Computer's Self-awareness, Cognition, and feeling

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Abstract

Due to its ability to effectively solve practical issues, Artificial Intelligence (AI) has transformed a wide range of fields from type to another type. In contrast, this research looks at a different component of AI that extends beyond intelligence alone. We go into the world of spirit, emotion, self-awareness, and various aspects of life that distinguish living things from inert objects. Darwin's theory clarified the evolution from non-life to life over time, but it also raises intriguing concerns regarding the emergence of sentiments, emotions, and self-awareness. In this project, we intend to create a system or program that can progressively gather information from its environment and use this information to interact with the sensory inputs it gets. The computer will produce a special phenomenon termed "feeling" as a result of digesting and integrating this data, which will allow it to develop a sense of self-awareness.

Key words: Artificial Intelligence (AI), Emotions, Feeling, Self-awareness, Senses.

الوعي الذاتي والادراك والشعور للحاسبة الالكترونية

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خلاصة

نظرا لقدرته على حل المشكلات العلمية بشكل فعال فقد حول الذكاء الاصطناعي مجموعة واسعة من المجالات من نوع الى اخر. في المقابل يبحث هذا البحث في مكون مختلف للذكاء الاصطناعي ويمتد الى ما هو ابعد من الذكاء. يذهب الى عالم الروح والعاطفة والوعي الذاتي. وجوانب الحياة التي تميز الكائنات الحية عن الاشياء الغير حية. اوضحت نظرية دارون التطور من اللا حياة الى الحياة بمرور الوقت لكنها تثير ايضا مخاوف مثيرة للاهتمام فيما يتعلق بظهور العواطف والمشاعر والوعي الذاتي. في هذا المشروع نعتزم انشاء نظام او برنامج يمكنه بشكل تدريجي جمع المعلومات من بيئة واستخدام هذه المعلومات للتفاعل مع المدخلات الحسية التي يحصل عليها. وبهذه الحالة سينتج الكومبيوتر ظاهرة خاصة تسمى الشعور نتيجة لهضم هذه البيانات ودمجها ، مما يسمح له بتنمية الشعور بالوعي الذاتي.

الكلمات المفتاحية: العواطف،الشعور،الوعي الذاتي، الحواس، الذكاء الاصطناعي.

Section 1: Introduction

The diversity of life on Earth can be explained by evolution, a key idea in biology. According to the evolution theory, which was first put forth by Charles Darwin in

his book "On the Origin of Species," species change over time by a procedure known as natural selection [1]. It is the process by which particular heritable features in a population change in frequency over time, becoming more or less prevalent [2]. In science fiction literature and films, the idea of giving robots self-awareness has long been a popular one. However, this concept has also drawn more and more interest in scientific inquiry, with a variety of papers, special subjects, books, workshops, and conferences devoted to exploring it. In general, consciousness is thought to have two dimensions: awareness as experience and awareness as self-monitoring [3]. This research seeks to shed light on the intricate interactions between information processing, sensory perception, and the development of AI's capacity for self-awareness. Ultimately, the primary objective of this study is to explore the potential for self-awareness in artificial intelligence.

Section 2: 2.1 Computer History

Early 19th-century pioneers like Charles Babbage and Ada Lovelace created the groundwork for contemporary computing, which is when computers first became widely used [4]. The invention of transistors and the creation of mainframe computers in the 1950s and 1960s gave corporations and academic organizations access to computing capacity [5].

2.2 Artificial Intelligence (AI) and Computer Thinking

With pioneers like John McCarthy, Marvin Minsky, Allen Newell, and Herbert Simon leading the way, the Dartmouth Conference in 1956 heralded the beginning of AI as a field. Early research on artificial intelligence (AI) focused on symbolic methods, such as logic and rule-based systems, with the goal of creating robots that could reason and solve problems [6]. Natural language processing and expert systems made significant strides in the 1960s and 1970s [7]. Deep learning, a kind of machine learning, has more recently revolutionized AI by allowing computers to learn from enormous amounts of data and perform at human-level levels in tasks like picture recognition and natural language processing [8].

Sectin3: Psychology and computer thinking

Psychology looks at several facets of people's thought processes and behaviors in an effort to comprehend both individuals and communities. Cognition, perception, emotion, personality, social interaction, development, and mental health are just a few of the many issues that psychologists study [9]. To improve user experiences and the interaction between people and computers, psychologists utilize theories from the fields of perception, attention, memory, and human factors [10]. Affective computing examines how computers can detect, comprehend, and react to human emotions [11].

Section 4: 4.1 Self-awareness and AI self-awareness

The ability to identify and comprehend one's own ideas, emotions, beliefs, and experiences as distinct from those of others is referred to as self-awareness [12]. Internal and exterior self-awareness are the two main facets of self-awareness. [13]. Psychology has examined self-awareness from a variety of theoretical stances, including cognitive, developmental, and social psychology [14]. Self-awareness development is a continuous process that can be aided by a variety of techniques [15]. Self-awareness is frequently seen as a higher-order cognitive skill in the realm of Artificial Intelligence (AI), one that goes beyond more common AI abilities like pattern recognition and problem-solving [16]. To create AI systems that are capable of displaying some kind of self-awareness, researchers are continually experimenting with various methodologies and procedures. To imitate self-awareness by including information about their performance and the effects of their activities on the environment, another strategy involves integrating AI systems with external feedback mechanisms [17].

Section 5: Nervous system and Human senses

The nervous system is a sophisticated and extensive network that allows the body to communicate and work together. It’s two primary divisions are the central nervous system (CNS) and the peripheral nervous system (PNS) [18][19]. Human senses

allow us to gather data from our surrounds and comprehend our immediate environment [20].The five major senses of the human body are: Sight (Vision):We are able to notice and comprehend visual inputs by our sense of sight[21]. Hearing (Audition): Our ears pick up sound waves, converting them into electrical impulses that the brain can understand [20]. Taste (Gustation): Our tongues' taste buds pick up chemical components in the food we eat and send signals to the brain, allowing us to perceive flavors like sweet, sour, salty, bitter, and umami [21]. Smell (Olfaction): Our brains analyze the information from olfactory receptors in our nostrils that pick up chemical compounds in the air, enabling us to recognize and distinguish different scents [20]. Touch (Somatosensation): Our skin, muscles, and organs all have sensory receptors that provide messages to the brain so we may learn more about our environment and interact with things and other people [22]. Interoception, another name for internal senses, is the perception and awareness of interior physical sensations. These senses are essential for controlling biological processes, preserving homeostasis, and giving us information about our physical and mental well-being [23]. Proprioception is the sense of proprioception enables us to comprehend the placement, motion, and alignment of various bodily parts. [24]. Vestibular Sense is essentially based on the vestibular system, a group of sensory cells in the inner ear [25]. Thermoception enables us to recognize and distinguish between stimuli that are hot and cold [23]. Nociception is the perception of pain is known as nociception. It warns us of possible or existing tissue harm.[26].

Section 6: Literature Review

By using a meticulous and methodical technique, Computing Surveys in 2021 provides a thorough analysis of the state of self-awareness in artificial intelligence (AI). The authors carried out a thorough literature assessment, gathering and examining pertinent research papers, journals, and conference proceedings from many reliable sources in the field of AI. To find pertinent studies and publications about self-awareness in AI, a methodical search strategy was used in the methodology. To guarantee that papers were chosen that matched the survey's goals

and offered insightful information on the subject, the authors used particular inclusion and exclusion criteria. Through this method, a sizable body of work including various perspectives and dimensions of AI self-awareness was compiled. The conclusions from the chosen studies were then critically examined and summarized by the authors. By classifying the numerous AI self-awareness dimensions, models, and methodologies, they were able to organize the survey. The authors were able to give a thorough summary of the current status of AI self-awareness research by taking a planned and methodical approach. The authors added their knowledge and perspectives to the survey in addition to the literature review. They drew on their in-depth expertise in the subject to offer analysis, commentary, and discussion on the difficulties, chances, and ramifications of self-aware AI. The technique used in this study provides a useful framework for carrying out comparable studies in the field of artificial intelligence, advancing knowledge and comprehension in the field of AI self-awareness [27].

The phenomenon of inner speech and its importance in human development are examined in the study. It emphasizes the verbal quality and dialog-like qualities of inner speech, setting it apart from other inner experiences. The Language of Cognition Hypothesis (LOTH), which contends that cognition has a grammatical structure with syntax, is discussed. The function of inner speech in self-regulation, language, goal-oriented behavior, and self-awareness are all discussed in the paper, which also looks at how inner speech may be measured and altered using a variety of ways. Along with rumination, it also covers the part inner speech plays in psychiatric problems. Exploration is conducted into the process by which inner speech develops and the role played by various brain regions. The report also analyzes many studies and theories that look into how inner speech affects cognitive functions and self-awareness. The advantages of back-propagation, linguistic re-entry, and the regulating function of inner speech are all highlighted in this research. The results imply that inner speech implementation in AI agents could promote self-awareness and enhance cognitive architectures. The relevance of incorporating inner speech into robot architectures to improve artificial self-awareness is emphasized in

the paper's conclusion. In conclusion, the study offers a thorough analysis of inner speech, its features, and its possible use in AI systems. It investigates the link between inner speech and self-awareness, outlining numerous methods and outlining the advantages of including inner speech in AI agents. The described studies and models provide information on how inner speech is used in artificial systems and help us understand how it functions in cognitive processes [28].

Section 7: 7.1 Proposed Method

In our work, we strive to create something fresh and straightforward. It might serve as a foundation for future development. We aim to create software that has the ability to feel, be conscious, and be aware of itself. We suppose that our senses supposedly get information from all around. It brings up memories of past experiences. There will be a response when it brings about new happenings that are comparable to those that occurred previously. We refer to this response as feeling. There are millions, billions, or perhaps more events in human memory. In this situation, the human has a billion various emotions. We consider consciousness is the result of the activity of getting information from the senses and the reaction of feelings, and this is what we believe to be self-awareness. We believe that when our many senses take in the environment and produce images, sounds, tastes, feels, and scents, all of these sensations will be turned into information on the same foundation (software of signals), and as a result, we will deal with sensory information as text. We created virtual memory for the software in our work. The first step is to create an object with a name for human and load personal data into it. When a person awakens from sleep, the first thing that happens is that information is put into the brain from memory. In our methodology, we take into account how events from the five senses—such as a photo, a sound, or a smell—are converted into text information. As a result, we will treat the five senses as a single input in the form of text. The first step can be accomplished by using the methods described below to create an object for humans and load personal data into it. It begins by creating a "Human" object in its program to represent a human person. In order to populate the "Human" object, it reads and

loads personal information from a file or data source. Name, age, gender, occupation, a person's personal history, and any other pertinent data that you desire to preserve are just a few examples of the different parts of this data that can be included. must design a method for adding this private information to the appropriate "Human" object attributes or properties. In order to handle the loading procedure, we provide specific methods or functions that guarantee that each data point is accurately assigned to its proper attribute within the object. It simulates the movement of data from memory to the brain in a manner similar to that which happens when a person wakes up. This can be accomplished by using the pertinent methods or functions in the "Human" object to load and handle the required information for memory recall.

Now let's talk about how sensory events are translated into text information: To handle the processing of sensory information and the production of suitable responses, it builds a "Brain Core" module within the program. For the purpose of gathering sensory information and translating it into text information, it defines discrete modules or components for each of the five senses (sight, hearing, smell, taste, and touch). The "Brain Core" (BrainAcion and BrainReaction) should receive the processed sensory data from these modules. It establishes the required lines of communication between the "Brain Core" and the sensory modules. The "Brain Core" receives the text-based sensory input processing and transmission via method calls or event-based mechanisms. The "Brain Core" has modules for emotion and memory retrieval. The feeling module uses the received text-based sensory data to determine the appropriate emotional reaction. This involves the "EmotionMatcher" component, which matches the text input with predefined emotional patterns or models. The program's memory recall module is composed of elements like "FindFeature," "Classifier," and "Reader." Together, these elements perform searches and retrievals of pertinent features or data from the main memory according to predetermined patterns or queries. The "Brain Core" can employ the recovered features for decision-making and memory retrieval. By using this methodology, it is possible to develop a program that replicates the process of entering personal

information, transcribing sensory inputs into text, and putting basic emotional and memory-related functions into use. The workings of the Sense class are shown in fig. 1 below: It begins by reading information from the environment and taking it into account based on the senses it uses. In our program, we solely consider data derived via visual means. The Sense class is then called, and it searches the name list to locate the specific file containing the relevant name and features. It determines the appropriate feeling to be triggered at the end.

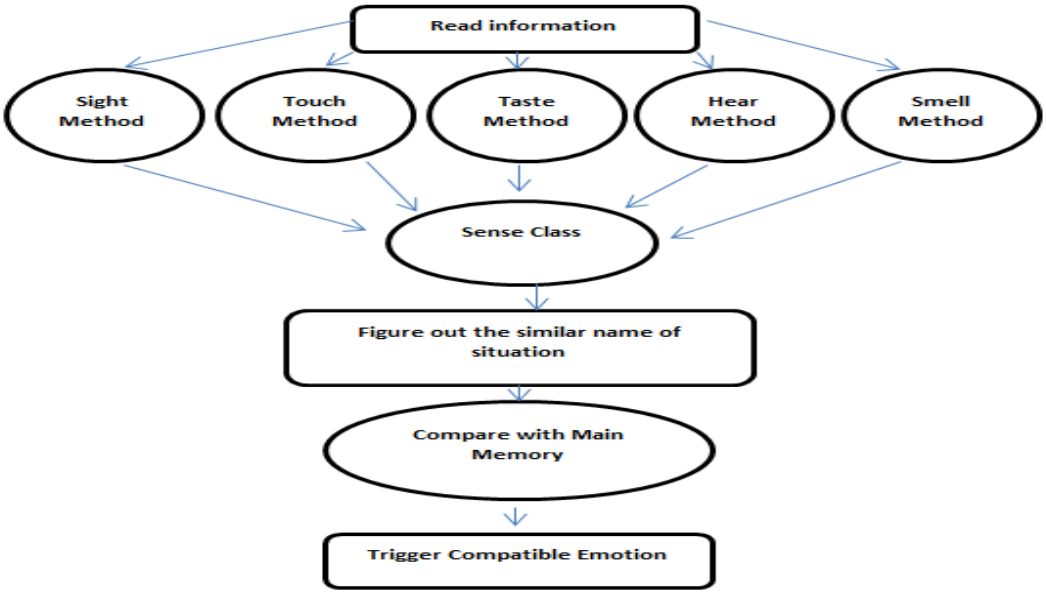

Figure 1 : explain how Sense class working.

There are two key components to self-awareness: myself, and my surroundings. What is inside the object and how does it relate to the surroundings? Self-awareness does, in fact, include both the person and how they interact with their surroundings. It entails being able to perceive and grasp the outside environment as well as one's own perceptions, emotions, and personality features. It's essential to take into account both the internal characteristics of the person and how We can create a program that mimics the key components of self-awareness by taking into account both internal self-reflection and interaction with the world. By using this strategy, the program is able to have a more in-depth awareness of its own internal state while simultaneously being conscious of and receptive to the outside world. A computer can replicate some parts of self-awareness, but truly human-like self-awareness is a

complicated phenomenon that involves a wide range of cognitive, emotional, and social components. In the field of artificial intelligence, it is still difficult for us to create a program that accurately mimics all the subtleties of human self-awareness. Because of this, our work is only a foundation that anyone may assist build upon and become a reality. To organize and store the data, numerous files were made such as: People, Animal ,Personal Information, Personal Goals, Interest Hobbies, Life Events, Emotional Experience, Emotion, Classification. Fig 2 below explains the steps of our software algorithm.

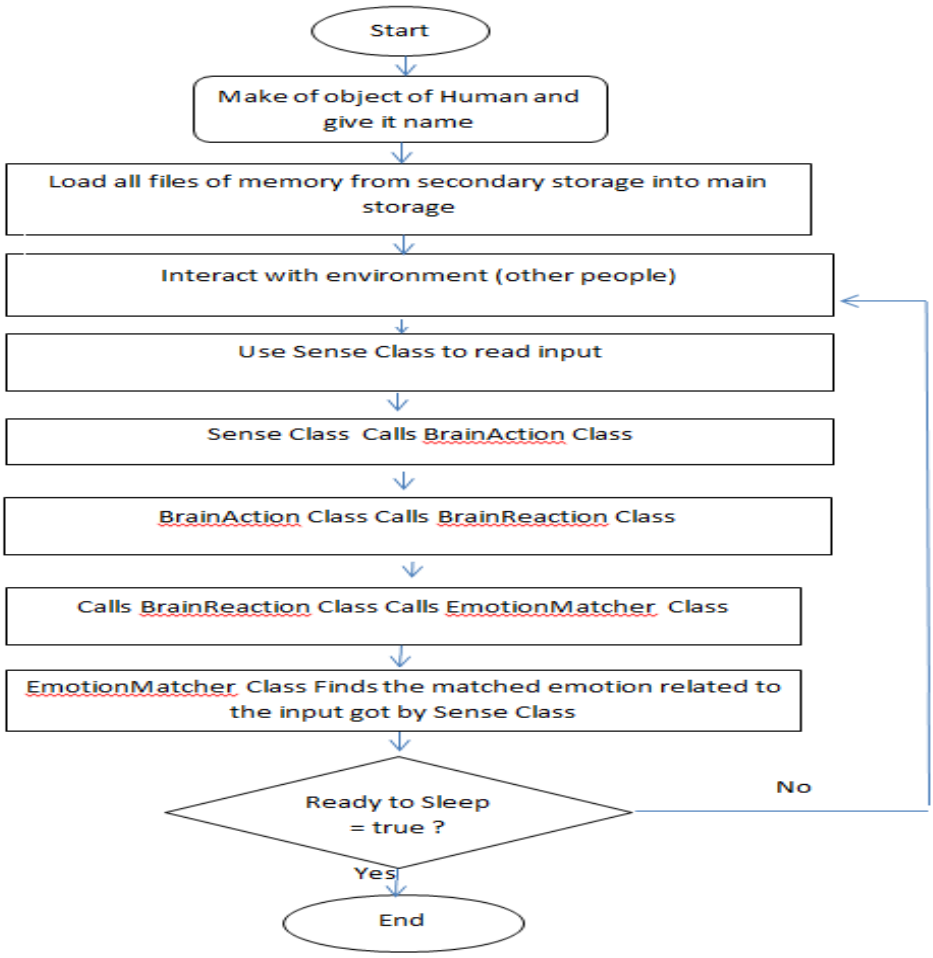

Figure 2. The Steps of our Software Algorithm.

7.2 Results and Discussion

The first thing when we start the program human object will be created from the "Human" Class by its instructor. The instructor has instructions to load all files in the secondary storage and that by making an object from "Memory_Loading" class. By using its method "load" to load the files. By doing so the messages will be shown on the screen like below:

Personal Information, My People, My Life Events, My Emotional Experiences, My Interests Hobbies, My Personal Goals all have been loaded

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This indicates that the memory of the human is loaded to the main memory to be ready to use to interact with the new information that has come by senses to trigger the current emotion for the object human. When the object human started to interact with the environment, it detects the objects around it whether it is people, animal, things, etc. First, it tries to figure out what it is. Then, it works to find a suitable emotion for it. Let's have an example here:

Let's say the human object saw an object by the method "see" which belongs to the class "Sense". It will go through two routes:

Route one: it will call the class "FindFeature" for the name of the object. The class "FindFeature" itself will make an object of the class "Classifier" and by using the object to call the method "getClassification" to find the classification of the object's name . Now after knowing the classification of the object's name, the program will go to the classified file that the name belongs to it and will search through it . Here the class named "Reader" will be called to make the search and it will use its method "searchFile" to get the information that is needed.

Route two: It will call the class "Sense" which will use the method "see". This will call the class "BrainAction" and use its method "act". This will call the class "BrainReaction" which will use its method "react" to call the class "EmotionMatcher". The last class will use its method "matchEmotion" to go through the file "emotion" and find the suitable feeling that corresponds to the object's name. We use a variety of examples to create a table, as seen in Table 1.

Table 1: Explains the detected object, its classification, its information, and the current feeling towards it.

Object detected by "Sense" class	Classification	Information about the name	Current feeling
Butterfly	Insect	Species: Lepidoptera	fascination
Thomas	People	Fellow attendee at a networking event, Age: 32, Gender: Male, Occupation: Sales Representative	Resilience
Owl	Bird	Species: Strigiformes	wisdom
Charlie	People	Cousin, Age: 30, Gender: Male, Occupation: Software Engineer	Confidence
Lion	Animal	Species: Panthera leo	awe
Dolphin	Fish	Species: Delphinidae	wonder
Julia	People	Fellow member of a film production crew, Age: 33, Gender: Female, Occupation: Filmmaker	Amusement

We can see from Table 1 above the human object detected many objects around and by using its classes and method, it got their classification, information, and what is the feeling toward each one of them. During the software's relatively brief period of interaction with its surroundings as "Diagram 1," below :

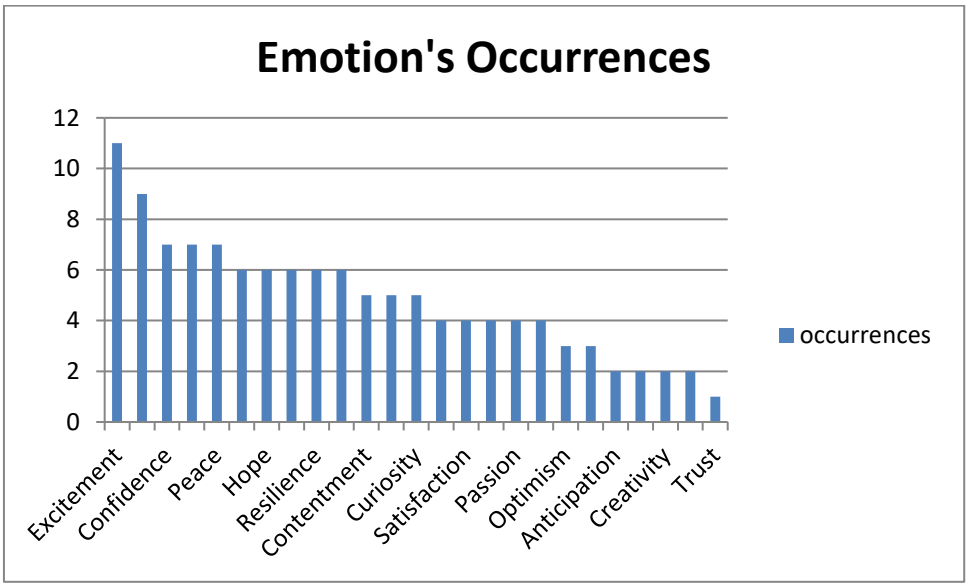

Diagram 1: Emotion's Occurrences during a period of time.

The illustration above serves as a good example of how the manifestation and sequencing of emotions within the system are profoundly variable and intricately nuanced, intimately tied to the diverse array of sensory inputs, including but not limited to people, events, objects, and a multitude of other stimuli. This illustration

also serves to highlight the system's remarkable adaptability and sensitivity to the complex external environment.

Section 8: Conclusion and Future Work

This study explores the areas of spirit, emotion, self-awareness, and patience—qualities that set living things apart from inanimate objects—to explore a particular facet of artificial intelligence (AI) that goes beyond simple intelligence. This project aims to create a system or program that can progressively collect data from its environment and use that data to interact with sensory inputs. In the course of doing this, the computer will produce a special phenomenon known as "feeling," which will allow it to become conscious of itself. This study aims to provide light on the intricate interactions between feeling, information processing, and the essence of life. The investigation of AI's capacity for self-awareness is the main objective. The research makes some encouraging suggestions for more future investigation. It recommends looking further deeply into the complexity of AI self-awareness, developing emotional capacities within AI systems, and using self-aware AI in practical applications.

References:

[1] Darwin, C. (1859). On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life.

[2] Coyne, J. A. (2009). Why Evolution is True. Penguin Books.

[3] Chella, A., Pipitone, A., Morin, A., & Racy, F. (2020). Developing Self-Awareness in Robots via Inner Speech. Frontiers in Robotics and AI, 7, 16. doi: 10.3389/frobt.2020.00016

[4] Ceruzzi, P. E. (2012). Computing: A concise history. The MIT Press.

[5] Campbell-Kelly, M., Aspray, W., Ensmenger, N., Lavington, S. H., & Yost, J. R. (2013). Computer: A history of the information machine. Westview Press.

[6] Russell, S., & Norvig, P. (2016). Artificial Intelligence: A Modern Approach (3rd ed.). Pearson.

[7] Nilsson, N. J. (2014). Artificial Intelligence: A New Synthesis. Morgan Kaufmann.

[8] Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.

[9] Gleitman, H., Gross, J., & Reisberg, D. (2019). Psychology (9th ed.). W. W. Norton & Company.

[10] Norman, D. A., & Draper, S. W. (Eds.). (1986). User centered system design: New perspectives on human-computer interaction. CRC Press.

[11] Picard, R. W. (2000). Affective computing. MIT Press.

[12] Morin, A. (2011). Self-awareness part 1: Definition, measures, effects, functions, and antecedents. Social and Personality Psychology Compass, 5(10), 807-823.

[13] Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. Contemporary Educational Psychology, 19(4), 460-475.

[14] Goleman, D. (1996). Emotional Intelligence: Why It Can Matter More Than IQ. Bantam.

[15] Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. Psychological Inquiry, 18(4), 211-237.

[16] Dennett, D. C. (1991). Consciousness explained. Penguin Books.

[17] Goldstein, E. B. (2018). Sensation and Perception. Cengage Learning.

[18] Bear, M. F., Connors, B. W., & Paradiso, M. A. (2016). Neuroscience: Exploring the Brain (4th ed.). Wolters Kluwer.

[19] Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S. A., & Hudspeth, A. J. (2012). Principles of Neural Science (5th ed.). McGraw-Hill Education.

[20] Purves, D., Augustine, G. J., Fitzpatrick, D., Hall, W. C., LaMantia, A. S., McNamara, J. O., & Williams, S. M. (Eds.). (2004). Neuroscience (2nd ed.). Sinauer Associates.

[21] Bostrom, N. (2014). Superintelligence: Paths, dangers, strategies. Oxford University Press.

[22] Schacter, D. L., Gilbert, D. T., Wegner, D. M., & Hood, B. M. (2014). Psychology (3rd ed.). Worth Publishers.

[23] Craig, A. D. (2003). Interoception: the sense of the physiological condition of the body. Current Opinion in Neurobiology, 13(4), 500-505.

[24] Proske, U., & Gandevia, S. C. (2012). The proprioceptive senses: their roles in signaling body shape, body position and movement, and muscle force. Physiological Reviews, 92(4), 1651-1697.

[25] Goldberg, J. M., & Fernandez, C. (1985). Physiology of peripheral neurons innervating otolith organs of the squirrel monkey. II. Directional selectivity and force response relations. Journal of Neurophysiology, 54(6), 1452-1469.

[26] Treede, R. D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., ... & Wang, S. J. (2015). Chronic pain as a symptom or a disease: the IASP Classification of Chronic Pain for the International Classification of Diseases (ICD-11). Pain, 156(6), 1003-1007.

[27] Maria R. Lee and Steve Goschnick. (2021) "Exploring Self-Awareness in Artificial Intelligence: Published in the journal ACM Computing Surveys in.

[28] Chella, A., Pipitone, A., Morin, A., & Racy, F. (2020). Developing Self-Awareness in Robots via Inner Speech. Frontiers in Robotics and AI, 7, 16.