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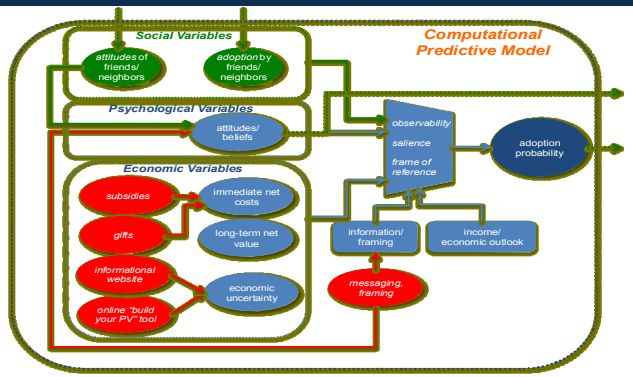

Design of Social and Economic Incentives and Information Campaigns to Promote Solar Technology Diffusion Through Data-Driven Behavior Modeling

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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Project Overview

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- Unify diverse sources of data and expertise
  - Technical challenge: different sets of variables in different data sources
    - Approach: learn Bayesian posterior, conditional on available features
  - Technical challenge: too many features
    - Approach: dimensionality reduction using greedy feature selection in cross-validation
- Hierarchical computational modeling
  - Individual-level model: features learned on individual-level data
  - Aggregate-level model: combine individual models via social influence variables; features learned on aggregate/macro data (e.g., visibility, timing, level of decision synchrony, etc)
  - Stochastic behavior models (capture uncertainty about decisions)
- Computational optimization
  - Aggregate-level model viewed as a MDP; compute optimal policy

Project Overview

- Policy guidance based on surveys and online/lab/field experiments
  - Collect data about behavioral variables, such as influence of political affiliation on response to specific messaging strategies (e.g., green vs. energy independence)
  - Consider interactions among variables
    - Influence of price, conservation attitudes, and political affiliation may interact (and price-based motivators may crowd out other motivators)
- Testing policy in the field
  - Pilot alternative policies (e.g., messaging strategies) and analyze outcomes
    - Leverage policy implementation expertise of CCSE
    - Leverage collaboration with Group Energy
- Data and analysis results are fed back into the computational model
  - End-to-End process: Data -> model -> optimal policy -> pilots -> data -> model -> …

Team

- *Sandia National Laboratories*
  - Yevgeniy Vorobeychik, Ph.D., PI
    - Research expertise: technology diffusion modeling, applied machine learning, optimization, behavioral network economics
  - Kiran Lakkaraju, Ph.D.
    - Research expertise: machine learning, cognitive modeling, agent-based modeling
  - Jaideep Ray, Ph.D.
    - Research expertise: Bayesian inference, uncertainty quantification
  - Ali Pinar, Ph.D.
    - Research expertise: large-scale social network analysis

Team

- University of Pennsylvania (Wharton)
  - Professor Howard Kunreuther, Ph.D.
    - Research expertise: behavioral economics, policy
  - Professor Ruben Lobel, Ph.D.
    - Research expertise: dynamic optimization, solar energy policy, behavioral modeling
  - Karen Campbell, Ph.D.
    - Research expertise: analysis of macroeconomic factors
  - Dena Gromet, Ph.D.
    - Research expertise: psychology, online/lab experiments

Team

- California Center for Sustainable Energy
  - Timothy Treadwell
    - Research expertise: program design and implementation, data analysis
- National Renewable Energy Laboratory
  - Easan Drury
    - Research expertise: solar energy policy, data analysis, computational modeling

Year 1 goals

- *Data Analysis*
  - Rank potential factors in order of importance for individual adoption decisions
- *Data Collection*
  - Deploy and analyze survey of adopters and non-adopters
  - Small focus groups, considering adopters and different groups of non-adopters
  - Initial online/lab pilot experiments
- *Computational Modeling*
  - Initial individual-level model
    - Predict probability of adoption, conditional on available features
    - Predict distribution over adoption time, conditional on available features