**AFFECTIVE COMPUTING AND ITS ASSOCIATED CHALLENGES**

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**Abstract**

The Affective Computing group creates and evaluates new ways of bringing together Emotions and Artificial Intelligence to make people's lives better. This paper provides a basis to help people who are not flourishing or at risk of not flourishing.  Affective AI computing finds new ways to prevent depression and to explore new solutions to help people who face communication, motivation, and emotion regulation challenges. Artificial Intelligence enables robots and computers to respond intelligently to natural human emotional feedback. This work focuses on making contributions to basic theory and science, including new improvements to machine learning algorithms, while other projects focus on advancing research outside the lab, with applications aimed at improving the lives of individuals in their everyday environments.

**Keywords: Emotional AI, Affective Computing, Robots, Computers.**

**Introduction**

Affective computing is the development of systems that can recognize, interpret, process, and simulate human feelings and emotions. It may seem strange that machines can do something that is so inherently human. However, growing research supports the point that human emotions are recognizable using facial and verbal clues. Understanding emotions is critical, especially for companies selling complex products. From those who are not working in customer-facing functions such as sales, marketing, or customer service, it may not be clear how effective computing is valuable for businesses. Emotions, guided by the unconscious mind, are likely to be the decision-makers in complex decisions. Furthermore, emotional, gut-based decisions can be better than conscious decisions when it comes to complex decisions.

**Can computers really understand emotions?**

People express emotions in surprisingly similar ways across cultures, and machines can pick up the visual and verbal clues of emotions. A large body of research since the 1970s demonstrates that even pre-literate cultures with minimal exposure to literate cultures can identify basic emotional expressions such as anger, happiness, or surprise. There is also new, contradicting evidence supporting the theory that emotions are expressed individually in different ways, and this is an ongoing debate. However, despite the recent challenges, the theory that emotions are expressed in similar ways by different people is still widely accepted. Machines are better than humans in identifying emotions from speech. Even in research conducted during 2003 and 2006, software achieved 70 to 80% accuracy. Human accuracy is ~60%. Machines are already at acceptable levels in identifying emotions from facial expressions. In a 2017 study cited >30 times, researchers achieved a classification accuracy of 73% for seven emotional states with a relatively simple model using the Facial Action Coding System developed by Ekman, one of the pioneers in the field of facial expressions and emotions. However, this was achieved using 3D Microsoft Kinect cameras under strictly defined conditions. Additionally, experiment participants posed to create facial expressions; they did not naturally generate them. Despite these caveats, ~70% is a significant achievement.

3. How does it work?

Most affective computing systems use labelled training data to train machine learning models which identify emotions in speech or videos. Since performance of deep learning systems improve with more data, companies in this space are trying to increase the scope of their labelled data set to improve their models. To normalize facial expressions, affective computing solutions working on images use these techniques:

1. Face is extracted from the background
2. Facial geometry (e.g. locations of eyes, nose, mouth) can be estimated.
3. Based on facial geometry, facial expressions can be normalized, taking out the impact of head rotations or other head movements.

**Challenges associated with affective computing**

## Building emotional capabilities into computers could both make them easier to interact with, and also make them cognitively radically more capable.

## a) Limitations in algorithm design and hardware

The accuracy of affective computing is rising with the developments in algorithm designs. With the advances in technology, AI can identify emotions with new sources like blood volume pulse and facial electrography. However, it still requires further improvements in the algorithm design and more advanced hardware to be more widespread in real-life.

### **b) Ethical issues about increased surveillance**

As more use cases of affective computing emerge, some use cases require video surveillance or social media monitoring to identify human emotions. While the main goal is to understand users’ mental states for better services, some people might not want to be monitored and their voices, images, or social media posts to be analyzed by affective computing software. The advances in emotion AI can bring some controversial ethical issues especially in some use cases like tracking employees during work, job interviews etc. Political campaigns’ use if sentiment analysis already proved deeply unpopular after the 2016 US presidential elections.

### **c) Ethical issues about bias**

Even if people are ok with estimates about their emotions being used for analytics, the results may have bias which is especially concerning in cases like job interviews. There has been research claiming that other AI techniques (e.g. [facial recognition](https://www.theverge.com/2019/1/25/18197137/amazon-rekognition-facial-recognition-bias-race-gender)) have significant bias against underrepresented groups.

**Conclusion**

Affective computing is a relatively new field of study researching the use of emotional capabilities in computing machines. Its background relies on findings and theories emphasizing the importance of emotions in decision making, learning, memory, and virtually all cognitive processes. Building emotional capabilities into computers could both make them easier to interact with, and also make them cognitively radically more capable.

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