Chapter 23
Towards Emotion Classification Using Appraisal Modeling

Gert-Jan de Vries
Philips Research, The Netherlands & University of Groningen, The Netherlands

Dirk Brokken
Philips Consumer Lifestyle, The Netherlands

Paul Lemmens
Philips Research, The Netherlands

Steffen Pauws
Philips Research, The Netherlands

Michael Biehl
University of Groningen, The Netherlands

ABSTRACT

The authors studied whether a two-step approach based on appraisal modeling could help in improving performance of emotion classification from sensor data that is typically executed in a one-stage approach in which sensor data is directly classified into a (discrete) emotion label. The proposed intermediate step is inspired by appraisal models in which emotions are characterized using appraisal dimensions, and subdivides the task in a person-dependent and person-independent stage. In this paper, the authors assessed feasibility of this second stage: the classification of emotion from appraisal data. They applied a variety of machine learning techniques and used visualization techniques to gain further insight into the classification task. Appraisal theory assumes the second step to be independent of the individual. Results obtained are promising, but do indicate that not all emotions can be equally well classified, perhaps indicating that the second stage is not as person-independent as proposed in the literature.

INTRODUCTION

Within affective computing there are various classification challenges like for instance affective annotation of images, video, or written text; or the recognition of various affective states given sensor data. In this work we focus at the subdomain of emotion classification from sensor data, which can be based on many different input signals. The field is dominated by three main input types, all measuring signals from the human body: video, audio and physiology. Emotional states can be derived from video through facial expressions, postures or movements (Gunes and Piccardi, 2009; Sanchez et al., 2010; Xiao et al., 2011; Van Kuilenburg et al., 2008); from audio through utterances (Sobol-Shikler and Robinson, 2010;

DOI: 10.4018/978-1-5225-0159-6.ch023

Van den Broek et al., 2011; Wu et al., 2011); and from physiology through a variety of bodily signals such as cardiac activity, skin conductance and respiration (Chanel et al., 2009; Hosseini et al., 2010; Van den Broek et al., 2010). We refer to Janssen et al. (2013a) for a more comprehensive overview of studies that use one or more of these input signals for emotion classification.

Despite various advances in the field, performances are generally below those in other fields of automated classification, such as finger print recognition, restricted cases of handwriting recognition, etc. This indicates that affective classification tasks are generally difficult. We also observe that most automated affective recognition systems use a one-step approach, directly mapping measured features to emotion labels. As suggested by some (Ptaszynski et al., 2009), the integration of contextual information in a multi-step approach might aid in the interpretation of various input signals. Because this approach might be applicable to a wide range of different affect recognition systems it calls for a structural approach.

We hypothesize that models coming from appraisal theory might provide such a reasoning framework in which factual contextual information can be combined with other sensor data that carry information about the personal interpretation of the person being measured. We propose a system that uses an appraisal model in a two-step approach, in which the first step maps measurement data to an appraisal representation, and a second step maps the appraisal representation onto emotion labels. Several appraisal theories have been coined (Ortony et al., 1988; Scherer, 2001; Frijda, 1987; Lazarus, 1991; Marsella et al., 2010) that have in common that they propose the process towards appraisal of stimuli to be person dependent whereas the generation of emotion from an appraisal is proposed to be person-independent. This means that interpersonal differences can be taken into account in the first step of the suggested two-step approach, while the second step is independent of the user of the system.

Regarding the mapping of sensor data to appraisal, several studies have shown that various appraisal dimensions can be obtained from, e.g., physiological measurements (Aue et al., 2007; Grandjean and Scherer, 2008; Bradley et al., 1993; Smith, 1989; van Reekum et al., 2004). The second step of mapping appraisals to emotion labels, has been studied to certain extent by the authors of appraisal models (Scherer, 1993; Scherer et al., 2006), but apart from one recent publication (Meuleman & Scherer, 2013) have not involved more sophisticated classification techniques from machine learning research. Our aim is to research the potential use of appraisal models in a two-step approach to emotion classification. In the present study we will provide an independent assessment of one such appraisal model using a variety of machine learning techniques and use visualization techniques to gain further insight into the classification task.

Given the limited performance observed in existing affective classification systems, the benefit of the two-step approach we propose is that it will separate the person-dependent and person-independent variability in the data. In the two separate steps, dedicated classification techniques can be applied that specifically address the different sources of variation. Thereby the overall system could come to a better performance than the one-size-fits-all approach of one-step classification can achieve. In addition, from a research perspective, the two-step approach enables separate study of both steps while still enabling easy integration (presuming a common framework).

In the next section, we will continue with an overview of appraisal theory. Section 3 sketches the field of emotion classification and the potential of appraisal theory in this respect. In section 4 we will discuss the experiment performed, of which the results are presented in section 5. Finally we end with a discussion, conclusion and outlook in sections 6 and 7.