

Classification of affective and social behaviors in public interaction for affective computing and social signal processing

Maria Konstantinova^{1,2}, Evdokia Kazimirova¹, and Olga Perepelkina¹

¹NeurodataLab LLC

²Lomonosov MSU, Russia

Corresponding author:

Evdokia Kazimirova¹

Email address: e.kazimirova@neurodatalab.com

ABSTRACT

There are numerous models for affective states classification and social behavior description. Despite proving their reliability, some of these classifications turn out to be redundant, while others — insufficient for certain practical purposes. In this paper we propose a classification describing human behavior in the course of public interaction. We relied on existing literature to adopt the current achievements to a practical task—to automatically detect various aspects of human behavior. Our goal was not to suggest a new universal model describing human behavior, but to create a quite comprehensive list of affective and social behaviors in public interaction. The final list consists of the following seventeen scales: happiness, surprise, anxiety, anger, sadness, disgust, shame, pride, contempt, admiration, self-presentation, self-disclosure, mental effort, friendliness, engagement, pleasure and self-confidence. These scales concern only behavior patterns which can be observed by outside annotator and do not include personal traits or hidden states.

INTRODUCTION

Since information technologies have taken top priority nowadays, it is crucially important to be able to filter, categorize and analyze data. While significant progress has been made in the sphere of objects classification, there is still a considerable scope for the development of automatic recognition of human emotions and behavior.

In the last decade the interest to automatic human emotion recognition has increased in connection with the development of human–computer interaction devices. The term affective computing (or artificial emotional intelligence) suggested by Picard (1995) means the study and development of systems capable to recognize, interpret and process emotions, as well as respond to them and simulate human affect. One of the main goals of affective computing is to create algorithms that can adapt to users' emotions in order to produce more natural and efficient interaction (Novak, Chanel, Guillotel, & Koenig, 2017). It is an interdisciplinary field that integrates affective and computational sciences. Social signal processing is related to affective computing research field (Pentland, 2007; Vinciarelli, Pantic, Bourlard, & Pentland, 2008). As authors define, social signals and social behavior are “the expression of one’s attitude towards social situation and interplay, and they are manifested through a multiplicity of non-verbal behavioral cues including facial expressions, body postures and gestures, and vocal outbursts like laughter” (Vinciarelli, Pantic, & Bourlard, 2009).

The developing of affective computing and social signal processing systems involves several steps. One important step is to obtain databases of annotated observations of human expressive behavior. These databases are necessary for building machine learning models. A large training corpus of annotated data is needed for the operation of machine learning algorithms. A gold standard labeling of training data is obtained through manual annotation, whereby people (annotators) observe videos, pictures or texts and match data items with preselected categories.

There are several approaches to person's states classification but in each practical case researcher should take into account content the study makes use of. For different content types the adaptation or coalescence of different classifications might be necessary.

While by now the complete description of person's state with machine learning algorithms is beyond reach, these algorithms are successfully implemented for some specific objectives. For instance, to predict bonding in conversation (Jaques, McDuff, Kim, & Picard, 2016), to make individual prediction about well-being and mood (Taylor, Jaques, Nosakhare, Sano, & Picard, 2017) or to estimate soldier's suicide risk (Baucom et al. 2017).

1 DATASETS FOR AFFECTIVE COMPUTING AND SOCIAL SIGNAL PROCESSING

To enable affective computing and social signal processing unimodal and bimodal datasets were created, e.g., VAM corpus (Grimm, Kroschel, & Narayanan, 2008); SEMAINE (McKeown, Valstar, Cowie, & Pantic, 2010); Montreal Affective Voices (Belin, Fillion-Bilodeau, & Gosselin, 2008); HUMAINE project (Douglas-Cowie et al., 2007), etc. For more information regarding the existing datasets see (Bänziger, Mortillaro, & Scherer, 2012; Poria, Cambria, Bajpai, & Hussain, 2017).

Furthermore, there are well-designed multimodal corpora, e.g., RECOLA (Ringeval, Sonderegger, Sauer, & Lalanne, 2013); GEMEP (Bänziger et al., 2012); IEMOCAP (Busso et al., 2008); RAMAS (Perepelkina, Kazimirova, & Konstantinova, 2018). For more details on social signal processing systems see (Pantic & Vinciarelli, 2014).

The datasets mentioned above are limited by the number of interlocutors (404 participants maximum; for review see Poria, Cambria, Bajpai, & Hussain, 2017). For automatic recognition of human behavior much more data is needed to cover variations of states' expressions. It is almost impossible to collect a dataset of such span, so it seems reasonable to use some external source of data, such as TV shows or movies.

TV interviews are very popular — according to Statista (2017), among the primetime TV programs in the United States as of May 2015 10% are TV interviews or talks. Because of their plentitude and great diversity, TV interviews represent a useful source for machine learning in the emotion recognition field. Furthermore, the behavior of an interviewee is more natural than an actor's behavior in a movie (Aslama & Pantti, 2006). Thus, TV interviews have clear benefits in comparison with other types of affective television content.

TV interviews can be grouped into two main categories by video shooting conditions: studio interviews and street interviews. Audio-video content shot in a studio may serve as a valuable source of high-quality data needed for AI model training, since studios have stable lighting and there is no environmental noise as opposed to outside shooting.

Affective TV content can be divided into four groups: political debates, movies, talks and interviews (inside and outside). The most extensively studied type is political debates (Grebelsky-Lichtman, 2016). Participants' behavior in the course of an interview is more diverse than that during political debates, because politicians are highly motivated to participate in debates and a priori they take opposite sides. Besides, political debates have a well-defined structure: participants normally speak by turns, so there is no natural turn-taking. Interviewees demonstrate a broader range of behavior types: they may have different levels of motivation, interviews have various formats (dyadic interaction, group interview, street interview, etc.) and a greater topic diversity than debates.

In fact, studio interview has some peculiar properties and limitations. One can expect that some types of social behavior would occur less often than others. Furthermore, a TV interview cannot provide a big diversity of interpersonal relationships since the managing and leading role belongs to the show host. The host always plays the same role, which implies that his or her behavior is more 'adapted' to the studio environment than that of the interviewee.

Apart from TV shows, one can also try to obtain the whole gamut of social and affective behavior data from movies. The amount of good-quality data with great diversity of states inspires researchers to work with this content. For example, the LIRIS-ACCEDE database, which contains discrete and continuous movies excerpts rated in arousal-valence scales (Baveye, Dellandréa, Chamaret, & Chen, 2015), was used to predict the affect dimensions of the video (Baruah, Gupta, & Narayanan, 2017).

However, this type of content also has its limitations. One of the obstacles for computer analysis is that for artistic purposes scenes and camera angles in movies may change rapidly which makes it hardly

possible to monitor the entire behavior pattern of a person. The technical peculiarities of movie content require careful approach to data processing with careful speaker identification (Li, Narayanan, & Kuo, 2004). Other limitations of movie content include exaggerations, circumstances and contexts unlikely in everyday life. As we intend to use machine learning algorithms to process natural human emotions, we need to train these algorithms using such material that reflects real-life social behavior. Therefore, we assume that a TV show format is more appropriate for practical purposes.

As for data annotation and classification, the most common task in this field is affective states classification. For this purpose discrete and dimensional approaches to data categorization are typically used.

The discrete emotions approach relies on the categorization reflected in the organization of emotion semantic fields in natural languages (Scherer, 2005). Plutchik (2001) introduced a wheel of emotions consisting of eight basic emotions and eight advanced emotions, each composed of two basic ones. For further information about some existing discrete approaches see (Cambria, Livingstone, & Hussain, 2012; Ortony, Clore, & Collins, 1988).

The dimensional approach represents emotions as coordinates in a multi-dimensional space. The number of dimensions in model may vary from two (Lang, Bradley & Cuthbert, 1998; Russell, 2009; Thayer, 1989; Watson, Wiese, Vaidya, & Tellegen, 1999) to three (Osgood, 1966; Wundt, 1896) or four (Fontaine, Scherer, Roesch, & Ellsworth, 2007; Nowlis & Nowlis, 1956).

Furthermore, there are affective models that combine both — they are called hybrid emotional models. The affective data can be represented both in a dimensional and in a discrete form (Cambria, Livingstone, & Hussain, 2012; Lewis & Granic, 2000; Sacharin, Schlegel, & Scherer, 2005).

2 PROPOSED CLASSIFICATION

We propose the list of affective states and social behaviors that can be used to describe human behavior in public dyadic social interaction. Human behavior in a TV interview is highly influenced by two forms of social interaction: the dialogue with the interviewer and interaction with the audience. We selected affective and behavioral states that met certain criteria:

- They should be well-observed in external behavior.
- They should occur in content like TV shows with relatively high probability.
- Every scale should include a wide range of behavior manifestations.

In relation to human behavior in TV interviews we propose a classification that meets the above-mentioned criteria and includes the following scales: happiness, surprise, anxiety, anger, sadness, disgust, shame, pride, contempt, admiration, self-presentation, self-disclosure, mental effort, friendliness, engagement, pleasure and self-confidence.

Below we provide a description of these scales supported by literature references.

2.1 Affective States

We include in our list the following affective states: happiness, sadness, surprise, anger, disgust, anxiety, shame, pride, contempt and admiration.

The pragmatic advantage of the emotions mentioned above is that their semantic concepts are relatively universal. Behind each of these states lies a cluster of affective states representing the diversity of expressions and nuances (Scherer, 2005). We assumed that in case of video annotation the description of these concepts must neither be too detailed nor include references to a behavior pattern (for instance, particular facial mimic). Otherwise it might impel raters to select episodes involving only one form of emotion expression.

The first five of the above mentioned affective states (i.e. happiness, sadness, surprise, anger, and disgust) belong to so-called basic emotions (Darwin, 1956; Ekman, 1992; Izard, 1992). It should be noted, though, that at present the concept of 'basic emotions' remains arguable (Barrett & Wager, 2006). Nevertheless, the term is practically convenient and widely used in affective computing studies (Osman & Falk, 2017).

Instead of fear which is usually included in the basic emotions group, we chose the anxiety state. The term 'fear' is defined as an emotion resulting from a known external danger that may threaten life or

personality (Woody & Teachman, 2000). Occurrence of natural fear has low probability in the situation of public interview, while anxiety and nervousness in the situation of public speech in front of cameras can be observed more frequently. In spite of the fact that the word 'anxiety' has multiple meanings including specific symptoms in psychiatry involving certain neurophysiological changes (Stein & Stein, 2008), or a trait characteristic of a person (Spielberger, 2014), in case of video annotation this word appears to be the most precise and understandable for defining anxiety-related behaviors induced by the situation.

Shame is a feeling that a person is not matching the self's standards or is losing his or her social status. The self's standards are heavily influenced by the social ones and often include aspects of morality, knowledge, competence and aesthetics (Tangney, 1999; Tracy & Robins, 2004).

Tomkins (2008) gave a broad definition of shame: shame is a negative affect felt in response to any impediment to the ongoing experience of interest or joy. Parker (1988) defines shame as a painful self-focused affect. Shame involves a painful negative scrutiny of the entire self and feelings of worthlessness, powerlessness, and incompetence (Stoeber, Harris, & Moon, 2007).

There are two kinds of shame (Gilbert, 1998; Stoeber, Harris, & Moon, 2007): external shame (i.e., awareness that the self may be viewed negatively by others) and internal shame (i.e., negative self-evaluation originating from the self). There is also such phenomenon as 'vicarious shame' denoting embarrassment experienced on behalf of another person (for example, your friend got drunk and stole a refrigerator — you feel embarrassed when you are telling this story).

Pride is a feeling that a person is matching the self's standards (Tangney, 2005; Tracy & Robins, 2004). It is associated with positive self-evaluation, feelings of accomplishment and satisfaction, and awareness that one is a socially valued person, which contributes to self-esteem and subjective well-being (Stoeber, Harris, & Moon, 2007). Tracy and Robins (2007) distinguish two forms of pride: authentic and hubristic pride. With both forms, the attributional focus is on internal causes. However, authentic pride implies attributing success to unstable and specific causes (e.g., specific accomplishments or prosocial behaviors: 'We've made the super project!', 'I've made the original thing'), whereas hubristic pride attributes success to stable and global aspects of the self (e.g., 'I'm tough!', 'That's how good I am!'). Tangney (2002) named the two forms of pride alpha pride (pride in self) and beta pride (pride in behavior). Pride can also occur in relation to self indirectly. You can be proud not only of your own achievements, but also feel pride for someone else connected with you in some way: your son, your fellow countryman who won a prize, or your dog that saved a neighbour.

Shame and pride are termed as self-conscious emotions because they fundamentally involve evaluation of the self (Tangney, 2002; Tangney & Dearing, 2002; Orth, Robins, & Soto, 2010).

Contempt is a feeling that a person or thing is worthless or deserves no respect; it also implies considering oneself supreme over a person or social group in any aspect. Fischer and Roseman (2007) suggest that contempt is the result of unresolved angry interactions.

Contempt, along with anger and disgust, is considered to be emotional basis for morality (The CAD Triad Hypothesis by Rozin, Lowery, Imada, & Haidt, 1999). Suggestively, these are reactions to violation in three different ethical domains: anger — in reaction to the violation of autonomy (individual freedom, rights), contempt — in reaction to the violation of the ethics of the community (respect, duty, hierarchical relations), and disgust — in reaction to the violation of the ethics of divinity (purity, beauty). Separation between disgust and contempt was first introduced by Ekman and Friesen (1988). Contempt commonly occurs together with anger in negative social interactions, and they both imply a negative appraisal of the intentions of the other person (Fischer & Roseman, 2007; Kuppens, Mechelen, & Meulders, 2004; Ortony, Clore, & Collins, 1988). Contempt is typically a less intense but longer-lasting emotion than anger, implying more negative and permanent changes in beliefs about another person and in the treatment of that person (Fischer & Roseman, 2007; Frijda & Mesquita, 1994).

Admiration is a feeling of respect towards a person or social group that often implies astonishment at or appreciation of somebody's qualities, skills, or achievements. Van der Ven (2017) defined admiration as a feeling of delighted approval of another person's accomplishment. Ortony, Clore and Collins (1988) include appreciation, awe, esteem, and respect into the 'appreciation emotions' group. Admiration, as well as contempt, contributes to the forming of one's social circle. But while contempt aims at excluding the person from one's social network (Fischer & Roseman, 2007), admiration, in contrast, is most likely to lead to a motivation to affiliate with the person (Van de Ven, Zeelenberg, & Pieters, 2011).

2.2 Engagement

Engagement is a term used in relation to conversation (Bednarik, Elvazi, & Hradiz, 2012; Ringeval, Sonderegger, Sauer, & Lalanne, 2013) and, often, to work (Kahn, 1990; Macey & Schneider, 2008) or education (Kahu & Nelson, 2017). Engagement is one's degree of participation, involvement, or interest in action. It can be physical, cognitive, or emotional. Disengagement is the lack of involvement or interest in action. This scale was used for describing social behavior in the RECOLA database (Ringeval et al., 2013). Bednarik et al. (2012) provide the description of conversation engagement levels. In literature concerning "employee engagement" this term is considered from a different point of view (for review see Macey & Schneider, 2008). Macey and Schneider (2008) distinguish three types of employee engagement: trait engagement (positive views of life and work: proactive personality, autotelic personality, trait positive affect, conscientiousness); state engagement (feelings of energy, absorption: satisfaction (affective), involvement, commitment, empowerment); behavioral engagement (extra-role behavior: organizational citizenship behavior, proactive/personal initiative, role expansion, adaptive). In Macey and Schneider (2008) classification the concept "conversation engagement" overlaps with "state engagement" sharing the terms "absorption" and "involvement". It should be emphasized that in the situation of a public interview the managing role belongs to the interviewer.

2.3 Pleasure

Pleasure indicates a degree of emotional comfort in a given situation. As literature survey has shown, the term 'valence' is closely connected with the term 'pleasure'. Valence as a property of affective experience in terms of feeling from pleasant to unpleasant was proposed by Wundt (1893). Valence is a subjective characteristic of a stimulus as positive or negative. From this point of view, it is the basis of a fight-or-flight reaction that modulates attention, mood and cognitive activity (Taylor & Crocker, 1981). Shuman, Sander and Scherer (2013) distinguish two levels of valence: macro- and micro-valence. Macro-valence is referred to as a 'common currency' used to estimate the alternatives and make a choice. As for micro-valence, it is a multiscale appraisal. Micro-valence may concern several events or objects at the same time, which results in a mixed feelings situation.

However, the term 'pleasure' appears to be more appropriate in relation to our purposes. The word 'pleasantness' is often used to describe the sense of valence. As for the valence levels mentioned above, our approach to the definition of pleasure is close to macro-valence, implying estimation of the situation as a whole. 'Low pleasure' means that the person is not comfortable with the situation, feeling ill at ease, whereas 'high pleasure' implies that the current situation is absolutely comfortable for the person.

2.4 Self-presentation

Self-presentation is the behavior that a person uses to communicate some information about oneself to others in order to create a particular impression in interpersonal communication (Baumeister, 1982; Maddux, Norton, & Leary, 1988).

Self-presentation behavior can be addressed to a particular audience or others in general. Audience-pleasing self-presentation is an attempt to present oneself 'favorably' (according to the audience's values), it is specific to a particular audience, and is motivated by a desire for rewards that this audience controls or dispenses. Self-presentation behavior addressed to the audience in general arises from self-constructive needs (Baumeister, 1982). Suggestively, self-presentation performance can be modified by interaction and situation context (Barrick, Shaffer, & DeGrassi, 2009). The social influence theory suggests that practically every interpersonal relationship involves social influence in one form or another; people tend to influence others and to be influenced by them (Cialdini & Trost, 1998; Levy, Collins, & Nail, 1998). Thus, social influence processes are tactics used by individuals to maximize the desired rewards and minimize the potential negative repercussions associated with a given interpersonal interaction. The interdependence theory illustrates the importance of self-presentation tactics in an interview, emphasizes the role of the situation, and argues that social context itself can exert strong effects on behavior (Rusbult & Van Lange, 2003). Self-presentation can be achieved by verbal cues (intonation, speech rate) and non-verbal behavior (Barrick, Shaffer, & DeGrassi, 2009) and by means of clothes, impression management (self-promotion, ingratiation, opinion conformity, favor doing, feigned helplessness).

Self-presentation is connected with social anxiety (Maddux, Norton, & Leary, 1988; Schlenker & Leary, 1982), altruistic and helping behavior, aggressive behavior, task performance, attributions, attractiveness (for review see Baumeister, 1982).

2.5 Self-disclosure

Self-disclosure is defined as an act of revealing personal information about oneself to another person (Collins & Miller, 1994; Cozby, 1973; Wheelless, 1976). This personal information can be divided into descriptive information, such as one's political affiliation, or evaluative information, such as how one feels about starting college (Collins & Miller, 1994).

The disclosure could be characterized by depth or quality and breadth or quantity (Altman & Taylor, 1973; Collins & Miller, 1994). Depth is the intimacy level of disclosure determined by the intimacy of conversation topics. For instance, one's feelings about marriage represent a more intimate topic than one's favorite musical band. Breadth is the amount of time spent talking about oneself or the number of self-relevant statements made during an interaction. However, highly accurate identification of the intimacy level of another person is problematic. Annotators with different cultural backgrounds may evaluate the disclosure level of interviewees differently.

Self-disclosure has several attributions: dispositional, situational and personalistic. Dispositional attribution is the result of a person's natural tendency to self-disclose at a particular level. Situational attribution is the result of environmental specificity. For example, psychotherapy groups demand a higher level of self-disclosure in comparison with job interviews. Finally, personalistic attribution is the result of some special quality of the recipient (Collins & Miller, 1994). Suggestively, dispositional and situational attributions prevail in TV interviews in comparison with personalistic attribution, because the relationship between the interviewer and the interviewee is formal (even if they demonstrate a high level of friendliness).

Self-disclosure is non-linearly connected with liking: people who engage in intimate disclosures tend to be liked more than those who disclose at lower levels, but excessive disclosing of personal information makes the person to be perceived as maladjusted and less likeable (Altman & Taylor, 1997).

Because self-disclosure is linked with liking, it can perform a rewarding function in social interaction. People tend to give more rewards to those whom they like (Worthy, Gary, & Kahn, 1969), so self-disclosure can be used to win the recipient's liking. Furthermore, disclosure itself can be viewed as a positive reward since the recipient may believe that he or she has been personally singled out for intimate disclosure (Collins & Miller, 1994). Suggestively, it also plays protective role in close relationships, because individuals are more comfortable interacting with partners who have an accurate perception of them (Swann, Stein-Seroussi, & Giesler, 1992).

2.6 Mental effort

Another scale included into our classification of human behavior is 'mental effort' (which can also be referred to as 'cognitive load' or 'cognitive effort').

Mental effort is connected with emotions (DeFraine, 2016; Van Dillen, Heslenfeld, & Koole, 2009; Van Dillen & Koole, 2007; Tsouli et al., 2017) and various phenomena of social behavior: perspective-taking (Cane, Ferguson, & Apperly, 2017), lying (Vrij, Fisher, Mann, & Leal 2008), decision making (Gerhardt, Biele, Heekeren, & Uhlir, 2016), and goal achievement (Ma, Tamir, & Miyamoto, 2017).

Mental effort is closely related to emotion intensity. DeFraine's study (2016) shows that cognitive load reduces the intensity of negative emotions during passive viewing of emotional images but does not influence the retention of emotional information in working memory. Moreover, the emotion intensity decrease depends on task difficulty: complex math tasks reduced negative emotional feelings significantly more than did simple math tasks (Van Dillen & Koole, 2007; Van Dillen et al., 2009). Emotional intensity declining effect is described by the distraction and resource hypotheses (DeFraine, 2016). The distraction hypothesis assumes that loading working memory can distract a person from preexisting negative feelings (Van Dillen & Koole, 2007). According to the resource hypothesis, experiencing emotional feelings requires resources, while the same limited resources are also required to perform cognitive tasks (Kron, Schul, Cohen, & Hassin, 2010).

Cognitive load influences emotional experience. In situations that demand high mental effort, people may, consciously or unconsciously, be motivated to experience emotions that help them perform better. Thus, people often regulate their emotions to achieve instrumental benefits. A person is motivated to experience emotions that he or she considers instrumental in a given context, no matter if these emotions are positive or not (Erber & Erber, 1994; Ma et al., 2017; Tamir & Ford, 2012). Cultural contexts shape the perceived utility of emotions and therefore influence emotion regulation. Thus, Ma et al. (2017) show that Americans tend to savor rather than dampen positive emotions more than Asians when expecting

tasks that require high cognitive effort.

Cognitive load affects not only emotional experience, but also emotion recognition. Tsouli, Pateraki and Spentza (2017) report a longer reaction time for negative stimuli during dual-task performance (an additional task demanded high cognitive load). This result suggests the involvement of higher cognitive processes in negative stimuli discrimination which is necessary for evaluating potential threats. Pecchinenda and Petrucci (2016) point out the influence of cognitive control on the perception of emotional facial expressions.

There are several examples of connection between mental effort and social behavior. Cognitive load is associated with perspective-taking (Cane, Ferguson, & Apperly, 2017). Perspective-taking is the ability to infer others' mental states (beliefs, knowledge, attitudes). It is an important part of social interaction, which helps to reduce ambiguity in social interactions and conversations (Cane et al., 2017; Hanna, Tanenhaus, & Trueswell, 2003). Furthermore, mental effort has an effect on decision making: concurrent working-memory tasks increase risk aversion. In the study conducted by Gerhardt et al. (2016) subjects made faster choices under cognitive load. This result can be explained by the risk-as-feelings hypothesis. It suggests that decision making under risk is shaped by an interplay between emotional and cognitive responses that are 'often conflicting' (Gerhardt et al., 2016; Loewenstein, Weber, Hsee, & Welch, 2001). Lying is also considered to be a cognitively demanding process. Several aspects of lying contribute to the increase of mental load: formulating the lie, doubting credibility, monitoring and controlling demeanour, monitoring the interviewer's reactions, reminding oneself to act and role-play, and suppressing the truth (Vrij et al., 2008).

2.7 Friendliness

As we are talking about social interaction it is necessary to include scale for interpersonal relationship between interlocutors. Scherer (2005) describes different types of affective phenomena: emotions, moods, attitudes, preferences, affect dispositions, and interpersonal stances. Attitudes towards others are mapped by Argyle (1981) on two dimensions: Friendly/Hostile and Dominant/Submissive. The friendliness–hostility dimension is also included in the interpersonal models proposed by Kiesler (1983) and Wiggins et al. (2003). Interpersonal theories (Kiesler, 1983) claim that interpersonal behavior tends to draw responses from others that are reciprocal for some scales (for instance, dominance draws submission and vice versa), whereas for friendliness and hostility the responses are correspondent: hostility draws hostility, and friendliness returns friendliness. Although complementarity is neither the only reciprocal interpersonal pattern nor a universal law of interaction, empirical studies find support for its probabilistic prediction (Pincus & Ansell, 2003).

2.8 Self-confidence

Self-confidence is an estimation of one's strengths, skills, abilities, resources, arguments, and chances to achieve desired goals. According to Shrauger and Schohn (1995), self-confidence is a sense of self-competence and skill, one's perceived capability to deal effectively with various situations. Serrat (2017) includes self-confidence in his model of emotional intelligence as sureness of one's self-worth and capabilities. Self-confidence is a part of the core self-evaluation concept (Judge, Bono, Erez, & Locke, 2005). It consists of self-esteem, general self-efficacy, internal locus of control and emotional stability. There are several hypotheses regarding self-confidence functions: it can enhance well-being; it can compensate limited self-control and enhance performance (Mobius et al., 2011). Self-confidence is connected with life satisfaction (Ozer & Sackes, 2011); thinking of oneself favorably can make a person happier (Benabou & Tirole, 2006). Self-confidence can enhance motivation, making it a valuable asset for individuals with imperfect willpower (Benabou & Tirole, 2006).

3 DISCUSSION

Emotions and social context have reciprocal influence on each other (Kappas, 2013). Behavior patterns and emotion manifestations in public depend on communication aims (Parkinson, 2005; Wilutzky, 2015), social context (Jakobs, Manstead, & Fischer, 2001) and other factors (Park et al., 2013; Parkinson, 1996). This allows us to suggest that by analyzing affective and social behaviors in public interaction we may obtain diverse data with a broad natural spectrum of affective and social behaviors. At the same time, it should be mentioned that a wide variety of manifestations of each state requires a respective dataset expansion.

It is also worth pointing out that public interaction is a complicated process involving multiple components such as relationships between the interviewee and the interviewer, conversation topic, audience's reaction, the interviewee's past feelings he or she is talking about, and so on. Most of the states in our classification can be experienced towards any of these components. However, the precise instructions for raters may be adapted to the goals of a particular study, taking into account the amount and type of content, etc. The instructions should also specify whether the raters are supposed to consider speech content (e.g., if they should mark "pride" when the interviewee says "I am proud of ..." even though there are no perceivable indications of pride in mimics or intonation).

Another important issue to mention is the uneven distribution of scales. The expression of positive emotions is considered to be a goal achievement tool (Lyubomirsky, King, & Diener, 2005; Wong, Tschan, Messerli, & Semmer, 2013), which accounts for the fact that positive emotions are expressed more often in social interactions. At the same time, negative emotions tend to be disguised, and it is harder for an outside observer to estimate them (Jordan et al., 2011). All these factors contribute to the prevailing of positive states.

The next step is to apply our classification to field data in order to improve and clarify understanding of the states' manifestations in behavior. It is necessary not only to study different scales separately but also to investigate their interrelation and the way they modify each other. It should be highlighted that the context must be taken into account too, because the manifestation of states depends on the situation. By context we mean a broad range of circumstances including behavior and reactions of the interviewer and audience, speech topic, etc. The final goal of the work is to build emotional and social behaviors recognition system for video content analysis based on the proposed classification.

REFERENCES

- Al Osman, H. and Falk, T. H. (2017). Multimodal Affect Recognition: Current Approaches and Challenges. In *Emotion and Attention Recognition Based on Biological Signals and Images*, page Ch. 05. InTech.
- Altman, I., Taylor, D. A., and Derlega, V. J. (1997). *Social penetration: The development of interpersonal relationships*, volume 42. Oxford, England: Holt, Rinehart & Winston.
- Argyle, M. (1981). Social Behaviour. In *Psychology for Teachers*, pages 285–340. Macmillan Education UK, London.
- Aslama, M. and Pantti, M. (2006). Talking alone: Reality TV, emotions and authenticity. *European Journal of Cultural Studies*, 9(2):167–184.
- Banziger, T., Mortillaro, M., and Scherer, K. R. (2012). Introducing the Geneva Multimodal expression corpus for experimental research on emotion perception. *Emotion*, 12(5):1161–1179.
- Barrett, L. F. and Wager, T. D. (2006). The structure of emotion evidence from neuroimaging studies. *Current Directions in Psychological Science*, 15(2):79–83.
- Barrick, M. R., Shaffer, J. A., and DeGrassi, S. W. (2009). What you see may not be what you get: Relationships among self-presentation tactics and ratings of interview and job performance. *Journal of Applied Psychology*, 94(6):1394–1411.
- Baruah, S., Gupta, R., and Narayanan, S. (2017). a Knowledge Transfer and Boosting Approach To the Prediction of Affect in Movies. *Proceedings of IEEE International Conference on Audio, Speech and Signal Processing (ICASSP)*.
- Baucom, B. R., Georgiou, P., Bryan, C. J., Garland, E. L., Leifker, F., May, A., Wong, A., and Narayanan, S. S. (2017). The promise and the challenge of technology-facilitated methods for assessing behavioral and cognitive markers of risk for suicide among U.S. Army National Guard Personnel. *International Journal of Environmental Research and Public Health*, 14(4).
- Baumeister, R. F. (1982). A self-presentational view of social phenomena. *Psychological Bulletin*, 9(1):3–26.
- Baveye, Y., Dellandrea, E., Chamaret, C., and Chen, L. (2015). LIRIS-ACCEDE: A video database for affective content analysis. *IEEE Transactions on Affective Computing*, 6(1):43–55.
- Bednarik, R., Eivazi, S., and Hradis, M. (2012). Gaze and Conversational Engagement in Multiparty Video Conversation: An Annotation Scheme and Classification of High and Low Levels of Engagement. *Proceedings of the 4th Workshop on Eye Gaze in Intelligent Human Machine Interaction*, (February 2016):10:1–10:6.
- Belin, P., Fillion-Bilodeau, S., and Gosselin, F. (2008). The Montreal Affective Voices: A validated set

- of nonverbal affect bursts for research on auditory affective processing. *Behavior Research Methods*, 40(2):531–539.
- Benabou, R. and Tirole, J. (2006). Incentives and Prosocial Behavior - Slides. *American Economic Review*, 96(5):1652–1678.
- Burgoon, J. K., Magnenat-Thalmann, N., Pantic, M., and Vinciarelli, A. (2017). Social Signal Processing. *The Oxford handbook of affective computing*, page 84.
- Cambria, E., Livingstone, A., and Hussain, A. (2012). The hourglass of emotions. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 7403 LNCS:144–157.
- Cane, J. E., Ferguson, H. J., and Apperly, I. A. (2017). Using perspective to resolve reference: The impact of cognitive load and motivation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 43(4):591–610.
- Cialdini, R. B. and Goldstein, N. J. (2004). Social influence: Compliance and Conformity. *Annu. Rev. Psychol.*, 55:591–621.
- Colby, B. N., Ortony, A., Clore, G. L., and Collins, A. (1989). *The Cognitive Structure of Emotions.*, volume 18. Cambridge University Press.
- Collins, N. L. and Miller, L. C. (1994). Self-Disclosure and Liking: A Meta-Analytic Review. *Psychological Bulletin*, 116(3):457–475.
- Cozby, P. C. (1973). Self-disclosure: A literature review. *Psychological Bulletin*, 79(2):73–91.
- Darwin, C. (1956). the Expression of the Emotions in Man and Animals. *The American Journal of the Medical Sciences*, 232(4):477.
- DeFraigne, W. C. (2016). Differential effects of cognitive load on emotion: Emotion maintenance versus passive experience. *Emotion*, 16(4):459–467.
- Douglas-Cowie, E., Cowie, R., Sneddon, I., Cox, C., Lowry, O., McRorie, M., Martin, J.-C., Devillers, L., Abrilian, S., Batliner, A., Amir, N., and Karpouzis, K. (2016). The HUMAINE Database: Addressing the Collection and Annotation of Naturalistic and Induced Emotional Data. *Affective Computing and Intelligent Interaction*, pages 488–500.
- Ekman, P. (1992). An Argument for Basic Emotions. *Cognition and Emotion*, 6(3-4):169–200.
- Ekman, P. and Friesen, W. V. (1988). Who knows what about contempt: A reply to Izard and Haynes. *Motivation and Emotion*, 12(1):17–22.
- Erber, R. and Erber, M. W. (1994). Beyond mood and social judgment: Mood incongruent recall and mood regulation. *European Journal of Social Psychology*, 24(1):79–88.
- Fischer, A. H. and Roseman, I. J. (2007). Beat Them or Ban Them: The Characteristics and Social Functions of Anger and Contempt. *Journal of Personality and Social Psychology*, 93(1):103–115.
- Fontaine, J. R. J., Scherer, K. R., Roesch, E. B., and Ellsworth, P. C. (2007). The world of emotions is not two-dimensional. *Psychological Science*, 18(12):1050–1057.
- Frijda, N. H. and Mesquita, B. (1994). The social roles and functions of emotions. In *Emotion and culture: Empirical studies of mutual influence.*, pages 51–87. American Psychological Association, Washington.
- Gerhardt, H., Biele, G. P., Heekeren, H. R., and Uhligh, H. (2016). Cognitive Load Increases Risk Aversion. *SFB 649 Discussion Paper*, page 34.
- Gilbert, D. T. (1998). Ordinary personology. In D. T. Gilbert, S. T. Fiske, & G. L. E., editor, *The handbook of social psychology*, pages 89–150. New York, NY, US: McGraw-Hill.
- Grebelsky-Lichtman, T. (2016). The Role of Verbal and Nonverbal Behavior in Televised Political Debates. *Journal of Political Marketing*, 15(4):362–387.
- Grimm, M., Kroschel, K., and Narayanan, S. (2008). The Vera am Mittag German audio-visual emotional speech database. *2008 IEEE International Conference on Multimedia and Expo, ICME 2008 - Proceedings*, pages 865–868.
- Hanna, J. E., Tanenhaus, M. K., and Trueswell, J. C. (2003). The effects of common ground and perspective on domains of referential interpretation. *Journal of Memory and Language*, 49(1):43–61.
- Jakobs, E., Manstead, A. S., and Fischer, A. H. (2001). Social context effects on facial activity in a negative emotional setting. *Emotion (Washington, D.C.)*, 1(1):51–69.
- Jaques, N., McDuff, D., Kim, Y. L., and Picard, R. (2016). Understanding and predicting bonding in conversations using thin slices of facial expressions and body language. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 10011 LNAI:64–74.

- Jordan, A. H., Monin, B., Dweck, C. S., Lovett, B. J., John, O. P., and Gross, J. J. (2011). Misery has more company than people think: underestimating the prevalence of others' negative emotions. *Personality & social psychology bulletin*, 37(1):120–35.
- Judge, T. A., Erez, A., Bono, J. E., and Locke, E. A. (2005). Core self-evaluations and job and life satisfaction: The role of self-concordance and goal attainment. *Journal of Applied Psychology*, 90(2):257–268.
- Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33(4):692–724.
- Kahu, E. R. and Nelson, K. (2018). Student engagement in the educational interface: understanding the mechanisms of student success. *Higher Education Research & Development*, 37(1):58–71.
- Kappas, A. (2013). Social regulation of emotion: messy layers. *Frontiers in psychology*, 4:51.
- Kiesler, D. J. (1983). The 1982 Interpersonal Circle: A taxonomy for complementarity in human transactions. *Psychological Review*, 90(3):185–214.
- Kron, A., Schul, Y., Cohen, A., and Hassin, R. R. (2010). Feelings don't come easy: Studies on the effortful nature of feelings. *Journal of Experimental Psychology: General*, 139(3):520–534.
- Kuppens, P., Van Mechelen, I., and Meulders, M. (2004). Every cloud has a silver lining: Interpersonal and individual differences determinants of anger-related behaviors. *Personality and Social Psychology Bulletin*, 30(12):1550–1564.
- Lang, P. J., Bradley, M. M., and Cuthbert, B. N. (1998). Emotion, motivation, and anxiety: Brain mechanisms and psychophysiology. *Biological Psychiatry*, 44(12):1248–1263.
- Levy, D. A., Collins, B. E. and Nail, P. R. (1998). A new model of interpersonal influence characteristics. *Journal of Social Behavior & Personality*, 13(4):715–733.
- Lewis, M. and Granic, I. (2000). *Emotion, Development, and Self-Organization*. Cambridge University Press, Cambridge.
- Li, Y., Narayanan, S., and Kuo, J. (2004). Adaptive Speaker Identification with AudioVisual Cues for Movie Content Analysis. *Pattern Recognition Letters*, 25:777–791.
- Loewenstein, G. F., Weber, E. U., Hsee, C. K., and Welch, N. (2001). Risk as feelings. *Psychological bulletin*, 127(2):267–86.
- Lyubomirsky, S., King, L., and Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin*, 131(6):803–855.
- Ma, X., Tamir, M., and Miyamoto, Y. (2018). A socio-cultural instrumental approach to emotion regulation: Culture and the regulation of positive emotions. *Emotion*, 18(1):138–152.
- Macey, W. H. and Schneider, B. (2008). The Meaning of Employee Engagement. *Industrial and Organizational Psychology*, 1(01):3–30.
- Maddux, J. E., Norton, L. W., and Leary, M. R. (1988). Cognitive Components of Social Anxiety: An Investigation of the Integration of Self-Presentation Theory and Self-Efficacy Theory. *Journal of Social and Clinical Psychology*, 6(2):180–190.
- McKeown, G., Valstar, M. F., Cowie, R., and Pantic, M. (2010). The semaine corpus of emotionally coloured character interactions. *2010 IEEE International Conference on Multimedia and Expo, ICME 2010*, pages 1079–1084.
- Nega C (2017). The effect of presentation time and working memory load on emotion recognition. *J Psychol Cognition*, 2(1).
- Novak, D., Chanel, G., Guillotel, P., and Koenig, A. (2017). Guest Editorial: Toward Commercial Applications of Affective Computing. *IEEE Transactions on Affective Computing*, 8(2):145–147.
- Nowlis, V. and Nowlis, H. H. (1956). The descriptiyon and analysis of mood. *Annals of the New York Academy of Sciences*, 65(4):345–355.
- Orth, U., Robins, R. W., and Soto, C. J. (2010). Tracking the Trajectory of Shame, Guilt, and Pride Across the Life Span. *Journal of Personality and Social Psychology*, 99(6):1061–1071.
- Osgood, C. E. (1966). Dimensionality of the semantic space for communication via facial expressions. *Scandinavian Journal of Psychology*, 7(1):1–30.
- Ozer, B. U. and Sackes, M. (2011). International Conference on Education and Educational Psychology (ICEEPSY 2010) Effects of Academic Procrastination on College Students' Life Satisfaction. *Procedia - Social and Behavioral Sciences*, 12:512–519.
- Park, J., Kitayama, S., Markus, H. R., Coe, C. L., Miyamoto, Y., Karasawa, M., Curhan, K. B., Love, G. D., Kawakami, N., Boylan, J. M., and Ryff, C. D. (2013). Social status and anger expression: the

- cultural moderation hypothesis. *Emotion (Washington, D.C.)*, 13(6):1122–31.
- Parker, S. T. (1998). A social selection model for the evolution and adaptive significance of self-conscious emotions. In M. D. Ferrari & R. J. Sternberg, editor, *Self-awareness: Its nature and development*, pages 108–134. Guilford Press.
- Parkinson, B. (1996). Emotions are social. *British journal of psychology (London, England : 1953)*, 87 (Pt 4):663–83.
- Parkinson, B. (2005). Do Facial Movements Express Emotions or Communicate Motives? *Personality and Social Psychology Review*, 9(4):278–311.
- Pentland, A. (2007). Social Signal Processing [Exploratory DSP]. *IEEE Signal Processing Magazine*, 24(4):108–111.
- Perepelkina, O., Kazimirova, E., and Konstantinova, M. (2018). RAMAS : Russian Multimodal Corpus of Dyadic Interaction for studying emotion recognition RAMAS : Russian Multimodal Corpus of Dyadic Interaction for Studying Emotion Recognition. *PeerJ Preprints*, (March).
- Picard, R. W. (1995). Affective Computing. *M.I.T. Media Laboratory Perceptual Computing Section Technical Report*, 321:1–26.
- Pincus, A. L. and Ansell, E. B. (2003). Interpersonal Theory of Personality. In *Handbook of Psychology*. John Wiley & Sons, Inc., Hoboken, NJ, USA.
- Plutchik, R. (2001). The nature of emotions: Human emotions have deep evolutionary roots. *American Scientist*, 89(4):344–350.
- Poria, S., Cambria, E., Bajpai, R., and Hussain, A. (2017). A review of affective computing: From unimodal analysis to multimodal fusion. *Information Fusion*, 37:98–125.
- R.E., T. (1989). *The biopsychology of mood and arousal*. New York: Oxford University Press.
- Ringeval, F., Sonderegger, A., Sauer, J., and Lalanne, D. (2013). Introducing the RECOLA multimodal corpus of remote collaborative and affective interactions. *2013 10th IEEE International Conference and Workshops on Automatic Face and Gesture Recognition, FG 2013*, (i).
- Rozin, P., Lowery, L., Haidt, J., and Imada, S. (1999). The CAD triad hypothesis: A mapping between three moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity). *Journal of Personality and Social Psychology*, 76(4):574–586.
- Rusbult, C. E. and Van Lange, P. A. M. (2003). Interdependence, Interaction, and Relationships. *Annual Review of Psychology*, 54(1):351–375.
- Russell, J. A. (2009). Emotion, core affect, and psychological construction. *Cognition and Emotion*, 23(7):1259–1283.
- Sacharin, V., Schlegel, K., and Scherer, K. (2005). Geneva Emotion Wheel rating study (Report). *Social Science Information*, 44(4):695–729.
- Scherer, K. R. (2005). What are emotions? and how can they be measured? *Social Science Information*, 44(4):695–729.
- Schlenker, B. R. and Leary, M. R. (1982). Social Anxiety and Self-Presentation: A Conceptualization and Model. *Psychological Bulletin*, 92(3):641–669.
- Serrat, O. (2017). Understanding and Developing Emotional Intelligence. In *Knowledge Solutions*, pages 329–339. Springer Singapore, Singapore.
- Shrauger, J. S. and Schohn, M. (1995). Self-Confidence in College Students: Conceptualization, Measurement, and Behavioral Implications. *Assessment*, 2(3):255–278.
- Shuman, V., Sander, D., and Scherer, K. R. (2013). Levels of valence. *Frontiers in psychology*, 4:261.
- Spielberger, C. D. (1972). *Anxiety: Current Trends in Theory and Research*. Elsevier Science.
- Spielberger, C. D. and Reheiser, E. C. (2010). The Nature and Measurement of Anger. *International Handbook of anger*, 49(April 2016):403–412.
- Stein, M. B. and Stein, D. J. (2008). Social anxiety disorder. *The Lancet*, 371(9618):1115–1125.
- Stoeber, J., Harris, R. A., and Moon, P. S. (2007). Perfectionism and the experience of pride, shame, and guilt: Comparing healthy perfectionists, unhealthy perfectionists, and non-perfectionists. *Personality and Individual Differences*, 43(1):131–141.
- Swann, W. B., Stein-Seroussi, A., and Giesler, R. B. (1992). Why people self-verify. *Journal of personality and social psychology*, 62(3):392–401.
- Tamir, M. and Ford, B. Q. (2009). Choosing to be afraid: Preferences for fear as a function of goal pursuit. *Emotion*, 9(4):488–497.
- Tangney, J. P. (1993). *Shame and guilt*. Guilford Press.

- Tangney, J. P. (2002). Perfectionism and the self-conscious emotions: Shame, guilt, embarrassment, and pride. In Flett, Gordon L. (Ed) & Hewitt, P. L. E., editor, *Perfectionism: Theory, research, and treatment*, pages 199–215. Washington, DC, US: American Psychological Association.
- Tangney, J. P. (2005). The Self-Conscious Emotions: Shame, Guilt, Embarrassment and Pride. In *Handbook of Cognition and Emotion*, pages 541–568. John Wiley & Sons, Ltd, Chichester, UK.
- Taylor, S., Jaques, N., Nosakhare, E., Sano, A., and Picard, R. (2017). Taylor, S. A., Jaques, N., Nosakhare, E., Sano, A., & Picard, R. (2017). Personalized Multitask Learning for Predicting Tomorrow's Mood, Stress, and Health. *IEEE TRANSACTIONS ON AFFECTIVE COMPUTING*, (99).
- Taylor, S. E. and Crocker, J. (1981). Schematic bases of social information processing. *Social cognition: The Ontario Symposium*, 1:89–134.
- Tomkins, S. S. (2008). *Affect Imagery Consciousness: The Complete Edition*, volume 109. Springer Pub.
- Tracy, J. L. and Robins, R. W. (2004). Putting the Self Into Self-Conscious Emotions: A Theoretical Model.
- van de Ven, N. (2017). Envy and admiration: emotion and motivation following upward social comparison. *Cognition and Emotion*, 31(1):193–200.
- van de Ven, N., Zeelenberg, M., and Pieters, R. (2011). Why envy outperforms admiration. *Personality and Social Psychology Bulletin*, 37(6):784–795.
- Van Dillen, L. F., Heslenfeld, D. J., and Koole, S. L. (2009). Tuning down the emotional brain: An fMRI study of the effects of cognitive load on the processing of affective images. *NeuroImage*, 45(4):1212–1219.
- Van Dillen, L. F. and Koole, S. L. (2007). Clearing the mind: A working memory model of distraction from negative mood. *Emotion*, 7(4):715–723.
- Vinciarelli, A., Pantic, M., and Bourlard, H. (2009). Social signal processing: Survey of an emergin domain. *Image and Vision Computing*, 27(November 2008):1743–1759.
- Vinciarelli, A., Pantic, M., Bourlard, H., and Pentland, A. (2008). Social signals, their function, and automatic analysis: a survey. In *Proceedings of the 10th international conference on Multimodal interfaces*, pages 61–68.
- Vrij, A., Fisher, R., Mann, S., and Leal, S. (2008). A cognitive load approach to lie detection. *Journal of Investigative Psychology and Offender Profiling*, 5(1-2):39–43.
- Watson, D., Wiese, D., Vaidya, J., and Tellegen, A. (1999). The two activation systems of affect: Structural findings, evolutionary considerations, and psychbiological evidence. *Journal of Personality and Social Psychology*, 76(5):820–838.
- WHEELLESS, L. R. (1976). Self-disclosure and interpersonal solidarity: measurement, validation, and relationships. *Human Communication Research*, 3(1):47–61.
- Wiggins, J. S., Behrends, R. S., Ben-Porath, Y., Blatt, S. J., Costa, P. T. J., Gurtman, M. B., McAdams, D. P., Piedmont, R. L., Pincus, A. L., and Trobst, K. K. (2003). Paradigms of personality assessment. *Paradigms of personality assessment*.
- Wilutzky, W. (2015). Emotions as pragmatic and epistemic actions. *Frontiers in psychology*, 6:1593.
- Wong, E., Tschan, F., Messerli, L., and Semmer, N. K. (2013). Expressing and amplifying positive emotions facilitate goal attainment in workplace interactions. *Frontiers in psychology*, 4:188.
- Worthy, Morgan, Gary, Albert L., Kahn, G. M. (1969). Self-disclosure as an exchange process. *Journal of Personality and Social Psychology*, 13(1):59–63.
- Wundt, W. (1896). *Grundriss der Psychologie*. Leipzig: Engelmann.