Socially-Assistive Robots for Improving Non-Verbal Understanding in Children with Autism School of Engineering Ming Hsieh Department

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Overview

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of Electrical Engineering

- Autism is a common and often debilitating development disorder affecting between one in 80 and one in 240 children in the United States.
- The use of robotic systems is a promising technological possibility for enhancing the oftenintensive therapy these children require.
- Anecdotal evidence and case studies suggest that not only are robots highly salient to children with autism, but that those children may exhibit social behaviors with robots that they do not otherwise use.

Objective

- We are exploring the role of an **embodied** robot in its abilities to <u>engage</u>, <u>influence</u>, <u>interact</u>, and teach—seeking to develop principled methods for controlling the robot's embodiment and expressiveness through natural language.
- Develop and enhance methods that allow robots to adapt to specific user and personalize

Research Questions:

- How can a SAR quickly maximize the effectiveness of its integration into a social interaction?
- How can collected *multimodal data* be used to evaluate the 2. effectiveness of the SAR in each interaction?

Approach

Design a SAR peer that adapts its conversational behavior to the users' comprehension of social cues to improves their comprehension by integrating literal translations of nonverbal cues into conversation.





- their interaction in order to provide effective, long-term human-robot interaction.
- To build a socially-assistive robot (SAR) peer that, in long-term interactions, will be able to improve overall nonverbal comprehension through intermittent translation of such cues.



EscapeBots Demonstration

- EscapeBots is an exploratory study that will be run at USC during the 2016 Robotics Open House. Visiting students will work in groups to program Sphero Robots to navigate a physical maze using the Lightning Labs App. Observing how children work in team to tackle such a task can be interesting in many ways, including how performance correlates with sharing as well as the impact that assigned groups has on sharing and performance.
- We tracked turn-taking, engagement, and group 'types' to build a custom classifier to run through a learning model.
- Convenience Population for Robotics Open House to observe group dynamics in typically-developing (TD) schoolchildren and gain intuition on their collaboration methods in computational tasks.
- Eventually will be able to focus generalized model onto subpopulations (ie children with autism)



Group Dynamics Human Annotation Tool

- Data collection in Human-Robot Interaction research is always difficult because of walking the fine line of collecting relevant data points while also minimizing the collection of identifiable data—especially complicated in studies with children and children with special needs.
- Human annotation is a technique that, although labor-intensive, can help lessen the barrier to entry for certain data collections.
 - One major caveat of human annotation is the validation of the annotation and consistency in the annotation—commonly handled by having more than one-third of the data points collected be validated by coder agreement (ie Have more than one annotator on the same data collection and cross-validation their annotations)
- Together, we designed and built the HAT—an online annotation tool that allows for multiple annotators to annotate the same data on the same time scale.



Gender:	М	Gender:	M \$	Gender:	M \$	Gender:	M \$	Gender:	М	‡	
Group:	Assig	gned	Notes:								
Outlier group:		Yes	\$								
Friendship Leve	el:										
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				Setup	Experiment						

Summary and Future Work

- We ran a demonstration for computational tasks and observed group dynamics in typicallydeveloping schoolchildren.
- Eventually the turn-taking policies of TD children will be used to build a SAR peer for children with autism that will seamlessly integrates literal translations of gestural cues into conversation.
- Next steps is to build a learning model that can be applied to sensing nonverbal comprehension.

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