

Facial Expression Recognition for Semantic User Modeling

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Human computer interaction covers the methods of information exchange between man and computer. The interaction is typically used to obtain explicit user commands and/or to collect implicit feedback, which is the more problematic of the two. The observations of implicit actions may be ambiguous in that we try to guess what the user is thinking without actually knowing it explicitly. In this paper we explore detecting user's facial expressions/emotions – which ultimately serve as a vehicle for better user modeling – as one of the possible ways to obtain implicit information from the user beyond the scope of the typical human input devices allow.

Basic human emotions and their expressions are innate generic reactions, constituting an implicit way of communication. Implicit signals like tone of voice, gestures and facial expressions are applied in verbal communication and often have non-trivial power of expression, which can confirm, refute or totally alter the meaning of the verbal part of communication. Analogously in the task of information retrieval, user's informational need affects his/hers emotional need, and vice versa [2]. Our project is based on this influence of user's informational and emotional needs, ultimately aiming to enrich the user feedback with them.

In this paper we describe the stages of our research. We propose a method for recognizing facial expressions/emotions of a human subject based on a sequence of images (frames) of the subject's face. In order for the recognition method to provide feature rich input for subsequent machine learning-based method of user modeling, we recognize lower level facial features that can be effectively used to build up the higher level emotions. Most existing recognition systems consider the discrete representation of the six basic emotions: joy, sadness, anger, disgust, surprise and fear [3], while others represent the extracted information in two-dimensional space (positive - negative and active - passive). Our experiments have shown that the facial expression of these basic emotions can be more complex; consequently we decided to recognize facial features with lower granularity. The output of our method is a set of small atomic

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movements of the facial muscles – so called Action Units [1] – which are, or are not present in the input image. Due to their physical nature, the complex facial expressions consist of the simple movements. Using this representation we obtain a more accurate description of user's emotional state. Our approach is based on several similar implementations [3, 4] which are realized using Support Vector Machine (SVM) learning.

In the final stage, we propose a user modeling method that uses the emotional states for user/student modeling in a personalized information system, which, in our case, is an online web-based learning environment used by hundreds of users in teaching of programming. Our method determines the relations between the emotion recognition output and user activities within the information system. The ultimate goal is to anticipate user's (student's) immediate action based on previous activities and emotional state.

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