



Traversing through Emotional Tech: A Review of Technologically Driven Methods of Emotion Recognition

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ABSTRACT

Emotional Recognition is a subfield of artificial intelligence that is concerned with identifying human emotion through the use of technology, more particularly by recognizing facial expressions from video, spoken expressions from audio, written expressions from text, and body language through physiology. This was first studied by Ekman in 1967 when he went to Papua New Guinea to conduct an experiment. Ever since then, there has been extensive research and development in this field and various tech giants have been improving and deploying this technology in their products to better understand their consumers. Apart from the boundless potential, this technology is facing some moral and ethical issues, such as data privacy and inaccurate interpretation of emotions, that need to be addressed for its seamless usage. These problems can be solved if a proper framework, which outlines a clear set of guidelines for the collection and usage of the people's data is set up, along with an overseeing body that makes regular audits to ensure the guidelines are being followed by the companies involved in the development of this technology. If these problems are resolved by taking the necessary steps, emotion recognition technology can help us improve our lives immensely.

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I. INTRODUCTION

Emotion plays an important role in human life. Human beings express emotions in day-to-day interactions to convey their messages powerfully. The ability to decipher a person's true intent and emotional response from their facial expressions, despite their attempts to mask or deceive what they feel, is an evolutionary advantage of great interest to a wide range of sectors, from physicians to marketers and political analysts. In the last decade, emotional recognition has seen an increase in both academia and the industry, and its market is anticipated to grow to \$56 billion by 2024.

It is essentially a branch of artificial intelligence that identifies human emotion through technology by recognition of facial expressions from video, spoken expressions from audio, written expressions from text, and physiology as measured by wearables. This method is used in software that permits a program to “examine” the sentiments on a human face. Various companies have been experimenting with this method with sophisticated algorithms and image processing techniques that have emerged in the past decade to decipher a person's feelings or state of mind.

For technology-driven companies, the use of emotional recognition yields a much better grasp of their consumer market, that is, the better they understand customer needs, the better they can get at innovating their products; resulting in a win-win situation for both parties.

For instance, in 2016, Microsoft announced Face API, which is an algorithm that can detect “anger, contempt, disgust, fear, happiness, neutral, sadness, and surprise.” Another company, Spire, manufactures a small stone-shaped sensor that can be clipped to a bra strap or belt and is able to pick up on your stress levels. A majority of this development is part of the emerging field of affective computing, which examines ways to create sensors and computers that can detect and respond to human emotions. It has several applications such as allowing companies to gauge consumer mood towards their product or brand, alerting car drivers to take a break or stop when they are feeling drowsy, and helping people who are blind to read facial expressions. An industry that's taking advantage of this technology is Health Care, with AI-powered recognition software helping to decide when patients require medicine.

The video game industry is also applying emotion recognition technology to evoke a particular behaviour and set of emotions from the users. Using facial emotion recognition can aid in understanding the emotion a user is experiencing in real-time as he or she is playing without analyzing the complete video

manually. It is already used by schools and other institutions to help prevent violence and improve the overall security of a place. Another important application this has seen over the past few years is in identifying deepfake video manipulations. In 2019, the Computer Vision Foundation partnered with UC Berkeley, Google, and DARPA to create a system claimed to identify deepfake manipulations via the analysis of expressions in the targeted subjects. Though emotion recognition has vast application in several fields, it still has various limitations which need to be acknowledged. For example, the recognition system has no intrinsic understanding of human emotion and thus relies on our ability to accurately label expressions.

II. BACKGROUND

The connection between emotion recognition and artificial intelligence is dated back to 1967 when a young American psychologist named Paul Ekman arrived in Papua New Guinea to gather evidence for a controversial hypothesis: that all humans exhibit a small number of universal emotions that are the same all over the world. His theory assigned a weight to 'micro facial' expressions deemed to be indicative of hidden emotions. He attempted to conduct experiments on the natives using flashcards and translators, but due to his lack of training in language and culture the experiment failed and he left Papua New Guinea. However, this experiment marked the beginning of research in the field of emotions and emotion-led technology.

As work into the use of computers in affect recognition began to grow, a 1992 National Science Foundation report co-written by Ekman recommended that "a readily accessible, multimedia database shared by the diverse facial research community would be an important resource for the resolution and extension of issues concerning facial understanding."

Though Ekman's work had a profound and wide-ranging influence, it has been subject to increased scepticism. Over the years, critics and scientists from different fields questioned the universality of emotions and were unconvinced by Ekman's belief in biological determinants of behaviour that exist separately from highly conditioned cultural factors. An early critic was the cultural anthropologist Margaret Mead, who debated Ekman on the question of the universality of emotions in the late 1960s. Possibly, the foremost critic of Ekman's theory is the historian of science Ruth Leys, who sees a fundamental circularity in Ekman's method. Nevertheless, powerful institutional and corporate investments have been made on the perceived validity of Ekman's theories and methodologies.

The idea of automated effect emotion recognition is enthralling as well as remunerative.

Several big tech companies are continuously trying to develop and understand this technology by studying billions of photos and videos from the internet as well as from test subjects, who are placed in an environment that evokes their natural emotions.

This information, along with several other projects, has helped machine-learning researchers to assemble, label, and make the data sets public, which drives much of today's machine-learning research.

III. DISCUSSION

There are several automated emotion recognition techniques that are performed by measuring various human body parameters. These techniques are broadly classified into three categories. These are:

1) Statistical methods: They involve the use of various supervised machine learning algorithms in which a large annotated data set is passed into the algorithms for the system to learn and predict the appropriate emotion types. These methods mostly provide more reasonable classification accuracy in contrast to other approaches, but it requires a sufficiently large training set.

2) Knowledge-based techniques: These make the use of domain knowledge and the syntactic characteristics of the language in order to detect certain emotion types. This approach is preferred due to the accessibility and economy brought by the ample availability of such knowledge-based resources. However, its inability to handle concept nuances and complex linguistic rules limits its capability. Knowledge-based techniques are further classified into two categories: dictionary-based and corpus-based. Dictionary-based methods look for opinion or emotion seed words in a dictionary and search for their antonyms and synonyms to inflate the initial list of opinions or emotions. Whereas corpus-based approaches begin with a seed list of opinion or emotion words and expand it later by finding other words with context-specific characteristics in a large corpus.

3) Hybrid approaches: Hybrid approaches are an amalgamation of knowledge-based approaches and statistical methods. They use the complementary characteristics from both techniques, leading them to have a better classification performance in contrast to employing knowledge-based and statistical methods independently. But this leads them to acquire computational complexity during the classification process.

Technology has improved immensely at detecting emotions in humans through voice, body language, facial expressions, etc. and several benefits associated with it, such as consistency in decisions, continuous work without getting tired, and not requiring wages, have led to its exponential development and usage in the current times. The advantage of having a method that can detect your emotions is unparalleled. As technologies are becoming more and more interactive, their capability of recognizing human emotions is increasing. Research suggests that this could lead to them slowly affecting human emotions in a manner that is unprecedented. In other words, automated human recognition has imposed some major moral and ethical challenges to mankind. It invades the personal space of people as it requires examining their physical gestures which require the machine to have full access to the personal space of the person being examined. This information can fall into the wrong person's hand who can access their information and use it against them. The lack of transparency regarding when and how we are being monitored and how our data is being used has forced various governments around the world to put restrictions on its usage. For example, law officers of California are not allowed to use such technology as it violates the rights of the citizens. Moreover, there is a growing scepticism around the accuracy of the current methodologies owing to the fact that emotions largely depend on context. For instance, a person appearing to be crying can be misinterpreted by the machine as a sad emotion even when he/she may not be in a sad mood. Likewise, the machine could also be deceived by faking facial expressions that the machine cannot comprehend as it links facial expressions to certain emotions, which leaves it incapable to distinguish them as genuine or fake. Human recognition software has come a long way but it still has some issues which need to be addressed to ensure its seamless use in the future.

Apart from the data privacy concerns raised by emotion recognition technology, emotions heavily influence decision-making. Scope to commodify emotions must be treated critically and carefully. The aim is not to "ban" emotion-capture technologies, but find appropriate means to live with them in a way that respects the dignity of human life and enhances the experience of technologies.

IV. CONCLUSION

The emotion recognition technology cannot be implemented until the various concerns regarding it are addressed. The most prominent issue among them is data privacy and its protection, which needs a regulatory framework and an overseeing body needed to ensure the safe deployment of this technology. The framework should make a clear set of guidelines for the collection, storage, and usage of the biometric data of the users. Clarification about the deployment of these technologies to the public is extremely crucial, where the people should have a chance to openly discuss the pros and cons of these surveillance-driven technologies. Moreover, the overseeing body should regulate audits and ensure that the companies and individuals are in adherence to the guidelines.

Another important aspect that needs to be addressed is the data sets used for the initial training of the machines. They should be representative of all individuals and groups so as to arrive at accurate results, which abolish the societal prejudices and discrimination of certain groups. A study conducted at the University of Maryland has shown that some facial recognition software interprets Black faces as having more negative emotions than White faces, specifically registering them as angrier and more contemptuous.

If privacy and consent hurdles are addressed and holistic and accurate results are worked upon, then the potential for emotion recognition technology to impact the lives of people, for the common good, is enormous. The promotion of the common good, however, requires a thorough understanding and awareness about these technologies, which can only be facilitated by extensive research on the theoretical and practical aspects of technology-assisted emotional recognition.

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