https://doi.org/10.20378/irbo-51764

Facial Expressions of Pain
Automated Analyses

Michael Siebers

Cognitive Systems Group, Faculty Information Systems and Applied Computer Science, University of Bamberg

Facial expressions convey a lot about the mental state of a person. Thus, the analysis of facial expressions is a promising research area [1]. My thesis is attended to facial expressions of persons in pain, especially the individually of those expressions. I'm surveying this topic from two perspectives: One aim is to determine whether subject-specific image classifiers are neccessary for a good accuracy. On the other hand I'm interested in the temporal patterns of facial pain expressions.

To answer the first question a study comparing subject-specific and general classifiers were compared. A broad repertoire of learning algorithms was used. The study was conducted with images of subjects in pain (no acting involved). Though first results indicated that subject-specific classifiers were not needed, it could be shown that the study suffered a lot of overfitting. The experiences of the first study will be used to redesign the experiment.

Nevertheless, at first we are collecting a baseline for the classifiers. We are running a study with human observers which are to rate images according to the shown facial expression. Shown are neutral expressions, expressions of pain, and – as distraction – expressions of disgust. The study is designed as a learning experiment that allows us to attribute accuracy to general knowledge about pain expressions, familarity with the shown person, and knowledge about the individual pain expression of the person shown.

For the second aim the facial expressions are encoded as Action Units (AU). The temporal patterns of AU beginning and endings are analysed. In general this kind of learning is challenging as only positive examples (in a narrow meaning) are available. In a first study we tried to form a context-free grammar from the beginnings using the ABL framework of van Zaanen [2]. The results are promissing yet disappointing. Jusing clustering methods we could identify related patterns. However, the grammars contain too many rules to be comprehensible. In further

studies I will try different approaches to the grammar induction (evolutionary algorithms) and also adhere to the endings of the AUs. Also context-sensitive grammars might pose a more natural representation of expression generation rules.

References

[1] B. Fasel and J. Luettin (2003). Automatic facial expression analysis: a survey. Pattern Recognition, 36: 259–275

[2] M. van Zaanen (2002). Bootstrapping structure into language: Alignment-based learning. PhD thesis, University of Leeds, UK.

Building a Hierarchy of Functional Representations for Domain-Independent Reinforcement Learning in Non-Markovian Environments

Mark Wernsdorfer

Cognitive Systems Group, Faculty Information Systems and Applied Computer Science, University of Bamberg

This project explores dependencies between specific ways of representing sensomotoric data, identifying its functional role and in how far it enables inferring appropriate conclusions about different rewarding environments. Following the initial proposal of Harnad (1990), a hybrid architecture has been designed that consists of a sub-symbolic and a symbolic layer. The project is motivated by the assumption that symbols need not be grounded in communication, but can also be exclusively mental in nature. Therefore it differs from other research in Symbol Grounding like Steels (1999) where a community of artificial speakers tries to agree upon a common dictionary for designating objects. Furthermore, the motivation for grounding is not consensus but reward in a continuous environment. Successful interaction with different rewarding environments can be approached by Temporal Difference Learning (Sutton & Barto, 1998). But optimality of this method is limited to environments where the agent's sensorimotor states are dependent only on the frequency of previously experienced states (Markov assumption).