Video and Graph-Based Visualizations to Show Performance of Modeling Engagement

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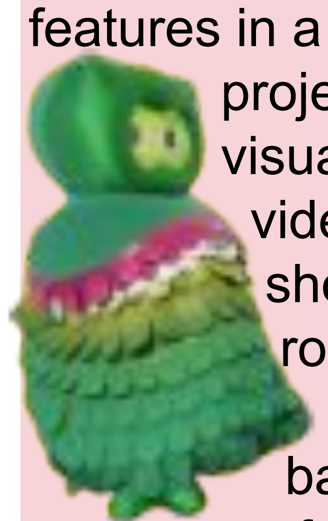
Introduction

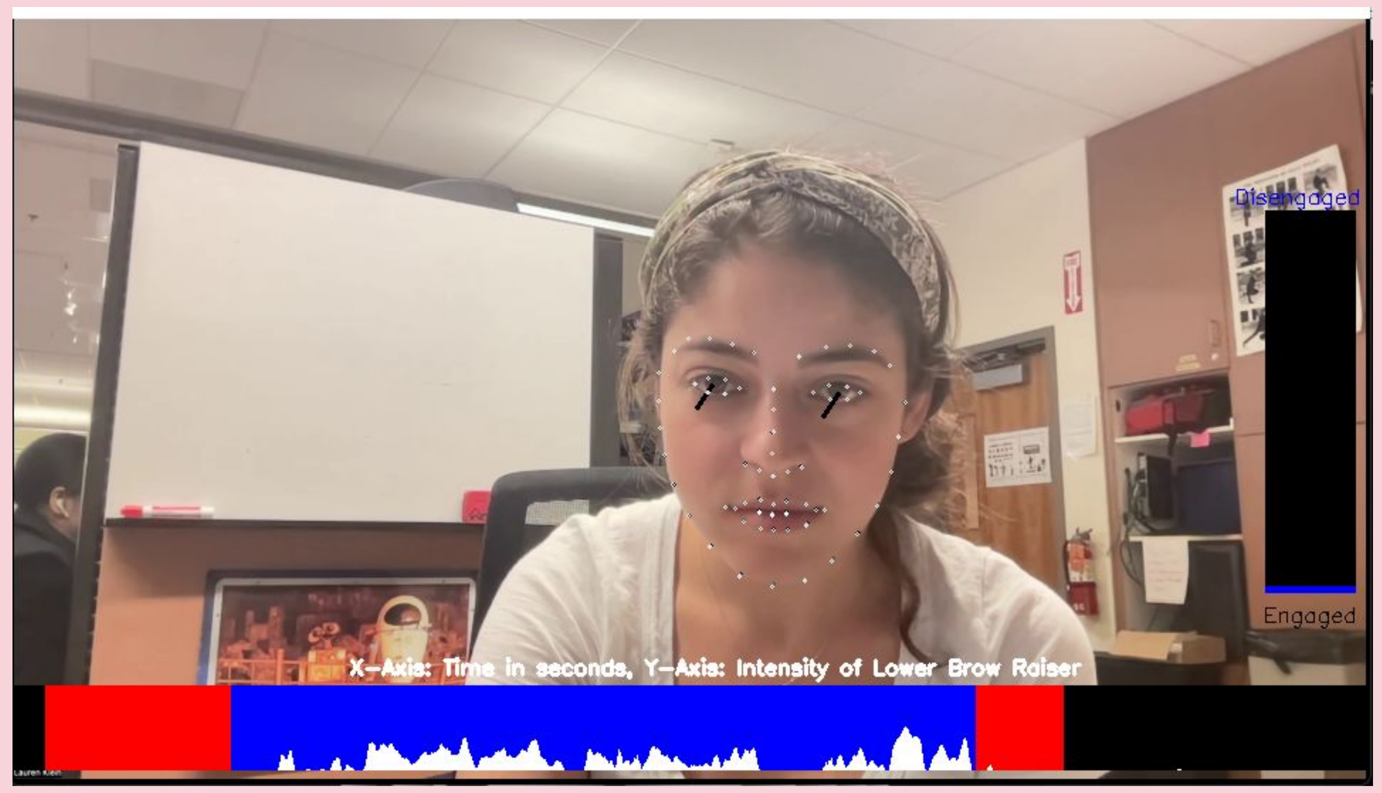
Socially Assistive Robots (SAR) are a subset of human-robot interactions (HRI) and are focused on developing social skills (1). The implementation of SARs with children on the autism spectrum has shown significant advances, one of which utilizes machine learning to alter the robot's behaviors based on the child's engagement with the activity (3). The inputted features into the model can be locations of facial features and facial action units (4).

On the other hand, visualizing the engagement model is necessary to make it more explainable to the general audience. It also helps them to choose features in a more visual manner. This project contributes two visualizations, graph-based and video-based, that are used to show the performance of the robot's machine learning model to determine engagement based on a user-inputted set of features *F*.

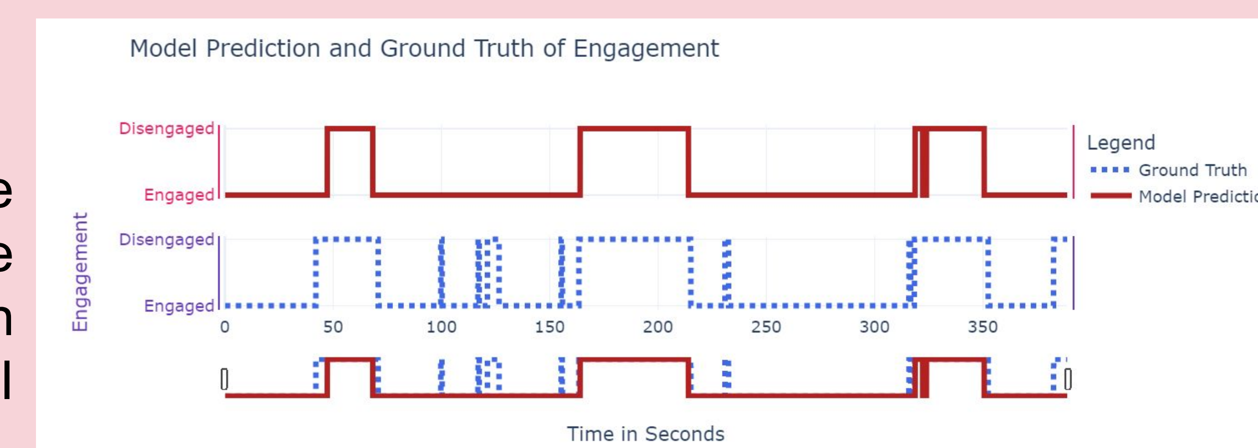


Methods

Both visualizations were created in Juypter Notebook and used Openface to extract the facial features and facial actions. To test the effectiveness of each visualization, an example video was taken, modeling the child engagement with the robots. The visualizations used child engagement videos from (3) for the training datasets and the example video was used for the testing dataset. Both the input features and facial actions and the output model predictions were visualized in the graph-based and video-based visualizations.



Top: Figure 2, Video-based visualization output. Engagement bar is on the right, and a live graph with the inputted facial action is shown on the bottom. When the model predicts wrong, the background of the graph changes to red. The locations of the inputted facial features are also drawn on the participant's face.

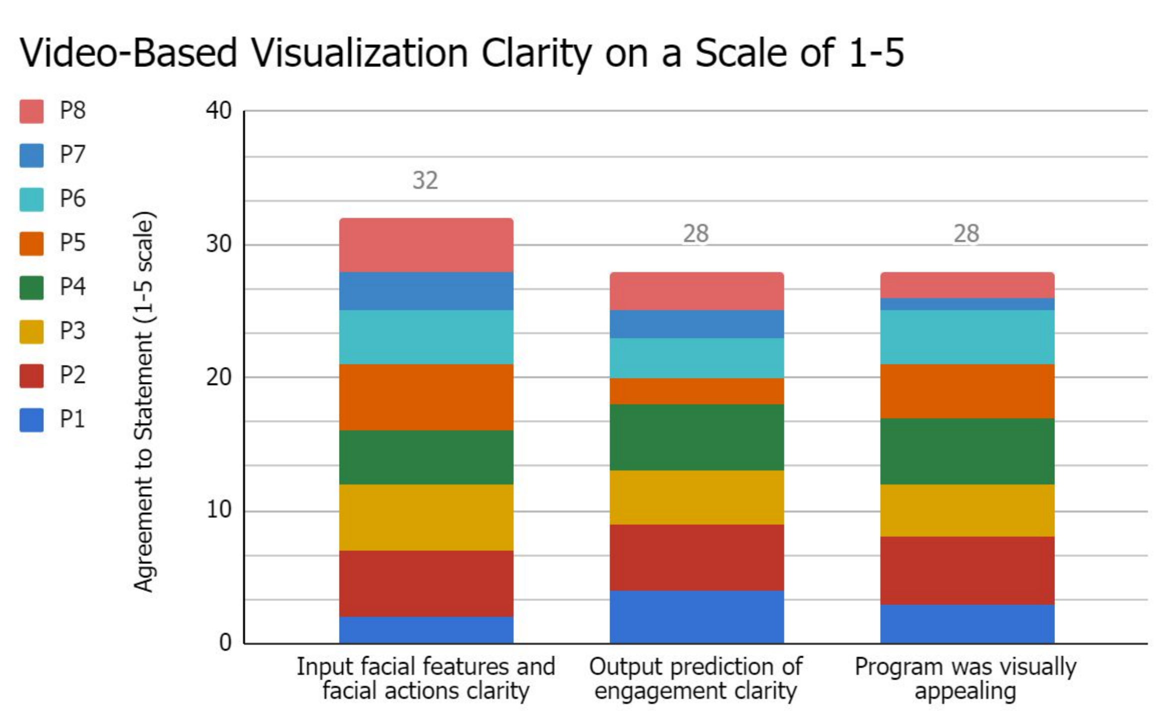


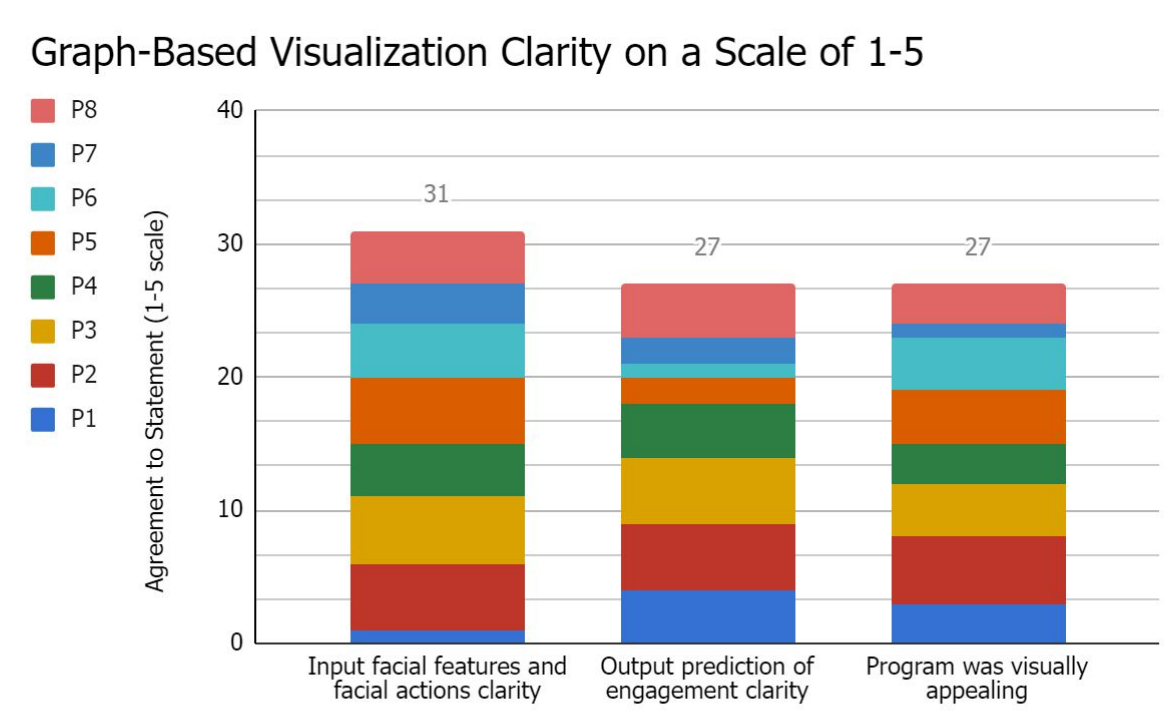
Left: Figure 3, and 4, Graph -based visualization output. Location of the inputted facial features are graphed with the times of engagement and disengagement shaded in the background. Later in the program the user inputs a facial action unit to feed into the model. After the user inputs facial features and facial action units, the program graphs the model's prediction of engagement and the ground truth underneath.

Results

Qualitative Analysis: *Likes/Dislikes* -- An overwhelming majority of the participants liked the video-based visualization (75%). **P5** (Participant 5) thought is was "easier to understand and interpret." **P7** liked how the video showed "parts that scored higher."

The study included 8 participants, 2 who preferred graph-based visualization, 6 preferred video-based, and 2 had no opinion. The participants were students in SHINE and people in the Interaction Lab. Since the sample size was small, there can be no statistical conclusion to which is visualization is better. However, more participants favored the video-based visualization qualitatively.





Top: Figure 5, Responses from study for evaluating Video-based visualization.
Top-Right: Figure 6, Responses from study for evaluating Graph-based visualization.

The difference between the responses of the two visualizations is minute, only by one point with each prompt. This can be an effect of having a smaller sample size.

Python Visualizations

More Information

Advice for Future Students

Use your resources, talk to different people, and get to know their research as well! Seven weeks go by fast, so make lasting connections that you will cherish.

References

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