Social companion robot that helps stay on a workout goal

Human-robot interactions, rewards to keep human motivated and reward saliency

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Motivation

- Humans often display seemingly suboptimal behaviour
  - Procrastination
  - Impulsivity
- Specific focus : Inability to stick to workout goals
  - Can we build a robot that incentivizes people to stick to their own goals for workout?

Human-Robot Interaction

- Human sets a goal for workout
  - E.g.: 2.5 hours every week for 5 weeks.
- Human comes from work, possibly tired.
- Robot interacts with the human and finds out how he/she is feeling.
- Robot provides intervention if human is demotivated from the workout schedule
- Human can choose to cease interaction with the robot.
  - Robot will further probe humans mood with questions right before interaction ends

Interventions

- Here the interventions provided by the robot to increase motivation can be categorized as follows:
  - Arbitrary Interventions
    - E.g., Telling the human a joke or playing pleasant music
  - Goal-specific Interventions
    - E.g., Reminding the human how close they are to achieving the goal or of consequences of deviating from goal
- These interventions can be seen as modifying either reward or reward saliency for the human

Reward Saliency

- Can be seen as a knob to modify the subjective value of an action for a human. For e.g.,
  - Value of a marshmallow may be very high to a child compared to me.
  - Exercising may seem more effortful to a tired person than to a rested person
- Modifying saliency of rewards can potentially elicit different actions from the human than their intended course
  - E.g., reminding someone of the consequences of procrastinating before an exam might make them work again.

Challenges

- How do we determine which interventions are more effective and for what scenarios?

- How do we build a behavioural model that allows the robot to learn and create personalized motivation schemes for different people?

Preliminary Approaches/Thoughts

(with help from Brad)

- How do we determine which interventions are more effective and for what scenarios?
  - **Build an effective exploration-exploitation trade-off scheme**
  - **Treat it as a multi-armed bandit problem (choosing b/w interventions)**
- How do we build a behavioural model that allows the robot to learn and create personalized motivation schemes for different people?
  - **Model the human's strategy as an MDP or POMDP**
  - **Allow parameters in the model that allows for individual differences in behaviour (like discount rate/ saliency coefficient)**

Evaluation on human subjects

- Pre-survey and post-survey on human subjects before and after workout respectively
- Quantify or measure how well the behavior coaching worked - Was the goal reached solely because of the motivation robot provided ? If the robot assistance was not there, then was the goal still achieved ?
- Divide subjects into two groups - one group without any robot companionship (control) , other group with robot companionship (testing)

Stretch goals

- Can we infer the human's mood by minimum interaction ? Using facial expressions, eye movements, etc.
- Decide what rewards will work best in the given human's emotional state estimated using the above method that will motivate the human to work towards their goal ?
- Quantify if the robot's companionship is effective in improving the positive mood of the human ?