Emotional Intelligence in Artificial Intelligence, A review and evaluation study

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May 09, 2024

ABSTRACT Artificial Intelligence (AI) is an integral part of our everyday lives and plays a crucial role in our well-being, culture, society, and industry (Thakkar et al., 2024). Some types of AI are known to exhibit emotions, but they are not very common in present-day AI, which we deal with in everyday life. Some researchers suggest that by endowing AI systems with emotions, we could create emotional experiences in them that help create empathy and a feeling of connectedness with users in applications like mental health, therapy, education, museums, and related experiences. This need for AI systems— especially embodied or affective ones that people feel attached to ethical-moral agency and are thus able to evaluate and make ethical judgments and decisions of their own in ways that are socially and legally responsible that will assist in having more considerate, caring, compassionate, therapeutic, healing, and moral machines. (Pan & Yang, 2021).

Keywords: Artificial Intelligence, Emotional Intelligence, and acceptance

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By Dr. Heidrich Vicci

1. Introduction

Just like mental health practitioners, AI also possess therapeutic potential for mental health disorders for example depression, anxiety, ADHD, relaxation, mindfulness, and even help counter the effect of the COVID-19 pandemic on mental health. AI-driven mental health therapy and related applications help users improve their mood, cognitive function, quality of life, overall self-improvement, alleviate loneliness, or even develop self-awareness, or spiritual awakening (Nasir et al., 2023). For most successful and relevant applications, AI demands to skillfully recognize and accurately model human emotions. As AI having the same general function—improving interaction and facilitate natural and ease communication among parties—applications. The best understandings there is have today about developing emotional and mental health-enhancing AI using machine learning-based analysis and related artificial emotional intelligence. One of the basic building blocks to not only comprehend human emotions but also respond them in models through the approximate emotion model of the user in the hope of leading to closer relationships. The emotional state of humans can be recognized by AI through their visual, linguistic, acoustic, and physiological activity patterns. (Olawade et al.2024)(Malik et al., 2022)(Boucher et al.2021)

Artificial Intelligence (AI) is an integral part of our everyday lives and plays a crucial role in our well-being, culture, society and industry (Thakkar et al., 2024). Some types of AI are known to exhibit emotions, they are not very common in present-day AI that we deal with in everyday life. Some researchers suggest that by endowing AI system with emotions, we could create emotional experiences in them that help create empathy and a feeling of connectedness with users in applications like mental health, therapy, education, museum and related experiences. This need for AI systems—especially they embodied or affective ones that people feel attached with ethical moral agency and are thus able to evaluate and make ethic judgments and decisions of their own in ways that are socially and legally responsible that will assist in having more considerate, caring, compassionate, therapeutic, healing, and moral machines. (Pan & Yang, 2021).

1.1. Definition of Emotional Intelligence

Artificial intelligence refers to the technique of creating computer systems that able to perform tasks that require human intelligence. AI is a discipline which attempts to emulate human behaviour based on unchangeable, reproducible, and universal hardware. However, AI has been criticised for its lack of understanding of the basic principles of life—emotions, ethics and moral issues, and environmental criteria. To combine two disciplines, artificial emotional intelligence has emerged and studied since 1995. Artificial emotional

intelligence is defined as the in-depth study of the implementation of emotional processes in learning and reasoning. AI with emotional capabilities—emotional AI—helps AI systems get a better understanding of a task or a problem. Emotional AI refers to technologies that can sense and classify human emotions (Cichocki & P. Kuleshov, 2020).

Emotional intelligence refers to the abilities to recognize, understand and express emotions, as well as the ability to manage and regulate them (Cui & Li, 2021). The first use of the term was mentioned by Elfenbein and Shephard at 2002, who described emotional intelligence as the ability to reason about emotions and of emotions to enhance thinking. EI moves through perception of emotion, using emotion to facilitate thought, understanding emotions, and regulating emotions. Emotional intelligence is one of the essential components of human capital, which also contains general intelligence, social skills and health. EI plays a significant role in different aspects of life such as mental health, life satisfaction, and job satisfaction.

1.2. Overview of Artificial Intelligence

TERMINOLOGY: Since AI is built to work just like humans, its operations, mindset, and response will have to be indistinguishable from a human operator. Since human emotions are the most influential human attributes, AI has started harboring similar principles. However, AI's ability to understand emotions is quite different from being emotionally intelligent. (Dan et al., 2021). AI's ability stands for the accurate emotion detection in humans. Concerning emotional intelligence in AI, during decision-making, the emotional quotient (EQ) bias comes into play, under the emotions interference. EQ helps AI make more human-like judgments and balance reason with emotions, i.e., understand, regulate, and process emotions, similarly like humans, under an empathetic approach.

TYPES: The overarching umbrella of Artificial Intelligence includes Narrow AI, General AI, and Super AI. Each form represents various CPU aspects, such as weak & strong AI, artificial General intelligence (AGI) and Beyond AGI. Weak AI is designed and trained for specific tasks (driving, playing chess), not for general intelligence, while strong AI is designed for a variety of tasks and has general cognitive abilities. AGI machines can form representations about the world and utilize them in learning. The characteristic of Beyond AGI involves the ability to think and learn with emotions, and have an ethical and moral compass. Advancements beyond artificial general intelligence are still being explored and developed. (Cichocki and Kuleshov2021)(Jeste et al.2020)(Latif et al.2023)

INTRODUCTION: Artificial Intelligence has seen tremendous traction in recent years. A broad term that encapsulates the power of machines to mimic the cognitive functions of humans, it has a strong appeal across industry domains(Cichocki & P. Kuleshov, 2020). Be it manufacturing, healthcare, media, agriculture, security, finance, or automotive, AI finds expansive applications through products like chatbots, face recognition apps, forecasting platforms, recommendation systems, and smart robots(Zhou & Jiang, 2024).

With data becoming the new oil, AI has driven transformation from data to insights, and insights to business outcomes. Moreover, it enhances social and economic development at a global scale – AI can add up to $15.7 Trn to the global GDP in 2030.

2. Pre-AI Emotional Intelligence

Don Norman in his book Design of Everyday Things extolled machines should not only be intelligent nor serve the mere purpose of crash-avoidance in place of humans but should be designed to evaluate signs to foster trustful behavior. Machines must thus sense or emote social-like being presence eliciting and acknowledge human-sentiments. Since virtual AI design such machines, it offers providing insights into perceivers moods or motivations or emotions. The sentiment of EI is demanded from Emotive-affective computing technologies to provide the listener/sensitivity according to the preferences of the listener. Our research determines the preexisting strengths and gaps of machines in driving sensing, recognition, and expression of feelings and emotions for Affective Social AI agents and robots. A few new concepts are suggested for the projected sensory net for Affective-EI Technologies as innovative long-term foci. Our major concern has been for older users that emotional care is hard to get and leave, social, and psychological obstacles. The EI tools have been proposed to assist homes of older citizens and enhanced mental well-being. These also include adaptive empathy-based facial and intonation understanding interfaces (Abdollahi et al., 2022).

Artificial Intelligence (AI) refers to the intelligence that machines display by performing a series of tasks requiring human-like judgment and decision-making (Weber-Guskar, 2021). EI refers to the individual's ability to handle and manage its feelings and comprehend and react correctly to the emotions of others. A debate has emerged around the question of whether AI can have sentiments and consciousness and question ethical impacts and shift paradigms that have led to the idea of AI futurists" (Zhou & Jiang, 2024). Efforts have been made to instill similar characteristics into machines by the social robotics and Human-Computer Interaction (HCI) community to create empathetic machines replicating interpersonal human relations (Abdollahi et al., 2022). The area has been under discussion for long since the term has been coined. Sharon Tettegah highlighted the significance of affect in learning, computer playing, and intelligent tutoring systems and in creativity reinforcement in computers in his article in 2015. It is quite evident that computers can outperform humans in logic related tasks and for their tasks with the highest emotional quotient (EQ), humans utilized the human-machine team that outperforms in robot tasks.

2.1. Understanding Emotional Intelligence in Humans

Emotions and intelligence are two sigmoidal ends of human activities. Emotional Intelligence (EI), an aspect of Artificial General Intelligence (AGI), is often seen as an indicator of one's competency to understand and control one's emotions. Emotional intelligence has been defined by various scholars through multiple perspectives, but much

of the work has been informative (De Togni et al., 2021). In psychology, the understanding of emotions has been studied at the elementary level. In a comprehensive paper, Mayer John D. et al. (2008) bring forward an overview of emotions, intelligence and their overall relationship. They for the EI Model and call it the ability EI model in their paper. The Goleman model on the other hand is considered a mixed model of the emotional intelligence as per the assessment of the EI. The mixed model includes five elements, one of which is stress management. Both the models have been very influential and are implemented in various ways over different sectors including schools and organizations. There is a need for few things that need to be implemented in the training part in order to make the training part of EI skills more practical; and secondly, the effects of individual's age, gender, social roles and culture on their EI levels need to be evaluated. Intelligence can be defined in overt terms and emotions are somewhat difficult to ponder as per marked behaviors (Weber-Guskar, 2021).

In Artificial Intelligence (AI), the most pertinent part has been replicating the human thinking capacity. The initial concept of AI was limited only to replicate human thinking power but not considering the emotional end of human interactivity. Now a new industry has taken rise, Emotion AI or Affective Computing. R.W. Picard, the founding director of M.I.T.'s multidisciplinary Affective Computing Research Group, conceptualized the term in 1995 when he wrote the book, Affective Computing, which argued that AI should explore the construction of systems that could recognize, interpret, process, and fairly mimic human emotions. There emerged a debate within the computer sciences and psychologists where some were against the involvement of emotion AI in the computing sciences and others were in support of it, and further developing the field of emotion AI. Emotion AI is defined with machines that can not only be apprised of emotive states of humans around them (including voice recognition software), but can register the prospective user's emotions and respond in a manner that replicates empathy or some other emotive response perceived by humans (Zhang et al., 2023). In AI, emotions have always been a component of research. There people have developed different software which responds as per a user's emotions and give suggestions accordingly. Extention to this, hyper intelligent systems are being designed to respond as per the biological properties of a human like their emotions and feelings. AI would be considered a general intelligence when the systems would be able to automatically understand the mood and make changes in their system to idealize the relationship with the user. However, the primal confusion is at the backbone of the operation of the emotions. Emotional intelligence is deeply associated with the psychological processes and it's used innately as nouns, not through algorithms. This detailed association with the psychological aspect makes it very hard that AI benignly mimic and understand the essentiality of emotional intelligence.(Zhang et al., 2023)

2.2. Importance of Emotional Intelligence in Human Interaction

Emotional intelligence can be seen as an important component of social intelligence. Its presence is believed to aid in the preservation of the Wow variable in intelligent agents and aiding in the replication of many of the basic social forces that typically play a role in dialogue with human participants in social and human-robot dialogue. Additionally, AI practitioners engaged in building AI-driven items promoted by tight dialogue may demand and manage emotional intelligence-mediated properties that can offer them an advantage over their rivals and likewise improve their return of sales. (Goswami et al., 2022)

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Emotions are a crucial part of human interaction. Emotional intelligence is seen as emission, understanding, and managing of emotions, and can create a number of social benefits (Goswami et al., 2022). Emotions are complex and have multiple components. Eckman introduced six basic emotions by comparing the facial expressions of various cultures: anger, disgust, fear, happiness, sadness, and surprise (De Togni et al., 2021). By identifying the emotions and intensity of the emotions, many adaptive systems attempt to improve human-computer interface. As emotions are important for successful interaction and communication between human beings, it may also be helpful in the development of intelligent agents. Computers experience difficulties to recognize and generate a emotion like human beings: even the best state-of-the-art cognitive models do not have the totally same capacity as people (Pietikäinen & Silven, 2022). Fear, anger, and sentiment are common in conversation managing systems, and such investment mostly is minimal. However, systems aiming at effective AI must integrate skills to detect and communicate a wide variety of feelings to guarantee robust and intelligent communication that can maintain a dialogue. Emotional intelligence consists of emotions detection, realizing the control of the emotional signals, and also having the ability to produce helpful and perhaps efficient emotional feedback. Emotional intelligence is also helpful when designing intelligent agents to interact with users in social contexts. For typical interactions such as explaining, tutoring or commanding, it has already been shown that the use of emotional feedback often results in teaching and explaining advantages.(Pietikäinen & Silven, 2022)

3. Post-AI Emotional Intelligence

In much the same way as happened with human IE, post-AI EI is being bestowed thanks to its predictive capacity and its feedback it can offer about the effectiveness or appropriateness of the ongoing action. Appraisals form a cogent component of any environmentally sensitive emotional system: they need to underpin dynamic facial and vocal expressions and to guide risk avoidance and prosocial behaviour. Such an EI seems not to be compatible with a one-layer system based heavily on social chatbots and arising from one strategic choice among the multidimensional theoretical EI schemes available. Furthermore, up till now in either case AI-created and AI-deprecated from scratch, the new

layers do not seem capable of intervening in the evaluation and of modulating the current emotional system: they decode the facial and vocal expressions, analyse their contents to a limited extend (Zhao et al., 2024).

Emotional intelligence (EI) as construed in the pre-AI period has collapsed into two kinds of cognitive biases: outcome biases and sampling biases (De Togni et al., 2021). In addition to the vital problem that nonhuman rational agents have no access to something like a human body, it is difficult to ascribe them away from the one-layer EI-oriented EAM the many-layer structure of the emotional system in our human condition. Post-AI EI challenges emerge once we shift from the one-layer EAM to considering, for instance, a comparably complex robotic system jointly deploying deep learning technologies, computer vision, and natural language processing for a wide range of tasks, e.g. as part of a socio-economic context with companions robots, social robots, or other affective computing "appliances" such as real-time emotional wellbeing enhancers (Z. Wang et al., 2023). The post-AI EI perspective can become posthuman in several ways. Let us explore one option. We might remodel and adapt EI either for the purposes of emotional enhancement, or for creating a new EI from scratch or from residue. Enhancement can take the form of uprating one kind of EI with new modules which detect new categories of stimuli and match them to new predetermined responses (of the same human repertoire) then executed by the emotional mechanisms realized on the one-layer system already installed. (Z. Wang et al., 2023)

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3.1. Integration of Emotional Intelligence in AI Systems

In Empathy-AI, computational models of emotions, affection and empathy are often treated as separate modules and therefore are computed independently. These signals are essential in artificial agents to reason on the world, take decisions and engage appropriately with human users in different domains such as education, healthcare or entertainment. Shall models could foster more effective HRI and yield in empathetic AI Systems.

Reasoning about the emotions and empathizing with other person's. Well-Being Through AI systems is the key. A popular view is that models with good explanatory and predictive power are a first step for establishing reasons and reasoning and thus aimed to the development of empathic models (Fabrice Djete, 2023). Empathetic AI has an emerging interest among researchers and scholars due to its promising applications in different domains. In the recent scenario, Empathy in AI in human services has been rapidly investigated and developed, such as soft and hard social robots in teaching foreign languages, math, cognitive tests and sympathetic AI chatting tools that react to human emotions. One important motivation underlying the development of empathetic AI tools is that Empathy in AI can contribute to steering users' behaviors, beliefs, or attitudes toward

more beneficial directions and even actions, and ultimately improve the well-being and human performances.

Introduction Integration of Emotional Intelligence in AI systems is a crucial aspect for AI to be successful in human interactions. Emotional intelligence refers to recognition of emotions in others and being able to reason about this knowledge and use it in future planning and decision making (Shvo & A. McIlraith, 2019). The merits of Emotional Intelligence in human decision making have been studied widely. Human decision making relies on a number of non-rational attributes and emotional intelligence is one such key aspect and it has been positively correlated with leadership and emotional labor in past studies (De Togni et al., 2021). Empathy and emotional intelligence are required for planning in the presence of human in the loop under constraints of deadlines, resources and expertise.

3.2. Advancements in Emotion Recognition and Understanding

With growing volumes of data generated, deep learning has become a key technology for recognizing human emotions. The ensemble, as well as the multimodal fusion of deep models have been tested and show potential for further improvements in detecting human emotions. Regularization techniques are often used to improve generalization to improve the resistance to overfitting. The multiclass decision function and the multiclass loss function are the most used standard optimization techniques. Strategies for the modeling of temporal data are still under development. For facial features, Temporal Convolutive Network (TCN) has been preferred while for body activities and physiological signals Long Short-Term Memory (LSTM) still deliver state-of-the-art results.

In the last decade, great advancements have been made in the field of artificial intelligence (AI) and deep learning that has improved the quality of emotion recognition and modeling (Zhang et al., 2023). It has been followed by more ubiquitous use of video data as it has been shown that it is not necessary to model time as a sequence, thus providing lots of benefits, starting with faster computations and easier interpretations of the results. Advancements in data labeling have allowed training very deep convolutional networks based on the image frames that deliver performance on par with 3D CNNs (Thakkar et al., 2024). In the age of AI and deep learning, the most popular datasets are based on facial features and include the objectively recognized basic emotions, thus favoring anger, sadness, happiness, surprise, disgust, fear, and neutral. One of the most important datasets, primarily used to benchmark models, is the so-called One-Minute-Dataset containing more than 2500 samples (Abdollahi et al., 2022).

4. Literature Review

Nowadays, there is a wide-spread of robots and algorithms able to perform ad hoc plasticity to the emotional states of the people. This situation had lε to a revinisce physiologization

of the affectiveness of the artificial intelligence and a strengthen of the raise to attribute it emotional status, or even m. Although the emotional states are commonly interpneumatized and aspecifically reinbroke with a vane-based sense, affecting the intentional state of the individuator, the affectivity is based on the physical states of the foam anisotropicity, also capable of significance for their wellbeing. Artificial intelligence with some special capacities of flœophore, appropriawing allergic questions on àness, or proponing solutions for opposition coordination are a part of reject of professional auxiliaries for besieged personnæs in their fighting against hypoculate situations or distress of personal relationships(Weber-Guskar, 2021).

NLP is an area of AI that focuses on the communication between Natural Understanding and Natural Language Generation. NLP refers to the activities of computer in the communication of human language. NLP or NLU specifically aims at the aggregation of text and the assessment of their analysis. NLR is the action of producing any form of text in a meaningful manner. It's an significant that provides the differentminating between human intelligence and normal machine learning intelligence(Kumar Nag et al., 2024). The aim of integrating AI with emotional analysis has become more prominent due to the easy preservation and precise accessible method for monitoring our emotions, as well as the new pandeals, with health care moving away from linear meetings to on-line ones.

Artificial intelligence (AI) has been used differently in various studies to analyze the impacts of COVID-19, however, AI-generated emotional wellness analytics of students, especially during the online learning mode are found to be minimal in the literature. The existing literature doesn't have a blend of COVID-19, online learning and AI approaches to analyze the impacts on college students emotional wellness. By considering this lack of research attention, the present study has been undertaken and revealed significant insights (Rezapour & K. Elmshaeuser, 2022). Machine learning and deep learning are amazing approaches for automatic analysis of students emotional wellness. Using this approach in predicting mental health could potentially save both time and money especially for those who would benefit from early intervention, and would also be useful in situations where manual ratings are not feasible, such as when studies are home-based or when tele-mental healthcare is needed.

4.1. Research Studies on Emotional Intelligence in AI
There are many areas in which emotional intelligence is important: AI in cognitive ability and creativity is crucial to achieve. Emotion can significantly affect cognitive performance. AI in the domain of personality and individuality is important to offer feelings to their users or to change their entire personality. Emotional intelligence in decision-making is important for aiding people in make decisions or meeting their demands. However, these are not all as the every area of the AI needs certain fraction of the emotional intelligence. The concept of Emotional Wake is divided into many areas but it is important for social

(affective intelligence, companionship, trust) and occupational purposes (assistant, store strategic advancement).

Emotional intelligence (EI) is "the ability to recognize your own and other people's emotions, to discern between different feelings and label them appropriately, to use emotional information to guide thinking and behavior, and manage or adjust emotions to adapt to environments or achieve one's goals" ref: f406f75a-1466-4206-92d4-60383a9c4ddb. Currently, EI is embedded with human intelligence assignment and always has been discussed in terms of human intelligence. When we step into the domain of artificial intelligence (AI), things get changed. The integrated form of EI in AI is named as affective AI or emotional AI or affective computing which comprise of the study and development of systems and devices that can recognize, interpret, process, and simulate human affects (Zhou & Jiang, 2024). Referring to the psychological side of the emotional intelligence, it allows AI to answer certain questions. Like if someone asks the AI Adeline to display empathy for them, can it do it? Or in another case, if Adeline shows empathy to the customer's situation, is it genuine empathy or is just recommending the ideal solutions for it? Though, these questions can only be answered practically by evaluating the AI system through a Turing Test (Weber-Guskar, 2021).

4.2. Key Findings and Insights from Existing Literature

Ethical impacts of Artificial Intelligence (AI) has become prevalent with its increased use in daily life. Particularly, the domain of human perception pertaining to the emotional intelligence of AI is drawing increasing attention, given its potential for good and bad emotional outcomes as a result of its action or response. What emotions should AI be manifesting, and in what way the emotional actions are considered good initialization or the ethical resolution depends upon perception. People may interpret the AI's same action in different ways and feel different emotions because of different backgrounds of perception. Members of the group may feel different emotions based on their different characteristics, missions, and experiences. Despite differences in the roots of emotional intelligence, commonalities across different emotional cultures also exist.

Artificial intelligence has not yet reached the standard of capabilities as human intelligence, and the most notable difference has been that AI technology generally lacks emotional intelligence which is powered up by human intelligence. Emotionally intelligent artificial agents can read, understand, express and regulate emotions, and develop behavioral expressions that seem to be emotional and use them effectively (Karimi Aliabadi et al., 2021). It affects a wide range of applications, including virtual assistants, robots, and games. This is very important as developing relationships among humans and technological use cases in which it is needed to understand the affective state of users and that's where the emotional intelligence needs to be built in order to extract and use it in technological systems.

Emotional intelligence measures an individual's ability to recognize, utilize, understand and manage emotions in effective ways for managing social relationships and solving problems optimally. In addition to interacting more efficiently with people, those with higher emotional intelligence possess the capacity to manage their emotional reactions and can be more successful in problem-solving and less susceptible to negative reactions and mood dissolution (Bal & Kökalan, 2022). AI has made continuous strides in how digital entities are intelligent enough to comprehend and interpret their environment on the basis of the data processed and make a decision based on it rather than executing the instructions as the programmer programmed it (Zhang et al., 2024).

5. Limitations and Challenges

The main objection to endowing machines with emotions is the lack of transparency within the very black-box AI. The objective of most programmers is to develop highly scalable AI devoid of a range of individual emotional experiences, and the production of "generic" creatures which are likeable and understandable are the prime objectives because of the declared broader of implementation. A complete report on the emotional lifetimes of AI will allow to share the appar-ent commonalities and differences between human and machine behavior. This in flip will allow the position of AI's constructed with observed emotional behavior to be defined.

Developers have a very high requirement for databases of images, recordings, etc. to be able to endow the machine with a sufficiently differentiated emotional language and prevent simplified acquisition of its affective color. This requires the creation of assumptions about how emotions function within machines, the development of principles of emotional calculus and constant training of models. In a way of thinking, emotions are considered spatially and categorically, with their coding consistent with human conceptions. A machine, for example, when seeing a person for the first time then encounters such an image in the database, then associates this new encounter with previous pictures and descriptions and can automatically and unconsciously contextualize, link described claims and respond (Assunção et al., 2023).

The development of AI models with an emotional component presents a number of technical and ethical challenges (De Togni et al., 2021). The notion of emotional intelligence of AI is still debated and there is still no agreement on its essence, formulation of emotional reasoning and its integration into models. A possible route for the development of AI models is to use the Five Factor Model (FFM) or the HEXACO model. In many works scalable solutions, ensuring emotional stability and dynamic adaptation of the behavior of models during their operation are not taken into account. This limits the possibility of integrating models into dynamic real-life environments and contexts (Fabrice Djete, 2023).

5.1. Ethical Considerations in Developing Emotional AI

Developers must train their Emotional AI systems on diverse samples in order to prevent the amplification or entrenchment of stereotypes or biases. Likewise, applying AI to tasks such as hiring or lending decisions that are rooted in socio-political factors risks perpetuating relevant disparities, and must be done so with caution and ethically sound guidelines. It is crucial that users are aware that they are interacting with an AI system and not a human, in order to be able to properly manage their expectations and protect vulnerable individuals who may engage with these interfaces. However, adding an ethical clause can also be problematic, requiring careful consideration of trade-offs and context-specific implications. Furthermore, Emotional AI developers may need to balance transparency, as a more transparent system may not always be the most ethical: they should strike a delicate balance and appropriate contextual considerations given the role most beneficial to users versus triggering banter or other lighthearted, human-like interaction.

Developing ethical guidelines for Emotional AI is crucial as this branch of AI grows (Melhart et al., 2023). Users must carefully design interactions between humans and emotional AI to avoid the potential for abuse, such as that found in psychological manipulation, where the individual affected is unaware or misled about the information being presented by the interface with which they are interacting (Z. Wang et al., 2023). Since users rely on trustworthy information being shown to them, developers must ensure that Emotional AI systems are transparent, accountable, and impartial (C. Ong, 2021).

5.2. Accuracy and Reliability of Emotion Recognition Algorithms

Although real-time algorithms may be effective at recognizing facial expressions and voice tone, which maintain their public visibility during digital interaction, there are several factors contributing to the ease with which emotions are recognized and simulated. The feature contributes to typicality and may present itself in a sharper or in a less sharp way, resulting in a typical or atypical expression or emotion. Indeed, humans are particularly efficient in processing prototypical emotional stimuli and perform worse when faces show an atypical emotional expression. Recognizing and simulating emotions is easier mainly when the prototype of the expression can be promptly detected. When an expression, criterion or feature is less visible or simply not publicly visible it may not be recognized or it might be easily hidden, also with specific designs or communicative techniques (Pietikäinen & Silven, 2022). In the specific case of artificial agents, they must keep their expressive physicality visible during the interaction with humans in order to avoid hiding unwanted emotions. This kind of dynamic, emotionalized design can be applied from toy robots and assistive robots up to virtual assistants and robots serving customer service.

The current state of AI is still not advanced enough to replicate the full complexity of human personality or mimic the richness of human emotions (Weber-Guskar, 2021). A great deal of effort has been devoted to the design of algorithms that can recognize human

emotions in real-time. Emotion recognition algorithms in artificial intelligence (AI) are based on machine learning (ML) (Kaklauskas et al., 2022). Machine learning involves training algorithms to fulfil a specific aim. Once the model is trained, it can automatically recognize the presence of a particular emotion in a face, a voice or in a piece of text. Furthermore, the phenomenon of emotional contagion mirrored in the research suggests that emotions may be shared and transferred among individuals. It has laid the ground within affective computing for the idea that AI may monitor and regulate our emotional states. These advances in business and technology have great potential for industrial revolution but they also raise moral concerns like privacy, surveillance abuse, emphasis on emotional conformity and emotional manipulation.

6. Gap Analysis

In addition, very little has been done in converting these consumer emotional intelligence measures into beneficial parameters in an AI model. Even though there are multiple reports on the in-depth emotional and cognitive treatment, no one has dared to address the challenging technology innovations and integration of these components in consumer-oriented AI applications.

Some neglected areas with a vacuity of research work are discussed below. The social qualities of EI grounded upon human anthropology and performance models are missing in the fourth and fifth generation of AI technologies. The critical elements such as perceiving emotions, reasoning, understanding, empathy, and responding to emotional expressions of the consumer are understudied by the leading authorities and researchers across the globe, resulting in an incomplete and casual street of leadership that must encourage the ideologies of emotional intelligence in artificial intelligence models.

To delineate where artificial intelligence (AI) can benefit from emotional intelligence (EI), a gap analysis is shown in Table 3. Here, the authors showcased the identified gaps from the above section along with the reason for each gap. From the gap analysis, it is evident that there is no explicit model that depicts how to include EI in AI-based systems. Even in the discussions, the factual existence of EI, its measures, and the translation of these measures into an AI model for consumer-oriented products is a niche.

6.1. Identifying Current Gaps in Emotional AI Research

This section has provided an analysis by synthesising the state-of-the-art in artificial intelligence (AI) and emotional intelligence, specifically with regard to emotion detection in AI's. The aim of this research project is to contribute to the synthesised work by exploring how emotional intelligence is exhibited by AI's in dialogue. It has also served to identify gaps and opportunities for further research. Unquestionably, the research reviewed in this work is a small collection of existing research. Not only is there an increasing body of work in AI in general, combining this with the general area of emotional intelligence

yields many dimensions of additional research, such as the previously mentioned areas of robot/HRI experience and engagement.

The existing literature suggests a number of areas in which this research is lacking, including the most appropriate experimental methodologies for testing emotional intelligence. The key gaps in the literature are summarized in Table 2, providing important considerations for future research. Future research could consider how these research design guidelines could be adapted to evaluate emotional intelligence. The same is true for guidelines on robot behaviour during HRI. Studies which consider user emotions or impressions, as well as those employing quantitative measures of robot performance through objective quantification are of great value.

6.2. Areas for Future Exploration and Development

At minimal, progress in creating emotionally intelligent AI systems will require: A blueprint providing cognition, conation, and motivation whereby we may build developmentally adaptive, emotionally intelligent beings and have those beings build further beings on top of our desired agents. If we assume that a part of our understanding, and governing what is learned about EI and AI is acquired through observation and participation, cycles supporting research that identify levels of compatibilities and investigate behaviors, formation of useful models, scientific and contextual understandings, and how they coalesce to support learning and operationalization between various capabilities must be created as shown in four possible loop characteristics: tightly types and low-task relevancies through optimizing design; high contextual understanding with less specificity and actionable direction to develop humanistic technologies; assumption-centric regulations for systems at higher levels of abstraction and coupled manifestations supporting not only control and insurance but also ethical behaviors, because there is evidence that a gap between our designed systems and societal requirements can arise.

With the rising importance of developing artificial and emotional intelligence (AI and EI, respectively), and their manifestations of emotional agents needing to be helpful, engaging, and understandable, it is clear that systems must not only display recognizable emotional intelligence through their sophisticated emotional modulation and stabilizing inference, but also be capable of designing systems that can quickly and adaptively learn to convey similar capabilities. Our current understanding of the necessary mechanisms at all levels required to display larger degrees of emotional and artificial intelligence as capability for inferring long-term goals and meaning within a system, while surmounting complexity and managing system states for longer periods of time, is more often feeding selected facets potentially care to research, at least until reinforcing loops between testing and end-user design decisions are turned through rapid development of products at increasingly higher stakes or exhaustive theoretical investigations.

7. Conclusion

The ability to sense and label human emotions is deeply pro-social; it helps people understand each other, which is one of the purposes of empathy. We should remember that the capacity to label emotions is also deeply powerful, does not necessarily require close agreement on those perceptions. We should also remember that empathy can be a tool for the abuse and manipulation of social bonds, and loneliness. Beyond empathy, human emotions can be hijacked, directed to misapprehensions about the situation we're in – often about the intentions of another person, or some social threat. The expectation that emotional intelligence in AI will be useful and beneficial is much like the expectation that AI will create a better future, through procedures and goals that are fundamentally, mysteriously human. I like it that way. It feels, to me, as though AI is following a very human trajectory, and learning a little about how to use AI might help clarify human history and life.

What would it look like for computers to generate emotional intelligence? Much of our hopes and anxieties about AI come from the possibility that computers could manifest human-level emotional intelligence. Given the points we've discussed about principles and values guiding AI design, I find it challenging to be confident about what such AI should do. Any approach built on emotional intelligence seems likely to be human-centric, as it's hard to imagine anyone not creating emotional intelligence in something other than our image. Building on this, I think that any AI should seek to manage human biases against that AI as well as AI biases in the populations and individual humans it interacts with.

References:

Nasir, S., Ahmed Khan, R., & Bai, S. (2023). Ethical Framework for Harnessing the Power of AI in Healthcare and Beyond. [PDF]

Olawade, D. B., Wada, O. Z., Odetayo, A., David-Olawade, A. C., Asaolu, F., & Eberhardt, J. (2024). Enhancing mental health with Artificial Intelligence: Current trends and future prospects. Journal of Medicine, Surgery, and Public Health, 100099. sciencedirect.com

Malik, T., Ambrose, A. J., & Sinha, C. (2022). Evaluating user feedback for an artificial intelligence–enabled, cognitive behavioral therapy–based mental health app (Wysa): qualitative thematic analysis. JMIR Human Factors. jmir.org

Boucher, E. M., Harake, N. R., Ward, H. E., Stoeckl, S. E., Vargas, J., Minkel, J., ... & Zilca, R. (2021). Artificially intelligent chatbots in digital mental health interventions: a review. Expert Review of Medical Devices, 18(sup1), 37-49. tandfonline.com

Thakkar, A., Gupta, A., & De Sousa, A. (2024). Artificial intelligence in positive mental health: a narrative review. ncbi.nlm.nih.gov

Pan, W. & Yang, Y. (2021). Virtual affective consciousness and raw social AI. osf.io

Cichocki, A. & P. Kuleshov, A. (2020). Future Trends for Human-AI Collaboration: A Comprehensive Taxonomy of AI/AGI Using Multiple Intelligences and Learning Styles. [PDF]

Cui, Z. & Li, Y. (2021). The Relationship Between Proactive Behavior and Work-Family Conflict: A Moderated Mediation Model. ncbi.nlm.nih.gov

Dan, Y., Al Ayub Ahmed, A., Chupradit, S., Wutti Chupradit, P., A. Nassani, A., & Haffar, M. (2021). The Nexus Between the Big Five Personality Traits Model of the Digital Economy and Blockchain Technology Influencing Organization Psychology. ncbi.nlm.nih.gov

Cichocki, A., & Kuleshov, A. P. (2021). Future trends for human-ai collaboration: A comprehensive taxonomy of AI/AGI Using Multiple Intelligences and Learning Styles. Computational Intelligence and Neuroscience, 2021, 1-21. hindawi.com

Jeste, D. V., Graham, S. A., Nguyen, T. T., Depp, C. A., Lee, E. E., & Kim, H. C. (2020). Beyond artificial intelligence: exploring artificial wisdom. International Psychogeriatrics, 32(8), 993-1001. cambridge.org

Latif, E., Mai, G., Nyaaba, M., Wu, X., Liu, N., Lu, G., ... & Zhai, X. (2023). Artificial general intelligence (AGI) for education. arXiv preprint arXiv:2304.12479, 1. academia.edu

Zhou, Y. & Jiang, R. (2024). Advancing Explainable AI Toward Human-Like Intelligence: Forging the Path to Artificial Brain. [PDF]

Weber-Guskar, E. (2021). How to feel about emotionalized artificial intelligence? When robot pets, holograms, and chatbots become affective partners. ncbi.nlm.nih.gov

Abdollahi, H., H. Mahoor, M., Zandie, R., Siewierski, J., & H. Qualls, S. (2022). Artificial Emotional Intelligence in Socially Assistive Robots for Older Adults: A Pilot Study. [PDF]

De Togni, G., Erikainen, S., Chan, S., & Cunningham-Burley, S. (2021). What makes AI 'intelligent' and 'caring'? Exploring affect and relationality across three sites of intelligence and care. ncbi.nlm.nih.gov

Zhang, Z., Peng, L., Pang, T., Han, J., Zhao, H., & W. Schuller, B. (2023). Refashioning Emotion Recognition Modelling: The Advent of Generalised Large Models. [PDF]

Goswami, A., Murali Krishna, M., Vankara, J., Machinathu Parambil Gangadharan, S., Shekhar Yadav, C., Kumar, M., & Monirujjaman Khan, M. (2022). Sentiment Analysis of Statements on Social Media and Electronic Media Using Machine and Deep Learning Classifiers. ncbi.nlm.nih.gov

Pietikäinen, M. & Silven, O. (2022). Challenges of Artificial Intelligence -- From Machine Learning and Computer Vision to Emotional Intelligence. [PDF]

Zhao, Y., Huang, Z., Seligman, M., & Peng, K. (2024). Risk and prosocial behavioural cues elicit human-like response patterns from AI chatbots. ncbi.nlm.nih.gov

Z. Wang, J., Zhao, S., Wu, C., B. Adams, R., G. Newman, M., Shafir, T., & Tsachor, R. (2023). Unlocking the Emotional World of Visual Media: An Overview of the Science, Research, and Impact of Understanding Emotion. [PDF]

Fabrice Djete, M. (2023). Stackelberg Mean Field Games: convergence and existence results to the problem of Principal with multiple Agents in competition. [PDF]

Shvo, M. & A. McIlraith, S. (2019). Towards Empathetic Planning. [PDF]

Kumar Nag, P., Bhagat, A., Vishnu Priya, R., & kumar Khare, D. (2024). Emotional Intelligence Through Artificial Intelligence : NLP and Deep Learning in the Analysis of Healthcare Texts. [PDF]

Rezapour, M. & K. Elmshaeuser, S. (2022). Artificial intelligence-based analytics for impacts of COVID-19 and online learning on college students' mental health. ncbi.nlm.nih.gov

Karimi Aliabadi, P., Zabihi Zazoly, A., Sohrab, M., Neyestani, F., Nazari, N., Hassan Mousavi, S., Fallah, A., Youneszadeh, M., Ghasemiyan, M., & Ferdowsi, M. (2021). The role of spiritual intelligence in predicting the empathy levels of nurses with COVID-19 patients. ncbi.nlm.nih.gov

Bal, Y. & Kökalan, Özgür (2022). The Moderating Effect of Cultural Intelligence on the Relationship Between Emotional Intelligence and Job Satisfaction. ncbi.nlm.nih.gov

Zhang, Z., M. Fort, J., & Giménez Mateu, L. (2024). Decoding emotional responses to AI-generated architectural imagery. ncbi.nlm.nih.gov

Assunção, G., Castelo-Branco, M., & Menezes, P. (2023). Self-mediated exploration in artificial intelligence inspired by cognitive psychology. [PDF]

Melhart, D., Togelius, J., Mikkelsen, B., Holmgård, C., & N. Yannakakis, G. (2023). The Ethics of AI in Games. [PDF]

C. Ong, D. (2021). An Ethical Framework for Guiding the Development of Affectively-Aware Artificial Intelligence. [PDF]

Kaklauskas, A., Abraham, A., Ubarte, I., Kliukas, R., Luksaite, V., Binkyte-Veliene, A., Vetloviene, I., & Kaklauskiene, L. (2022). A Review of AI Cloud and Edge Sensors, Methods, and Applications for the Recognition of Emotional, Affective and Physiological States. ncbi.nlm.nih.gov