

# A Review on Affective Computing

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## ABSTRACT

Emotion plays major role in human life. Based on emotions we are changing our decisions day today life. Think, If computers can have that capability, we can achieve a lot more. In recent years, scientists have been trying to mimic human behaviors, actions, decision making, perception, and emotions. This technology changes the way of life. Some of the Intelligent Agents used in customer care service, chatbots and automated online Assistant. Such innovation is considered keeping in mind the end goal to prompt more regular and instinctive communications in the middle of human and machines. This prompts new impacts and user encounters. Video game industries have adopted this technology to NPCs for better believable games. As of late Affective Computing has been getting more consideration from specialists to act out machines. Affective computing covers the areas of cognitive science, Computer Science, and Psychology. It tries to fill the barrier between human feelings and computational innovation. This area of research helps to elicit emotions on computer. On E-Learning, this field has been getting more attention, adjusting the emotional behavior of virtual tutor as well as it improves presentation style. This paper reviews the how affective computing used in various fields.

**Keywords:** Affective Computing, cognitive Science, Psychology

## 1. INTRODUCTION

Affective Computing is a branch of counterfeit consciousness that arrangements with the outline of frameworks and gadgets that can perceive, decipher, and handle emotions. The term “Affective Computing” has been found by Rosalind Picard at MIT University in 1997. This field focuses on recognition and deduction of facial expression, and the deduction of voice inflexion [1]. Individuals normally express feeling to machines, yet machines don’t actually remember it. Feeling correspondence requires that a message both sent and got. Notwithstanding the endeavors above went for user disappointment, we are building devices to encourage conscious passionate expression by individuals, and to empower machines to perceive significant examples of such expression. Machines are able to deduce affective modulation in speech at the same time they are well at animating facial expression. These are capable to distinguish six different kind of facial expressions and eight kind of vocal expressions. Wearable computing will make computer to think deeply about human because these devices have the information about (physiological contact, person’s contact and behavior) users through with sensors attached to wearable devices. Adding emotive pattern recognition on wearable sensing, we have a novel chance to instruct a computer to spot the canonic responses of its user - assume, computer can understand the feeling of the user [2].

Not all PCs need to pay consideration on feelings or to have passionate capacities. A few machines are valuable as unbending apparatuses, and it is fine to keep them that way. In any case, there are circumstances where the human-machine collaboration could be enhanced by having machines actually adjust to their clients, and where correspondence about when, where, how, and that it is so essential to adjust includes enthusiastic data, potentially including articulations of disappointment, perplexity, loathing, interest, and that’s only the tip of the iceberg. Affective Computing extends human-PC cooperation by incorporating enthusiastic correspondence together with fitting method for taking care of emotional data [3][4].

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## 2. EMOTIONS

Emotion and Perception one of the main things in human being. These ability make the human as unique. That's what we are called "Social Animal". Feeling is major to human experience, impacting cognizance, discernment, and regular errands, for example, learning, correspondence, and even reasonable basic decision making. Be that as it may, technologists have to a great extent disregarded feeling and made a frequently baffling knowledge for individuals, partially in light of the fact that influence has been misjudged and difficult to quantify.

As indicated by James-Lange hypothesis, activities go before feelings and the cerebrum translates said activities as feelings. A circumstance happens and the cerebrum deciphers the circumstance, bringing about a trademark physiological reaction. This may incorporate any or the greater part of the accompanying: sweat, heart rate height, facial and gestural expression. These reflexive reactions happen before the individual knows that he is encountering a feeling; just when the mind intellectually evaluates the physiology is it named as an "emotion"[5].

Cannon and Bard restricted the James-Lange hypothesis by expressing that the feeling is felt in the first place, and then activities take after from subjective evaluation. In their perspective, the thalamus and amygdala assume a focal part; interpret a feeling inciting circumstance and all the while sending signs to the ANS (Autonomic Sensory System) and to the cerebral cortex which translates the circumstance psychologically[6].

Schachter and Singer( Two-factor theory of emotion) concurred with James and Lange - which the experience of feelings emerges from the psychological naming of physiological sensation. In any case, they likewise trusted this was insufficient to clarify the most unpretentious contrasts in feeling self-discernment that is the distinction amongst indignation and apprehension. In this way, they recommended that an individual will pick up data from the quick circumstance (ex: a threat is close-by) and use it to subjectively mark the sensation[7].

## 3. E-LEARNING USING AFFECTIVE COMPUTING

### 3.1. Emotion Recognition Algorithm

Figure 1 illustrates model of Affective Computing. This model consists of two modules: 1. Interface module and 2. Emotion Recognition module.

1. *Interface Module*: Affective Computing information will be added to human machine interface of a customary E-learning framework, which gathers learners' feeling input data fundamentally, in this way feeling remuneration is figured it out.

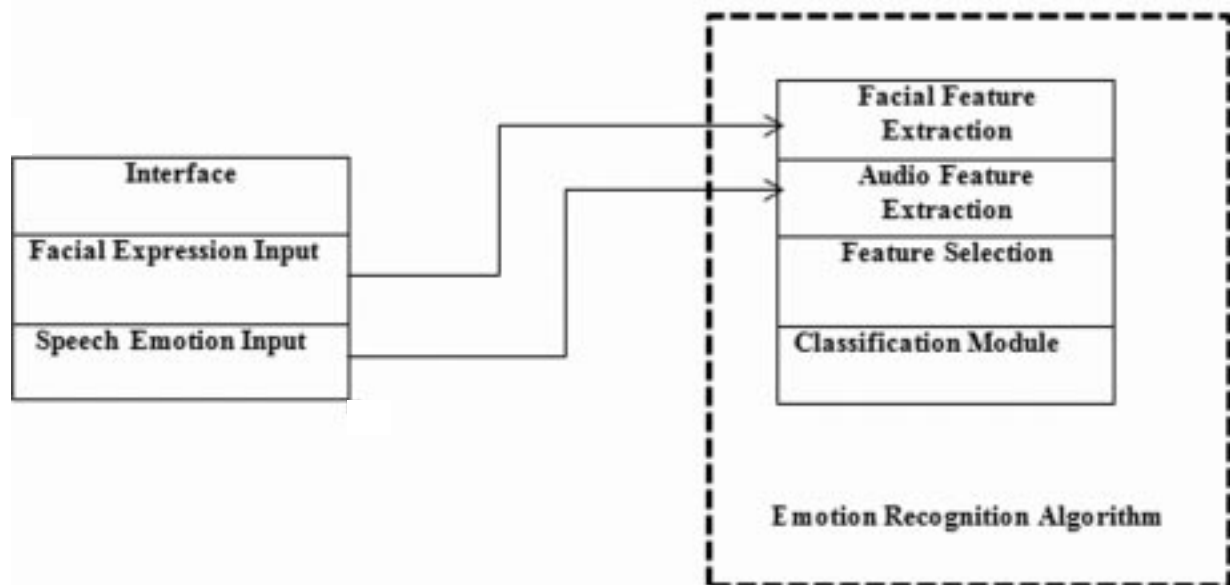


Figure 1: Affective Computing Model

2. *Emotion Recognition Algorithm*: Emotion recognition Algorithm module is made out of information, pre-handling, highlight extraction, highlight determination, grouping furthermore, yield. Firstly, facial picture and sound data of human are taken as information through some significant sensors. At that point, sound component and facial element are extricated from information. Besides, significant elements from all elements are chosen for feeling acknowledgment. At last, the general feeling is perceived by utilizing feeling acknowledgment calculation in view of Rough Set theory[8].

E-Learning is the one of the finest technology in education because we can easily access any lectures from anywhere and anytime. In this technology sometimes the tutor may be a virtual character. If the virtual tutor takes classes without any emotions the learner would feel bored. With the suggestion and the quick advancement of e-Learning on the planet, cutting edge data innovation to human learning strategies have had a significant sway, then it has huge changes in the documented of instruction and educating in the meantime, the quick advancement of affective computing, making e-Learning and affective computing joining get to be conceivable[9]. In this paper, the authors proposed “Ane-Learning system based on Affective Computing”. This model comprises two kinds of recognition one is facial expression and another is emotion speech. The two major parts of this model is user information input and direction learning of framework[10].

#### 4. MEDICINE USING AFFECTIVE COMPUTING

The fundamental commitment of this work[11] is the vigorous EEG-based feeling valence acknowledgment framework approved for high dimensional information of 26 subjects. Keeping in mind the end goal to decrease the high variability of neural endearments between subjects, determination of most discriminative, less subject particular components is of incredible significance. Among different options, Sequential Feature Selection (SFS) gives the most certain components in view of which separation models with high speculation limit over new subjects were gotten. In any case, SFS is a computationally overwhelming method that may take days to wrap up. Interestingly, an experimental element disposal system was proposed taking into account engaging insights as a tradeoff between computational time (it takes a couple of minutes) and separation execution (lower than with the SFS). Both techniques are reliable in selecting the parietal and occipital channels as better encoders of the class data and less variable crosswise over subjects. Fleeting relationship between visual passionate boost and the event of neighborhood possibilities is more discriminative concerning late waves (P200, P300). Feeling valence acknowledgment is an intriguing point, however restricted to just two states. The quantity of members in the tests is likewise critical for uncovering stable cross subject elements.

Spectral turbulence (ST) measure is exhibited as a decent option highlight extraction and information lessening for classifying EEG channels and selecting the most appropriate EEG channels for segregating among mental procedures, particularly full of feeling valence location. SVM-RFE calculation for highlight determination connected on SVM-based classifier is actualized[12].

#### 5. AFFECTIVE COMPUTING FOR AUTISM

Autism Spectrum Disorder (ASD) is the name for a gathering of formative issue. ASD incorporates a wide range of indications, abilities, and levels of disability[13]. Children with Autism Spectrum Disorder are not able to express their emotions. Sometimes we need depend on technologies when we fall short. Technologies always try to fill the gaps. Some of the wearable devices are available for sensing the emotions of autistic child. Affective devices like expression glass, blood-volume pulse earring, pressure-sensitive mouse, chest-worn heart monitor, skin-conductance shoe and galvactivator for sensing emotions of affected one[14].

#### 6. AFFECTIVE COMPUTING FOR FACIAL EMOTION AND GESTURE DETECTION

The power of human has communicating via emotions and body gestures. Challenging job here is making the computer to recognize process, understand and proceed to human emotion. For that reason we are using affective

computing today. PC outward appearance examination would be exceptionally valuable for some fields including those as differing as human PC connection, security, pharmaceutical, conduct science, correspondence, and training. As of now, all existing face appearance examination and acknowledgment frameworks depend principally on static pictures or element recordings from numerous 2D outward appearance databases. In spite of the fact that a few frameworks have been effective, the execution corruption remains when taking care of expressions with substantial head pivot, unobtrusive skin development, and/or lighting change with differing stances. With a specific end goal to alleviate the issues natural in the 2D based investigation, we propose to build up a new 3D outward appearance database, and behavior facial expression examination in a 3D space by investigating the surface data, which is past the accessibility from the 2D plane. In the accompanying segment, we will audit the current work, recognize the basic issues to show why investigating facial expression in a completely 3D space is essential.

A Kapur et al have designed VICON motion capturing system to get gestural information from the whole body to know different kinds of emotions [15]. This system has 6 cameras and is intended to chase and rebuild these pitches in dimensional space.

## 7. AFFECTIVE COMPUTING FOR GAMES:

Emotion makes our life colorful and drab [16]. Adding emotion to video games make the game will be more interactive on the other hand that emotion should appropriate for particular situation otherwise it will collapse the total theme of the game. Using appropriate emotion in a particular situation is vital one. To add emotion to our game we need some technology. That is affective computing [17].

Relaxation training is for emphasizing the player health and wellness. Luca Chittaro and Riccardo Sioni, proposed biofeedback application for unwinding preparing that joins thoughts from full of feeling processing and diversions. Biofeedback is a procedure that empowers a person to figure out how to change physiological movement for the motivations behind enhancing wellbeing and execution. Exact instruments measure physio-intelligent action, for example, brainwaves, heart function, breathing, muscle activity, and skin temperature. These instruments quickly and precisely “input” data to the client. The presentation of this data – frequently in conjunction with changes in considering, feelings, and conduct – bolsters craved physiological changes. Overtime, these progressions can persevere without proceeded with utilization of an instrument [18].

The utilization of biofeedback in unwinding preparing and push treatment is generally portrayed in the writing. It intends to enhance students’ wellbeing and health by expanding their capacity to unwind and to improve them figure out how to adapt to stretch. Indeed, high levels of excitement are regularly signs of tension issue and stretch which can undermine prosperity, wellbeing and security. Mediations, for example, biofeedback-helped unwinding preparing could diminish stress-related side effects, enhance personal satisfaction and expansion sentiments of prosperity.

## 8. CONCLUSION

Affective Computing is one of the technologies that can interpret process and deduct emotions of human. Adding emotion to computers will make the world another level. If computers are able to understand our feelings, then computer will get cognitive perception. Now-a-days this technology is used in many fields like e-learning to avoid monotonous in lectures. In this paper we have seen some of the fields, how Affective computing used in many fields and how they try to emote machines. Despite the fact that the idea of full of feeling figuring has turned out not for quite a while, it pulls in high and broad consideration from foundation and endeavor fields. The study furthermore, utilization of significant fields are blasting. To whole up, the current explores are for the most part restricted in the point by point and scattered fields like voice and non-verbal communication. As a result of the absence of extensive influence information assets, no powerful instrument for multi-highlighted full of feeling registering and applicable learning and controlling calculations and the inadequacy of adjustment to common situations, PCs cannot precisely judge what’s more, create a human-like influence status and have genuine powerful influence connection.

As an entire, different hypothetical issues concerning full of feeling registering are not very much comprehended. Notwithstanding for that, there are still a few applications, for occasions, including the capacity of programmed observation to individuals' state of mind in data family machines and smart instruments to give better administrations to individuals; making use of the capacity of effect idea examination in PC recovery framework to enhance the precision and proficiency of data recovery; including influence components in the remote instruction stage may increase the training impacts; using multi-model effect connection innovation in virtual reality application may manufacture shrewd space and virtual situation nearer to genuine and so on. Likewise, influence figuring may likewise be connected in the related commercial enterprises like advanced stimulation, bots and embodied agents to acknowledge assembling clearer situation.

## REFERENCES

- [1] Picard, R. W., "Affective Computing" M.I.T Media Laboratory Perceptual Computing Section Technical Report No. 321, 1997.
- [2] Picard, R. W., "Affective Computing" The MIT Press, 1997.
- [3] Picard, R. W., "Affective Computing for HCI", proceedings of HCI, 829-833, 1999.
- [4] Jimmy Or, "Affective Computing Focus on Emotion Expression, Synthesis and recognition" Croatia, I-TECH Education and Publishing, 2008.
- [5] Peter J. Lang, "The Varieties of Emotional Experience: A Medication on James-Lange Theory", American Psychology association, Inc., 211-211, 1994.
- [6] Cannon, W.B., "The James-Lange theory of emotions: A critical examination and an alternative theory". The American Journal of Psychology, 106-124, 1927.
- [7] Schachter, S.; Singer, J., "Cognitive, Social, and Physiological Determinants of Emotional State". Psychological Review, **69**, 379-399, 1962.
- [8] Ruiming Zhao, Zhenhui Ren, Li Zhang, Ruiguo Qin, "Research on affective Computing Model in E-Learning System" Springer, 599-602, 2007.
- [9] Xirong Ma, Rong Wang, Jinglian Liang, "The e-Learning system model based on Affective Computing" IEEE Explore on web based learning, ICWL Seventh International Conference, 54-56, 2008.
- [10] Sun Duo, Lu Xue Song, "Research on E-Learning system based on Affective Computing" IEEE International Conference on Information Management and Engineering, 697 - 699, 2010.
- [11] Lachezar Bozhkov et al, "ECG-based subject independent affective computing models", INNS conference on Bigdata, Elsevier, **53**, 375-382, 2015.
- [12] A R Hiidalgo-Munoz, M M Lopez, A T Pereira, I M Santos, A M Tome, "Spectral Turbulance measuring as feature extraction method from ECG on affective computing", Elsevier, 945-950, 2013.
- [13] Denise DuBois, Stephanie H Ameis, Meng-Chuan Lai, Manuel F Casanova, Pushpal Desarkar, "Interoception in Autism Spectrum Disorder: A review", Elsevier, **52**, 104-111, 2016.
- [14] Rana el Kaliouby, Rosalind Picard, Simon Baron-Cohen, "Affective computing and Autism", New York academy of Sciences, 228-248, 2006.
- [15] A Kapur et al, "Gesture-Based Affective Computing on Motion Capture Data", Springer Verlag Berlin Heidelberg, 1-7, 2005.
- [16] Andrew Ortony, Gerald L. Clore, Allan Collins, "The Cognitive Structure of emotions" Cambridge University Press, 1988.
- [17] Eva Hudlicka, "Affective Computing for Game Design" In Proceeding of the 4<sup>th</sup> Intl. North American Conference on Intelligent Games and Simulation (GAMEON-NA), 5-12, 2008.
- [18] Luca Chittaro, Riccardo Sioni, "Affective Computing vs. affective Placebo: Study of a biofeedback-controlled game for relaxation training", Elsevier, 1-11, 2014.