USC
Interaction Lab

# Developing Expressive User-Interfaces for Socially-Assistive Telepresence Robots

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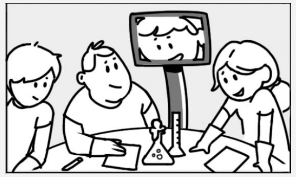
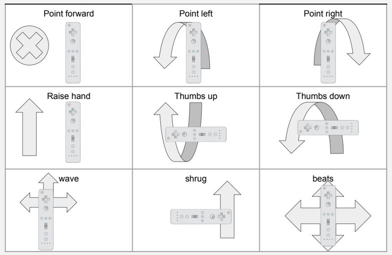
## Background and Motivation

- Each year, more than 6.5 million Americans miss significant amounts of school, causing educational and social issues [1].
- Current solutions lack the social experiences with peers that are important for healthy social and cognitive development [2]. Telepresence robot systems in classrooms provide a possible solution to this isolation.
- My research focuses on enhancing the expressiveness of telepresence robots in K-12 classrooms that are operated by remote students.



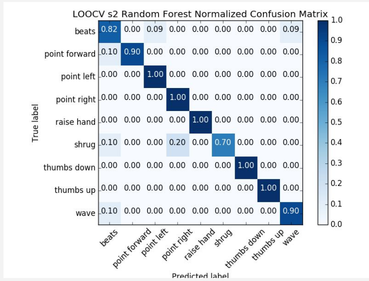
## Data Collection

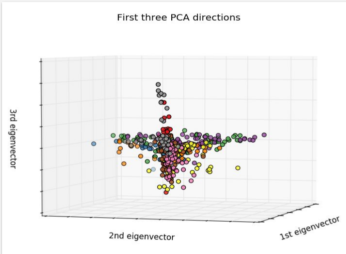
- I created a set of the most essential gestures for remote students to use to communicate via a telepresence robot so as to aid expressiveness in a classroom
- Collected IMU data of these gestures with a Wii remote
- Preliminary dataset: recordings of 9 gestures acted out by 5 people 10 times each

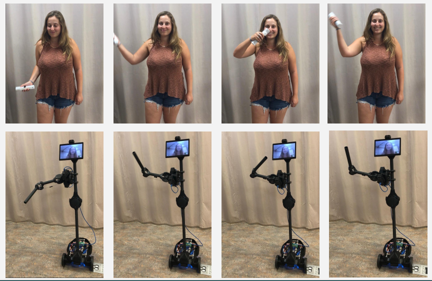



## Gesture Prediction

- I researched different ways to identify the predetermined list of human gestures, which would then be mapped to robot movement
- After trying to identify raw data in a time-series fashion using hidden markov model, switched to a classification model approach with various algorithms such as vector machines, decision tree, and random forest and using k-folds and leave one out cross validation. The classification algorithms classified preprocessed the IMU data (consisting of accelerometer and gyroscope data), extracting the maximum, minimum, mean, variance, skewness, and kurtosis values of recorded data channels and high/low pass filtered data channels as features.
- With both the real-time and classification models, some gestures were correctly identified with fairly high accuracy while others were not distinct enough to be correctly labeled. This suggests that some gestures may need to be redesigned to be more distinct, or perhaps more data is necessary to build intuitive models. Different features may also need to be extracted to help account for any noise in the data.



## Conclusions and Future Work

- Incorporating easy-to-use communicative gestures into the user- interface of the telepresence robot may increase its expressive abilities.
- Future work includes a usability study to test the effectiveness of the gesture classification models when compared to 1-1 gesture mapping and other models.

## References

[1] The Child and Adolescent Health Measurement Initiative. National Survey of Health, 2011-2012. Data Resource Center for Child and Adolescent Health.
[2] Bransford, J. D., Brown, A. L., and Cocking, R. R. How people learn: Brain, mind, experience, and school. National Research Council, Washington D.C. 2006.
[3] Adalgeirsson, S.O., and Breazeal, C. MeBot: A robotic platform for socially embodied telepresence. 2010 5th ACM/IEEE International Conference on Human-Robot Interaction (HRI), 15-22, Osaka, 2010.
[4] Pennycook, A. Actions speak louder than words: paralanguage, communication, and education. Tesol Quarterly, June 1985.

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