An Analysis of Recent Techniques in Emotional Artificial Intelligence

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Abstract- *This paper represents a novel design and control architecture In the field of artificial intelligence (AI), emotional intelligence (EI) is gaining importance. Although AI is adept at doing cognitive tasks, it is not yet able to comprehend emotions. To create interactions that are more like human interaction, researchers are working on a number of techniques to include EI into AI. This study examines facial recognition, natural language processing, and affective computing as approaches to emotional intelligence in AI. We will look at each method as well as how effectively it may be utilized in various fields.*

Keywords- Emotional Intelligence, Face Recognition, Algorithms , Natural Language Processing, Affective Computing

I. INTRODUCTION

People who have high emotional intelligence are better able to perceive, comprehend, and control their emotions. If interactions between humans and machines are to grow more human-like, AI must incorporate EI. A few techniques that have been looked at to merge EI with AI include facial recognition, natural language processing, and affective computing. These tactics have been used in a number of industries, including customer service, education, and healthcare. Research in the area of "artificial emotional intelligence" (AEI) aims to create robots that can recognise and react properly to human emotions. In order to develop algorithms and systems that can analyze and decipher emotional indicators including facial expressions, speech tones, and body language, AEI draws on a variety of fields, such as computer science, psychology, and neuroscience.

II. FACIAL RECOGNITION

Facial recognition is a prominent method for incorporating emotional intelligence into artificial intelligence. Analysis of facial expressions is used to identify and comprehend emotions. This method uses face recognition to identify or validate a person's identity. It has been used in many different contexts, including automated attendance in lecture rooms. Face recognition algorithms look for and analyse facial features including the eyes, lips, and brows using machine learning and computer vision. In the realm of mental health, this technique has been used to monitor and identify individuals' facial expressions. These algorithms are trained using enormous datasets of images and videos depicting a range of emotions. This method teaches the algorithms to distinguish specific facial patterns and features.By doing this, the algorithms learn to recognise specific facial characteristics and patterns that represent diverse emotional states.[1]

Facial recognition works in three steps:

- Detection,
- Analysis,
- Recognition.

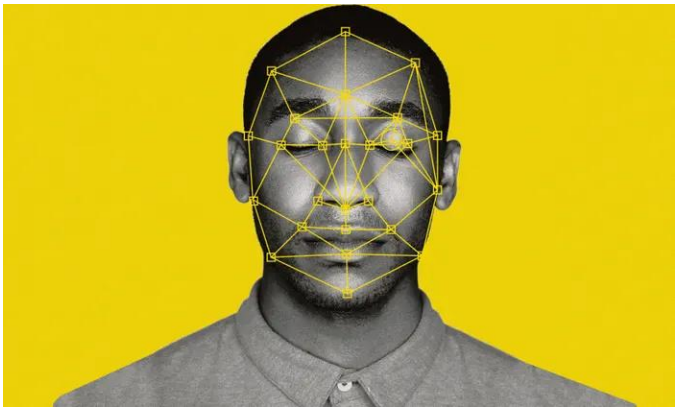

Fig 1 Facial Recognition[10]
Source : theguardian.com

2.1. Detection

The process of locating a face in an image is known as detection, and computer vision technology is often used to do this. Computer vision makes it possible to find and recognise faces in images of one or more people. This technology is able to recognise faces in both frontal and profile perspectives, as well as to record and process facial data.

2.2. Computer vision

Computer vision is a cutting-edge technology that enables robots to recognise and comprehend individuals, places, and things in photos, frequently with an accuracy level that is on par with or better than that of humans. Using powerful artificial intelligence (AI) technologies, this technology can swiftly and automatically extract, analyze, categorize, and interpret useful information from a number of visual data types.

Various sorts of visual data, including single photos, video sequences, views from several cameras, and even three-dimensional data, may be analyzed using computer vision, which is incredibly adaptable. Computer vision technology may offer insightful knowledge of the visual material included in various data types through automated analysis.

2.3. Analysis

The facial recognition technology analyzes the face image after detection and maps out the emotions and facial geometry. It highlights crucial facial characteristics that aid in separating a face from surrounding objects or backdrops.

In order to identify a person, facial recognition technology often uses a number of markers, including the distance between the eyes, the distance from the forehead to the chin, how far apart the nose and mouth are, how deep the eye sockets are, and how the cheekbones, lips, ears, and chin are shaped..

In order to create a unique faceprint, the system converts the facial recognition data into these important traits, which are then identified by the system. Every person has a distinct faceprint that is similar to a fingerprint. These faceprints may be used to compare and match faces in various photos or datasets or to digitally rebuild a person's face.

2.4. Recognition

When using facial recognition technology, a person's identity is determined by comparing their faces in two or more photos and determining the chance that the two faces match. For instance, it can validate that the face in the selfie does not match any face in a collection of previously taken selfies or that the face in the selfie matches the face on an official ID like a driver's license or passport.[6][7]

III. NATURAL LANGUAGE PROCESSING:

Natural language processing, or NLP, is a method for fusing EI with AI. Language analysis is used in NLP to recognise emotions in oral and written communication. Text analysis, which incorporates methods like word counting, grouping, and classification to extract the structure and valuable information from massive volumes of text data, is a crucial component of NLP.[2]

In the area of mental health, AI-enabled chatbots have been used to offer patients therapeutic services based on their emotional states, using natural language processing (NLP) to interpret and reply to their messages.[3]

3.1. KEY COMPONENTS

3.1.1. Computational Linguistics

An interdisciplinary discipline called computational linguistics combines linguistics and computer science to study and create natural language processing (NLP) methods. In order to make it possible for computers to comprehend and produce human language, research is being done on a variety of linguistic topics, including syntax, semantics, and discourse. Automatic question-answering, dialogue systems, language translation, sentiment analysis, and text categorization are just a few of the numerous applications that fall under the umbrella of computational linguistics. Its primary objective is to develop algorithms and models that accurately and efficiently analyze and produce natural language.

3.1.2. Natural Language

Humans engage with one another using natural language, which is made up of a variety of words and expressions that are often employed in daily interactions. Natural language refers to the information that computers are striving to understand, which may be represented in any language and take the form of text or voice.

3.2. Three main NLP tasks:

3.2.1. Natural Language Understanding (NLU):

In NLU, meaning is derived from text or voice by understanding the context of a text or conversation and extrapolating information from it.

3.2.2. Natural Language Generation (NLG):

By extracting data from a source and converting it into a readable or spoken format, NLG is the process of creating new text or voice from an input.

3.2.3. Natural Language Processing Tools:

These are computer programmes made to help with NLP tasks including sentiment analysis, text processing, and machine translation.

3.3. Five phases of Natural Language Processing:

Step 1: Lexico-structured analysis is the process and it entails dissecting a text into its individual words and meanings.
Step 2: Synthesis involves taking the parts of the old text and creating a new one.
Step 3: Understanding a text's meaning is accomplished through semantic analysis.
Step 4: Discourse integration entails knowing how many texts connect to one another.
Step 5: The process of determining how to interpret a text in a certain situation is known as pragmatic analysis.[3]

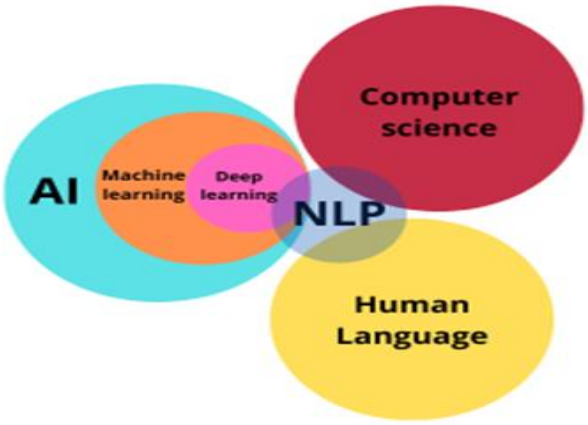

Fig 2 Natural Language Processing[8]
Source : saxon.ai

IV. AFFECTIVE COMPUTING

A subject of artificial intelligence (AI) called affective computing, commonly referred to as AI emotion detection, focuses on identifying and recreating human emotions. Enhancing the sincerity and naturalness of interactions between humans and robots is its main goal.

Through voice tone, text, gestures, and facial expressions, affective computing may recognise human emotions and respond appropriately to alter the tone of an encounter. To reach this degree of human emotion interpretation, its algorithms make use of a variety of technologies and techniques, including speech science, computer vision, and deep learning algorithms.

The most effective computer systems use machine learning models, which are trained on labeled training data to identify emotions in speech or video. Since deep learning systems work better with additional data, businesses in this area are extending the breadth of their labeled datasets in order to enhance their models.[5]

4.1. Affective Computing Work In Three Steps

Affective computing systems commonly employ the following techniques to standardize face emotions while dealing with photos:

- The face is isolated by removing the backdrop.
- The mouth, nose, and eye placements, along with other aspects of facial geometry, are estimated.
- Based on face geometry, facial emotions may be standardized to account for head rotations and other movements.

4.2. The concept of affective computing

All of these elements must be present for computers to learn how to recognise emotions in films, including quick broadband connections, twin high-resolution cameras, and top-notch video recording equipment.[4]

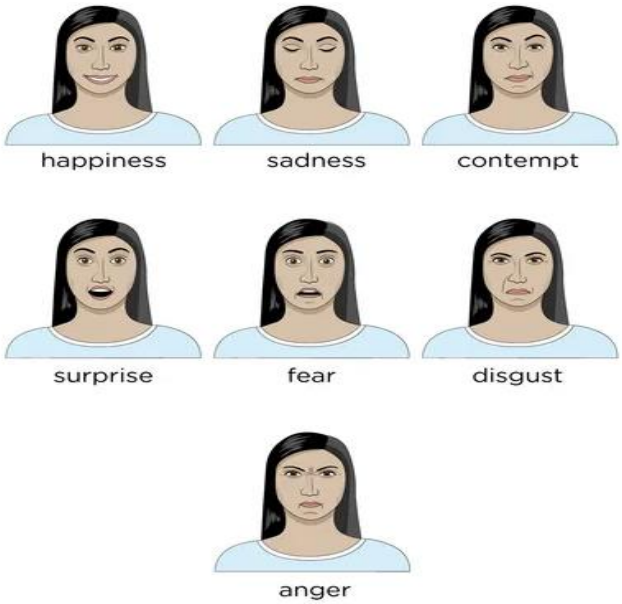

Fig 3 Seven basic human emotions[9]
Source : jackwestin.com

V. CONCLUSION

In comparison to the current standard methods of AI, the application of Emotional Artificial Intelligence provides a far more thorough insight on how robots might assist people. Traditional AI relies on efficiency and logic to solve problems quickly in a given field of study, such as doing mathematical computations in the sciences. AI can expand into new fields of study if emotional intelligence is incorporated into it. Emotional bias is used in every sector to create stability for those who are struggling with emotional issues.

We must implement the ideal artificial intelligence agent with the most sophisticated emotional intelligence recognition if we want to acquire superior results and improve artificial intelligence technology across all disciplines of study. This will address the issues that people face every day and forge a connection between people and machines that will help people grasp difficult circumstances.

We conclude that, It is inevitable that technology will be incorporated into every facet of modern business and Emotional artificial intelligence will become increasingly dependent. By enabling machines to recognise, comprehend, and react to human emotions, emotional AI has the potential to revolutionize a number of industries. Hence Future predictions predict that a variety of industries will depend more on emotional AI. Some of those industries include healthcare, customer service, education, gaming, entertainment, marketing and advertising. These industries will be analyzing the client's or customer's facial expressions and vocal tunes to detect their emotional state which will help them to provide a very appropriate service in return to them. Therefore, Emotional AI is the future of artificial intelligence.

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