ADVANCING THE TECHNOLOGY OF ARTIFICIAL INTELLIGENCE USING NEURAL NETWORKS

Anup Kumar, Ranjeeta Chauhan
Student, B.Tech 6th SEM, Department of Electronics and Computers Engineering
Dronacharya College of Engineering, Gurgaon-123506, India

***Abstract*--This paper reviews about the implementation of neural network in the field of artificial intelligence. The human brain works on the principle of neural networks where electrical impulses are transmitted in the brain through a complex web network of neurons where information are stored in these neurons and can be accessed using either of the way. For an instance two different paths of their electrical signals may lead to a same conclusion in the end. This property of the human thought process is known as common sense. Whereas today's robots don't have this capability. In their brain information is stored in disks and files which can be accessed step by step. This forces them to perform the same actions if the situation is different. Through the concept of neural network these robots might be able to recognize the environment and condition and enables them to react there upon.**

I. INTRODUCTION

Intelligence is a gift provided by the nature to the humanity. We, as a human being are able to detect the environment around us using the five senses i.e. vision, hearing, smell, taste and touch. Moreover we are able to learn from our environment. From the time of our birth, we detect things and changes that took place in the nature through the five senses and this information get stored in our mind which we can use further to identify the identical happenings. This gift of nature is now being passed artificially by the human civilization. Artificial intelligence is the concept that has revolutionaries the human society since its existence. As the modern technology keeps on growing, the robots are continuously getting more intelligent. The time is not far when the artificial intelligence technology will create a machine that can take decisions itself depending on the present environment and the learning from the past. But the million dollar questions present today is can the two different civilizations i.e. human and bots exist together or the world wide increasing capability of the robots will results in vanishing us?

II. WHAT IS A REAL SCI-FI ROBOT?

We will be trying to build a robot that has all the features of a science fiction character. Further unlike many of the science fiction movies it should not be as powerful that it will become a threat to the human society. But first of all we will be assigning some primary objectives that can shape a real sci-fi robot:

1. Superfast brain
2. Learn of its own
3. Recognition of the environment
4. Versatile body

These features are more than enough to construct a robot that will be as intelligent as a human brain and will be recognized as a sci-fi robot. Let's study each of these perspectives in detail.

2.1. LEARNING ON ITS OWN

Our first primary objective to build a sci-fi robot is almost complete. Till now it is able to recognize and identify objects in the world. However without the common sense or ability to think upon and took decisions it is not going to be so called intelligent. For the robot to

think as our human brain it needs to have what our brain has, neural network a web of neurons that work together and perform operations simultaneously.

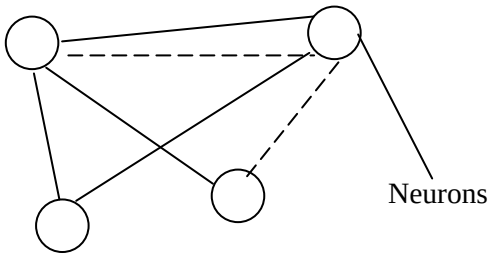

Fig2. Structure of a neural network.

Our brain consists of a series of neurons that are connected with each other to provide information in the form of electrical signals. However when we learn something new it possesses some new connections. So the brain literally rewires itself after performing every given tasks. But is it possible to implement an artificial neural network into a robot? Yes it is.Scientists at New York University have invented a robot that has an artificial neural network that rewires itself each time, the robot performs a task. What it actually does is, it takes real time images of the surroundings and sent the images to a computer that does the processing. The computer distinguishes the traversing plane to the obstacles by differentiating them with colors. It constructs a simulation in which the traversing path will be of green color and the obstacles are shown with red and purple colors. This simulation will be sent to the robot again in real time which helps him to differentiate between the obstacles and the safe path. It took a little bit more time, but it learns as it experiences. [5] Thus in a few decades our robot will be able to gain enough common sense so that it can take its own decisions and live in our world.

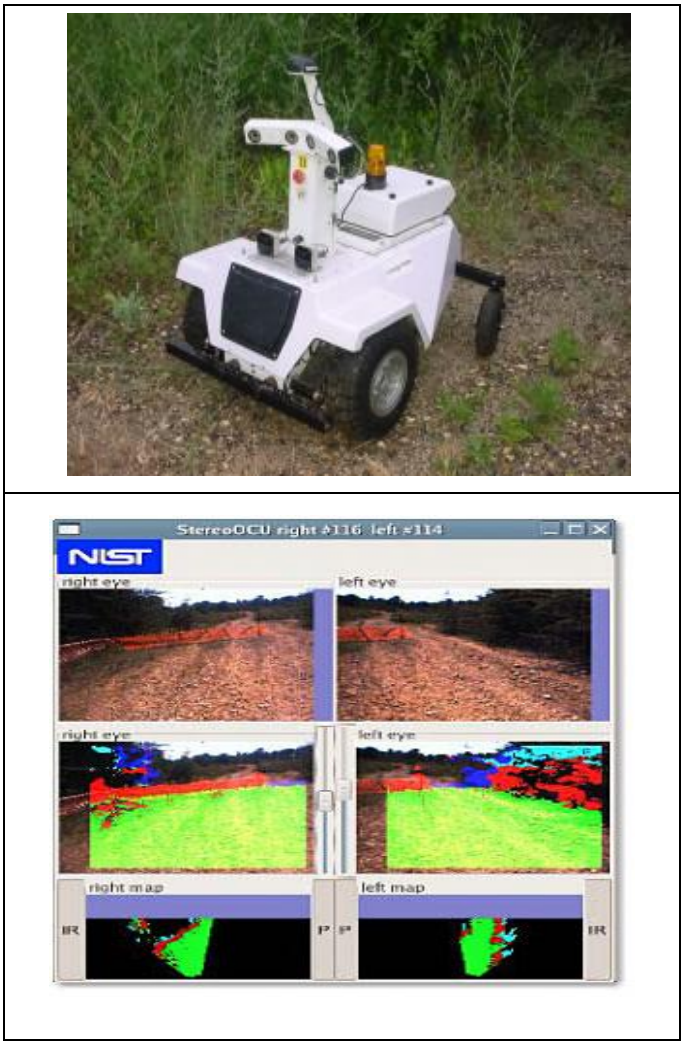

Fig3. LADR: Model and the simulation it observes

We are half way down in the search to find ways to build a robot straight out of science fiction. So far the robot is able to identify the environment and take decisions on its own.

Further it is able to learn from what it experiences. But still something is lagging behind. Scientist have found that our brain can perform 20 million billion calculations per second.[6] So our robot needs some kind of super processor that has enormous amount of speed as well as processing power.

1.1. ENVIRONMENT RECOGNITION

Until now we are familiar with the robots that can be programmed using a special set of programs. The processor embed in the robot will decodes the information as a set of binary digits and perform specific task. However in the construction of a robot that can move and take decisions itself, programming is not going to work. In our daily experiences we change our decisions simultaneously depending on the current situations, for example when suddenly someone steps in our way we have to stop or change our direction. Providing this decision making capability is not an easy job to do. But researchers at Artificial Intelligence lab of Stanford University have already taken a step ahead which is popularly known as STAIR. STAIR of Stanford Intelligent Robot is one of a kind. The hardware components of this robot mainly consist of a robot arm that has 5 degrees of freedom, a stereo camera and a laser scanner. [1] The basic operation of STAIR is that it uses the camera as well as a laser scanner to capture a picture of an object and then it compares the orientation of the object and how the objects interact towards the environment with the images in its database.

The robot works on the principal of jigsaw puzzle. First of all the robot takes an image and breaks down the image into tiny pixels. Then it compares the patterns of these tiny pixels with the patterns that the image in its database forms. Moving back and forth, recognizing patterns one by one, it identifies the object. The famous 'picking up a stapler demonstration' demonstrate the robot identifying and picking up a stapler from a bunch of objects. For a human being it is the easiest job to do but for a machine it is very hard especially when the objects have similar shapes. But the STAIR creators found a simple solution. They designed the robot in such a way that when it is not able to identify the object clearly or it is confused about the shape of the object it simply rotates the object to have a different view of that particular object and then again compares with the millions of pictures in its database and identifies the object. [2] But there the problem strikes. For a little task to identify an object the robot will take about one and a half minute but for a human it consumes only one-tenth of a second. The theory is invincible only it needs some up gradation.

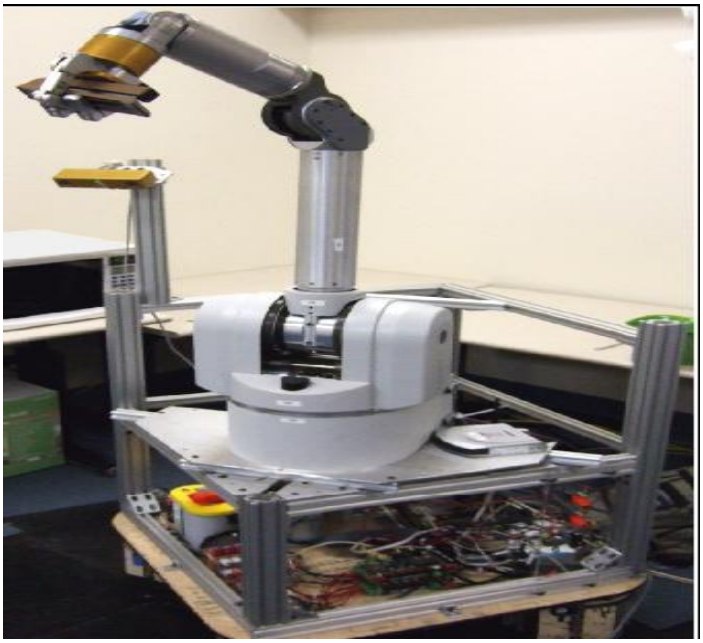

Fig1. STAIR: Stanford artificial intelligent robot

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Finally we will be able to provide our robot the recognizing ability through which it identifies an object and perform functions according to that. Our robot will consist of a camera and a laser scanner in its eyes through which it captures the image of the surrounding world and its objects. Then we will have a database which consists of not only thousands but billions of images of the objects that the robot will encounter in its daily routine. This will surely take decades but it is not less than practical.

So far our robot will be able to see and identify objects around it but identification only is not going to get the job done. It needs to have something that enables it to take decisions itself by learning the rules of the present world. It needs to have something which the A.I. researchers commonly called Common Sense.

Without it, the robot will be going to do silly mistakes and keeps of hurting itself. To provide this common sense to a machine researchers are trying for decades. They used simple set of instructions that will be embedded on a Pentium chip which can perform specific tasks. But the technology suggests that creating instruction for each specific task that a human body perform on a particular day is not near to possible. A digital computer gets the input from the user, processes it on a processor and shows the output. It simply adds the two numbers 1+1=2, however it performs the task billions of times quicker than the human brain that we assumes that it is thinking but actually it is not.[3] Our brain performs specific tasks not by computing but by real time thinking. Our brain is not a digital computer, it is a neural network.

1.1. SUPERFAST COMPUTERS

Our robot that will be challenging the abilities of human brain will be able to think and process much faster than the present day computers. The twist in the story is that they won't be build using a silicon chip. Instead they will compute on individual atoms. It will be a computer that will be powerful thousand to million times more powerful than anything that we have today. Welcome to the world of Quantum Computers!

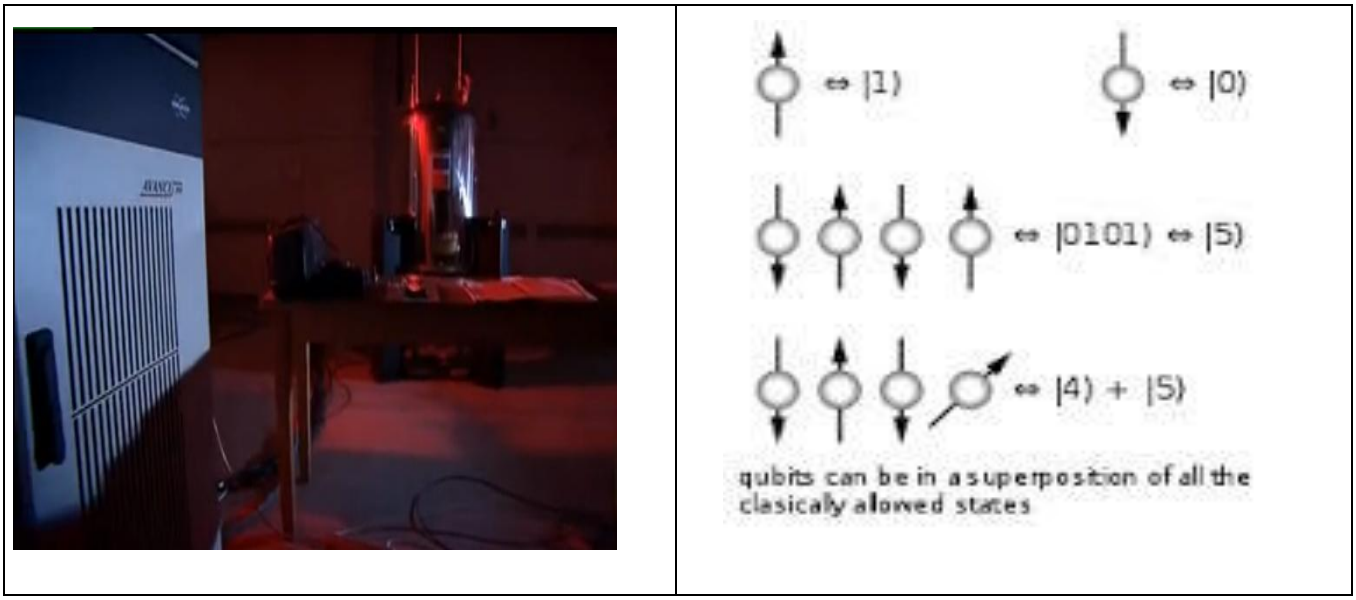

Fig4. Structure of qubits in the quantum computer

At MIT researchers are building prototype of a quantum computer that can transform atoms into calculators. Inside a metal drum, are the atoms cooled with liquid nitrogen, instructions are relayed the scientists at the project is Dr. Seth Lloyd. In the early stage quantum computers are rather big because it takes from a computer near a console that zaps the atoms with microwaves to make them compute. One of a room for the apparatus to talk to an individual atom and have the atom take back to the individual.

Conventional computers are very simple, they calculate using electrical pulses with only two values 0 and 1. Quantum computers are different, they compute by spinning atoms in different directions. But because they are atoms quantum mechanics open up a load of weird possibilities. In our world we as an individual can be up or down, on or off. In the world of computers a particular bit can be either 0 or 1 at one time. But in the world of quantum mechanics, a particular atom can be at different stages spinning around at a single time. Instead of bits they contain cubits. As the figure shows, an atom can possess value 0 if its spin is down and 1 if its spin is up. It works on the principle of probabilities. In the addition of two numbers the last atom can be both 1 and 0. Hence if the conventional computers take 3 cycles to perform a single calculation, the quantum computers can perform it in one cycle, hence increasing the processing speed very much. This may take a little time to be reality but when it comes it will be fit straight into our design. [7]

If we can combine the neural networks and the imagery database with these quantum computers the information sending and receiving process will be boosted many times as compared to anything present today. It will be able to perform 20 million billion tasks per second as our brain performs today. Till now our robot is well equipped with intelligent brain, all it needs is a body.

2.2. VERSATILE BODY

With the advancement of technology in the field of artificial intelligence, the robots are continuously growing as humanoid. ASIMO manufactured at Japan is the world's first

Humanoid robot, performing almost every task like a human. But there is a twist. Researchers in the Carnegie Mellon University, US are developing not only robot but super robot. It is not a single robot but a collection of marginal robots that can recombine and reconstruct themselves to create a new machine. In one configuration it can crawl like a snake and in another configuration it could roll like a tire. [9]

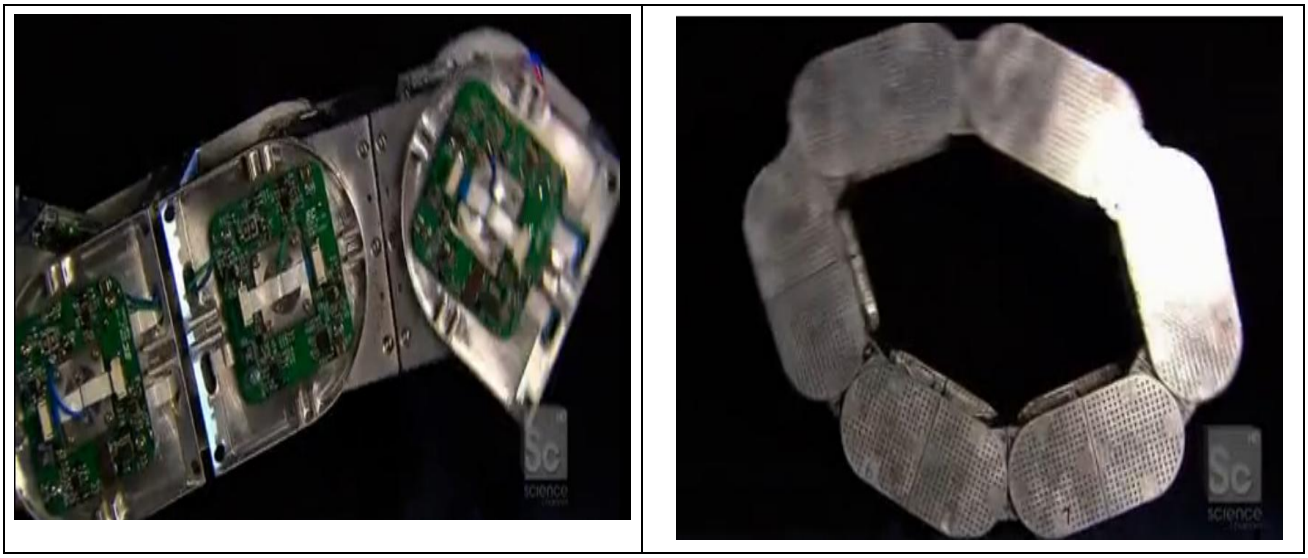

Fig5. Self organized programmable matter

This type of machine that has the ability to transform itself is known as programmable matter. It works on the principle of electromagnetism and advanced computing. The basic building block of a programmable matter i.e. Atom is itself a tiny cube shaped robot. These blocks can work together using advanced programming and can create a machine that can transform into any shape and size. If we will be able to combine the technology of programmable matter with the quantum computing we will be having a robot that can instantly change shape and act upon any condition and circumstances. Though a little far in the future, our robot has all the features that can make it practical and effective. [10]

III. CONCLUSION

Our main objective is to build a robot straight out of science fiction. It would have all the features that can make it versatile, intelligent, lightning fast and a good learner. Our robot emerging straight out of a production company initializes the neural network that can be rewired each time the robot face some new situations. In this way if becomes smarter and smarter day by day because it learns everything it experiences. Next if it faces an obstacle in its way, the camera and the scanning eyes instantly takes the picture and start comparing it with the huge amount of database. This process will be lightning fast as the processor used will be evolved from the technology of quantum computing. The computers will take decision and act upon in a millisecond recognizing the obstacle. The

versatile and modular body of the robot enables it to change its shape by simply detaching the individual catoms and rearranging forming another machine. And that is how our robot will work.

REFERENCES

1. M. A. Nielsen and I. L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2000).

2. R.P. Feynman, Simulating physics with computers, Int. J. Theor. Phys. 21, 467–488 (1982).

3. D. P. DiVincenzo, The physical implementation of quantum computation, Fortschr. Phys. 48, 771–783 (2000)

4. J. Bugun, G. H. GranLund, and J. Wiklund. Multidimensional orientation estimation with applications to texture analysis and optical flow. *IEEE Trans PAMI*, 13(8), 1991.

5. T. Chang. Spherical regression and the statistics of tectonic plate reconstructions. *Int'l Stats Rev*, 1993.

6. A. d'Aspremont, L. El Ghaoui, M. Jordan, and G. Lanckriet. A direct formulation for sparse pca using semidefinite programming. In *NIPS 17*, 2004.

7. P. Dollar, V. Rabaud, and S. Belongie. Non-isometric manifold learning: Analysis and an algorithm. In *International Conference on Machine Learning*, 2007.

8. T. D. Downs. Orientation statistics. *Biometrika*, 59:665, 1972.

9. T. D. Downs. Spherical regression. *Biometrika*, 90:655, 2003.

S. Fiori. Unsupervised neural learning on lie group. *Int'l Journal Neural Sys*, 12(3):219–246, 2002.