Besides receiving information from the platform, bidders can acquire extra information by themselves in a rational inattention framework. We find that keywords with low and high matching probability information discourage bidders from participating in auctions. As a result, platforms mix low-value and high-value slots up to the keywords with critical matching probability for bidders that can incur both bidders to participate. This value of the critical matching probability is independent of the value distribution of slots. However, it decreases as the per-unit information cost increases. The platform may increase bidders' information costs when the expected product value is low and decrease them when the expected product value is high. We find that bidders' information acquisition behavior may have a positive externality on other bidders, which may lead bidders who spend more to obtain information finally receive fewer profits. In the extension, we examine the importance of first-party data in the world without third-party cookies by discussing the scenarios in that one bidder has extra free information. Contrary to popular belief that additional private information is beneficial, we find that free additional information may harm both the owner and its competitors.

Other Projects:

Predicting Long-run Coupons Effects with Customer Learning

An attempt to combine analytical modeling with deep learning

Ongoing

- Keywords: *Deep Learning, Bayesian Inference, Hidden Markov Model*
- According to the literature on marketing and economics, coupons, in addition to promoting sales in the short run, can also affect the future consumption of customers. It is, therefore, essential to consider more than the one-stage effect of coupons when considering firms' optimal promotion strategies. Unlike Gabel and Timoshenko's model (2022) which predicts purchase probabilities with coupons in one stage, I intend to develop a model that predicts the long-run effects of coupons in my deep-learning project. Unfortunately, there is a problem in that coupons may have relatively weak long-run effects, and the traditional deep-learning model may find it challenging to learn them directly. To help my deep-learning model learn the long-run effects, I introduce the mechanism of customer learning. In this mechanism, coupons can be used to attract some consumers who fit a product but haven't purchased it due to the lack of information. These consumers can be attracted by the low price with coupons of the product and realize the information of the product's high value for them. The first step in my deep-learning process is to estimate consumers' prior knowledge based on historical data, followed by adding the estimated prior knowledge to the input layer of the model. This deep-learning model combined with economic structure is more interpretable and can give better instructions to firms' promotion policies.

Advertising Coupon

The project completed during the semester I visited HKUST

2021

- Keywords: *Game Theory, Analytical Modeling*
- Supervised by Prof. *Song Lin* (HKUST)
- Abstract:** We create a new promotional model that combines coupons and advertising. Customers can help the company by advertising in exchange for coupons for products. We compare this program with discounts. If the profit on the product is low, the program is profitable compared to a discount because free advertising is preferable to the profit generated by selling the product. Suppose the profit from the sale of the product is relatively high, and the consumer's estimate of the value of the product is very high. In that case, the company will use this option in order to profit from free advertising to consumers. When the profits from the product's sale are relatively high, and the product's value to the consumer is moderate, the company will use discounts to avoid the loss of consumers as a result of using the new promotional program.

Should Firms Pay for Useless Referrals?

The project in algorithmic game theory PhD seminar

2021 Spring

- Keywords: *Game Theory*
- Abstract:** Many firms provide referral programs for consumers, which allows consumers to get rewards by referring new customers. Firms pay for successful referrals that lead to new customers. This project discusses another kind of program, and I call it the same return program. The program rewards customers according to the number of friends they refer. In the program, a firm pays for all referrals, no matter whether it generates new customers. The project proves that if the product is hard for consumers to infer others' valuations towards it, the same return program is better than the referral programs because the same return program could eliminate the game in the referral programs and remains the best equilibrium for firms and consumers.

Research Assistant.....

Illinois Risk Lab, Department of Mathematics, UIUC

Research Associate

2020 Fall

- Topic: Financial Mathematics, Stochastic Optimization
- Research associate in the program of *AI-Powered Life-cycle Financial Planning* lead by Prof. *Zhiyu (Frank) Quan* and Prof. *Runhuan Feng*.
- This project aims to build algorithms that optimize decision making process for meeting important financial goals in life. I played a pivotal role in the group that working on develop life cycle strategy in asset management.
- 1. Built a Stochastic Linear Programming model independently to optimize the expected utility under uncertainties (factors including death rate, the interest rate of risk asset.) with heterogeneous goals. 2. Assist in implementing the model by utilizing Python.

Core Coursework

University of Illinois at Urbana-Champaign.....

Economics and Business

- Game Theory
- Intro to Applied Econometrics
- Numerical Methods in Economics
- Microeconomic Theory I (PhD Micro Sequence)
- Math Models in Marketing (Analytical Modeling PhD seminar)

General Mathematics and Statistics

- Statistics and Probability II (Mathematical Statistics)
- Abstract Linear Algebra
- Intro to Abstract Algebra
- Statistical Modeling I (Applied Regression and Design)
- Statistical Modeling II (Sampling and Categorical Data)
- Applied Bayesian Analysis
- Stochastic Processes

Optimization and Operations Research

- Linear Programming
- Nonlinear Programming
- Introduction to Optimization
- Pricing and Revenue Management (Revenue Management PhD seminar)
- Game Theory and Fair Division (Algorithmic Game Theory PhD seminar)

Computation and Learning

- Numerical Methods I
- Fundamentals of Deep Learning
- Basics of Statistical Learning
- Data Science Programming Methods
- Computational Math (computations on graphs, computational topology, quantum computing, etc.)
- Computational Inference and Learning (Computational methods in ML for ECE PhD)

Nanyang Technological University (Singapore).....

- Real Analysis I
- Ordinary Differential Equation
- Industrial Organization

Zhejiang University (China)

- Mathematics: Calculus, Linear Algebra, Probability Theory and Mathematical Statistics, Complex Function and Integral Transforms
- Social Science: Microeconomics, Macroeconomics, Intro to Psychology, Intro to Brain and Mind
- Management: Intro courses of Finance, Accounting and Management
- Programming courses of C, Python, Statistical Analysis

Skills

Skills: : Python, LaTeX, R, C, MATLAB.

Languages: : Chinese (native), English (fluent)

Other Experience

Risk Management Intern

Wanxiang Trust

2019 Summer

Student Reporter

Zhejiang University Student Press Corps

2018–2019

Student Member

Marketing Association of Zhejiang University

2018–2019

References

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