Towards Computational Persuasion for Behaviour Change Applications

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1 What is persuasion?

In dialogues, the persuader collects information, preferences, etc from the persuadee; The persuader provides information, offers, etc to the persuadee. And the persuader wins favour (e.g. by flattering the persuadee, by making small talk, by being humorous, etc). **But arguments (and counterarguments) are the essential structures for presenting the claims (and counter claims) in persuasion**

2 Persuasion via chatbot

In **computational persuasion**, a chatbot can take on the role of the persuader, and dialogues can be delievered over chat apps. The chatbot (blue) presents arguments for behaviour change, and counterarguments to the user's misconceptions and perceived barriers to behaviour change. The user (green) presents their responses (arguments, questions to system, and answers to the system's questions).

All hospital staff should be encouraged to take the annual flu vaccine.

Hospital staff can infect patients.

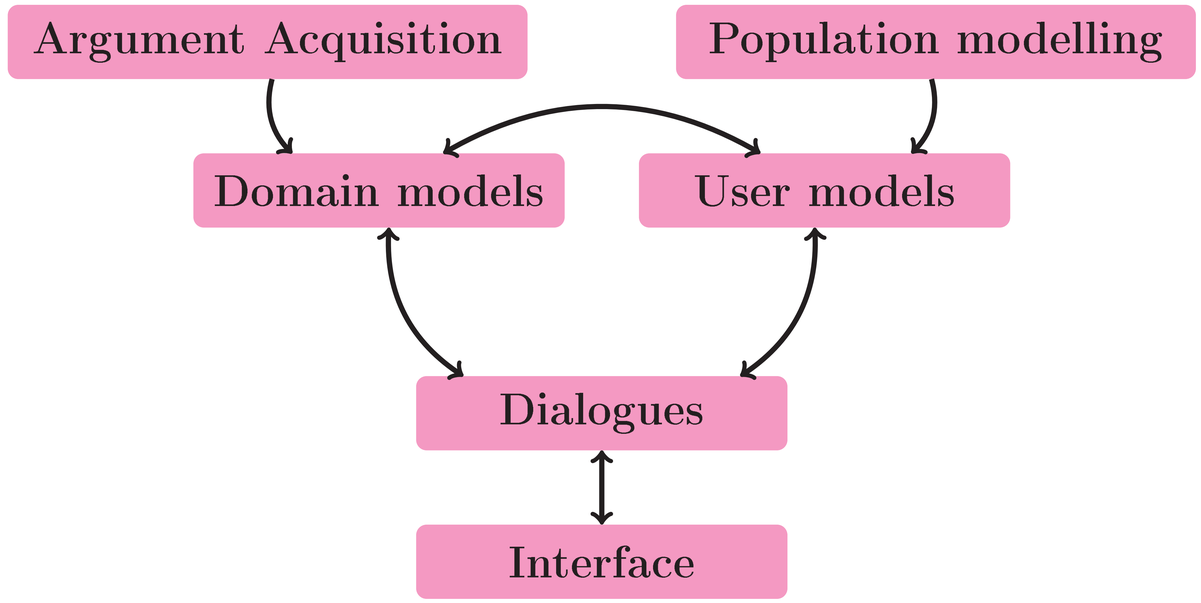
The majority of hospital staff have no face-to-face contact with patients.

Hospital staff are in the same building, breathing the same air, sharing the facilities, touching the same surfaces.

There are disinfectant dispensers that can inhibit the spread of infection.

Infection can also spread with coughing and sneezing.

3 Framework for building persuasive chatbots



4 Dialogues

A dialogue is a sequence moves involving the chabot (persuader) and the user (persuadee). The kinds of moves (presenting arguments or counterarguments, asking questions, answering questions, etc), and when they can be used, is defined by a **protocol**.

The chatbot aims to maximize the probability that the dialogue results in the user being persuaded by using either a **local or global strategy** to choose the moves it makes. This draws on the user model and is based on **decision theory**.

5 Domain modelling

We use formalisms from **computational models of argument** to represent arguments and counterarguments (e.g. a directed graph where each node represents an argument and each arc denotes an attack by one argument on another).

Argument acquisition is via authoring (e.g. based on healthcare literature) and crowdsourcing (in order to acquire barriers, issues, and misconceptions people have on the topic).

6 User modelling

In order to optimize the persuasion, we have developed a two-dimensional approach for modelling users in argumentation. The first dimension is the **beliefs** that the user has in the arguments and counterarguments (and is based on a formalism called epistemic graphs), and the second dimension is the **concerns** that the user has. Many arguments either raise a concern or address a concern. A user is more likely to present arguments that raise concerns that are important to them, and is more likely to be convinced by arguments that address their concerns.

When we have a new user, we do not want to ask them lots of questions in order to build a user model. Rather we want to ask as few questions as possible, or even glean answers from their moves, in order to build a user model. We do this by **population modelling** (e.g. using beta distributions for modelling beliefs of subpopulations of users, or using machine learning to predict beliefs or concerns of a user).

7 Interface

To get moves (e.g. arguments, questions) from the user, the chatbot uses either a **menu-based interface**, which means when it is the user's turn, the user chooses from a list of arguments or questions presented to them, and a **free-text interface**, which means that the system uses NLP to understand the user input (e.g. sentence2vec to find the most likely user argument in the argument graph).

8 Evaluations

We have evaluated various aspects of our framework with participants (e.g. people tend to present arguments, and are more convinced by acceptable arguments, that are of more concern to them).

We have implemented chatbots for various issues including doing more exercise, commuting by cycle in the city, and taking the covid vaccine. We have promising results with participants (e.g. change in stance, feeling understood, points being addressed, etc.). For example, at the start of 2021, our covid chatbot was used by 240 recruited users, and 11% of them changed stance from negative or neutral to positive.

In collaboration with Christian von Wagner (UCL Health Behaviour Research Centre), we are undertaking a pilot study, with Cancer Research UK funding, for improving participation in cancer screening.

10 Conclusions

Our framework involves a number of options for computational persuasion that can be incorporated in chatbots. Deploying chatbots for behaviour change applications (e.g. healthcase) offer numerous advantages including being **informative**, **personalized**, **interactive**, **cost-effective**, **accessible**, and **non-judgmental**.

11 Collaborators

Key AI collaborators include Lisa Chalaguine, Ivan Donadello, Emmanuel Hadoux, Sylwia Polberg, Nico Potyka, and Matthias Thimm.