

# Detecting emotion with force sensitive touchscreens

[...]

Kevin Blom  
University of Amsterdam  
Science Park 904  
xxxxxx@xxxxxx.xx

## ABSTRACT

### 1. INTRODUCTION

Affective computing as introduced by Picard[8] in 1995 lays a foundation for computers and technology to incorporate the recognition and expression of emotions. It can provide better performance when assisting humans or enhance the computers ability to make decisions. It does not have the goal of making computers more human-like, but it is more practical in nature; make computers function with intelligence and sensitivity towards its users[9]. According to Shah et al.[11] there are two general models to represent emotion; discrete and continuous. The discrete model represent emotions that are measurable and physiologically distinct like angry, sad, happy, etc. [2] The continuous model represents emotions on a two-dimensional scale, where one axis represents *valence* and the other *arousal* [10]. Since, the measuring of emotion has been a subject of research and several different angles have been discovered to approach it.

#### 1.1 Physiological detection

One angle uses physiological signals of the human body to measure and detect emotion. In a review by Wioleta[16], eight studies were collected that measure emotion using one or more physiological signals combined. These signals are *EEG*, *skin conductance*, *blood volume pulse*, *temperature*, *heart rate*, *blood pressure*, *respiration*, *EMG*, and *ECG*. Most of these physiological signals have the drawback that they need specialized sensors attached to the body, making unobtrusive measurements difficult. With the recent rise of smart wearables, heart rate is one of the signals that is more readily available to use in applications on smart devices.

#### 1.2 Facial detection

Facial detection of emotion incorporates the measurement of facial muscle movement, voice or speech [14], and also includes the eye as point of detection, i.e. movement, blinking, and pupil dilation [13]. By connecting facial muscle movement to visual display of emotions, Ekman et al. [3] conclude with a basic set of six mutually exclusive emotions that could be recognized. Expanding, De Silva et al. [12] found that several emotions are expressed by either visual or auditory cues, or both, meaning that some emotions can be recognized by visual cues alone, auditory cues alone, or need a combination of both to be detected accurately.

#### 1.3 Posture/gestures emotion detection

Other means of detection emotions involve the tracking and interpretation of posture and gesture. Wallbott et al.

[15] concluded in 1998 that there are, in some cases, distinctive patterns of movement and postural behavior that have a strong correlation to emotions. In other cases, they mention that in absence of patterns there are still distinctive features from which emotion could be inferred. Coulson et al. [1] researched static body postures and the recognition of emotions from these body postures by participants. It showed that disgust is a tough emotion to recognize but anger and sadness had over 90% correct detection rates. Furthermore, happiness and surprise were two emotions that were often confused.

#### 1.4 Practical applications

Looking at a more practical and applied side of emotion detection, Gao et al. [4] used touchscreen devices, where the application of gestures on touch screens was successfully linked to emotional states with the use of a game. The emotional states that were tested for are: excited, relaxed, frustrated and bored, and accuracy of detection reached at minimum 69%. However, the research of Gao et al. was limited to gestures and did not incorporate data from taps. Furthermore, Lv et al. [5] have created means to detect emotion from keyboard pressure using feature extraction. This indicates that the use of a keyboard on a touch screen could also be used as means of detecting emotion, but one must keep in mind that a regular keyboard is not fully comparable to a touchscreen keyboard. It lays flat on a desk, and is often typed upon with more than one or two fingers, which means that the pressure exerted on the keyboard is likely not directly correlated with the pressure on a touchscreen keyboard. Moreover, Lee et al [6] propose an unobtrusive way of detecting emotion by analyzing smartphone usage patterns (not unlike LiKamWa et al. [7]) and social network status updates. However, this required that the user would post status updates through independently developed social networking applications, that are not officially supported by the social networks themselves.

#### 1.5 Research Question

From the related work can be concluded that most types of detection of emotions are invasive, either requiring constant monitoring, possibly with sensors attached to the body, or by constant recording of audio and visual data. The touch screen is a technology a lot of people interact with every day, where they deliberately choose to participate in those interactions. Using touch screen presses as indicators for emotional state could be an unobtrusive way of detecting emotion without the need for constant monitoring. With the introduction of pressure sensitive touchscreens in re-

cent smart devices, an interesting new sensor is added to the plethora of sensors already available. Subsequently, this leads to the following research question:

*Can pressure sensitive touch screen devices be used to tell more about the mood of the user?*

- Description of background.
- Explanation of why research was necessary.
- Description of how research will be undertaken.

## 2. METHODS

- Overview of the research.
- Report of who took part and where.
- Report of what procedures were used.
- Report of what materials were used.
- Report of any statistical analysis used.

## 3. RESULTS

- Report of findings.
- Reference to any diagrams used.

## 4. DISCUSSION

- Summary of main purpose of research.
- Review of most important findings.
- Evaluation of findings.
- Explanation of findings.
- Comparison with other researchers findings.
- Description of implications and recommendations.

## 5. REFERENCES

- [1] M. Coulson. Attributing emotion to static body postures: recognition accuracy, confusion and view point dependence. *Journal of Nonverbal Behavior*, 28(2):117–139, 2004.
- [2] P. Ekman. An argument for basic emotions, 1992.
- [3] P. Ekman, E. R. Sorenson, and W. V. Friesen. Pan-Cultural Elements in Facial Displays of Emotion, 1969.
- [4] Y. Gao, N. Bianchi-Berthouze, and H. Meng. What Does Touch Tell Us about Emotions in Touchscreen-Based Gameplay? *ACM Transactions on Computer-Human Interaction*, 19(4):1–30, 2012.
- [5] J. D. H. R. Lv, Z. L. Lin, W. J. Yin. Emotion recognition based on pressure sensor keyboards. *2008 IEEE International Conference on Multimedia and Expo*, pages 1089–1092, 2008.
- [6] H. Lee, Y. S. Choi, S. Lee, and I. P. Park. Towards unobtrusive emotion recognition for affective social communication. *2012 IEEE Consumer Communications and Networking Conference, CCNC'2012*, pages 260–264, 2012.
- [7] R. Likamwa, Y. Liu, N. D. Lane, and L. Zhong. MoodScope: Building a Mood Sensor from Smartphone Usage Patterns. *MobiSys '13 Proceeding of the 11th annual international conference on Mobile systems, applications, and services*, (April):389–402, 2013.
- [8] R. W. Picard. Affective Computing. *MIT press*, (321):1–16, 1995.
- [9] R. W. Picard. *Affective computing*, volume 252. MIT press Cambridge, 1997.
- [10] J. Posner, J. A. Russell, and B. S. Peterson. The circumplex model of affect: an integrative approach to affective neuroscience, cognitive development, and psychopathology. *Development and psychopathology*, 17(3):715–34, 2005.
- [11] S. Shah, J. N. Teja, and S. Bhattacharya. Towards affective touch interaction: predicting mobile user emotion from finger strokes. *Journal of Interaction Science*, 3(1):6, 2015.
- [12] L. C. D. E. Silva and I. T. Miyasato. Facial Emotion Recognition Using. (September):9–12, 1997.
- [13] M. Soleymani, M. Pantic, and T. Pun. Multimodal emotion recognition in response to videos (Extended abstract). *2015 International Conference on Affective Computing and Intelligent Interaction, ACII 2015*, 3(2):491–497, 2015.
- [14] D. Ververidis, C. Kotropoulos, and P. Ioannis. Automatic Emotional Speech Classification. *Artificial Intelligence and Information Analysis Laboratory*, pages 593–596, 2004.
- [15] H. G. Wallbott. Bodily Expression of Emotion. *European Journal of Social Psychology*, 28(6):879–896, 1998.
- [16] S. Wioleta. Using physiological signals for emotion recognition. *Human System Interaction (HSI), 2013 The 6th ...*, pages 556–561, 2013.