Integrated Model for Generating Non Verbal Body Behavior Based on Psycholinguistic Analysis in Human-Robot Interaction

Amir Aly and Adriana Tapus

Cognitive Robotics Lab - ENSTA-ParisTech, France
{amir.aly, adriana.tapus}@ensta-paristech.fr

Abstract

Robots are more and more present in our daily lives. They have to move in human-centered environments, to interact with humans, and obey some social rules so as to produce an appropriate social behavior in accordance with human's profile (i.e., personality, emotional state, and preferences). The user's personal profile links between different ways of communication like the verbal, nonverbal, and para-verbal. Verbal and nonverbal communication play a major role in transferring and understanding messages in a social interaction between a human and a robot, because of their natural alignment and synchronization. The nonverbal behavior can be generated based on a linguistic and contextual analysis of the verbal language, relying on rules derived from extensive research into human conversational behavior.

This study defines a new mechanism of generating gestures, in parallel with generated natural language based on human personality. Our model contains the following steps:

- Speech recognition platform.
- Personality recognition analysis.
- Natural language generation.
- Gestures generation corresponding to the generated language.
- Transferring the data of the generated gestures in real time to the humanoid robot (in our case Nao robot).

In this work, we used Dragon (Dragon Naturally Speaking 11.5) speech recognition system that can dictate continuous speech into a text with high accuracy. This text is used for the user's personality recognition analysis. The personality of the user is expressed through the Big Five personality dimensions [1]: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, based on some psycholinguistic cues in the written text [2].The natural language generator (PERSONAGE) developed by Mairesse and Walker in [3], receives the description of the human's personality as input, and tries to generate a corresponding text to the personality dimension to be used as a verbal reaction by the robot, based on the traditional pipelined natural language generation (NLG) architecture [4]. PERSONAGE generator was mainly developed to produce personality based utterances for the restaurants' domain in New York City, but it can also be extended to other domains, and this point is still under development. The user's personality and the gestures are highly correlated. In [5] the authors discussed the effect of the personality traits on the characteristics of the performed gestures (e.g., amplitude, direction, rate, and speed). Similarly, they can influence the verbal content of speech in terms of (verbosity, repetitions, etc). Moreover, Nass et al. in [7] discuss the similarity-attraction principle (i.e., individuals are attracted by others with the same personality traits). All this work constituted the inspiration of this current work, where we try to use the user's personality traits as an intermediate step towards automatically generating robot gestures based on the generated text that matches the user's personality traits.

Moreover, we use (BEAT) toolkit for generating different kind of gestures (e.g., eyebrows, iconic, beat, and deictic) based on the generated utterances in the previous step, from which it extracts some linguistic features (e.g., theme/rheme) in order to generate a series of synchronized gestures [6]. BEAT is driven by hand made rules synchronizing gestures with linguistic cues obtained from live conversations. However, the existing system doesn't include a lot of gesture types. In this work, we try to extend the existing model by training the system over new rules characterizing new kind of gestures to increase the gestural expressiveness toolkit.

The last step concerns the modeling of both the generated gestures and the generated language on the robot's behavior. In this way, we expect to obtain a multi-modal customized robot behavior capable to interact with humans autonomously in different contexts and scenarios.

A video of our system with Nao robot is available at: http://www.ensta-paristech.fr/~tapus/HRIAA/media.

1. References

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