# Personalizing Large Information Radiators Using Emotion Recognition

Laura Stojko
laura.stojko@unibw.de
University of the Bundeswehr Munich
Neubiberg, Bavaria, Germany

Michael Koch
michael.koch@unibw.de
University of the Bundeswehr Munich
Neubiberg, Bavaria, Germany

## ABSTRACT

Knowledge exchange in corporate settings can be facilitated by using large interactive displays, information radiators, displaying information about employees, current work topics, and projects. This paper gathers ideas about how to enhance the user's experience proactively using emotion recognition and how this could be useful for personalizing the interaction. Based on the literature, ideas of how this could be done are described. This should encourage discussions and creative visions about how to use emotion recognition as implicit user feedback for personalization.

## KEYWORDS

personalization, emotion recognition, large interactive displays, information radiators, collaboration

## 1 INTRODUCTION

Many companies already use large displays as information panels and for distributing news about the company, employees, etc. These displays can also be called large information radiators. One main challenge for their success is to attract users and add value to their daily work. A solution could be to adapt the user interface of such devices to the users' preferences and meet their needs, e.g., selecting appropriate content to cope with information overload and in return, exploit the potential of such devices more effectively.

Generally, they can only adapt to users who are expected to be there based on location and time. Identifying users and adapting the display to them is technically possible, e.g. via Bluetooth, RFID, or face recognition, but often cannot be done due to data privacy concerns. What is possible, however, and accepted by data protection officials, is determining the number of users in front of the screen using body tracking and recognizing their emotions using live images without identifying individuals.

There are many options on what to use as a base to personalize user interfaces like interaction logging, body or eye tracking, considering the cultural background of the users, actually asking users to rate the content, etc. The idea proposed in this paper focuses on the potential of emotion recognition to implicitly gather user preferences, as it would be a way to capture actual personal feelings, positive and negative, towards large information radiators, which, probably also in combination with others, would enhance the personalization opportunities.

Based on the literature, we have identified interesting approaches that might provide promising ideas for further research projects. In the next section, we will summarize the most important related work before providing a summary of ideas about how emotion recognition can be used in our scenario and, finally, what our next possible projects might look like.

## 2 RELATED WORK

Large information radiators, whose user experience should be enhanced by personalization, can be described as ubiquitous, interactive, and multi-user interfaces to collaboration systems that proactively display information beyond the confines of the classical desktop computer [11, p.47]. They particularly present information that is not explicitly sought after but might be interesting for the users [10]. These radiators are typically located in semi-public areas within enterprises, such as corridors, next to coffee machines, and waiting areas near elevators, among others [10, 12]. We deploy several information radiators as a network of "CommunityMirrors" [20] at our campus, one example is shown in Figure 1.

As one of our ideas is to use emotion recognition to personalize such information radiators, we define "personalization" as *"[...] a process that changes the functionality, interface, information access, and content, or distinctiveness of a system to increase its personal relevance to an individual or a category of individuals."[4]* Interesting terms that come along with personalization are "adaption" and

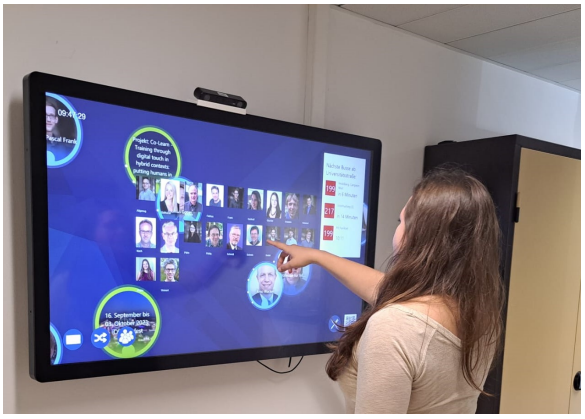

**Figure 1: A CommunityMirror deployment with an employee overview, the camera setup, and a user interacting with the display.**


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"customization". While the latter describes the approach in which users explicitly *customize* their experience and subsequently realize personalization themselves, adaptation means that the system itself automatically adjusts its behavior and interactions to user preferences [4]. The question arises whether and to what extent [19] users should be involved in the adaptation of the information radiator when using emotions as contextual information for personalization.

Emotion recognition is a highly researched field in human computer interaction (HCI), focusing on developing methods for identifying the user's emotions using text [2, 21], speech [8, 14], physical vital values [25], or visual input [6, 9]. The identified emotions can be used to make the interaction more natural for users, such as in intelligent assistants [3, 15]. For example, the recent solution from Beyond Emotion[1] can detect 17 different emotions from face images. We are interested in discussing how visual emotion recognition methods are suitable for identifying the emotions of information radiator users and how we can improve the user experience with this kind of information.

## 3 EMOTION RECOGNITION FOR LARGE INFORMATION RADIATORS

Using the classification scheme of Fan and Poole [4] for personalization, and adapting it to our scenario and goals, the following summary displays potentials using emotion recognition:

- Content: Implicitly, the display could select content to trigger positive emotions or gather feedback about the information by storing the detected emotions when users consume content. Content could be made available in different versions, e.g. funny version, creative / poetry version, serious version, to further support this.
- User interface: Based on the recognized emotion, the user interface could change its design, e.g. color adaption [7, 18], highlight content or interaction possibilities, a structural adaption of content.
- Access to information: After identifying positive emotions towards displayed information, the display could offer "take-away" options to the users, e. g. QR-Code popping up.
- Functions: The identified emotion could provide feedback on the functionalities of the displays. For example, after introducing a new feature, e.g., "liking" content or a new visualization, the recognized emotions could provide implicit feedback about how users perceive this new feature and maybe how this changes over time. The change over time can provide insights about the novelty effect [13].

In general, emotion recognition could be used to observe the collaboration between colleagues when using the large information radiator in a group. Further, it would be interesting to observe emotions over usage. In detail, when and how do emotions change over time when using the radiator? Can we foster users' positive emotions and change negative ones by adapting the user interface? How can the information radiator be personalized when simultaneously identifying multiple users' emotions? In this regard, there is a challenge in group modeling the emotions of several users and identifying a suitable aggregation method [16, 17]. Interesting research

[1] www.beyond-emotion.de/en/

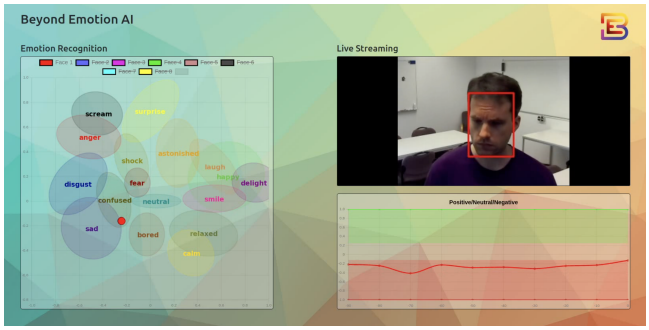


**Figure 2: An example of the Beyond Emotion analysis outcome using a video input from our large information radiator deployment.**

projects like [1] look at how adapting the system's user interfaces to the user's emotions can influence user behavior, focusing on mobile application interfaces. While the user interface parameters might differ for our use case, the methodological procedure may positively contribute to our project and plans.

An interesting question is also, the degree of user involvement: Should the user interface adapt itself [24] or should the information be used to improve content selection? When should the user be involved explicitly by customization or explicit feedback to improve personalization, e.g., when the emotion recognition is not precise enough?

## 4 FUTURE WORK

So far, we have tested the solution by Beyond Emotion with a video we produced using a ZED2 camera, installed for 24/7 observations of our large information radiators [22]. This test showed that the video quality and angle of the camera were good enough to identify various emotions of the users, as an example Figure 2 shows an example of emotion confused.

In the future, we want to conduct a proof of concept about how to deploy emotion recognition on information radiators to foster collaboration and create a positive user experience with the display. Emotion recognition could enhance implicit user feedback to proactively improve content selection and user interface design. In detail, we want to adjust the large information radiator design to become more adaptable and personalize certain user interface aspects like color, structure, or language support. Further, our content selection strategy can benefit from this user feedback to select more suitable content and proactively trigger positive emotions to promote a more positive work atmosphere. In addition to these interesting possibilities that emotion recognition could offer for personalizing large information radiators, it also entails dangers [5, 23] such as being perceived as invasive or infringing people's privacy, misplaced confidence in the system's accuracy, or lack of comprehensibility and replicability in the resulting interactions. Emerging research into the risk landscape of emotion recognition will need to be carefully considered and its negative impacts weighed against the benefits, particularly for public-use scenarios.

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