NRI: INT: Designing Effective Dialogue Gaze, and Gesture Behaviors in a Social Robot that Supports Collaborative Learning in Middle School Mathematics

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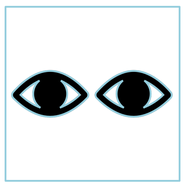
Key Challenge

How can interactions with a robot support the dyadic collaborations of middle school mathematics students? Addressing this problem requires transdisciplinary work in human-computer interaction, natural language processing, machine learning, and cognitive psychology.

Core Idea

A teachable robot uses **multimodal communication** to support **balanced participation** and **convergence on a shared mental model**.


Dialogue


Gaze


Gesture

Learning scenario: Two students teach a humanoid Nao robot, “Emma”, how to solve specific ratio problems.

We are currently collecting pilot data via zoom.

Research Plan

Train a reinforcement learning model to develop an optimal policy for robot interaction with middle school dyads.

Evaluate the model against various expert-authored policies, non-adaptive policies, and ultimately a parallel virtual agent.

A major challenge is the difficulty of collecting sufficient training data with middle schoolers.

We will pre-train the model using simulations grounded in learning theory and more readily available data from undergraduate students.

Computer Science Impacts

Apply reinforcement learning to human-robot interactions to automatically acquire social behaviors. Success paves the way for co-robots in school environments.

Learning Sciences Impacts

Understand how robot multimodal communication influences collaboration and learning. Success informs best practices for human facilitation of collaboration.

Educational Impacts

A two hour curriculum module on robotics research will complement our intervention. In total, 700 middle school and undergraduate students will interact with the robot.

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