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# Artificial Neural Network

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## I. INTRODUCTION

An artificial neural network is an information-processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information.

The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. Ann's, like people, learn by example.

An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning processing. Learning in biological systems involves adjustment to the synaptic connections that exists between the neurons. This is true of Ann's as well. The first artificial neuron was produced in1943 by the neurophysiologist Warren McCulloch and the logician Walter Pits.

Virtual Reality is technology for presentation of complicated information, manipulations and interactions of person with them by computer. Method of dialogue of person with computer is named interface and virtual reality is newest of row this interfaces. After applications of virtual reality in area of computer games are rise need to exercise these technologies in industry.

## II. BIOLOGICAL NEURONS

In the human brain, a typical biological neuron collects signals from others through a host of fine structures called dendrites. or in other words we can say that neuron is composed of a cell body, a tabular axon and a multitude of hair like dendrites shown in figure 1.

The neuron sends out spikes of electrical activity through a long, thin stand known as an axon, which splits into thousands of branches. The small gap between an end bulb and a dendrite is called synapse across which information is propagated. At the end of each branch, a structure called a synapse converts the activity from the axon into electrical effects that inhibit or excite activity from the axon into electrical effects that inhibit or excite activity in the connected neurons. Learning occurs by changing the effectiveness of the synapses so that the influence of one neuron on another changes.

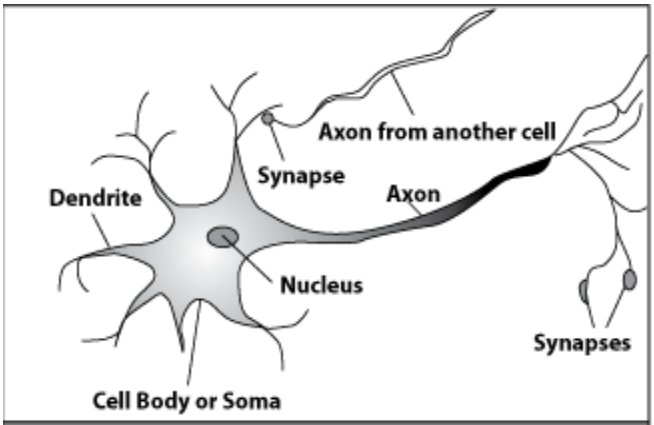


Figure 1: A Biological Neuron

## III. NEURAL NETWORKS VERSUS CONVENTIONAL COMPUTERS

Neural networks take a different approach to problem solving than that of conventional computers. Conventional computers use an algorithmic approach i.e. the computer follows asset of instructions in order to solve a problem & computers would be so much more useful if they could do things that we don't exactly know how to do. Neural networks process information in a similar way the human brain does. The network is composed of a large number of highly interconnected processing elements (neurons) working in parallel to solve a specific problem. Neural networks learn by example. They cannot be programmed to

perform a specific task. The examples must be selected carefully otherwise useful time is wasted or even worse the network might be functioning incorrectly.

On the other hand, conventional computers use a cognitive approach to problem solving; the way the problem is to solve must be known and stated in small unambiguous instructions.

Neural networks and conventional algorithmic computers are not in competition but complement each other. There are tasks are more suited to an algorithmic approach like arithmetic operations and tasks that are more suited to neural networks. Even more, a large number tasks, require systems that use combination of the two approaches (normally a conventional computer is used to supervise the neural network) in order to perform at maximum efficiency.

## IV. ARCHITECTURE OF NEURAL NETWORKS

Humans and other animals process information with *neural networks*. These are formed from *trillions* of neurons (nerve cells) exchanging brief electrical pulses called action potentials. Computer algorithms that mimic these biological structures are formally called artificial neural networks. Neural network research is motivated by two desires: to obtain a better understanding of the human brain and to develop computers that can deal with abstract and poorly defined problems. For example, conventional computers have trouble understanding speech and recognizing people's faces. In comparison, humans do extremely well at these tasks.

Many different neural network structures have been tried, some based on imitating what a biologist sees under the microscope, some based on a more mathematical analysis of the problem. The most commonly used structure is shown in Fig. 2 This neural network is formed in three layers, called the input layer, hidden layer, and output layer. Each layer consists of one or more nodes, represented in this diagram by the small circles. The lines between the nodes indicate the flow of information from one node to the next. In this particular type of neural network, the information flows only from the input to the output (that is, from left-to-right). Other types of neural networks have more intricate

The nodes of the input layer are passive, meaning they do not modify the data. They receive a single value on their input, and duplicate the value to their multiple outputs. In comparison, the nodes of the hidden and output layer are active.

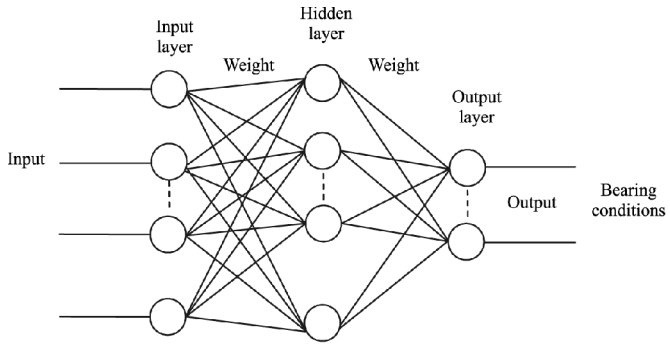


Fig. 2

A variety of input devices like data gloves, joysticks, and hand-held wands allow the user to navigate through a virtual environment and to interact with virtual objects. Directional sound, tactile and force feedback devices, voice recognition and other technologies are being employed to enrich the immersive experience and to create more "sensualized" interfaces.

## V. APPLICATIONS OF NEURAL NETWORKS

(i) **Character Recognition** - The idea of character recognition has become very important as handheld devices like the Palm Pilot are becoming increasingly popular. Neural networks can be used to recognize handwritten characters.

(ii) **Image Compression** - Neural networks can receive and process vast amounts of information at once, making them useful in image compression. With the Internet explosion and more sites using more images on their sites, using neural networks for image compression is worth a look.

**(iii) Stock Market Prediction** - The day-to-day business of the stock market is extremely complicated. Many factors weigh in whether a given stock will go up or down on any given day. Since neural networks can examine a lot of information quickly and sort it all out, they can be used to predict stock prices.

**(iv) Traveling Salesman's Problem** - Interestingly enough, neural networks can solve the traveling salesman problem, but only to a certain degree of approximation.

**(v) Medicine, Electronic Nose, Security, and Loan Applications** - These are some applications that are in their proof-of-concept stage, with the accepting a neural network that will decide whether or not to grant a loan, something that has already been used more

successfully than many humans.

## VI. ADVANTAGES

- **Adaptive learning:** An ability to learn how to do tasks based on the data given for training or initial experience.
- **Self-Organization:** ANN can create its own organization or representation of the information it receives during learning time.
- **Real Time operation:** ANN computations may be carried out in parallel, & special hardware devices are being designed & manufactured which take advantage of this capability.
- **Fault Tolerance via Redundant Information Coding:** Partial destruction of a network leads to the corresponding degradation of performance. However, some network capabilities may be retained even with major network damage.

## VII. IMPROVEMENT OF EXISTING TECHNOLOGIES SUMMARY

All current NN technologies will most likely be vastly improved upon in the future. Everything from handwriting and speech recognition to stock market prediction will become more sophisticated as researchers develop better training methods and network architectures.

**NNs: Future Prospects**

- Robots that can see, feel, and predict the world around them
- Improved stock prediction
- Common usage of self-driving cars
- Composition of music
- Handwritten documents to be automatically transformed into formatted word processing documents
- Trends found in the human genome to aid in the understanding of the data compiled by the Human Genome Project
- Self-diagnosis of medical problems using neural networks

## VIII. REMARKS

The paradigm of artificial neural network has become increasingly important, based on the success in many practical applications. Still the efficiency is not 100%. Most neural networks models combine highly connected network architecture with a simple neuron model. The neural network is based on symbolic representation rather on numeric concepts. This has lead to the difficulty in traditional computing. The efficiency of neural networks can be improved by the changes in the way it presently used for the tasks.

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