

Applying Computer Science Methods to User Emotion Recognition

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1 Introduction

In recent years computer science research has shown increasing efforts in the field of software agents with emotion. Several approaches have been made concerning emotion recognition, emotion modeling, generation of emotional user interfaces and anthropomorphic communication agents. This paper presents the current work on a small research framework for emotion recognition from facial expressions at the Berufsakademie Stuttgart, University of Cooperative Education.

Motivations for emotional computing are manifold. Emotions play an essential role in decision making, as well as in perception and learning and emotions influence rational thinking and therefore should be part of rational agents as proposed by artificial intelligence research [1]. Another focus is on human-computer interfaces which includes *believable* animation of interface agents [2].

The number of human communication channels is reduced in human machine interaction which makes communication more difficult. Psychological studies show that only 7 % of the meaning is in the words that are spoken [3]. This is a motivation to enrich human computer interaction by adding another channel by facial expression interpretation. *Basic emotions* are reflected reliably by facial expressions [4]. The emotions we consider in our work are anger, disgust, fear, joy, sadness and surprise.

2 Classification of facial expressions from digital images

Our system integrates image processing methods and AI methods. The design comprises four main phases: head location, identification of regions of interest (ROI), feature extraction and, finally, emotion classification.

For two of these steps we have completed first developments in a test environment. The first part is a set of algorithms for dedicated image region analysis [5]. Each ROI determines a dedicated context in which context-dependant algorithms are applied. An example for feature extraction is the following: the amount of detected horizontal edges in the forehead-ROI, determines the feature "forehead wrinkles". The feature is

given a symbolic value *small*, *medium* or *large* with an evidence value. In a similar way horizontal and vertical wrinkles at the root of the nose are classified and further methods for the eye and cheek region are developed for the significant facial features. In the next phase, given a symbolic description of a facial expression, the emotion classification is based on the Dempster-Shafer rule [6]. The alternatives are given by the basic emotions mentioned above. The basis for the association of a facial feature to an emotion is given by psychological analysis (e.g. [7]) and - for completion and first tests - from own experiments. As an example, wrinkles on the forehead generally appear with the emotions fear, surprise and sadness. Therefore, the alternative set {fear, surprise, sadness} is assigned an evidence value depending on the certainty of the feature detection. Combining all evidences leads to a classification of the emotion.



Fig. 1. Example for classification steps from head detection to ROI - analyses to emotion classification

3 Conclusion and Acknowledgements

Future work, supported by student research projects, will concentrate on the completion of the first phases, machine learning and improvement of the algorithms. Finally, I want to thank Martin Joos and Philipp Krauss for their valuable contribution and for providing a graphical user interface which has proven to be a very useful development tool.

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