Improving Human/Autonomous System Teaming through Linguistic Analysis

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Results

Both term comparison and document comparison LSA provide high correlation between predicted and actual scores, with term comparison on producing an r=0.73 and document comparison producing an r=0.72. However, these categories have a similarly high absolute difference between predicted and actual scores, 15.84% and 15.34% respectively. Though there is strong correlation between the predicted and actual scores, their absolute difference suggests that the predictive success of this method is not strong. The limited amount of data and reliance on stock LSA tools may contribute to the limited success of this analysis. The use of specialized topic spaces and lexica, as well as larger data sets, to enhance linguistic analysis may improve the predictive power of these methods.

Methods

To provide quantitative evaluation metrics, a proof-of-concept was carried out for the application of Latent Semantic Analysis (LSA) to evaluate human/chatbot teeming. By running the University of Colorado at Boulder’s online LSA tool[1] over data from the 2014 and 2015 Loebner Prize competitions [2] of human/chatbot teams, numerical scores were obtained that could be correlated with scores provided by human judges during the competition. Using linear regression over this correlation, formulae were obtained for predicting the score of this interaction. These formulae were then tested over the 2013 Loebner Prize transcripts [3] to determine predictive power. Current research is also being carried out to gather data from verbal interactions between humans and drones that allows for better defined semantic space and provides topic space-specific lexica for analysis. Human communication was observed and recorded during interaction with drones in the Autonomy Incubator at NASA Langley Research Center. A new LSA tool was developed in the statistical computing language R [4] to analyze the observed communication and develop a map of the semantic space of the Autonomy Incubator.

Conclusions

This research presents a novel use for standard natural language processing techniques, leveraging tested methods of communication evaluation in autonomy and human factors research, fields that are currently seeking quantitative metrics. Beyond the use of LSA for evaluating human/autonomous system interaction, linguistic tools can also serve to increase trust in the system by enabling transparency and mitigating frustration. Linguistic analysis can also serve to increase the usability of an autonomous system by enabling natural language communication and feedback, allowing these systems to be used in more fields and by more people.

Works Cited

[4] https://www-cpr-project.org/about.html