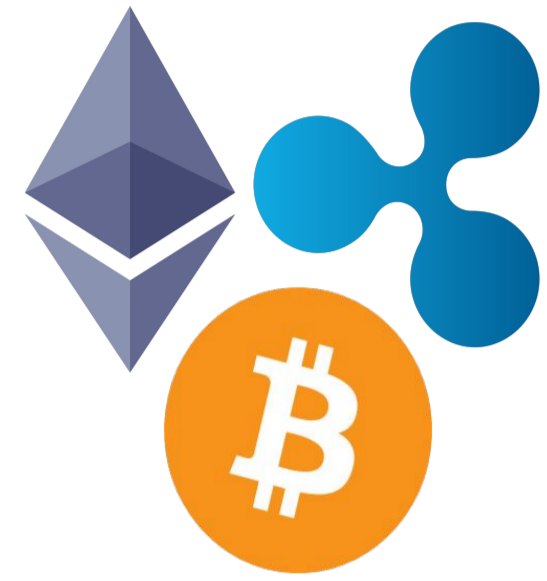# MAGNETAR: MAchine learning, Game theory, NEural networks, Trust and Algorithmic Research
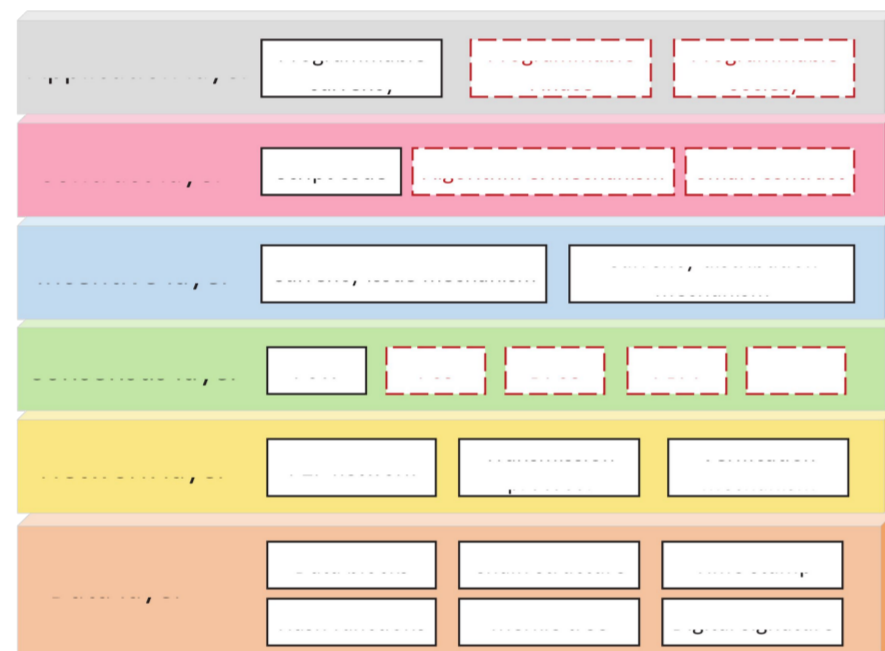
Distributing Trust via Blockchain

- Trade between two parties require trusted intermediaries, blockchain mitigates this reliance by distributing trust & running decentralized networks of exchange
- Blockchain enhances security & privacy
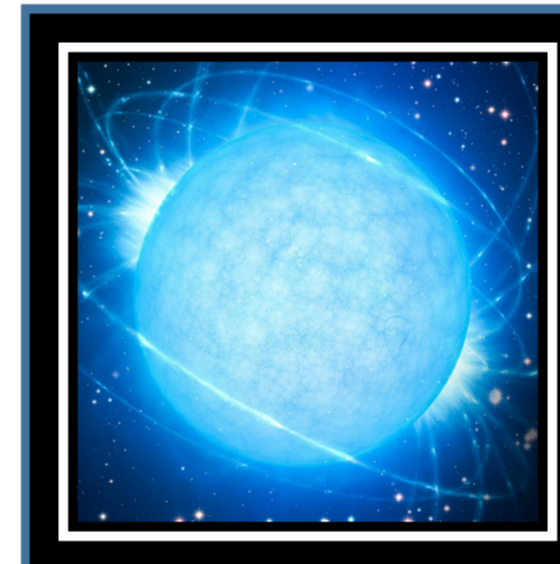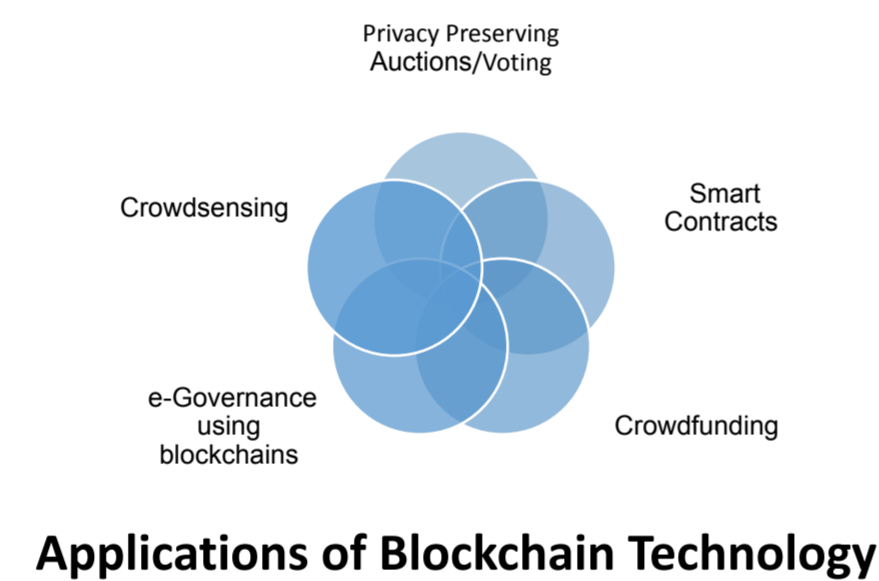- Blockchain can drive markets by reducing costs of economic activity.

Designing Next Generation of Blockchains

- Designing Faster and More Secure Protocols
- Analyzing flaws in existing protocols : Discovering possible attacks on existing protocols
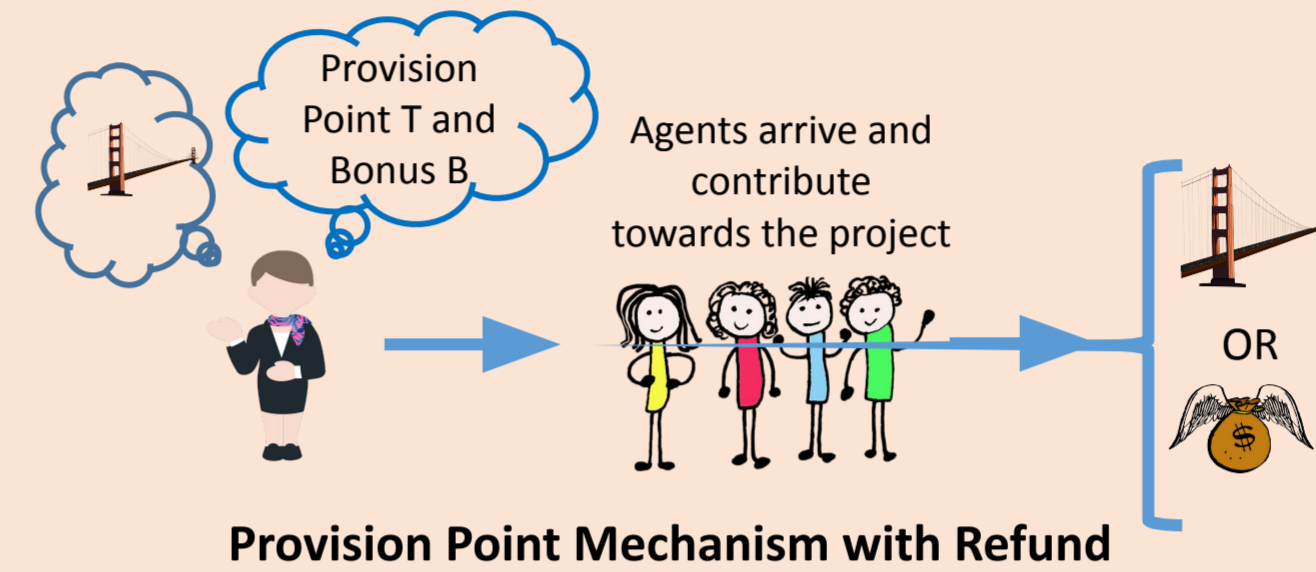- Use mechanism design to develop novel consensus protocols

E-Governance

- Use Smart Contracts for Voting and Auctions for better security
- Crowd Sensing and Crowd Sourcing to aggregate information from people

Privacy Preserving Auctions/Voting

Crowdsensing — Smart Contracts

e-Governance using blockchains — Crowdfunding

Applications of Blockchain Technology

Civic Crowdfunding

Provision Point T and Bonus B

Agents arrive and contribute towards the project

OR

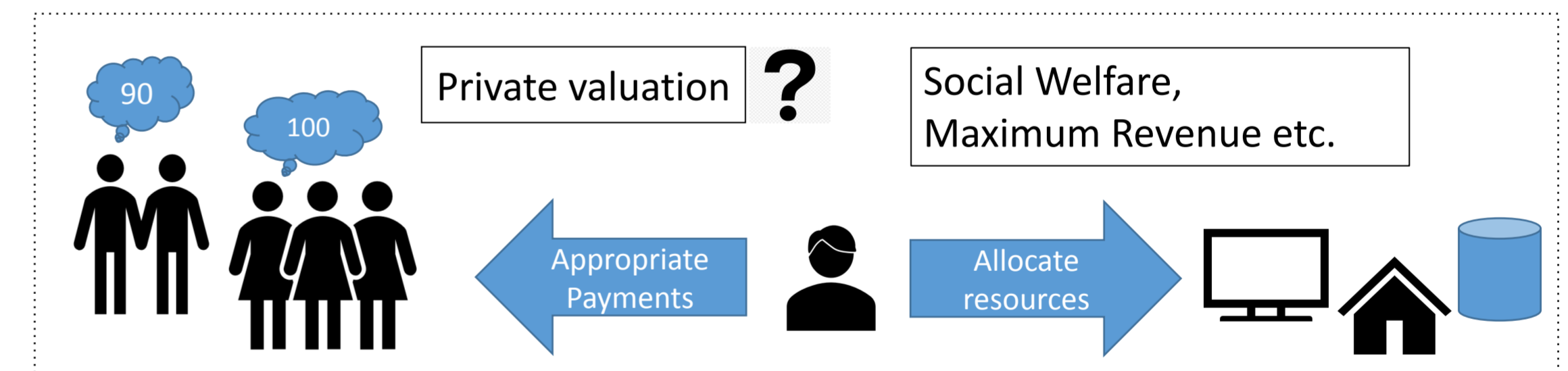**Provision Point Mechanism with Refund**

- RL based simulator for multiple projects
- Martingale theory to study the game induced by dynamic beliefs
- Efficient Refund Schemes for crowdfunding over Ethereum

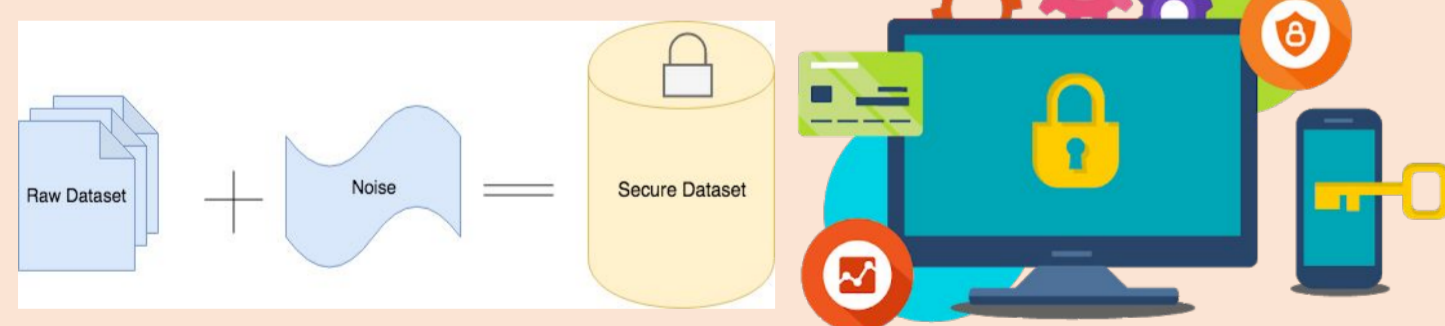## Online Discussion Forums

stack overflow

Quora

- Reinforcement Learning to recommend users relevant questions to keep them engaged
- Propose a coalition resistant credit score function which discourages manipulations

Mechanism Design Theory

90   100   Private valuation ?   Social Welfare, Maximum Revenue etc.

Appropriate Payments   Allocate resources
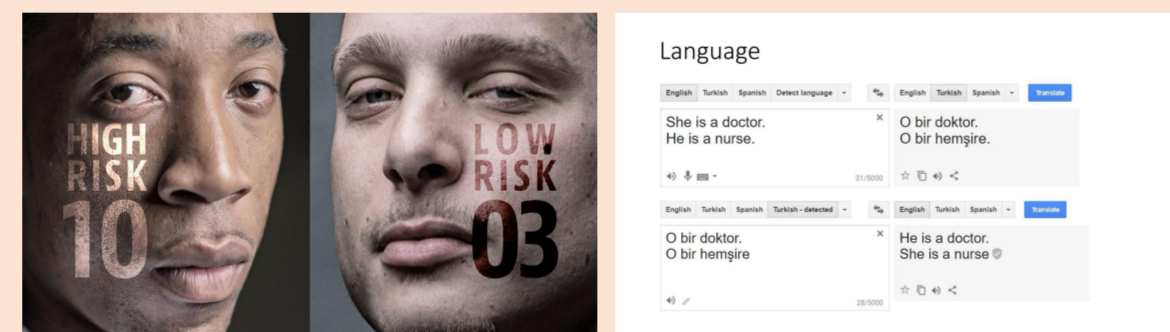
Privacy

Raw Dataset + Noise = Secure Dataset

As user data is valuable, we aim to preserve data privacy from internal and external attacks

To ensure privacy of data being used in Machine Learning, we make the use of
- Federated learning
- Multi-party computation
- Data encryption, and
- Differential privacy

Fairness

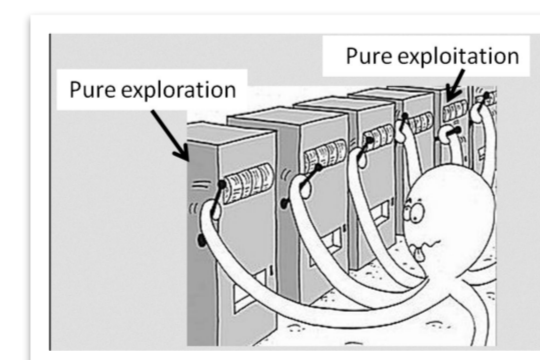HIGH RISK 10   LOW RISK 03

Language

Machine learning models are biased due to imbalanced data and aim for highest accuracy

We design neural-network classifiers which ensure
- Equalized Odds
- Demographic Parity
- Least reduction in accuracy
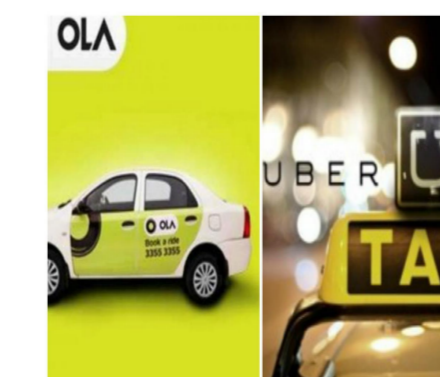
Multi-Armed Bandit (MAB) Mechanisms

Pure exploration   Pure exploitation

Sleeping MAB
Contextual MAB
Constrained MAB
Combinatorial MAB

Dynamic Matching Mechanisms
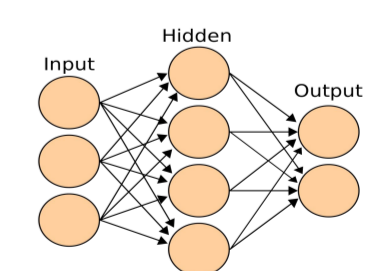
Share-ride in App Based Cab Services
Requests are dynamic and agents (drivers) may like to express their preferences

Neural Network Based Mechanisms

Input preferences (X) → Socially desired outcome (Y)

Redistribution Mechanisms
Auctions for crowdsourcing

Fair Reward Mechanisms

Customer Reviews

Incentivizing agents to report honestly in spontaneous localized settings

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