Truth Learning in Social and Adversarial Settings

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Motivation

- You have imperfect information about the world
- You are influenced by other people, also with imperfect information
- Examples:
  - Social media
  - Panel Discussions
Setup

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Q: When is it possible for agents to learn a ground truth given a network topology, prediction order, and distribution of private measurements?
Information Cascades/Herding

Agents can become biased if one opinion appears to dominate among those it has seen.

→ Can lead nearly the entire group to stop using their own observations and instead copy previous decisions.
Cascade example

An urn contains either 1 blue + 2 red balls, or 1 red + 2 blue balls w/ equal probability.

Taking turns, each person:

- randomly picks a ball to observe in private (with replacement)
- publicly states if they think the urn is majority red or majority blue
Cascade example

Suppose 2 blue + 1 red.

1. Person 1 observes red. Announces “majority red”.
2. Person 2 observes red. Announces “majority red”.
3. Person 3 observes blue. Announces “majority red”. No new information!
4. Person 4 observes xx. Announces “majority red”.

...
Directions

- Complexity: Decide for a given network whether truth learning can happen.
  - Is this NP-hard?
- Voting: Non-binary ground truth.
  - No “good” way of aggregating non-binary agent preferences.
  - Condorcet Paradox, Arrow’s Impossibility Theorem
- Adversaries: How can adversarial agents affect the outcome?
  - How does this depend on the network structure?
  - How can the remaining agents protect against this?
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