Computational Consciousness

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Abstract: ***Every Science has a philosophy in its background and every computation has a natural phenomenon in it's background.*** *One of the most pronounced research domains in the recent times is study of consciousness, what we have chosen as our area of research. This field of research conglomerates both philosophy and phenomenology. Philosophy of consciousness helped to derive the scientific interpretation of it, and phenomenology of consciousness helped us to derive the computational aspect of consciousness. Scientific study of consciousness is historically being the most challenging and has a history which is prolonged to origin of human civilisation. In all age, saints, philosophers, mathematicians and scientists have expressed their depiction about consciousness as the peak of their scientific arena. In recent times, one new dimension of scientific study of consciousness has emerged i.e., phenomenal view of consciousness which is proposed to develop computational aspect of it. The present paper is the resultant of my Phd research work on computational consciousness where we have started with philosophical interpretation of consciousness in context with Vedic philosophy and derived few noble scientific definition and logical explanations of consciousness. Then, we have used the phenomenal aspects of consciousness to design a computational model of consciousness architecture. The prime goal behind the*

study is to derive the computational aspect of it and implement it into artificial system architecture. The obvious benefit is that, we can automate the intelligence aspect of machine so that adaptability of machines can be as natural as a biological being and can be used to solve various complex decision making problems. The domain of study of consciousness is an highly interdisciplinary one and includes subject domains such as philosophy, mathematics, physics, biology, analog and digital signal processing, Natural language processing, Computational Intelligence, Machine Learning, Data Mining, Knowledge Mining and still the list is inclusive.

It will not wrong to say that, whatever philosophy, art, science, mathematics, engineering is involved in designing this beautiful creation, will involve to model the consciousness. In brief, consciousness is the origin of all knowledge streams and all knowledge streams required to have a complete model of consciousness. Here with my limited ability, I have constricted my work to probe it's structure or architecture, develop a logical definition and concentrate on optimisation property of consciousness, develop a computational model of it and apply into artificial systems for enhancing better adaptability of the artificial systems and enable it to take human like automated intelligent actions and decision making process in pre-defined domains.

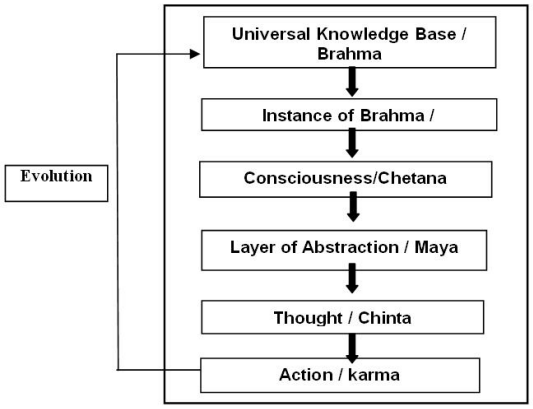
Introduction

We realize consciousness at every instance of life, as we all are conscious. The greatest proof of existence of consciousness is that our own existence and existence of universe coherently and consciously existing with us. Still structural depiction of consciousness is of biggest challenge rolling over since the ages. The real complexity lies in the simplicity of operation it involves in dealing with most complex problems of nature. Last few decades have witnessed tremendous growth in modelling the natural phenomenon such as soft computing, PSO, ACO etc., which in fact has changed the computational paradigm itself. The problem which was considered unsolvable or highly complex is now getting solved through nature or bio inspired computational models. But, still the systems are referred as artificially intelligent systems, as they are depend on a human agent for generating and manage its intelligence.

Present work is aimed to automate the intelligence generation process

in artificial systems, so that for inducting intelligence or manage intelligence, the system will no more require intervention of human agent, or if at all requires, it will be significantly minute. To make happen this challenging task, we need to go above the layer of intelligence i.e. consciousness. Because, consciousness is the layer, that is responsible for generation of intelligence in biological brains such as human brain. It is essential to note here that, all we act can be classified as voluntary or involuntary actions. In case of voluntary actions, our nervous system directly generates the action without involving the thought process. In case of voluntary one, first thoughts are generated as per our previous learning, experiences and then after certain thresh holding, actions are generated. The real complexity lies in voluntary actions. Here, we are depicting that thoughts are the primary stage of intelligence actions. Hence, one of our thrust points is the thought generation process in the thought space of brain which in turn generates actions, which we often declare as intelligent actions. Here, for understanding the phenomenon of consciousness, we have depicted the instructional architecture of universe derived from Vedic philosophy, is given in section 2 and figure 2.1

2. Instructional Architecture of Universe



(Fig 2.1: Framework of creation)

For scientific understanding of the consciousness, it is necessary to explain instructional architecture of consciousness as specified in figure 2.1 and position the consciousness with respect to the universe. Here, each layer explained for better understanding of the subject.

2.1 Universal Knowledge Base or *Brahman*

As depicted in Indian and philosophies and scriptures, Brahman is one without second and available in every matter of universe. Brahman is indivisible as it is devoid of all differences and it is formless in essence [3]. Before creation there was only Brahman which is existence itself on which whole creation is superimposed and precepted as existent [1].

From the above philosophical depictions about consciousness, we can narrowly define Brahman for our computational purpose (as broad definition and specific of Brahman is out of capability of author) as, the repository of whole knowledge that created the universe and it's matters (definition of matter is given in section 2.2.3).We can equivalently view Brahman as collection of classes in an object oriented architecture.

2.2 Universe / Brahmanda

The whole creation is manifested and characterized by Universe (Brahmanda). As per the Oxford Dictionary "all existing matter and space considered as a whole; the cosmos" and as per Webster Dictionary "the whole body of things and phenomena observed or postulated".

For a scientific and computational view of Universe or Brahmanda, we have defined universe as an ***instance of universal knowledge base (or Brahman)*** that is incident on each matter within a domain of enactment (Space). Hence, we can briefly depict that universe consists of ***matter, instance of Knowledge base and space.*** Components of universe is depicted in figure 2.2.1 and also defined individually.

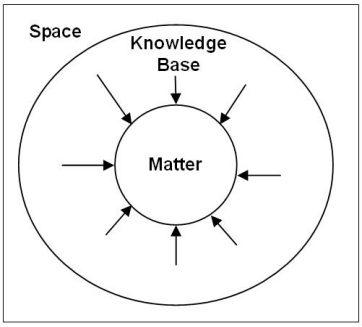


Fig 2.2 : Constituents of Universe

2.2.1 Knowledge Base

It can be defined as, logically arranged set of instructions for execution of matters and various phenomenon.

2.2.2 Space

Space is the universe of discourse or domain within which knowledge base is incident on matter.

2.2.3 Matter

Anything that governs with the universal knowledge base and within a space of enactment is a matter.

Matter = Space + Knowledge Base

2.3 Consciousness (Chetana)

Consciousness is the layer in the framework of creation that is responsible for executing the universal knowledge base in a matter. The dentition and organisation is depicted in section 3 and 4

2.3.1 Levels of Consciousness

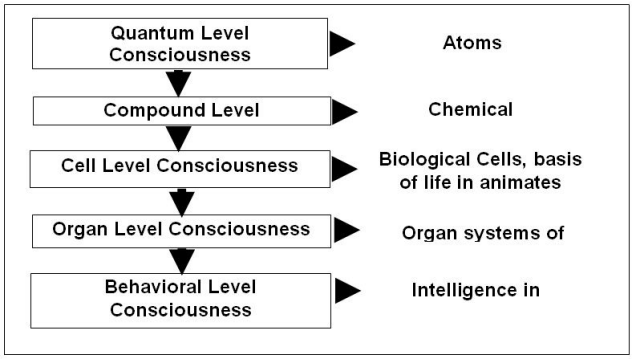


Fig. 2.3.1 Layers of Consciousness

At each level consciousness can execute the matter autonomously and can also give rise to next layer of consciousness to create a higher level of matter. In fact consciousness is responsible for generating the feel of universe at matter, as well as feel of matter in the universe, hence creating the coherency between universe and matter. Form the figure 2.3.1 we can distinguish inanimate and animates by depicting that inanimate having only two layers i.e. quantum layer and compound layer, but animates have all the layers specified in the figure 2.3.1. To be specific, our aim here is to achieve behaviour level consciousness into the artificial systems.

2.4 Illusion/Maya

This is the layer just below consciousness that hides the complexity of framework of creation from thought/chinta layer. Hence, thought process of an animate matter do not requires to realize about consciousness or above that layer for it's normal functioning. Illusion layer also hides simple principles of *Prakriti* and deludes as a complex phenomenon.

This layer is responsible for creation of various emotions such as: happiness, sad, anger, affections, infatuations etc.

In brief, this layer creates the illusions of duality in the nature which is not true in fact, such as pain and pleasure, affection and aversion, happiness and sorrow etc.,

2.5 Thought / Chinta

This is the layer which creates procedures for actions that an animate performs while executing various task. Prior to execution of every task, first a procedure of how to perform and what to perform is generated in the thought space. Normally thought process is hidden from the complexity of creation through the duality created by illusion layer.

2.6 Action/Karma

Action is generated through the stimulation/ prayarthan according to the procedure generated at thought space.
Hence,

Action/Karma = Thought or Chinta + Stimulation or Prayrthan

Action we depict here may be a speech, may be physical action or may be any sort of gesture, through which we categorize a biological being as intelligent one. In brief, It is the consciousness layer that, act on universal knowledge base, basing on the internal or external stimulations and generate the thought in brain and after thresh holding, it generates actions.

2.7 Evolution

Each action evaluated by consciousness and if it is feet to be learned by the being then it updates the knowledge base of the specific being and after a generation it updates the brahma itself for reflecting on every being, which we called as evolution. For example, an animal belongs to a specific species when constrained by environmental changes first reflects in it's own being, then after few generations it reflects in the whole species which we call it as evolution for that species.

3. Study of Consciousness

In the above discussed six layers of creation from section 2.1 to 2.7, consciousness is the layer that makes the Universal Knowledge Base (Brahman) functional in any matter or being. Again, in the following sub-

sections, we have attempted to find out the functional components of consciousness that could be mapped computationally. In section 3.1 we have given the functional definition of consciousness and then in section 3.2 we have provided the organisation of consciousness layer.

3.1 Definition of Consciousness

Consciousness can be logically defined as a function of parasitic, symbiotic, self-referral and reproductive behaviour.

Consciousness consists of following characteristics, such as: Parasitic Behaviour, Symbiotic Behaviour, Capacity to Refer Self and Reproductive Behaviour.

3.1.1 Parasitic Behaviour

It is the conscious behaviour or tendency to acquire resources for self-survival without concerning other's existence.

This behaviour makes a being autonomous, and generates the tendency to compete for resource for self-survival.

3.1.2 Symbiotic Behaviour

It is the conscious behaviour or tendency to associate peers for strengthening and smoothening, the survival. This behaviour generates the social behaviours and allows the being to live in a social ambience.

3.1.3 Capacity to Refer Self

It is the process of recursively referencing self and generating actions with respect to self. This behaviour allows to distinctly positioning self and performing actions with respect to self and creates the capability to identify self with respect to the surrounding and acquiring resources for self-survival autonomously.

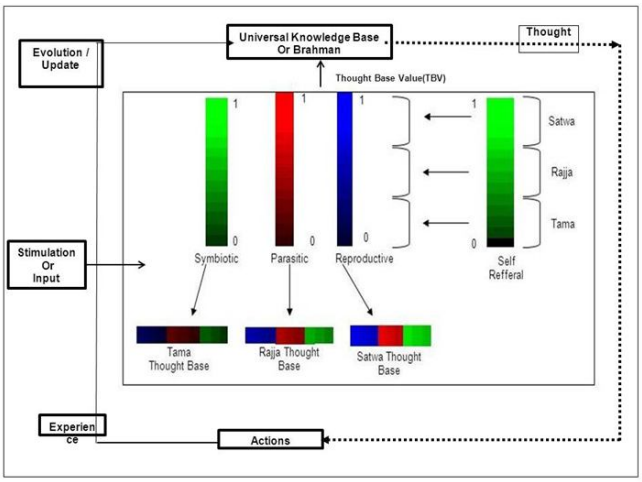
3.1.4 Reproductive Behaviour

Here, Reproduction means, reproducing a new combination from existing set of already produced objects. Here object means the characteristics traits. This behaviour or characteristics is used to create a new combination from existing set of characteristics. The resultant combination may be a biological child or a thought created inside brain that generates an intelligent action as a response to an external stimuli.

We need to view the consciousness in conjunction with it's levels (section 2.3.1) and characteristics (section 3.1). If we will observe the levels of consciousness(section 2.3.1), we can depict that, all matter in this universe are being conscious and exhibit the four characteristics of consciousness(Section 3.1.1 to 3.1.4).

3.2 Structure of Consciousness Layer

The figure 3.2.1 shown as below is the basis of computational model of consciousness. The brief, objective of the above architecture is to generate thought bases on the basis of which decisions are taken by human agent. If we will observe we can find that infinite number of thought bases is possible, for realistic and computational view, we have sampled them into three categories i.e., Satwa, Rajja and Tama. Hence, over all we can reduce the possibility into 27 categories, out of which three primitive thought bases has shown in the diagram i.e., Satwa, Rajja, Tama thought bases. Each thought base will have an unique ***Thought Base Value (TBV).*** We can visualise the thought base value, as RGB scale, where Red, Green and Blue is mixed together to produce a specific colour. In other words, each colour can be represented as mixture of R, G and Likewise, TBV is a numeric value that is generated by operating on all the four scales. Then, TBV is associated with incoming stimulation is



(Fig. 3.2.1: Organisation of Consciousness Layer)

operated on Universal Knowledge Base to generate a specific thought. Which again generates actions? After action is performed, the experience gained out of it is going to be updated back to universal knowledge base of individual being of a species, then after few generations it reflects in the whole species, which we have referred as Evolution.

The above model is still in it's developmental stage and very soon this architectural model is going to be reduced into computational model. Here, the author claims that, the above depicted architecture can automate the thought or intelligence generation process. Hence, can achieve the goal of inducting behavioural consciousness into an artificial system architecture.

5. Conclusion & Future work

This paper provides the basis for designing a conscious machine. First it presents the study and analysis of the concept of consciousness in an existing biological conscious being, architecture of consciousness and then

reproducing the same architecture in the machine to develop consciousness in the machine. The prime objective to develop consciousness is to reduce the dependency of human for creating and developing intelligence in the machine. The so proposed work can be enhanced by developing consciousness algorithm and behavioural algorithms. The next work includes reducing the algorithm into machine implementation form in a suitable machine architecture using suitable computer language.

6. References

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