

Emotions Recognition Agent for On-Line Learning Systems

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Abstract

The effectiveness of intelligent tutoring systems, for instance on-line learning systems, can be improved when the learner's emotions are taken into account. A necessary condition for this is how the system recognizes the learner's current emotional state. Traditional methods for doing this are based on measuring physical parameters, most typically the facial expression or muscle tension; however, they are neither comfortable for the user nor useful in a distributed environment such as the Internet. Furthermore, filling out a long questionnaire is a time-consuming task. In contrast, we present an extremely simple method that can be used instead, the Emotion Recognition Agent (ERA), which exploits the natural relation between emotions and colors. We have performed experiments demonstrating both the simplicity and the accuracy of our ERA method which employs machine learning techniques for determining a user's emotion given colors sequence.

Introduction

Emotions are presented everywhere in all time in human life, both in our interpersonal interactions and in front of our computer. In the context of learning, for instance, learners worry, hope, get bored, get embarrassed, envy, get anxious, feel proud, and become frustrated. Their emotions will moreover highly influence their performance [Isen, 2000]. If a tutor knows a learner's emotion during a learning session, he/she will adapt his /her teaching methods in the way that improves the learner's learning capacities [Hargreaves, 2000]. This shows the importance of the recognition of a learner's emotion in an ITS.

Currently, most methods for determining the learner's emotion, in particular in the context of an ITS, employ sophisticated systems based on physical sensors. However, these methods can recognize emotion from the facial expression; most of them need sophisticated technologies such as wearable sensors which consist of connecting electrodes to the body of the subject aiming to measure his physiological signals [Cacioppo, 2000].

In this paper we propose a method that is even easier and faster but at the same time reliable. It is also a considerable way to be used on the web. Our method is based on the relation between colors and emotions. In

fact, there exists a natural way of representing of emotions by colors [Black, 2002]. For instance, when we are *happy* we commonly say that we see life through *rose-colored* spectacles. Yellow has been found to be associated with both sadness and with cheerfulness. Red is related to anger and violence. However, cool colors are considered to have calming effects such as: sea green, violet, blue, light blue and cyan [Levy, 1984].

Emotion Recognition Agent Architecture

We have built an intelligent agent called Emotion Recognition Agent (ERA), which determine an emotion for a sequence of colors. This association is made by ID3 machine learning methods [Razek et al., 2002]. The ERA is designed as a generic process for Web-based tutoring systems. ERA is able to recognize learners' emotions using their ordered choice of three colors.

The architecture of ERA consists of three tiers: User interface, application server, and data base (see Figure 1). The user interface tier is where the learner's services (such as the colors chosen) reside.

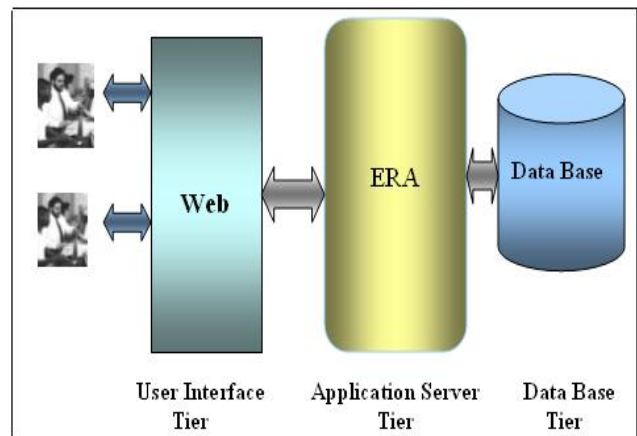


Figure 1 The Architecture of ERA

The application server tier provides the ERA's process management services (such as process data base and process ID3 tree). The third tier provides the database management functionality and is dedicated to data that are acquired during the experiments.

When a user connects to the web-based system, he will interact with the animated Emotion Recognition Agent

through the user interface. The Emotion Recognition Agent asks him to choose a sequence of colors representing his current emotions by clicking onto colored bubbles in a certain order (see Figure 2).

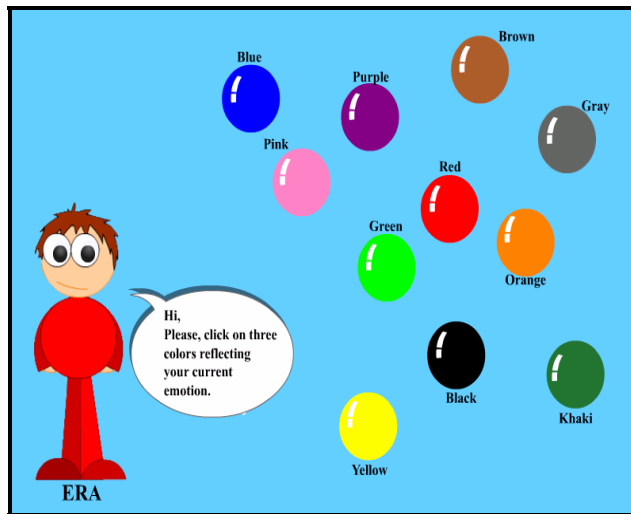


Figure 2: Screenshot of the User Interface

The Emotion Recognition Agent then determines the emotional state of the user by connecting to the database and searching for the emotion associated to this sequence of colors. In the following section, we show how the experiments were conducted.

Experiment and Results

Our objective in these experiments was to find a relation between emotions and colors, and, if so, how we can determine which color corresponds to which emotion. More precisely, we try to find out how people use colors to express their emotions. For this, we have chosen eleven colors: black, purple, brown, khaki, orange, pink, green, gray, and the three primary colors red, yellow, and blue. In order to determine the links between these emotions and colors, we have set up a Web site with a test where people are asked to give their description of emotions by colors. For the sake of attractiveness and user-friendliness, we have created an interactive game, using the software Flash.

The users' feedbacks of the two experiments have been accumulated through a period of two months. There were 322 participants in the experiments. The question whether there is a connection between emotions and colors was answered by 58 % of the people in an affirmative way, whereas 22 % did not agree and 20% gave no comment.

Figure 3 shows the relation between colors and emotions. For example: we found that more than 27% of the participants prefer blue color to represent Normal emotion, however about 25% of the participants choose yellow for expressing joy and nearly 22% prefer the same color to represent surprise. There are also more than 41%

of the participants who opt for red color to represent the emotion of anger. For expressing disgust, nearly 24% of the participants select brown, and more than 31% of the participants prefer gray color to express the emotion of sadness and about 22% of the participants choose black color to represent fear.

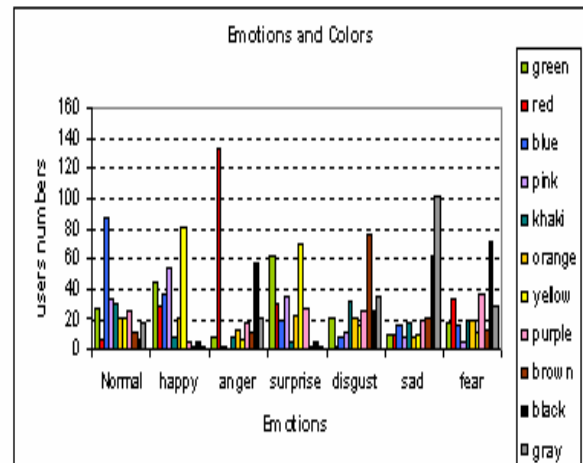


Figure 1: Learner's feedback

Conclusion

We have shown that there are a relation between a sequence of colors and a specific emotion as follows: By giving a sequence of colors, a person can express his emotion reliably. It is therefore possible to determine someone's emotion through his ordered choice of three colors with 57.6 % accuracy, a fact that we use in a very simple interactive system: the Emotion Recognition Agent (ERA). Our proposed method constitutes the simplest and fastest reliable online method for assessing the emotional state of a user.

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