

# SOFT COMPUTING AND ITS DOMAINS - AN OVERVIEW

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**Abstract:** This paper presents a new perspective of Artificial Intelligence (AI). Although, it is not so easy to define Artificial Intelligence, but I tried my best for doing so. This is a review paper and in this paper I'd made my efforts to describe soft computing and its domain having relevance with Artificial Intelligence. I hereby declare that all information used here is gathered by me through various resources.

**Keywords** - Neural Computing, Evolutionary Computing, Intelligence, Emotions, Soft Computing

## I. Introduction

As we know that artificial intelligence is a very general term but defining it precisely is very difficult. There are many definition of Artificial Intelligent.

According to [1] successful definitions are along two dimensions. Firstly whether it is with respect to reasoning (thought) or behaviour (action) and secondly, whether it is with respect to human or ideal (i.e. rational).

Category-1 Thinking Humanly	Category-2 Thinking Rationally
Category-3 Acting Humanly	Category-1 Acting Rationally

**Figure 1:** Four Perspective of Artificial Intelligence

While considering category-1 or 3 definition of Artificial Intelligence, developing an artefacts that can think and act like human being is tired by us. In case of consideration of category -2 or 4

definition of AI, we try to develop artefacts that can thinks or act optimally. Definition given by Hang land [2] and bellman [3] belongs to category 1. Charnaik [4] and Winston [5]'s definition falls under category 2. Category 3 includes the definitions by Kurzweil [6] and Rich and Knight [7] and the fourth category contains definitions of Pole and Alt [8] and Nilsson [9]. These all are briefly discussed in [1] and we've different model of Artificial agent according to definition from different Category.

Generally, we define Artificial Intelligence as the branch of computer science concerned with study and creation of computer system that behave some form of intelligence. In this paper, I will be concerned with my views on artificial intelligence according to the research made by me on this field. The area

includes definitions of AI, ALP agents and biologically inspired soft computer domains.

## II. Literature Survey

Sandeep Kumar and Medha Sharma presented a paper on "Convergence of Artificial Intelligence, Emotional Intelligence, Neural Network & Evolutionary computing". In that paper, they considered definitions of Artificial Intelligence from category 1 & 3 only and domains of soft computing inspired biologically that includes Artificial Neural Network, Evolutionary and Genetic Computing.

Shoshana L. Hardt & William J. Rapaport made a research on Recent & Current Artificial Intelligence. In that article they described the various researches made on Artificial Intelligence by their team. This article included An Approach to Natural Language Understanding, Expert Systems, Computer Vision and Pattern Recognition. Robert Kowalski, Imperial College London, United Kingdom presented a paper on Artificial Intelligence And Human Thinking. In this paper, he concerned mainly with the normative features of the alp agent model, and on ways in which it can help us to improve our own human thinking and behaviour. he focussed, in particular, on ways it can help us both to communicate more effectively with other people and to make better decisions in our lives.

## III. Biologically inspired soft computing Domains

### 3.1 Soft computing

The idea of soft computing was initiated in 1981 and was first discussed in [10] by

Dr. Zadeh 1997. According to him, soft computing in its latest incarnation as the combination of fields of fuzzy logics, Neuro-computing evolutionary and Genetic computing into a multidisciplinary system.

The aim of soft computing is to solve non-linear and mathematically un-modelled system problem [11] and to develop intelligent machines.

Neuro computing, evolutionary computing and genetic computing are biologically inspired domains of soft computing. It means they're developed on basis of some biological phenomenon.

### 3.2 Neuro-computing (Neural Network)

According to discussion in [12] and [13] by Morton- Neuro computing is the study of network of adaptable nodes, which, through a process of learning from task examples store experimental knowledge and make it available for us.

ANN (Artificial Neural Network) were actually realised in 1940s Warsen Mcculloch and Walter Pitts designed the first ANN [14]. Donald Hebb in Mc Gill University [15] designed first learning rule for ANNs.

ANN is a computational structure designed to mimic or copy biological neural network. It is made up of neurons which are connected by interconnected weights. There are three types of neutrons in an ANN, input nodes, hidden nodes & output nodes.

### A simple neural network

input layer    hidden layer    output layer

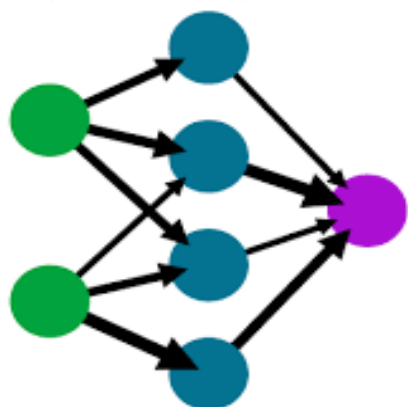


Figure 2: Simple Neural Network

Mostly two types of ANN are used. These are as follow:-

1. Feed Forward Neural Network
2. Feed Backward Neural Network

#### 3.2.1. Feed Forward Neural Network:-

Feed Forward Neural Network was the first and arguably simple network. In this information moves only in one direction i.e. forward direction. No cycle or loops are formed in this type of network.

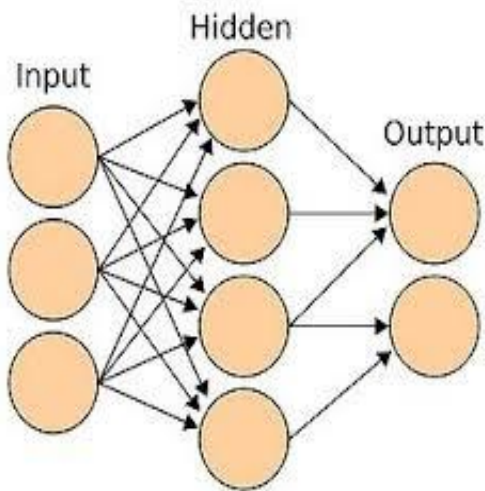


Figure 3: Feed Forward Neural Network

#### 3.2.2. Feed Backward Neural Network

Feed Backward Neural Network is also known as recurrent neural network. These are the neural network which contains feedback connections. In this; data flow is bi-directional. Loops formation is possible in this network.

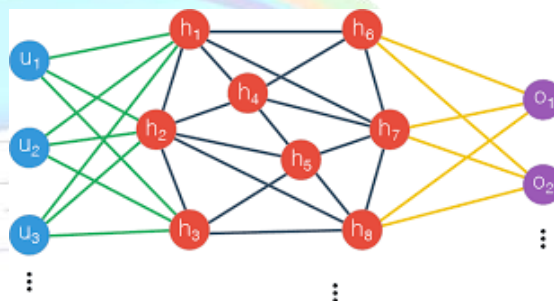


Figure 4: Feed Backward Neural Network

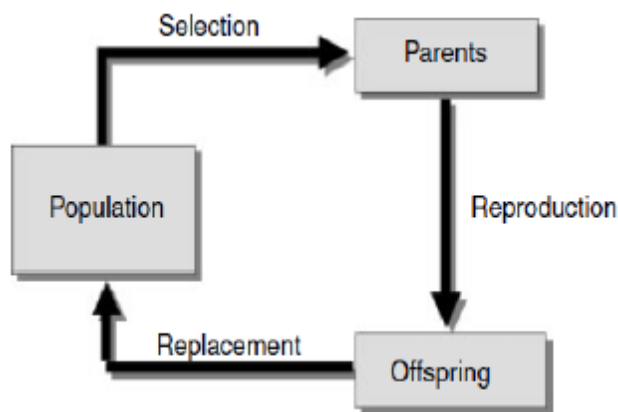
#### 3.3 Evolutionary Computing And Genetic Computing

In terms of nature, evolution refers to competition among different individuals for resources in environment or generally a natural selection. Those individuals are more likely to survive and propagate genetic material are better. The diversity in population is achieved by mutation operation.

Usually found grouped under term evolutionary computation or evolutionary algorithms [16], are domains of genetic algorithms (GA) [17], evolution strategies [18][19] evolutionary programming [20] & genetic programming [21].

These all share a common conceptual base of simulating evolution of individual structures through processes of selection, recombination & mutual reproduction, producing better solutions.





**Figure 5:** Flow Chart of Evolutionary Algorithms

### 3.4 Pattern Recognition

Pattern Recognition is a sub-topic of machine learning. It can be defined as the act of taking raw data & taking action based on category of data. Pattern recognition is more complex when templates are used to generate variants. It is studied in many fields including psychology, ethnology and computer science. It aims to classify data (pattern) based on either prior knowledge or on statistical information extracted from patterns. It can be done by both supervised and unsupervised learning. Image pre-processing segmentation and analysis, computer vision, Radar signal classification and analysis, face Recognition, speech Recognition, character Recognition, Handwriting Recognition, Data Mining, seismic analysis are some of the major applications of pattern Recognition.

### 3.5 Fuzzy Logic

Fuzzy Logic is an approach to computing based on “degrees of truth” rather than the usual “true or false”. The term Fuzzy Logic was introduced in 1965 with the

proposal of fuzzy set theory by LOTFI ZADEH [22][23].

Process of fuzzy logic is as:-

1. Fuzzify all input values into fuzzy membership functions.
2. Execute all applicable rules in rule base to compute fuzzy output functions.
3. De-fuzzify the fuzzy output functions to get “crisp” output values.

Japanese were the first to utilize fuzzy logic for practical applications. First notable application was on high-speed train in SENDAI, in which fuzzy logic was used to improve economy, comfort and precision of ride [24].

It is also being used in sony pocket computers, flight aid for helicopters, controlling of subway systems and many more areas.



**Figure 6:** Logo of Fuzzy Logic

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