Title: Emotion Detection in AI and its Impact on Business and Society: A Viable Systems Approach (VSA) Perspective in the Human+ Era.

ABSTRACT

The study of emotions through artificial intelligence (AI) is a hot topic, as technological development increasingly focuses on understanding and recreating human beings. However, the effectiveness of emotion detection as an investigative tool is at risk if solid theoretical foundations do not support it. These foundations should reinterpret emotions detected by AI from a broader perspective. Emotion detection is one of the most important components of current artificial intelligence (AI) research that is being explored nowadays, as it bridges the gap between business, technology, and societal dynamics in a quickly changing world. This article provides a holistic overview or in-depth discussion of the integration of emotion detection into AI systems from a Viable System Approach (VSA), with special emphasis on its significance in the Human+ age we live in. It also examines the effects of AI's ability to recognise and immediately respond to human emotions on business practices and wider community relationships.

The Viable Systems Approach (VSA) may be the missing link between studying the emotional sphere and understanding the social dynamics that characterise human interactions. The concepts of consonance and resonance, typical of VSA, enable the description of information acquisition patterns and understanding the dynamics underlying individual decision-making; in other words, a VSA view explaining how useful information is gathered and applied to decision-making dynamics suggests that consonance and resonance are the major guiding principles for facilitating this understanding among people who study AI-human interactions. Numerous industry sectors could represent some potential applications and limitations in the complex field of emotion-detecting technologies.

The research study examines the societal consequences and moral implications that may arise due to emotional intelligence in robots. In this way, this part enlightens more about how AI-induced emotional detection can be essential in this context for society and business. This paper tries to highlight the complex relationship that exists between human emotions, artificial intelligence, and the socioeconomic environment, in addition to the possibilities for future research and applications in this developing topic.

Key words: **VSA (Viable Systems Approach), AI, Human-Machine Interaction, Emotion Detection, Consonance, Resonance.**

1.INTRODUCTİON

AI has become an essential part of our daily lives, and it is imperative for technology to identify and respond to human emotions quickly through this platform. Communication will take a new direction as AI can be used to pick up emotions that bridge technological attributes with human features. Businesses and societies must therefore treat the skill of AI in interpreting human emotions very seriously because this can create more intuitive and empathetic systems. The Viable Systems Approach (VSA) is one unique way of seeing this interaction. Born out of management cybernetics, VSA goes beyond a systems view, focusing on the importance of interactions in complex systems. This will result in more knowledge about how these AI's can thrive well in an environment that considers humans.

The research paper is concerned with how emotion detection in AI integrates with and affects this during the Human+ Era from a VSA standpoint, especially in businesses and society that are experiencing deep integration between AI and human life. Our aim is to demonstrate how emotional intelligence in AI can affect business, alter social interactions, and change our view of human-AI relations. This study looks into how AI interfaces with human emotions, thus influencing decision-making processes and interaction dynamics through its systems. Additionally, it is important to highlight some of the key principles of VSA, such as consonance and resonance [1], as they relate to emotion detection in AI and how they relate to AI's detection of emotions. As a result, the issues surrounding the creation of emotionally intelligent robots, in this case, have also been highlighted.

The paper is organised in a way that makes it easy for readers to understand, starting with an overview of VSA's theoretical framework and its relevance to detecting emotions in AI. Then it talks about some business or societal implications or applications in relation to emotion detection, thereby informing us of what is happening today and tomorrow. In addition, a section discusses consonance and resonance within AI-human interactions, emphasising their importance during the construction of emotional AIs. This joins both viewpoints by suggesting that each view has certain insights peculiar to itself, depending on the transformative possibilities for emotion-detecting AIs within VSA. In conclusion, therefore, findings are outlined, followed by recommendations for further research and application areas.

2.LITERATURE REVIEW

As a result, if systems like AI have to stay effective in a constantly changing environment, VSA is an approach that helps explain this clearly [13]. However, researchers like Di Mascio have begun to address how organizational systems can be designed to account for the emotional states of their members, suggesting that VSA principles can be applied to manage the complexity of human emotions within systems [10]. Espejo and Harnden's have updated Beer's work, thereby emphasising the significance of system interactions, adaptability, and responsiveness [11]. In the case of emotion detection in AI, this is crucial. When machine learning is used to analyse facial expressions, voice patterns, and physiological signs, it becomes imperative for AI to be able to detect and interpret human emotions. Anything that can allow computers to perceive and express feelings has arisen from Picard, who pioneered the field of affective computing [22]. As an example, AI systems are increasingly being employed in order to measure consumer satisfaction levels or improve user experiences while rendering personalised services.

The age of Human+ is when humans are empowered by technology, including AI. This calls for rethinking traditional human-machine interaction dynamics in this period. Suchman's situated actions regarding human-machine communication offer a primary framework for understanding these relationships [28]. Therefore, during this era, there is a functional-emotional nature to human-AI interaction that makes emotional intelligence an important aspect of AI [21]. VSA has been applied to complex systems ranging from organisational structures to urban planning, but its foray into the emotional analytics of individuals within these systems is relatively novel.

Recent scholarship has begun to intersect these areas. Authors like Leonard (1999) have started to peel back the layers of how knowledge management within a VSA can benefit from the rich insights provided by emotion analysis [19]. Further, Hoverstadt (2008) has proposed frameworks for integrating systemic organizational health with the continuous feedback provided by intelligent analysis systems [15].

Nowadays, emotion detection technology has widely been integrated into various sectors of economies, significantly changing the way businesses relate to customers as well as their employees. There are customer service AI systems that can recognise emotions and gauge customer satisfaction. It helps them to understand what customers want and do, thereby enabling them to improve services and customise advertisements [16]. Studies have demonstrated that emotion AI plays a significant role in enhancing business operations, with a particular focus on customer service and marketing. Research by McDuff and Czerwinski (2018), published in "Emotion Review," discusses how technology for identifying emotions may help improve interactions between consumers and clients [20].

The use of emotion detection in human resources is aimed at enhancing employee engagement and well-being programmes. For instance, affective computing interfaces assist in measuring and improving employee satisfaction, which may lead to increased productivity and reduced loss. The applications of AI can detect emotions such as better customer experiences and staff welfare, among others, that could be used for making strategic business decisions. Nevertheless, there are still challenges, especially when it comes to privacy issues on the one hand and ethics on the other [25]. Corporations should find a middle ground between technological innovation and ethical responsibility to protect human privacy against emotional diversity.

3. CONSONANCE AND RESONANCE IN AI AND HUMAN INTERACTION

When there is harmony in AI-human interactions, it means that AI understands what humans need or expect from it. In emotion detection, harmony implies that AI can comprehend human emotions naturally [3].

In resonance, however, human beings affect artificial intelligence as much as artificial intelligence affects them in return. At times, emotion AI implies that the emotional response of an artificial intelligence can alter how a person feels towards it, which will shape its' future responses [12]. By doing this interaction, empathy is nurtured between AIs and humans, thus making these relations more effective and satisfying than before [17].

These principles are critical to developing a feeling-based A.I. system. They advocate for technically competent systems that understand human emotions' nuances on the one hand while being emotionally intelligent on the other [22]. Furthermore, they emphasise the ethical development of AI systems so that they support human well-being [8].

3.1. VSA for human systems dynamics

The VSA was born as a model, developed in the field of business economics, for evaluating the decision-making processes that take place within managerial contexts [2, 7, 13]. The aim was to investigate those elements and dynamics that intervene in the determination of strategies to be adopted in decision-making, whatever the type of organisation that can be identified, be it by socio-economic qualification (public or private), purpose and aim (profit or non-profit), or even by supra-system of reference (political, jurisdictional, or financial). Although the main concepts of VSA are closely linked to the socio-economic sphere, especially that of business management, the applicability of the model to human behaviour in decision-making contexts has extended the field of interest towards new horizons linked to the study of psychology and human emotionality [14, 23].

Given this paradigmatic shift from the economic to the psychological sphere, VSA stands as a tool for investigating the social and mental phenomena that lead a person, or a group of people, to make certain decisions depending on the context. The mental events at the basis of a choice rely on the concept of knowledge, understood as a cyclical process in which perception, action of the intellect, memorization, and processing of information (reasoning) combine to provide the individual with the necessary means to make his or her decision. The concept of knowledge itself, in addition to being understood as a dynamic instance in continuous becoming, is inevitably linked to the amount of information the person holds at any given time.

Information Variety (IV) is the basis of the decision-making model proposed by VSA. Taking up the static notion of knowledge, it represents the wealth of information resources possessed and conserved by a mind at a precise moment in time. IV can be considered the primary object to be investigated in order to understand the mental processes involved in decision-making [1]. As reported by several renowned studies in this field [9, 27], each IV establishes an initial configuration that can be perceived by an observer and can be traced back to three components:

- Value categories and general schemes: they make up the deepest interpretative dimension of any phenomenology; value categories represent innate schemes, based on the community of belonging and the strong beliefs of the individual subject.
- Defined schemes: derive from the rationalisation of general schemes in relation to the systemic context in which the subject grows, experiences, develops a certain behaviour.
- Specific schemes: derive from the application of the defined schemes in a specific context; specific schemes determine the subject's actions with respect to one issue rather than another but are nothing more than the practical use of the defined schemes from the previous point.

Simplifying the concepts described so far, a person's IV (i.e., his or her level of knowledge at a specific point in time) depends on innate characteristics (general schemes), social and family context (defined schemes), and application context (specific schemes). Each of these three components can be represented through an axis in the three-dimensional space (**Fig.1**).

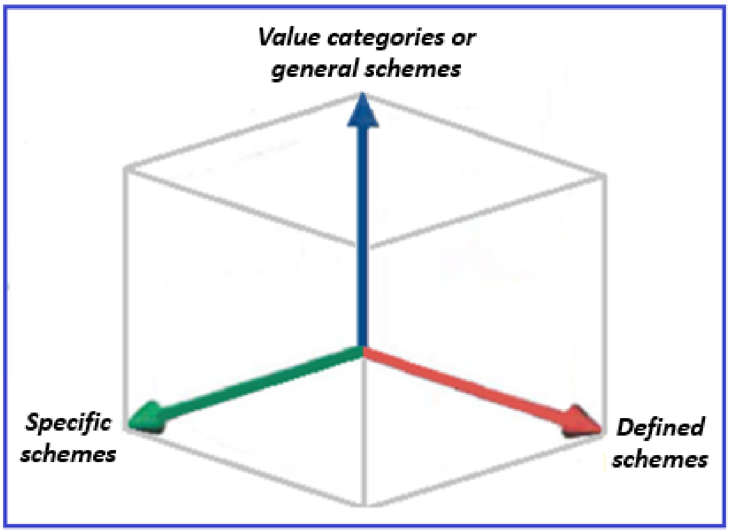

Fig.1: A three-dimensional representation of the three components of an information variety.

Vectors provide an ideal language for identifying the position of a configuration with respect to the origin in the framework of a Cartesian diagram. The vector that connects the origin of the axes to a point representative of a configuration of variety (¢) with specific characteristics is called the "configuration vector" and is denoted by $\vec{¢}$.

3.2. Human-centered representation of consonance and resonance

The introduction of a metric to transpose cognitive space onto the three-dimensional plane is necessary in order to redefine the concepts of "consonance" and "resonance," which represent the central theme of VSA, through a new perspective, allowing us to understand the dynamics of human interactions. Going back to the definition of knowledge as a dynamic entity, it is possible to state that if the configuration ¢ undergoes changes, then the $\vec{¢}$ redetermines itself as a function of the information perceived by the viable system; assume, in this regard, that, at the onset of the perception i_1, the information variety is initially in the configuration $¢_1$, while at the onset of the perception i_2, the same information variety has moved to the configuration $¢_2$, described by the configuration vectors r_1 and r_2, respectively (**Fig.2**): the vector $\Delta_r = r_1 - r_2$, representing the distance between points $¢_1$ and $¢_2$, refers to the configuration shift of the information variety due to the learning derived from the acquired information ($\Delta_i = i_1 - i_2$).

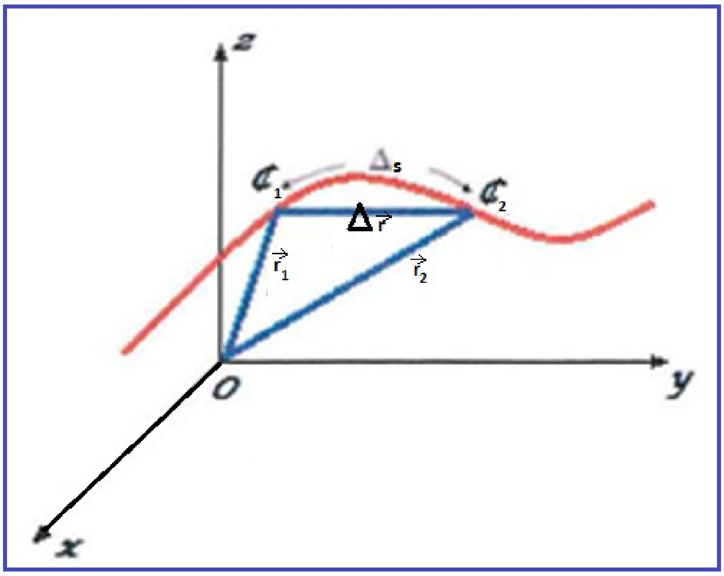

Fig.2: Representation of information variety configuration displacement in the Cartesian plane.

Still reasoning in physical terms, the vector Δ_r represents a displacement from one point to another in the Cartesian plane. From this perspective, consonance takes on the physical meaning of velocity, i.e. the first derivative of displacement with respect to time; in other words, consonance represents the speed with which a given information variety is willing to change to reach a new conformation. An alternative, but equally intuitive, representation of consonance is based on the concept of trajectory. Suppose we have two individuals whose information varieties are represented by points A and B, respectively; let C be a third configuration that represents the point of arrival for both individuals following the acquisition of a series of perceptions: if the two actors have a high level of consonance, the trajectories with which their information varieties change as they move from the initial to the final point are the same (**Fig. 3**).

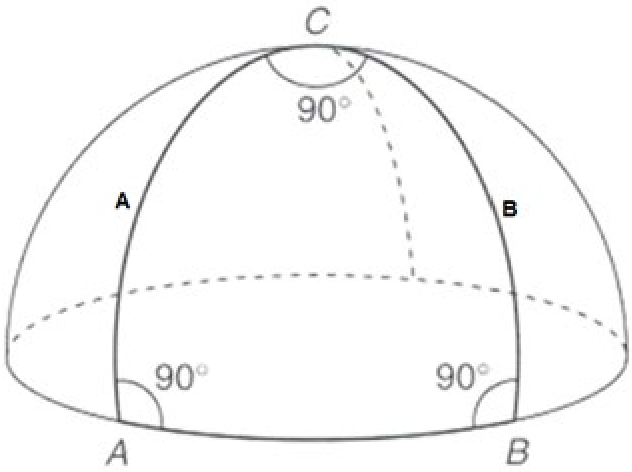

Fig.3: Representation of the consonance based on the concept of trajectory.

Consonance is thus a concept that varies according to perception: it is the way in which a given subject, characterised by a specific variety of information, processes the acquired information using interpretative schemes and synthesises it through value categories.

If consonance defines the trajectory of information varieties towards the point of convergence, resonance refers, on the other hand, to the variation of the trajectories themselves in function of a common goal; resonance qualifies a redrawing of the consonance trajectory, in fact determining an acceleration (or deceleration) that causes a reduction or an increase in the path to convergence (**Fig.4**).

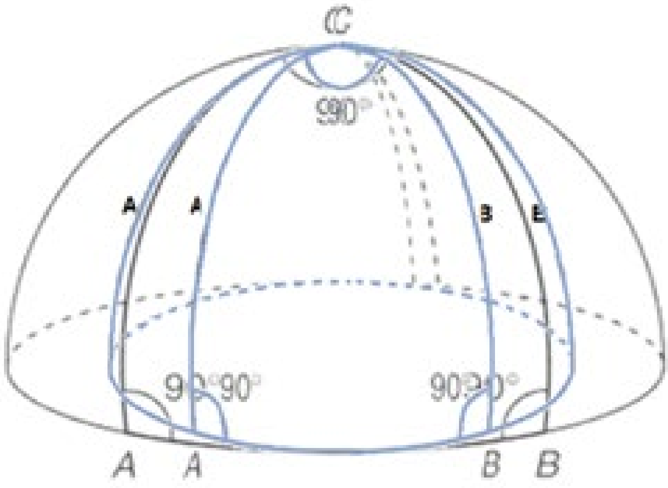

Fig.4: Representation of the resonance based on the concept of trajectory.

From a practical point of view, the speed at which two or more people assimilate certain information and perceptions is determined by consonance: where the level of consonance is high, different varieties of information change at the same rate. Resonance, on the other hand, determines the variation in the level of consonance with respect to a specific issue to be addressed.

3.3. How can AI detect the level of consonance?

Referring back to the pattern of interpretative patterns of IV, value categories represent the first building block at the basis of each individual's behaviour: every behavioural dynamic, reaction, or decision of the individual depends on his or her strong beliefs, i.e., on those values imposed on the individual by his or her social group in the first years of life or developed innately by the individual himself or herself. Value categories represent the first response to the mental and emotional stimuli that arise in the various decision-making contexts; in a certain sense, value categories can be said to be an impulsive reaction to the demands of everyday life. If there is a strong emotional component underlying every choice and every behaviour, it can be assumed that this is directly dependent on the general schemes and value categories that unconsciously influence the subjective worldview. The study of consonance and resonance by means of machine learning (ML) and AI techniques cannot, therefore, disregard the analysis of the human emotional sphere that characterises the different information varieties through the value categories. The innovative contribution of the research depends precisely on the possibility of surveying consonance through the detection of emotions: when observed through the lens of VSA, the human emotional sphere eventually becomes an expression of the decision-making processes that influence each person's actions. The impact of the research could be, given the premises, very significant both in the field of HCI and in the psycho-sociological field related to the study of human behaviour, since the study of emotions through AI is not only aimed at the development of a framework for HCI but also allows for a deeper investigation of the social dynamics underlying decision making.

In brief, value categories and emotions are closely related conceptually to such an extent that they represent the two sides of the same coin: the behaviour of each of us depends strongly, in addition to the contest, on the strong beliefs that characterize our personality; emotions, on the other hand, are the visible expression of our behaviour. Such reasoning justifies the use of emotions, detectable through AI algorithms, as the "unit of measurement" of the level of consonance.

The main field of Artificial Intelligence concerned with studying, analysing, and developing algorithms capable of recognising, expressing, and generating typically human emotions is Affective Computing (AC). The primary purpose of AC is to facilitate interaction between man and machine by endowing the machine itself with a kind of emotional intelligence, so that the computer can succeed in simulating the typically human concept of empathy. The possibility of adapting the machine's behaviour in a completely automatic manner to the emotional state of the user cannot disregard the recognition of the feelings of the interlocutor through targeted analysis techniques [22, 29]. "Emotional recognition" is the part of AC that is concerned with identifying the user's emotional state through the study of data collected by sensors, cameras, microphones, and other devices. The collected information generally concerns physical parameters (such as heart rate, blood pressure, and galvanic resistance) or a combination of data related to facial expressions, body posture, and speech or text; all these data are not directly related to the emotional state; therefore, a process of knowledge extraction is required, which cannot disregard statistical or machine learning techniques. The current context, characterised by the development of the Internet of Things (IoT), favours the use and dissemination of AC from different perspectives. The birth of smart cities, the development of smart homes, and a whole plethora of smart technologies, including smartphones themselves, have made it possible for all "things" to be connected to the global network, sharing a constant collection of information on the lifestyle of the individual user in his or her private and community spheres. The amount of data collected every day by sensors, processors, and smart devices, but above all the variety of data and the speed with which it is acquired, makes the concept of IoT inseparable from that of Big Data. Every human interaction with network-connected devices generates the sharing of an almost infinite amount of data useful for the extraction of knowledge aimed at different application domains. From this point of view, the possibility of processing a large amount of data and various types of information offers a great operational possibility for AC algorithms that have a lot of material to work with. Another advantage offered by the IoT is the many ways in which the necessary data can be collected: just think of the spread of wearable devices or the various sensors and monitoring systems installed within smart cities or smart homes, constantly searching for data to collect. It is no coincidence that in recent years, ML techniques have found wide use in the AC environment, especially in emotional recognition. The wide dissemination of sensors in the IoT environment makes it possible to monitor people's vital signs in real time, not necessarily within hospitals but also in their homes. The development of wearable devices allows users' health conditions to be monitored outside the home as well, collecting useful data for AC investigations. Nonetheless, a large percentage of the scientific community's effort in the search for techniques that can enable the analysis of the data coming from the various sensors and devices is addressed to the sphere of healthcare; mechanisms to protect against domestic accidents, the care of the elderly within smart homes, and the prediction of the health condition of hospital patients are all issues of primary importance that would seem to relegate the problem of emotional recognition to the background. Several psycho-sociological studies show, however, how much people's physical condition is in fact predominantly influenced by their emotional state: psychological well-being can in no way be disconnected from physical one [24]. From this point of view, emotional recognition becomes a fundamental objective not only for all applications involving human-machine interaction but also especially for the protection of the mental health of individuals approaching technology. The latest frontier of AC in the healthcare field concerns the possibility of developing so-called ‘social robots', capable of identifying the emotional state of the user with whom they interface and of regulating their behaviour consequently [18]: an innovation of this kind could make it possible to develop new communication technologies aimed at people with different types of disabilities.

4.DİSCUSSİON/CONCLUSİON

Integrating the Viable Systems Approach (VSA) in emotion detection within AI highlights the necessity for systems that are not only technologically advanced but also capable of sustainable and adaptive interactions with humans. This means that AI systems should be developed based on VSA principles, particularly consonance and resonance, which make AI systems correspond to human emotional dynamics in a way that both parties benefit from them [11]. By following these basic principles, it is possible to develop emotional AI in a way that can lead to more empathetic as well as responsive systems useful for societies or even businesses.

This study shows how emotion detection in AI, examined through a VSA lens, can be transformative across different sectors [30]. In business, this could mean improved employee welfare, personalised customer experiences, and better decision-making processes.Societally, emotion AI can contribute to advancements in healthcare, education, and public safety, offering new ways to meet human needs and challenges [31].

Some *limitations* exist within this research, such as the rapidly changing nature of AI and the technology used in detecting emotions. In addition, there should be long-term studies designed to understand how different sectors are impacted by emotion-based artificial intelligence technology and the evolving ethical landscape around it. Moreover, cultural and demographic limitations in emotion detection algorithms need more detailed research if we are to create equal or better forms of artificial intelligence. On this basis, therefore, integration of VSA in the development and application of emotion detection in AI is one way through which benefits from AI can be obtained.

In conclusion, the integration of emotion detection into AI under a Viable Systems Approach (VSA) is an important achievement reached during the Human+ era. Emotional intelligence has been described as, among others, affecting business strategies and social interaction areas where AI operates.This study emphasises that there is a need for consonance and resonance between humans and AI in order to make the latter more effective. Consequently, the issue of the ethicality and privacy of such technologies should be treated as a primary concern during their development and implementation stages. On the other hand, this study still presents some limitations around its argument, leaving room for further investigation on how AI's relationship with human emotions is a function of constant change. On the other hand, these findings make an important contribution to understanding how technology can support our future by examining the role AI plays in society and emphasising the need to integrate emotional intelligence into it.

In addition, this research not only demonstrates the challenges and complexities involved but also identifies how artificial intelligence could be used to understand human emotions. It essentially argues that customer service could be changed by AI-equipped organisations equipped with emotional intelligence, and the user experience could be improved, eventually leading to human-centric business models. However, it has pointed out some of the ethical dilemmas as well as privacy concerns that come along with these technologies, thereby demanding strong frameworks to protect individuals' rights.While this study provides valuable insights, it also recognises its limitations, especially in relation to the evolving nature of AI and emotional recognition.Further research could go deeper into specific industry applications, cross-cultural implications, and long-term societal impacts, providing more understanding about AI's role within our increasingly interconnected world.Therefore, this study is just one step towards realising emotionally intelligent artificial intelligence, which bridges the gap between humans and machines.

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