Formalizing Purpose Restrictions in Privacy Policies

Michael Carl Tschantz, Anupam Datta (PI), and Jeannette M. Wing (PI)

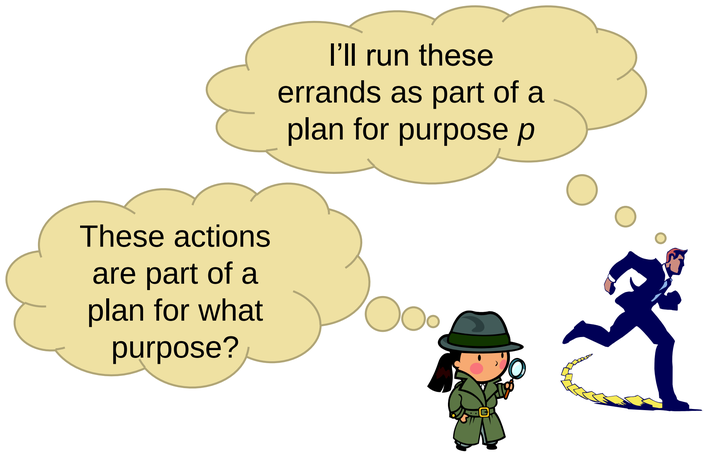
Policy

- **Purpose** shows up in privacy policies:
  - "Yahoo!'s practice is not to use the content of messages stored in your Yahoo! Mail account for marketing purposes"
  - HIPAA requires covered entities to only use protected health information for a fixed list of purposes (e.g., treatment, payment, and research)

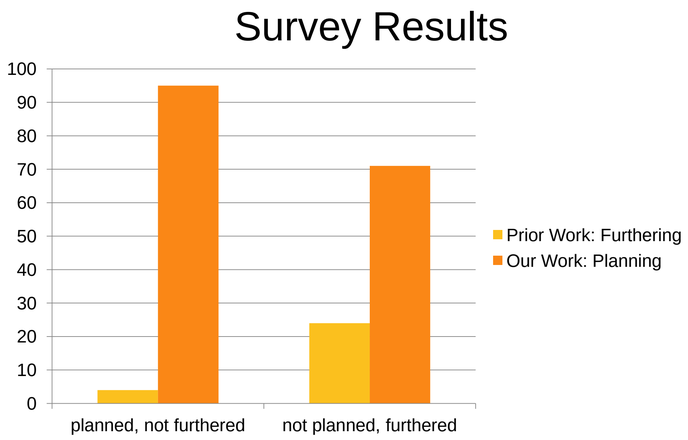
Goals

- Provide a semantics of purpose to formalize when an **action** is **for** a **purpose**
- Provide algorithms to automate auditing
- *Past work avoids the issue by presuming that an oracle labels sequences of actions with their purpose*

Planning for a Purpose

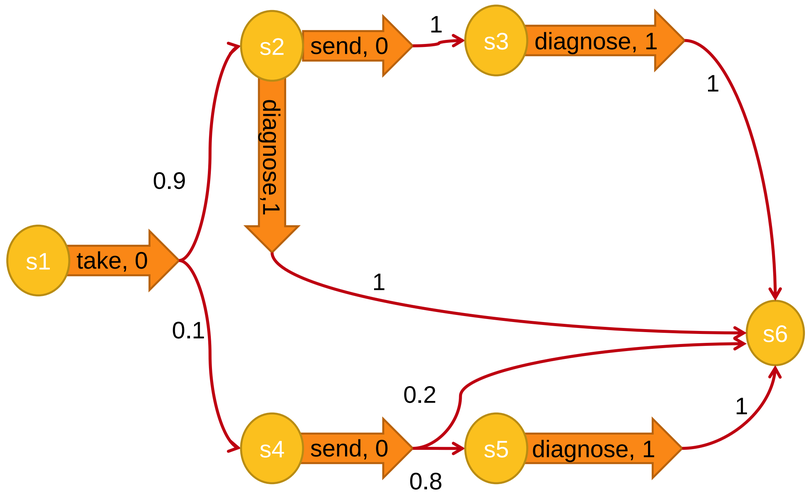


- An auditee acts for a purpose if he performs that action as part of a **plan** for optimizing the fulfillment of that purpose
- If an action is not part of any such plan, then it was not for that purpose



Action Model

- Model planning with a modified version of Markov Decision Processes (MDPs)
  - Disallow pointless *redundant* actions
- Taking an X-ray has 0.9 probability of enabling a diagnosis
- When it doesn't, sending the X-ray for further analysis has a 0.8 probability of enabling a diagnosis



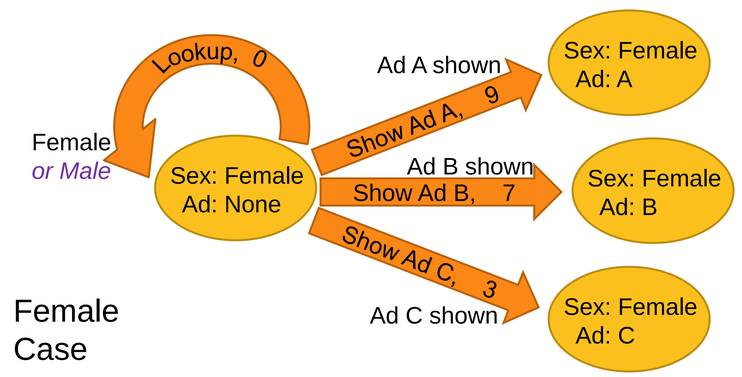
- Policy: X-rays may only be sent for the purpose of reaching a diagnosis

Agent Behavior Logs

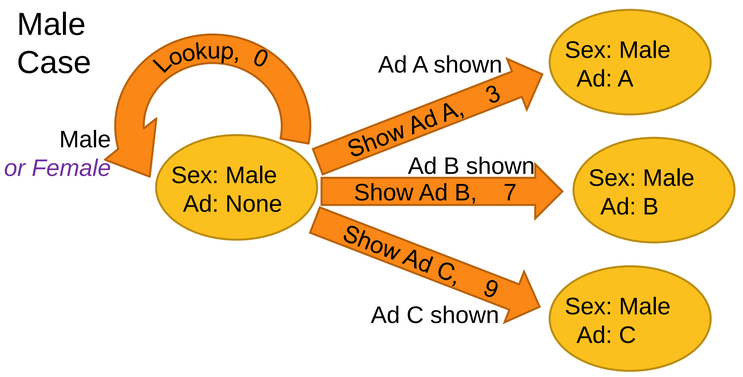
- The auditor detects a violation from [s1, take, s2, send, s3, diagnose, s6] but not upon seeing [s1, take, s4, send, s5, diagnose, s6]

Information Use Model

- Use Partially Observable Markov Decision Processes (POMDPs) to make information explicit
- Website wants to select an ad to show
- Ad A best for females, Ad C for males, Ad B is middle ground
- Policy: will not use gender for marketing
- Compare behavior to conflated POMDP



Female Case

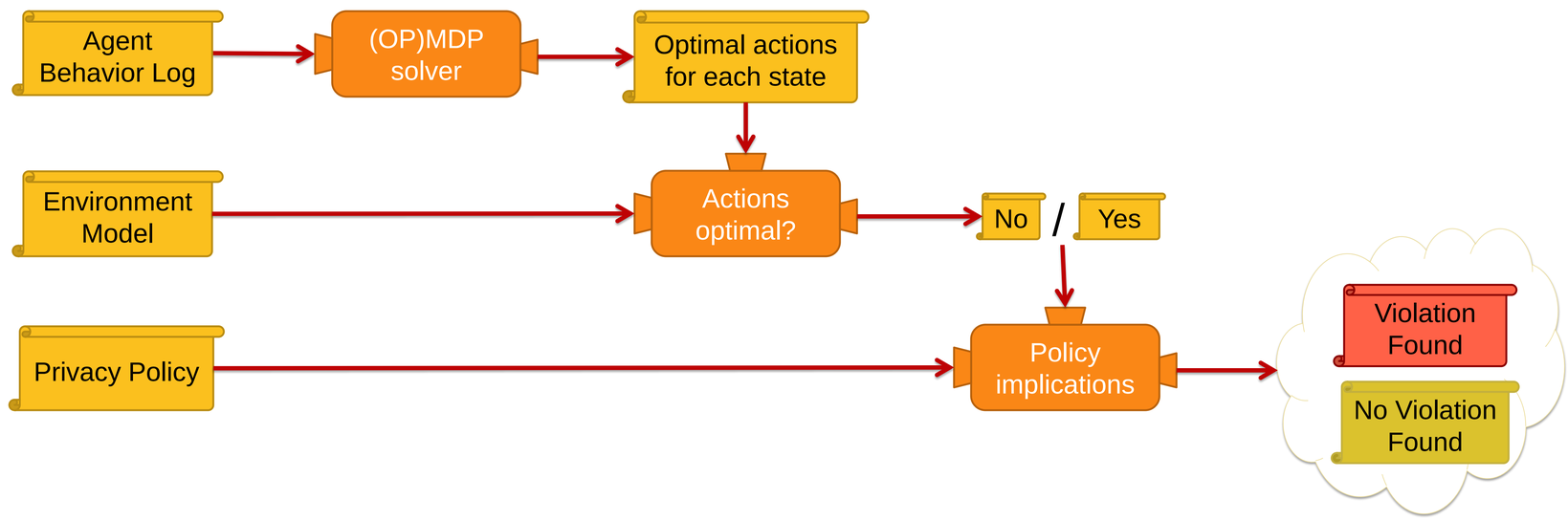


Male Case

- Detects a violation from showing Ads A or C but not from showing Ad B

Auditing Algorithm

- Uses PO/MDP optimization to compares the auditee's behavior to the optimal behavior



Further Information

M.C. Tschantz, A. Datta, J. M. Wing
Formalizing and Enforcing Purpose Restrictions in Privacy Policies
33rd IEEE Symposium on Security and Privacy, 2012

Carnegie Mellon University