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Bounded Rational Game-Theoretical Modeling of Human Joint Actions with Incomplete Information

Background

Physical human-robot interaction (pHRI) is increasingly used in applications where a human model needs to be developed to anticipate future actions including robot-assisted rehabilitation, robotic surgery, and collaborative manufacturing. Modeling humans is a challenging task because of the inherent uncertainties of human decision-making, but also because of the necessity of physical interaction for human learning and adaptation of robots.

In order to investigate these areas of uncertainty, it is necessary to study how humans collaborate with one another. Previous studies simplify the collaborative task as an optimal control problem between two agents, which oversimplifies human collaboration behavior and does not produce a robust model. Other studies on human-human cooperative motion conducted through haptic interfaces showed the capability of capturing human collaboration data. However, these data sets are rarely used for constructing a dynamic model of human collaborative motion generation.

Invention Description

Researchers at Arizona State University have developed a bounded-rational and game-theoretical human cooperative model to describe the cooperative behaviors of two humans. This model uses a haptic interface with a virtual environment and can be used to conduct experiments with human subjects. The model uses inverse optimal control (IOC) to model the reward parameters in a collaborative task. Initial tests showed more accurate prediction of human behavior based on the data collected, including suboptimal human behaviors. These tests also revealed additional insights into human collaborative behavior, including increased performance with greater leadership from the designated leader among the human collaborators.

Potential Applications

- Robot-assisted rehabilitation
- Robotic surgery & physician assistance
- Additive/collaborative manufacturing
- Sports training & physical assistance

Benefits and Advantages

- More accurate – increased fit of model with human behaviors
- Increased human insights – effects of leadership on performance of human

collaboration observed and accounted for

- Haptic interface for data collection – generates unbiased, accurate, real-time data

Related Publication: [Bounded Rational Game-theoretical Modeling of Human Joint Actions with Incomplete Information.](#)