An Emotion to Speech Mapping Framework for Electronic Negotiations and Negotiation Training

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Abstract. We propose a framework to automatically detect emotions in negotiation support and training systems through facial expression analysis. Facial expressions are recorded by webcams and transferred into emotions via machine learning algorithms. Additionally, speech is recorded and synchronized with the emotions to analyze emotional situations.

Keywords: Emotion Detection, Machine Learning, Negotiation Training

1 Introduction

Emotions and their expression affect human interaction. While emotions are affected by their social environment and social interactions, they do also affect human behavior and decision making. Especially negotiations are strongly influenced by the negotiation participants’ emotions.

"Emotions play a role in the development of relationships among negotiators; they also facilitate or hinder coordination of strategic exchanges." [1]

To take benefit of emotions and its detection in a negotiation situation or a negotiation training we suppose a framework which records facial expressions with the help of a webcam and uses machine learning (ML) algorithms to detect emotions. At the same time speech from microphone is recorded and synchronized with the detected emotions. The goal of this research in progress is to map the facial expression of emotions to the discussed verbal content to be able to figure out which parts regarding content has triggered an emotion and what type of emotion was triggered.

This research in progress aims at (1) the development of extensive negotiation training and support systems and (2) at gaining deeper insights into the role of emotions in negotiations.
The first prototype is finished and has been developed according to design science guidelines. We want to present the actual state of work in this extended abstract.

2 Theoretical Background

Emotions influence negotiation outcomes. If a negotiator’s anger increases, finding compromises and accepting common agreements becomes less likely. Anger often arises when people feel they have been treated unfairly [2]. As shown by Dannenmann [3, p.88-93], negotiators tend to fail in achieving optimal results while facing emotional disruption, such as increasing perceived conflict levels during the negotiation process. Even more, an extensive perceived conflict level can lead to the termination of the whole negotiation process.

Furthermore, the expression of emotions (real or played) can influence a negotiation. Daly [4, p.35] demonstrated how the emotional expression of anger can influence negotiations to either a positive or negative outcome and describes the expression of anger as a possible persuasive negotiation tactic.

As emotions are being expressed through facial musculature [5] and the core expressions of happiness, sadness, disgust, fear, anger, contempt and surprise being universal [6], [7], emotions can be detected through analyzing facial expressions [8, p. 266]. Despite the core facial expressions of emotions being considered universal, display rules can change the facial expressions in the manner of intensity or genuineness in dependence of the social environment or occasion [9, p.75], [10]. Furthermore, cultural differences may lead to a variation in underlying emotions itself.

As can be seen emotions play an important role. To get deeper insights into the role of emotions in the field of negotiation, these emotions must be detected and analyzed. As emotions can be detected through facial expressions, one possibility to automatically detect emotions with a negotiation support or training system is machine learning (ML). Bartlett et. al. showed, that ML can detect both, facial expressions [11] and spontaneous facial expressions [12] in video data using the Facial Action Coding System (FACS). Girard et al. were able to automatically detect spontaneous facial expressions in non-scripted social situations [13].

In the field of negotiations and negotiation support, ML so far is primarily used to automate negotiations [14], [15] while replacing human negotiators. ML is also used in negotiation training systems to simulate a human negotiation partner. Melzer [16] for example developed an expert system based on Fuzzy Logic to create a text-based negotiation training simulation. There are several further negotiation training systems like SimpleNS, Inspire or Imbins [17], which are not based on ML. However, they all do not consider emotional behavior, which, as described earlier, is crucial when at least one negotiator is human.
3 Framework and prototype

The presented framework is a component for a possible negotiation support and/or training system which considers emotions. Therefore, it is not a negotiation support or training system itself. The contribution of this work is an Emotion to Speech Mapping and Result Access (ESMRA) framework which enables researchers to develop instantiations or refining and improving the framework itself without having to start from scratch.

To gain information about emotional reactions from facial expressions triggered by speech, multiple components are necessary which process data and interact. The framework supposes two primary actions: (1) the storage of facial expressions and speech data (text) along with the timestamps of their occurrence to synchronize emotions and text and (2) the access of the stored data in order to analyze speech data and emotional data. The components of the framework and its basic architecture can be seen in fig. 1.

![ESMRA Framework components](image)

Based on the framework showed in fig. 1, a prototype was developed in the programming language Python which can

- retrieve speech data and data about facial-expression of emotions (Retrieval Engine in fig.1)
- match emotions to speech data with timestamps and offset calculations (Sync Engine in fig. 1)
- transform, sort and alter matched data to result data (Process Engine in fig. 1)
- provide user management to map users to data and allow access to result data to end users
- allow persistent documentation of and access to the data in several stages of processing (Storage and Access Engine in fig. 1)
4 Discussion and conclusion

Actual negotiation training and support systems lack the possibility to automatically detect emotions and to analyze the reasons for the occurrence of situational emotions and their influence on negotiation outcomes. The proposed framework helps to close this gap. With a working prototype, we could already demonstrate the technical possibilities by using Python libraries with machine learning algorithms to detect emotions through facial expressions and to synchronize and store speech data. First simple tests showed that emotion detection and synchronization work well. Even with some ready-to-use Python libraries for face detection emotions could be detected successfully. Further research in many fields is now necessary, e.g. to improve the detection rate of emotions and experiments must be conducted to prove the utility of the prototype. With the help of this framework new negotiation support and training systems can be developed which consider emotions in negotiations.

References


