Analyzing User's Mental State and Facial Expressions in Interaction with Different Personalities in a Critical Situation

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The personality of interlocutors plays a crucial role in shaping the structure and the flow of the conversation. There exists a significant body of research on personality and character attributes in dialogue systems, and on how modifying the behaviors of one interlocutor based on the conversant's personality profile can lead to better outcomes (Yang et. al. 2021). But the interaction between the personality profiles of the interlocutors and how they affect one other in the flow of the interaction has not yet been studied widely. In this work, we aim to use realtime user's facial expressions as well as offline data collected through surveys to explore the mental state of the user and its relation to task performance upon confronting different synthetic personalities in a fast-paced simulation environment.

A wildfire simulation environment was introduced by Chaffey et. al. 2019. In this simulation, the operator (human user) acts as a leader in a search and rescue operation to evacuate a town threatened by an approaching wildfire, with the object of saving as many residents as possible. The simulation consists of a series of residents with different personality profiles (e.g. stubborn person or co-operative couple) positioned randomly across the simulation map (illustrated in Figure 1), 10 aerial unmanned drone robots that perform the search & rescue tasks, and 1 transport vehicle that can evacuate residents who cannot evacuate themselves safely. The rescue task involves (1) locating residents with the help of the available swarm, (2) convincing the residents to evacuate (sometimes this requires having a direct conversation with them), and (3) (in some cases) helping them to reach safety using the transport vehicle.

In this work, we first define our method of modeling user's mental state (using the method introduced in Shao et. al. 2019) and task performance (measured as the number of rescued residents). We explore three research questions about the interaction of users with different personality profiles of virtual residents.

1- Whether there is a corelation between user's mental state and their performance

2- Exploring the relations between different mental states in confrontation with different personality profiles of the residents

3- Whether the user's performance is affected by the order of personality profiles that they are confronted with.

To answer our questions, we utilize the facial expressions of the operator as well as the personality models obtained in pre and post study surveys to model user's mental state. We use OpenFace software (Baltrusaitis et. al. 2018) to extract the facial expressions of the operator during the course of the interaction with the simulation environment. The recorded information contains a complete log of simulation events, including the operator's timestamped actions and instructions to the spokesperson, their performance, and their frontal video recording while interacting with the system. Facial emotion extraction was done during the episodes of confrontation, which we define as the periods in which the operator has a direct and open line of communication with a resident and is conversing with them.

Keywords: Search & Rescue; Personality Traits; Facial Emotion Detection

Figures

Figure 1. *A bird's eye view of the town from Chaffey et. al. 2019*

References

Chaffey, P., Artstein, R., Georgila, K., Pollard, K. A., Gilani, S. N., Krum, D. M., ... & Traum, D. (2019). Developing a virtual reality wildfire simulation to analyze human communication and interaction with a robotic swarm during emergencies. In Proceedings of the 9th Language and Technology Conference.

Yang, R., Chen, J., & Narasimhan, K. (2021, Αύγουστος). Improving Dialog Systems for Negotiation with Personality Modeling. Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (Volume 1: Long Papers), 681–693. doi:10.18653/v1/2021.acl-long.56

Baltrusaitis, T., Zadeh, A., Lim, Y. C., & Morency, L. P. (2018, May). Openface 2.0: Facial behavior analysis toolkit. In 2018 13th IEEE international conference on automatic face & gesture recognition (FG 2018) (pp. 59-66). IEEE.

Shao, Z., Chandramouli, R., Subbalakshmi, K. P., & Boyadjiev, C. T. (2019). An analytical system for user emotion extraction, mental state modeling, and rating. *Expert Systems with Applications*, *124*, 82-96.