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AN INTEGRATION OF EMOTIONAL ATTIRE - THE ARTIFICIAL INTELLIGENCE

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Abstract: Mainly Artificial Intelligence is viewed as a base for only few selected streams like Computer Engineering, Neuroscience, Psychology etc but it is actually the foundation of every field across the world if we apply an altogether distinct perspective towards it. Like any core stream as Physics, Mathematics before coming into existence was in someone's mind or thought process or in imagination as a part of computation and later we come to know this 'computation process' or 'thought process' is itself an "Artificial Intelligence" according to the Quantum Mechanics which tells us the basic difference between brain and mind. This is the solid reason in order to project my vision in right direction of Strong Artificial Intelligence [AI]. I can exhibit different paper on individual relationship of AI with other streams but my underlying aim is to show strong foundation which AI has blessed to every stream of Science and Mathematics.

In short, AI is philosophy underneath of the growth of every technology & stream. My primary objective of this paper is to project the scope of AI in other fields as AI has spread its wings very rapidly in its short history. I have presented these ideas as worth of consideration on their own, but they really have a long history in a variety of contexts.

***Keywords**:* Artificial Intelligence, Neuroscience, Cognitive Psychology, Quantum Mechanics.

1. Introduction:

Artificial Intelligence is a branch of Science which deals with helping machine finds solutions to complex problems in a more human-like fashion. This generally involves borrowing characteristics from human intelligence, and applying them as algorithms in a computer friendly way. A more or less flexible or efficient approach can be taken depending on the requirements established, which influences how artificial the intelligent behaviour appears. In brief one may say "Artificial Intelligence is a science to comprehend intelligence."[1]

Intelligence can be coined in following few tasks which needs a perfect blend of Theoretical knowledge as well its practical applications,

1.1 Expert Task:
- a. Medical diagnosis
- b. Airplane Mechanic

1.2 Formal Task:
- a. Mathematics
- b. Game playing

1.3 Creative Task:
- a. Painting
- b. Music Composition

1.4 Everyday Task:
- a. Visual Recognition
- b. Language Understanding

Four desired outcomes which are pursued in AI:
- a. Computers with the ability to think as humans;
- b. Computers with the ability to act like humans;
- c. Computers with the ability to think rationally;
- d. Computers with the ability to act rationally.[2][3]

Before proceeding further lets take a closer look how the artificial intelligence came into existence & how this seasoned branch spread its wings & still counted as core field to derive lots of applications out of it.

2. AI Origination:

The history of artificial intelligence began in antiquity, with myths, stories and rumors of artificial beings endowed with intelligence or consciousness by master craftsmen; as Pamela McCorduck writes, AI began with "*an ancient wish to forge the gods."*

The seeds of modern AI were planted by classical philosophers who attempted to describe the process of human thinking as the mechanical manipulation of symbols. This work culminated in the invention of the programmable digital computer in the 1940s, a machine based on the abstract essence of mathematical reasoning. This device and the ideas behind it inspired a handful of scientists to begin seriously discussing the possibility of building an electronic brain.[4]

Philosophy of AI:

AI's practices of formalizing and "working out" an idea constitute a powerful method of inquiry, but precisely for this reason they are also a powerful way to force an idea's internal tensions to the surface through prolonged technical frustrations: excessive complexity, intractable inefficiency, difficulties in "scaling up" to realistic problems, and so forth. These patterns of frustration have helped clear the ground for a new conception of technical work, one that recognizes the numerous, deep continuities between AI and the humanities. Although these continuities reach into the full range of humanistic inquiry, I will restrict myself here to the following four assertions about AI and its relationship to philosophy:

a. AI ideas have their genealogical roots in philosophical ideas.

b. AI research programs attempt to work out and develop the philosophical systems they inherit.

c. AI research regularly encounters difficulties and impasses that derive from internal tensions in the underlying philosophical systems.

d. These difficulties and impasses should be embraced as particularly informative clues about the nature and consequences of the philosophical tensions that generate them.[5][6]

Biasing of ARTIFICIAL INTELLIGENCE with other fields:

1. AI & Robotics
2. AI & Communication Systems
3. AI & Mathematics
4. AI & Electronics
5. AI & Computer engineering
6. AI & Psychology
7. AI & Linguistics
8. AI ,Physics & Quantum Mechanics
9. AI & Neuroscience
10. AI & Control Theory, Cybernetics
11. AI in Music
12. AI in Gaming
13. AI & Bioinformatics engineering

3. AI & NEUROSCIENCE: a computer in your head

What has billions of individual pieces, trillions of connections, weighs about 1.4 kilograms, and works on electrochemical energy? If you guessed a minicomputer, you're wrong. If you guessed the human brain, you're correct! The human brain: a mass of white-pink tissue that allows you to ride a bike, read a book, laugh at a joke, and remember your friend's phone number. And that's just for starters. Our brain controls our emotions, appetite, sleep, heart rate, and breathing. A brain is who you are and everything you will be.

Let's look at the similarities and differences between the two.

3.1 Going to the Source

Computers and brains both need energy. Plug our computer into the wall, push a button and it will get the power it needs to run. Pull the plug and it will shut down. Our brain operates in a different way. It gets its energy in the form of glucose from the food we eat. Our diet also provides essential materials, such as vitamins and minerals, for proper brain function. Unlike a computer, our brain has no off switch. Even when we are asleep, our brain is active.

Although computers and brains are powered by different types of energy, they both use electrical signals to transmit information. Computers send electrical signals through wires to control devices. (Our brain also sends electrical signals, but it sends them through nerve cells, called neurons. Signals in neurons transfer information to other neurons and control glands, organs, or muscles.

There are fundamental differences in the way information is transferred through electrical circuits in a computer and through nerve cells in our brain. When a computer is turned on, electrical signals either reach parts of the machine or they do not. In other words, the computer uses switches that are either on or off. In the nervous system, neurons are more than just on or off. An individual neuron may receive information from thousands of other neurons. The region where information is transferred from one neuron to another is called the synapse. They do not physically touch because they are separated by a cleft. The electric signals are sent through chemical interaction. The neuron sending the signal is called pre-synaptic cell and the neuron receiving the electrical signal is called postsynaptic cell. A small gap between neurons is located at the synapse. When information is transferred from one neuron to another, molecules of chemicals ("neurotransmitters") are released from the end of one neuron. The neurotransmitters travel across the gap to reach a receiving neuron where they attach to special structures called receptors. This results in a small electrical response within the receiving neuron. However, this small response does not mean that the message will continue. Remember, the receiving neuron may be getting thousands of small signals at many synapses. Only when the total signal from all of these synapses exceeds a certain level will a large signal (an "action potential") be generated and the message continues.

3.2 Form . . . and Function

Despite the differences in the way messages are sent through wires and neurons, computers and brains perform many similar functions. For example, both can store memories - computers do it on chips, disks, and CD-ROMs, and brains use neuronal circuits throughout the brain. Both computers and brains can be modified to perform new tasks. New hardware and software can be installed in computers to add additional memory and programs. The brain undergoes continual modification and can learn new things. The brain can sometimes rewire itself when necessary! For example, after some kinds of brain injuries, undamaged brain tissue can take over functions previously performed by the injured area. I'd like to see a computer rewire itself after its hard drive failed!

Computers and brains both have the ability to monitor their surroundings and respond with behavior to manipulate their environment. Sensors attached to computers can sample temperature, humidity and light levels. Computers can be programmed to control heaters, lights, and other equipment in response to the information they receive. Our brain is also connected to sensors or receptors in our eyes, ears, nose, mouth, and skin. Our brain may respond to sensory information automatically (such as causing our body to shiver when it is very cold), or it may cause us to alter our behavior. For example, if a room is too cold, our brain might send signals to muscles to get us to move to a warmer place or to put on a sweater.

The delicate contents inside our computer are protected by a hard cover. Our skull provides a similar function for our brain. Nevertheless, the external and internal components of computers and brains are all susceptible to damage. If we drop our computer, infect it with a virus, or leave it on during a huge power surge, our precious machine will likely be on its way to the repair shop. When damaged parts are replaced or the virus-caused damage is removed, our computer should be as good as new. Unfortunately, brains are not as easy to repair. They are fragile and there are no replacement parts to fix damaged brain tissue. However, hope is on the horizon for people with brain damage and neurological disorders as scientists investigate ways to transplant nerve cells and repair injured brains. [7]

3.3 The brain, neural networks and computers:

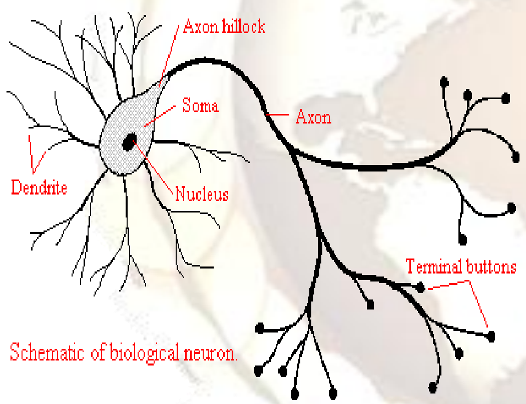

Fig 1: The Biological Neuron

These neurons are represented as models of biological networks into conceptual components for circuits that could perform computational tasks. The basic model of the artificial neuron is founded upon the functionality of the biological neuron. By definition, “Neurons are basic signaling units of the nervous system of a living being in which each neuron is a discrete cell whose several processes are from its cell body”.

The biological neuron has four main regions to its structure. The cell body, or soma, has two offshoots from it. The dendrites and the axon end in pre-synaptic terminals. The cell body is the heart of the cell. It contains the nucleolus and maintains protein synthesis. A neuron has many dendrites, which look like a tree structure, receives signals from other neurons.

A single neuron usually has one axon, which expands off from a part of the cell body. This is called the axon hillock. The axon main purpose is to conduct electrical signals generated at the axon hillock down its length. These signals are called action potentials. The other end of the axon may split into several branches, which end in a pre-synaptic terminal. The electrical signals (action potential) that the neurons use to convey the information of the brain are all identical. The electrical signals are generated by the membrane potential which is based on differences in concentration of sodium and potassium ions and outside the cell membrane. The brain can determine which type of information is being received based on the path of the signal.

Biological neurons can be classified by their function or by the quantity of processes they carry out. When they are classified by processes, they fall into three categories: Unipolar neurons, bipolar neurons and multipolar neurons.

Unipolar neurons have a single process. Their dendrites and axon are located on the same stem. These neurons are found in invertebrates.

Bipolar neurons have two processes. Their dendrites and axon have two separated processes too.

Multipolar neurons: These are commonly found in mammals. Some examples of these neurons are spinal motor neurons, pyramidal cells and purkinje cells.

When biological neurons are classified by function they fall into three categories. The first group is sensory neurons. These neurons provide all information for perception and motor coordination. The second group provides information to muscles, and glands. There are called motor neurons. The last group, the interneuron, contains all other neurons and has two subclasses. One group called relay or protection interneuron. They are usually found in the brain and connect different parts of it. The other group called local interneuron are only used in local circuits.[7][10][11]

3.4 The Mathematical Model:

Once modeling an artificial functional model from the biological neuron, we must take into account three basic components. First off, the synapses of the biological neuron are modeled as weights. Let’s remember that the synapse of the biological neuron is the one which interconnects the neural network and gives the strength of the connection. For an artificial neuron, the weight is a number, and represents the synapse. A negative weight reflects an inhibitory connection, while positive values designate excitatory connections. The following components of the model represent the actual activity of the neuron cell. All inputs are summed altogether and modified by the weights. This activity is referred as a linear combination. Finally, an activation function controls the amplitude of the output. For example, an acceptable range of output is usually between 0 and 1, or it could be -1 and 1. Mathematically, this process is described in the figure2

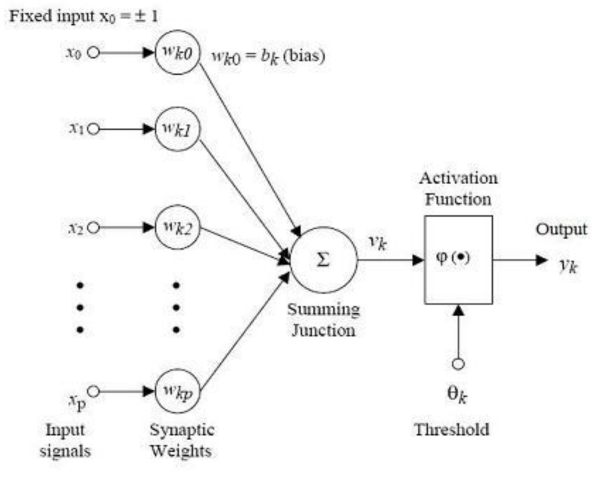

Figure2: Mathematical Modeling

From this model the interval activity of the neuron can be shown to be:

$$v_k = \sum_{j=1}^{p} w_{kj} x_j$$

The output of the neuron, yk, would therefore be the outcome of some activation function on the value of vk.

3.4.1 Activation functions

As mentioned previously, the activation function acts as a squashing function, such that the output of a neuron in a neural network is between certain values (usually 0 and 1, or -1 and 1). In general, there are three types of activation functions, denoted by Φ(.) . First, there is the Threshold Function which takes on a value of 0 if the summed input is less than a certain threshold value (v), and the value 1 if the summed input is greater than or equal to the threshold value.

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{if } v < 0 \end{cases}$$

Secondly, there is the Piecewise-Linear function. This function again can take on the values of 0 or 1, but can also take on values between that depending on the amplification factor in a certain region of linear operation.

$$\varphi(v) = \begin{cases} 1 & v \geq \frac{1}{2} \\ v & -\frac{1}{2} > v > \frac{1}{2} \\ 0 & v \leq -\frac{1}{2} \end{cases}$$

Thirdly, there is the sigmoid function. This function can range between 0 and 1, but it is also sometimes useful to use the -1 to 1 range. An example of the sigmoid function is the hyperbolic tangent function.

$$\varphi(v) = \tanh\left(\frac{v}{2}\right) = \frac{1-\exp(-v)}{1+\exp(-v)}$$

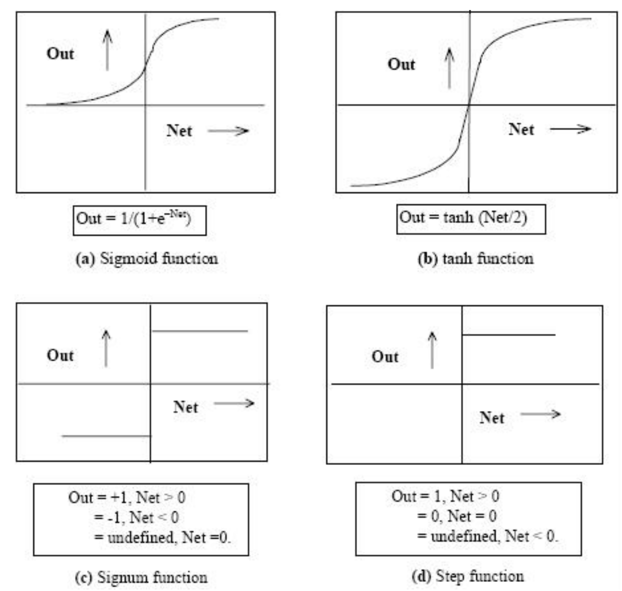

Figure3: Common Non-Linear Functions used for Synaptic inhibition

The artificial neural networks which I described are all variations on the parallel distributed processing (PDP) idea. The architecture of each neural network is based on very similar building blocks which perform the processing. [8][9][10][11]

4 AI, PHYSICS & QUANTUM MECHANICS:

I am here going to draw analogies between mental and quantum phenomena! Some of these have been pointed out by Bohm (1951) and more recently by Jahn & Dunne (1986) and Zohar (1990) (although perhaps understood in different ways.

Jahn and Zohar have tended to concentrate on the analogies between mental structures, and the structure of matter entailed by quantum mechanics. They look at analogies between, for example, minds and quantum systems, and then especially analogies between how minds interact and how quantum systems interact. I will be looking rather at analogies between individual mental processes within minds and individual quantum processes. I believe that only when we understand the elementary processes of both the mind and quantum matter, we can more completely understand complex systems of either kind.

In order to make analogies with quantum physics, I am going to assume something like the `propensity interpretation' of Maxwell (1988) and others (Thompson, 1988). I am also going to assume a view of mind that is in part phenomenological (after Bergson especially), and in part influenced by (a few of) the aims of artificial intelligence (AI) and the recognition of the complexity of even apparently elementary mental processes. On this basis, we can draw analogies between the fundamental processes of quantum physics and the fundamental processes of mental activity:
Quantum objects do not evolve uniformly in time, but as a succession of `states' between intermittently `actualizing' to one outcome of a certain range.

a. The state of a mind is not static, but more a `state of propensity': it is a continual recollection of past events and continual anticipation of future possibilities.

b. The state of a quantum object may be described by a wave function distributed is space, but this does not mean that the quantum object is composed of elements so distributed. Rather, it has a basic unity in that it will always act as a whole. These spatial distributions merely describe where it can be actualized.

The state of a mind has a similar basic unity. The thoughts in the mind may be diverse, and each may implicitly contain diverse elements (usually the better for doing so), but if they lead to action these diverse elements were merely describing where the mind could have operated.

c. The driving impetus of quantum processes is not external, but the very propensities of which quantum objects are forms. These propensities operate according to the (spatiotemporal) circumstantial relations with other objects.

The driving motivation of mental processes is not external, but the very motivational loves which underlie all psychic activities. These motivations operate according to the circumstances at each time. .

As a consequence of simulation efforts in Artificial Intelligence, we know that the operation of even seemingly simple events such as the perception of solid objects must involve `behind the scenes' a great deal of information processing which is not apparent in the act of perception itself.

In view of these analogies, it is unlikely that the mental and physical processes are independent, and merely interact with each other at certain `mental-neural' events (Eccles, 1989). We could hold that they both derive from a `quantum realm', but I hold to a more radical (but simpler) idea that the propensities for physical processes derive from mental processes, which in turn always act according to past physical events. These ideas, explain that the mental and physical realms are far from separable, but are intimately related in a very systematic manner. Thus, although the basic idea may not be exactly fashionable these days, it is an idea with significant predictive power and good empirical content.

How Minds and (Quantum) Brains Fit Together

In order for people to have functioning minds, their minds must at least be able to:

a. Implement intended functions using the motor areas.
b. Establish permanent memories, presumably by means of permanent physiological changes.
c. Form perceptions using information from the visual & auditory (etc.)
d. Be able to follow `internal' trains of thought/feeling/imagining without necessarily having any external effects.

One way that these requirements can be most simply accomplished is by means of the idea above, formulated in the following three principles:

I. That the mind predisposes the physical/physiological potentialities (either deterministic or indeterministic according to quantum physics).

II. That the `predispositional' capacities of the mind are consequentially restricted (and hence conditioned) by their actual effect.

III. That the pattern of I and II is repeated for individual stages of more complex processes. [12][13]

5 Mind and Brain as `Hand and Glove':

This theory of mind and brain connection establishes an intimate relation between them. It is not a relation of identity, or a relation of aspects or points of view. It is more a relation of inner and outer, or cause and effect: propensities in the brain are the causal product of mental actions. As put in by Bawden (1947), `the role of the psychical in relation to the physical (in the living organism) is essentially the relation of the potential or incipient to kinetic or overt action'.

The mind and brain fit together by approximate analogy with hand and glove, or, better, with tissue and skin. The analogy is most precisely with the functions of tissue & skin, and not so much with their material shape. The mind provides all the directed activity of the brain, just as the tissue of the hand provides all the directed activity of the skin of the hand. When we look at the head, we only see the brain, just as we only see skin when we look at the hand. It appears that the skin of the hand does all the work, but we don't assume that is all there is. It appears that the skin has life, but we know that all but the simplest life comes from the underlying tissue. The skin (as does the brain) has simple capacities for action and reactions, but it is a mistake to imagine that all capacities for activity and information processing belong to the skin (or the brain). [12][13]

6 Conclusion:

In order to understand how the mind and brain function together, it is not enough for there to fill gaps in our physical theories. We also need to have a unified picture of both minds and brains. In this paper I have tried to outline such a unified approach in biasing with artificial intelligence.

AI has made great progress in its short history, but final sentence of Alan Turing's essay on Computing Machinery and Intelligence is still valid today, "We can see only a short distance ahead, but we can see that much remains to be done." [a]

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