

Zhide Wang

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Current Position

Texas A&M University
Graduate research assistant

09 2018 – Present
College Station, TX

Education

Texas A&M University
PhD Candidate, Industrial and Systems Engineering

09 2018 – Present
College Station, TX

Texas A&M University
Master of Science, Industrial and Systems Engineering

09 2016 – 06 2018
College Station, TX

Shanghai Jiao Tong University
Bachelor of Science, Department of Industrial Engineering

09 2012 – 06 2016
Shanghai, China

Research Interest

Methodology-wise, I am interested in the **modeling** and **estimation** of human decision making for both single agent setting and multiple-agents' strategic interactions (game model). Application-wise, I seek for using decision models to understand the rationale behind human decisions across multiple disciplines such as **marketing**, **economics** and **cognitive science**.

Publications

- **Zhide Wang**, Yanling Chang, Nathan Yang, and Alfredo Garcia. Retail Investment under Hidden Business Cycle. *Under Review*, 2024.
- **Zhide Wang**, Yanling Chang, Brandon J Schmeichel, and Alfredo Garcia. The Effects of Mental Fatigue on Effort Allocation: Modeling and Estimation. *Psychological Review*. American Psychological Association, 2022
- Yanling Chang, Alfredo Garcia, **Zhide Wang**, and Lu Sun. Structural Estimation of Partially Observable Markov Decision Processes. *IEEE Transactions on Automatic Control*. IEEE, 2022.

Research Experience

Inverse Reinforcement Learning with Categorical Perception

2022 – Present

- Categorization is crucial in human information processing. This work aims to model and learn the role of categorization in human decision making.
- Design a model of information processing pipeline with which an agent categorizes past information to make a decision that maximize cumulative payoff.
- The model combines the advantages from both sequence to sequence translation model and Reinforcement Learning model: the former model performs categorization task while the latter model maximizes utility.
- An end-to-end training method is proposed to learn the model primitives including categorization related parameters and utility function from observation and agent's action data.

- The model could potentially work with various types of data including video and text. The model has a wide range of applications such as investigating context-dependent driving behavior, and analyzing investment decisions based on investor's sentiment.

Strategic Firm Expansion under Partially Observed Business Cycles 2023

- Developed a Partially Observable Stochastic Game (POSG) model to analyze firms' strategic interactions in response to some latent state (e.g., business cycle).
- Designed a two-stage estimation procedure to find our POSG model primitives from data.
- Applied the model to Canada's fast-food industry (data from 1970-2004). Model estimates indicated that at industry-level, Canada's fast-food industry is recession-proof due to a positive base profit at each stage of business cycle; At firm level, McDonald's outperformed its rivals consistently due to its higher marginal profitability.
- Counterfactual simulations revealed that firms with high expansion rates but low recession-proofness can lose significant market share in prolonged recessions. High economic volatility reduces investments and expansions due to increased uncertainty in firms' belief of business cycle.

Modeling and Estimation of Mental Fatigue 2020 – 2022

- Proposed a value-based theory explaining mental fatigue's impact on perceived effort costs and rewards. Developed a Partially Observable Semi-Markov Decision Processes (POSMDP) to model cognitive effort allocation under mental fatigue.
- Introduced an estimation method for subjective values and hidden mental fatigue dynamics.
- Tested the model using a simulated n-back task under a free choice paradigm (with data from past studies). The estimated model can capture performance and engagement patterns observed under fatigue.
- Our model offered new research avenues on quantitative understanding of how cognitive operations are affected by mental fatigue.

Structural Estimation of Partially Observable Markov Decision Processes 2018 – 2020

- Developed a methodology for the structural estimation of entropy-regularized Partially Observable Markov Decision Processes (POMDPs) based on observable histories of sequences of observables and actions.
- Established identifiability conditions on POMDP dynamics and rewards.
- Developed a two-stage maximum likelihood estimation method and a soft-policy gradient algorithm for computing maximum likelihood estimators.
- Tested the method on an optimal engine replacement problem using synthetic and real data, improving data fit by 17% compared to previous (Markov Decision Process based) methods.

Professional Experience

Lecturer Texas A&M University	Spring, 2024
Teaching Assistantship Texas A&M University	Spring, 2022/2023
Reviewer of Ergonomics	2022

Research Presentations

2023 INFORMS Annual Meeting on the structural estimation of Partially Observable Stochastic Games applied to fast-food industry expansionary decision analysis.

2023 Army Research Laboratory (ARL) funded projects presentation on the modeling and estimation of mental fatigue.