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Full Length Research Paper

Emotion-oriented computing: Possible uses and applications

André Valdestilhas[1]* and Paulo Marcotii[2]

[1]Rua América do Sul, 812, Santo André – São Paulo – Brazil.
[2]Termomecânica College of Technology (FTT), Caminho do Mar. Avenue, 2.652, São Bernardo do Campo, São Paulo –Brazil.

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This article discusses the concepts of using digital television affective computing and computer vision. The proposal involves the union of some techniques such as capturing facial expressions through a video camera, use of accelerometers in ball and touch holograms to work a certain level of interactivity with the viewer. Some uses of the proposal in question are described, such as control of the hearing, background content, among others. This article reveals numerous benefits that can be addressed with the use of matters presented which can be applied in a broad context, such as for the blind in video games, among others.

Key words: Digital television, affective computing, computer vision.

INTRODUCTION

The television is most often assisted in groups. Generally, this is a group of family, whose task is to adapt to the TV content of this group of people and earn a task to which the level of complexity is due to a greater variation of viewers simultaneously, as is the case of a family which, for example, is composed of a group of five people. The worst case arises when the elements of this group have their tastes and different opinions and conflict.

With regards to this point, the article aims to discuss the techniques used to capture facial expressions through the use of video cameras usually covered by the area of computer vision to interact with objects attached to accelerometers in order to guide the television's content as a function of the viewer's emotions which is assisted by one or more persons.

Affective computing

Affective computing or emotion-oriented computing is a field of computing that takes into consideration the feelings for the configuration of hardware and software. It uses several fields of knowledge such as Computing, Education, Psychology, Sociology and Artificial Intelligence among others. With this body of knowledge seeking to build tools capable of "dealing" with the subject and his emotional state in order to create situations that monitor computing these "states" of the subject to facilitate the tasks of the same.

Picard (2004) states that if machines were emotional, it would be possible for skills to build robots and synthetic objects that are capable of emulating human and animal life, build intelligent machines, understand emotions from their modeling and, finally, build machines that are less frustrating in human-computer interaction. In addition, the systems become more accessible, enabling a more user friendly with the machine.

Thus, the affective systems are built and have the ability to recognize, express, possess or develop emotions. In the context of implementing emotions, as Picard, may point to the existence of four elements:

1. Emotional aspect - includes behavior or expressions that give the impression that the system has emotions (one can use synthetic objects animated, audible

*Corresponding author. E-mail: firmao@gmail.com. Tel: 55 11 8795-9880.

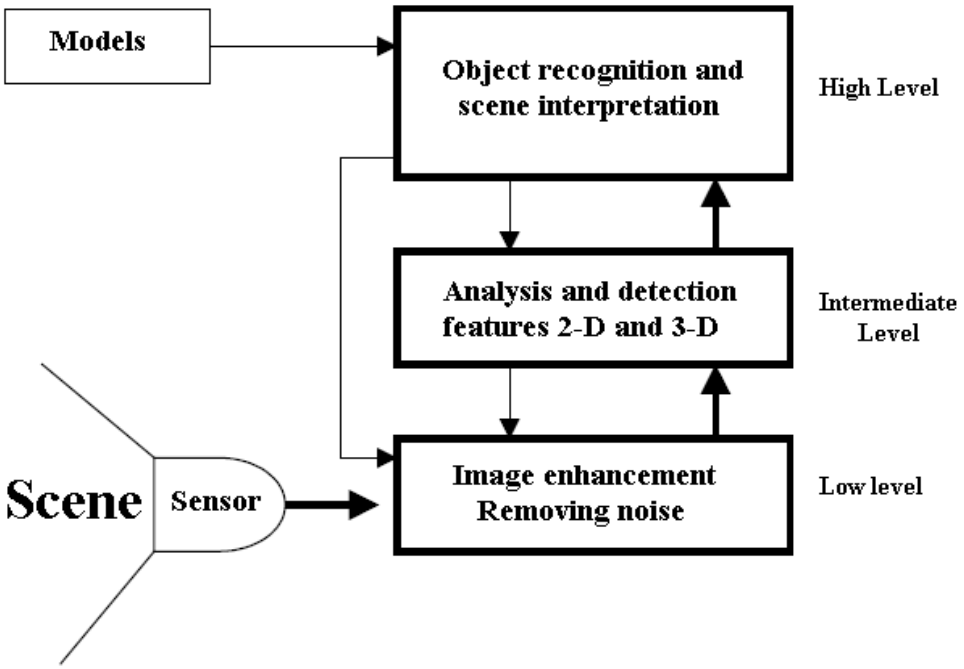

Figure 1. Hierarchy of computational tasks in computer vision (Molz, 2001).

feedback, facial expressions and other behavioral);
2. Multiple levels of emotion generation - refers to the generation of emotion;
3. Emotional experience - refers to how they are perceived emotional states. They are related to consciousness and this is a problem for intelligent systems;
4. A broad category of mind-body interactions - Finally, the fourth concerns the signaling mechanisms and regulation of emotions that are related to cognitive activities and body.

Computer vision

In 1982 David Marr made a proposal that addresses a complete methodology for computer vision, which appears in the book "Vision" (Marr, 1982). Marr defines vision as "a process that produces a description, from images of the external world, which is useful to the viewer and not cluttered with irrelevant information." The word "process" refers to the mapping of different representations of a scene, present in the external world, obtained from the arrays of intensity values to different brightness patterns that describe this scene. The matrices are obtained in the early stages of computer vision, Equant that different patterns are obtained in the latter stages of the same.

Conceptually (Gonzales et al., 2006) the spectrum ranging from image processing to computer vision can be divided into three levels: low-level, mid-level and high-level. The cases involve low-level primitive operations such as noise reduction or improvement in the contrast of an image. The processes are medium-level operations like segmentation (partitioning of the image regions) or classification (recognition of objects in the picture). High-level processes are related to the cognitive tasks associated with human vision, as shown in Figure 1.

Computer vision is comprised a series of stages that handle different types of data (pixels, numbers in fixed point or floating-point) of different sizes (number of bits resolution) (Molz, 2001).

STATE OF THE ART: TECHNIQUES AND TOOLS FOR CAPTURING EMOTIONS THROUGH INTERACTIVE

Capturing facial expressions

Lee et al. (2006) present a tool called “attention meter” in which a video camera that captures the facial expressions of more than one viewer, providing an alternative to the problem of television being watched as a group most often as Figure 2 shows.

As a way of measuring the attention of viewers, this proposal uses a video camera for input. From the behavior of people work proposes the adoption of care levels, which are qualified by, looking, standing, watching, reading carefully, and engaging. This technique works as follows: The camera is positioned

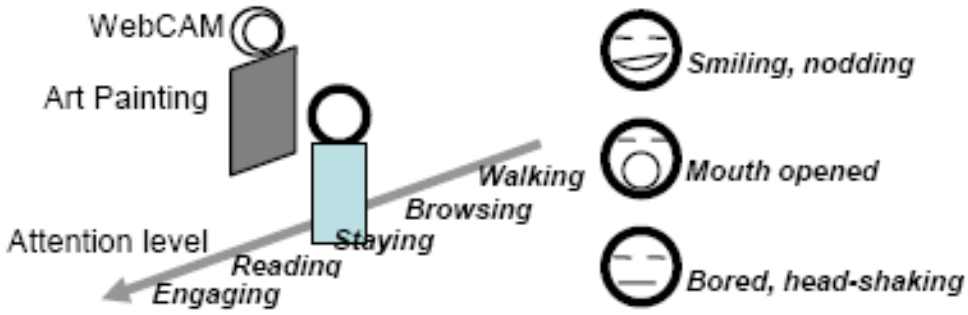

Figure 2. The system measures the level of attention of people using computer vision techniques to monitor the movement of the head, the frequency of heartbeat and proximity (Lee et al., 2006).

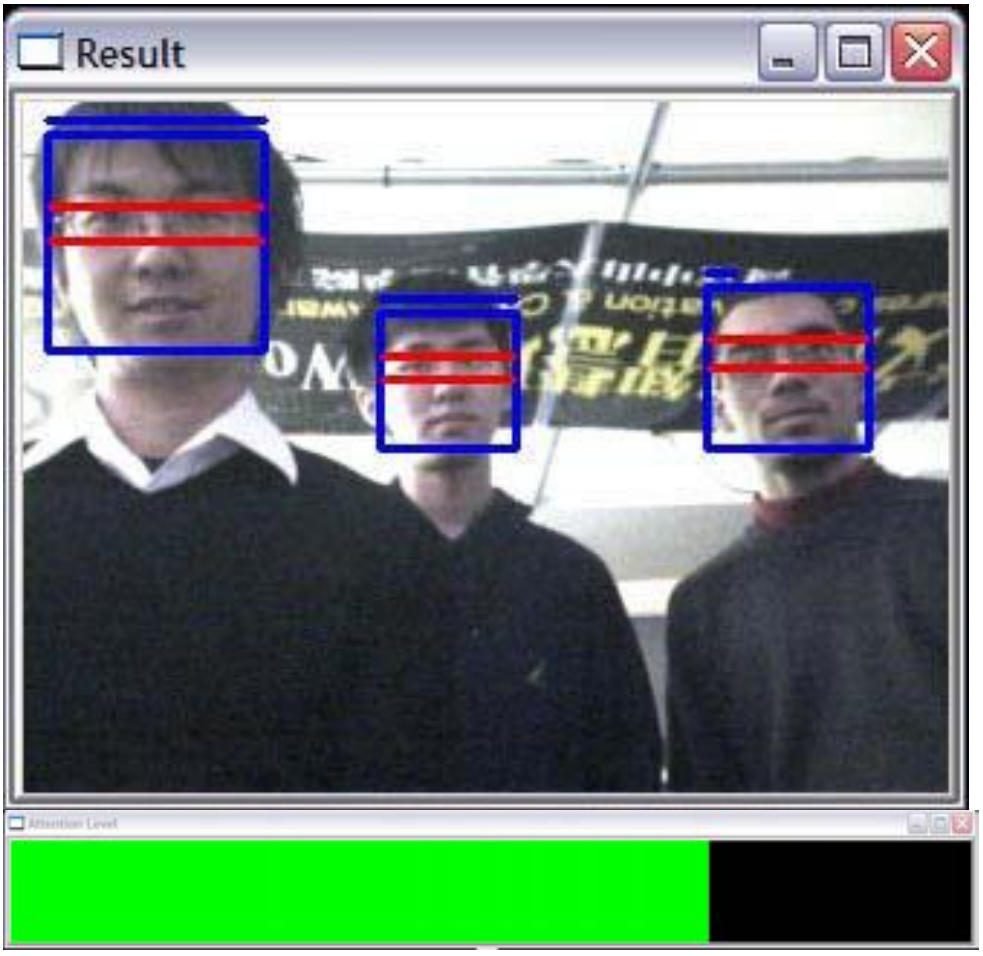

Figure 3. Attention meter showing the attention of a group being measured and presented through a bar of green (Lee et al., 2006).

close to people in a way that they look almost directly to it, allowing for an analysis of their faces.

The system makes use of a software library called the Intel Open Computer Vision (OpenCV), which provides an algorithm for locating and sizing of all the faces in an image on the screen, as shown in Figure 3, in which this method the tool is enhanced with attention meter.

The evaluation of facial expressions of viewers in

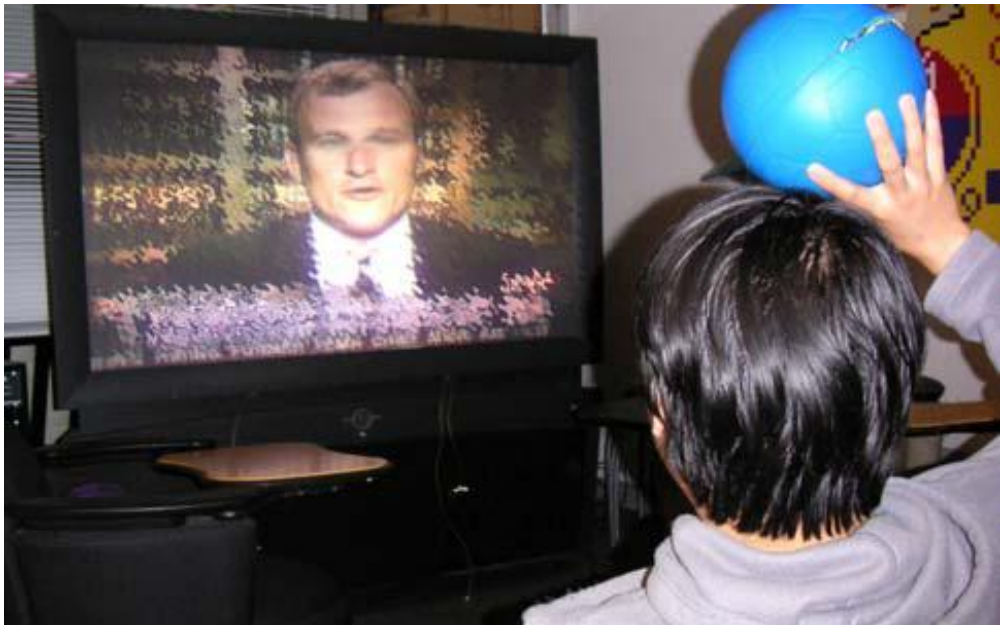

Figure 4. User HiTV system with a rubber ball fitted with an accelerometer, which makes the picture shaking due to interactivity provided (Lee et al., 2007).

order to form a database for audience research and the actual profile of the viewer, as well as measuring the level of acceptance of the viewers on this concept could be used as objects of study.

Affective interaction with use of accelerometer

The camcorder is not the only way to capture the emotions of the viewer, because as presented in the paper entitled HiTV (Lee et al., 2007). The viewer can interact with various objects, in this case is used a rubber ball attached to an accelerometer to help work with the emotions of the viewer, through the manipulation of this sphere, it is pitching against television in the case of anger or just squeezing it as is the case of a thriller, it is possible to manipulate the television content according to the product of some emotions people, as shown in Figure 4.

Hologram touch sensitive

Hologram touch sensitive was presented at the SIGGRAPH event 35 and 36 (Iwamoto et al., 2008), a project that addresses a concept of holographic image with touch sensation, which also provided a demonstration of this concept as presented in Figure 5.

The technique combines the technology addressed the Nintendo Wii to an ultrasound system that mimics the sensation of touch to real images floating in the air. The example provided has created the sensation of raindrops send holographically reproduced, falling in the palm of the hand, begins with a display called "Holo", which uses concave mirrors to project objects that seem to float to the surface 30 cm. Already the sense of touch itself comes from the airborne ultrasound tactile display (Iwamoto and Tatezono, 2008), which emits an ultrasound called acoustic radiation pressure. When the flow of the ultrasound is stopped, for example, on one hand below the image, the display creates a pressure field on the object that caused the interference.

Since the manipulation of holograms is made possible thanks to Wiimote, Nintendo's (Wii, 2010). With its infrared camera, it locates the exact position of user's hand in a 3D mapping system. This is only possible because a bullet is stuck in the middle finger of one who wants to play to push the image up and down.

The version shown has 324 ultrasonic transducers, operating at the resonant frequency of 40 kHz. The prototype produces vibration of 1 kHz.

DISCUSSION

Possible uses of the proposal in question

The following describes some possible uses of issues addressed in this study.

Audience control

A feedback based on data collected through user

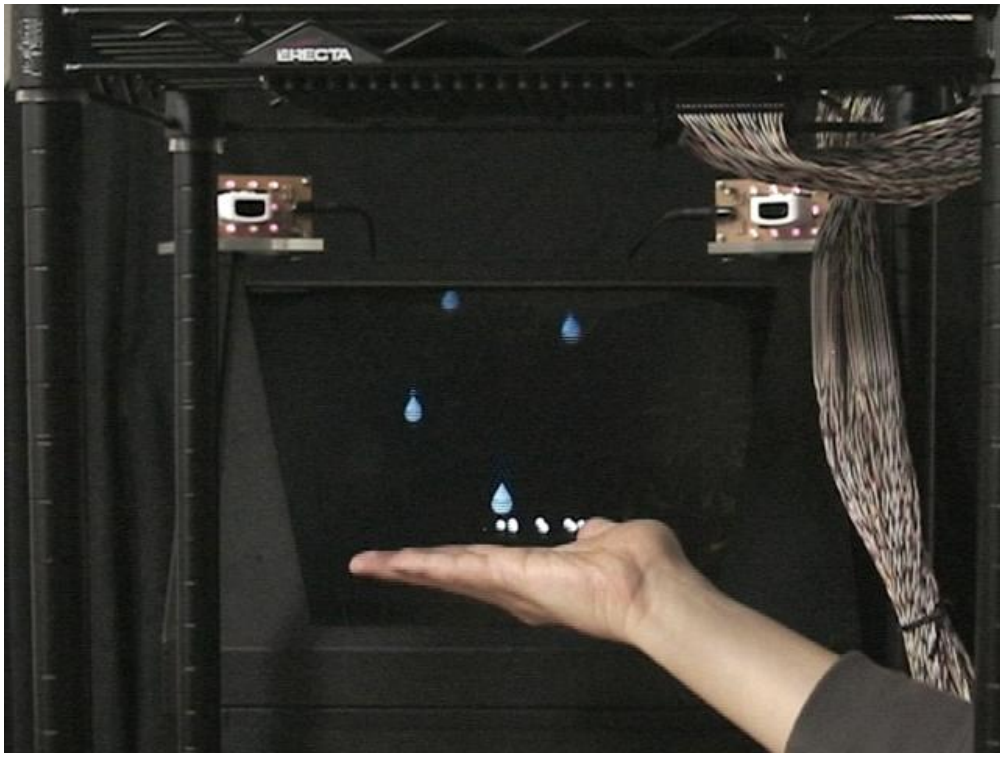

Figure 5. Example shown during the Siggraph, 2009 event, where the hand feels the sensasão of raindrops through the hologram (Iwamoto and Tatezono, 2009).

interaction with devices such as cameras, balls, among others, connected to the television to measure such emotions. The work of Chia-Hsun Lee (Lee et al., 2007) presents this interaction using a ball next to an accelerometer.

Content contextualization

The affective computing can collaborate with the context of television, because according to Article (Bonanni et al, 2005); we can adapt the content depending on the emotions of the viewer.

As the example, the screen size could vary according to the emotion of the viewer, the screen could grow or shrink, objects can appear on the screen, and so on, the possibilities are endless.

Use with autistic people

The Affective computing can be used for the treatment of autistic individuals, such as seen in the work done by the research group at MIT (Poh et al., 2010) that offers a new approach to investigate the relationship between seizures and autonomic changes using concepts of affective computing and computer vision.

Use for HCI

Reducing the frustration of the user, as seen in the work of Picard (Rosalind, 1999) which discusses the frustration at design time and runtime of a computer system. Through physiological analysis of the users, it is possible to understand and measure the level of frustration they are having with the use of affective computing concepts and computer vision.

FINAL CONSIDERATIONS

We discussed concepts of affective computing, computer vision applied to digital television, which involved linking techniques such as capturing facial expressions through a video camera, use of accelerometers in balls and holograms to touch a certain level of work interactivity with the viewer. Examples of use of these concepts were described for example, the control of audience and the context of television content.

Numerous benefits can be addressed with the use of matters presented in this article which can be applied in a broad context, such as applying for the blind in video games, among others.

Personal devices such as mobile phone should not be discarded in this study due to the integrated video

camera increasingly available in these devices.

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