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Knoweldege representation and reasoning: A detailed study in AI.

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***Abstract*—The following paper talks about artificial intelligence and the different types of its concepts in terms of how knowledge is being represented and reasoned. Moreover, the paper will talk about both concepts critically followed by a literature review that supports the study from different types of sources that were taken from online journals and other materials.**

Keywords: Artificial intelligence, knowledge representation, reasoning in AI.

I. INTRODUCTION

Starting first it's important to understand what artificial intelligence is and what are the concepts that are included in this field. Artificial intelligence is defined as the way a machine imitates and stimulates a human intelligence. Moreover, artificial intelligence machines perform various operation such as accuracy in decision making, prediction and self-repair. However, a machine is only said to be intelligent if it can think and perform things on its own and that can only be done if it has captured knowledge from its surrounding or environment. An artificial intelligence machines would constantly keep on learning about their environment and the things that are surrounding them where they would store that knowledge and use them when the time is needed. Like for example; the self-driving car where it would get the percept of the things that are surrounding and for example it has learned that in a specific road the speed is 80 KM/H for example the next time it passes that same road the knowledge about the speed in that specific location is retrieved and put to use where the car will immediately slow down its speed and drive according to a specific speed in that road. Moreover, the concept of knowledge representation and reasoning is performed by an agent and agent is defined as something that understands it environment that is surrounding it by the help of some sensors or radars which allows the agent to perform some action on that specific environment by relying on effectors which is nothing but a term that is used to show the representation of how an item can be triggered with simulation or action.

II. MAIN BODY

First, it's important to understand the meaning of knowledge. Knowledge is collection of facts that is then transformed to information and once those information's are being understood by the person it considered as knowledge. Moreover, knowledge can be gained by sight, experience or for example for a source like a book, report etc. according to Alvin Toffler, " Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms."
(Alvin Toffler). However, the following explanation was provided in the perspectives of the human brain, for machines its quite similar but the difference is when the machine learns a new fact that is then transformed into information and eventually its becomes knowledge, it would store that knowledge in its internal memory and make use of it when that time is needed. Knowledge representation and reasoning is one of the most crucial fundamental requirements of the concept of artificial intelligence where every machine would require showcasing its knowledge that was gained and apply depth thinking to understand the true meaning of it. Furthermore, since artificial intelligent machines are said to be adaptive, its important that the machine must adapt to its environment and apply the knowledge that was gained in the most possible new situations which leads to new patterns being explored and that can be done through the communication and interaction between the machine and the world that is surrounding it which means the knowledge is constantly updated to the previous one that has been capture

before. Knowledge representation is considered one of the most important subarea of artificial intelligence where it is mainly concerned with understanding various ways of how information's can be represented and it concentrates to communicate with people in their natural language, perform decisions to what it should do next and attempt constant planning for future tasks. Moreover, in solves problems in situations where it would usually take a human expert to solve. According to john McCarthy who explains more about the concept of KRR, "a program has common sense if it automatically deduces for itself a sufficiently wide class of immediate consequences of anything it is told and what it already knows. . . For a program to be capable of learning something it must first be capable of being told it." (john McCarthy, 1959).

III. The need of logic

Part of reasoning is logic and logic are required to implement correct reasoning but however, it's not a specific language in knowledge representation and reasoning, whereas its needed to find the most applicable logic to reason the knowledge that the agent has gained. Moreover, in knowledge-based system symbolic logic are used represent the idea of reasoning in the form of a logical language where the reasoning is being done in the form of true or false. Furthermore, there are other symbolic syntaxes that are used where each of them is used in a different situations and rules that must be followed. For example, the agent can perform reasoning by the help of propositions which is nothing but an expression that is used in English language where things can either be true or false, it can be believable or not and that helps the agent perform reasoning in a better perspective. Like for example; is the car driving or its on standby, if the speed exceeds 120 KM/H the speed needs to be reduced, how can the brakes be used or how can the car sensors be triggered and make noise to alert the driver. The following examples represents how reasoning can be performed in the perspective of an agent. However, the following logical symbols help the agent understand and reason with the knowledge that is has but there are other symbols that are out there where each of them helps the agent perform reasoning in a different way and an example of those symbols are:

Logical Operator	Logical Symbol
and	$\wedge$
or	$\vee$
exclusive or (*XOR*)	$\oplus$
if … then	$\rightarrow$

Figure 1: examples of logical symbols

Figure 1 shows the different types of logical symbols where this is just an example of how reasoning can be made however, there are other logical symbols out there that provides a better affect for the agent to reason the knowledge that it has.

IV. Litreature review

Knowledge representation and reasoning [1], the following text book talks about the concepts of artificial intelligence in the form of how agents constantly keep on representing the knowledge that they have gained and how they can reason with that knowledge. Moreover, what was useful in the following text book is the fact the author explains the logical symbols and how they can affect an agent when it comes to performing the most suitable decisions based on taking the knowledge and applying the logical operators in order to capture the best suitable results that measures the intelligence of the agent and it allows the agent to understand what it needs to perform next. Moreover, the author constantly keeps on explaining why the concept of knowledge representation and reasoning is used in ai system where he states that, "Knowledge Representation Hypothesis implies that we will want to construct systems for which the intentional stance is grounded by design in symbolic representations. We will call such systems knowledge-based systems and the symbolic representations involved their knowledge bases" (Ronald j. Brachman).

Knowledge representation and reasoning methodology based on CBR algorithm for modular fixture design [2], the following paper talks about a type of algorithm that is called case-based reasoning in which it constantly keeps on adapting the old solutions of a problems to reach and encounter new demands in which old cases are being used to find new solutions or the process of reasoning old knowledge to create new situations as a solution for problems in terms of fixture designers where they would constantly asked to design a work that is similar to the work that has been designed before. According to schank who explains more about the algorithm where he stated that, "CBR is derived from a view of understanding as an explanation process". (Schank 1982). The following paper was useful where it provides more examples of how knowledge representation and reasoning is being applied in different types of industries and how effective it is.

Knowledge representation and reasoning logics for artificial intelligence [3], the following journal article explains about the representation languages and the right the one to be selected. Moreover, it discusses the principles of logic when it comes to reasoning where the author discusses the requirements that is needed for a knowledge-based agent like for example:

- What it currently knows where the knowledge of the agent is in the form of a belief.
- The agent must be capable of being told what to do where it constantly puts the beliefs in the form of a knowledge base.
- The agent must automatically perform self-understanding where it will rely on a reason mechanism to include new beliefs from the one it has already gained or that is already existing in the agent's knowledge base.

Moreover, the paper concentrates a lot in how logic can be included with reasoning to provide the agent a better way to reason the knowledge that is existing and comparing it with what it already knows, and this process is done by the help of using propositional logic. Where it always the agent to perform some deep thinking and check if what's its doing or wants to perform can logically be done or not and that is performed by the help of relying on truth or false on different types of logical symbols. According to Stuart C, "propositional logics conceptualize domains at, but not below the level of propositions. A proposition is an expression in some language". (Stuart C, 2009).

Knowledge representation and reasoning with deep neural networks [4], the following dissertation paper explains how challenging knowledge representation and reasoning in artificial intelligence and its importance in the field of neural network. Moreover, a perfect knowledge representation and reasoning system must be able to simplify large numbers of concepts and relationships where it should perfectly adapt to the settings of the real world. an example has been provided of a KRR system where it contains natural language interfaces models that are used to highlight texts of questions in the form of concepts and it initially performs some reasoning to allow the knowledge-based agents to create the most applicable solutions of the given questions. According to Simon.et,
"Representing knowledge with symbols, and reasoning via search and logic has been the dominant paradigm for many decades." (Simon et al, 1959). Moreover, as it was stated that logical symbols are important in KRR systems. However, they tend to suffer small disadvantages where the symbols are representing knowledge is challenging to generalize and that's due to huge number of concepts and relationships that are existing since the symbols were modeled separately without sharing information's amongst each other.

Handbook of knowledge representation [5], the following text book talks about how knowledge representation and reasoning is being implemented in using various types of symbolic logics such as:

- Propositional logic.
- First order logic.
- Second order logic.

Moreover, the book provides a detailed example of the various types of models in terms of knowledge-based systems that are existing in today's world.

V. Conclusion

In conclusion I would like to conclude that without a shadow of a doubt, artificial intelligence is indeed the next big thing in the information technology industry where it posses a huge potential of how smart machines can be created to surpass the level of thought and decision making of the human beings. Moreover, knowledge based agents is a very challenging area in artificial intelligence where machines that are being created would constantly keep on learning and comparing what it has learned before with the new knowledge that was gained and implementing this mechanism allows the machines to improve drastically every single second they would learn something new and implement them when the knowledge is needed to be put to use. Moreover, its interesting how the logical symbols are very important for agents since it provides them to understand the rules that are needed to perform reasoning in the most significant perspective.

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References

[1] Brachman, R. and Levesque, H. (2009). Knowledge representation and reasoning. Amsterdam: Elsevier.
[2] Sun, S. and Chen, J. (2007). A modular fixture design system based on case-based reasoning. *The International Journal of Advanced Manufacturing Technology*, [online] 10(6), pp.389-395. Available at: http://csme-journal.nutn.edu.tw/file/02806006.pdf [Accessed 26 May 2019].
[3] Shapiro, Stuart. (2009). Knowledge Representation and Reasoning Logics for Artificial Intelligence.
[4] Neelakantan, A. (2017). Knowledge Representation and Reasoning with Deep Neural Networks. PHD. University of Massachusetts Amherst.

[5] Harmelen, F., Lifschitz, V. and Porter, B. (2008). Handbook of Knowledge Representation. 1st ed. Amsterdam, The netherlands: The Boulevard, Langford Lane.

[6] Bolisani, Ettore & Bratianu, Constantin. (2018). The Elusive Definition of Knowledge.