D I S S E R T A T I O N D E F E N S E

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"Applications and Economic Impact of Machine Learning and Blockchain Technologies"

Monday, October 5, 2020
1:00 pm
Via Zoom

Machine Learning (ML) and Blockchains have been two major technology disruptions in the last decade. On the one extreme, Blockchain decentralizes decision making power to a crowd of anonymous participants. On the other extreme, ML centralizes decision making into uninterpretable algorithms. The first chapter uses ML as a tool to study behavioral biases in the labor markets. The second and third chapter deal with strategic interaction of market participant with Blockchain and ML platforms respectively.

The first chapter, co-authored with Prof Param Vir Singh and Prof Kannan Srinivasan, examines biases arising from attractive appearance. We show that Preference Bias contributes to an attractiveness gap of 0.52% per year, adding to a 2.4% gap over a 15-year career. Belief Bias does not have a statistically significant contribution in our sample of 43,533 MBA graduates. This finding is important because Belief Bias, arising from evaluators group-level priors on subjects job fit, can be overcome by providing rich performance information. But, Preference Bias, arising from evaluators taste for social, romantic or marital relationship with attractive subjects, can be harder to eliminate. The research methodology is unique in that, we use ML based image morphing of subject appearance and page ranking of subject career milestones to construct a pseudo random experiment on observational data.

The second chapter, co-authored with Prof Manmohan Aseri, Prof Param Vir Singh and Prof Kannan Srinivasan, examines peer to peer payments on Blockchains. We show that upgrade to Bitcoin payment throughput can be rolled back by tacit collusion among Bitcoin miners. We identify an intervention of banning miners above a compute power threshold to eliminate collusion. But, such an intervention makes payments less secure from double spend attacks. Thus owing to the dual threat, of collusion and double spend attacks, its untenable to offer a high throughput payment ledger to users with widely different willingness to pay fees, bear delay and risk attacks. We advocate for miner collusion as a useful mechanism which endogenously spills over excess collusion revenues into an investment into platform's security.

The third chapter examines ML pricing in housing market. These ML models are revised regularly using recent sample of sales. The recent sales are themselves confounded by previous version of the ML model. We theoretically show how this Feedback Loop creates a self fulfilling prophecy where ML platform over estimates its own prediction accuracy and market participants over rely on ML predictions. We calculate size of resulting pricing errors. We identify conditions on ML and market characteristics such that participants are worse off after introduction of ML. We provide empirical support to primitives of our theoretical model using data from Zillow's Zestimate algorithm.