



SNS COLLEGE OF TECHNOLOGY



Coimbatore-35

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DEPARTMENT OF INFORMATION TECHNOLOGY

19CSE303 – ARTIFICIAL INTELLIGENCE
III YEAR IV SEM

UNIT V – LEARNING

TOPIC : Neural Network and Genetic Network



ABSTRACT

- Combining neural network with evolutionary algorithms leads to evolutionary artificial neural network. Evolutionary algorithms like GA to train neural nets choose their structure or design related aspects like the functions of their neurons. Along with basic concepts of neural networks and genetic algorithm this paper includes a flexible method for solving travelling salesman problem using genetic algorithm. This offers a solution which includes a genetic algorithm implementation in order to give a maximal approximation of the problem with the reduction of cost.



KEYWORDS

- ❑ Genetic algorithm, Neural network, Travelling salesman problem



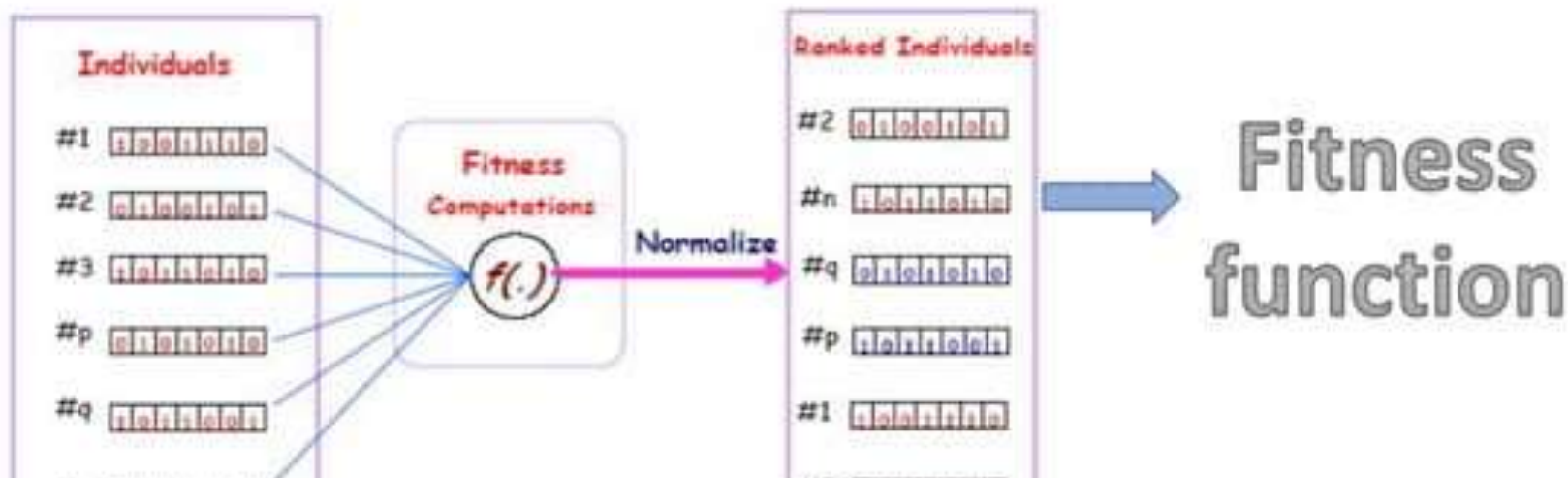
INTRODUCTION

- Genetic algorithm and neural networks are both inspired by computation in biological system. A good deal of biological neural architecture is determined genetically. Neural networks and genetic algorithms are two techniques for optimization and learning, each having its own strengths process tries to artificially reproduce the mating process where the DNA of two parents determines the DNA for the newly born.



Genetic algorithm :

“Genetic algorithms are based on mechanics of natural selection and natural genetics”. This method combines Darwinian style survival of the fittest among binary string "artificial creatures" with a structured, yet randomized information exchange.





Fitness function(def)

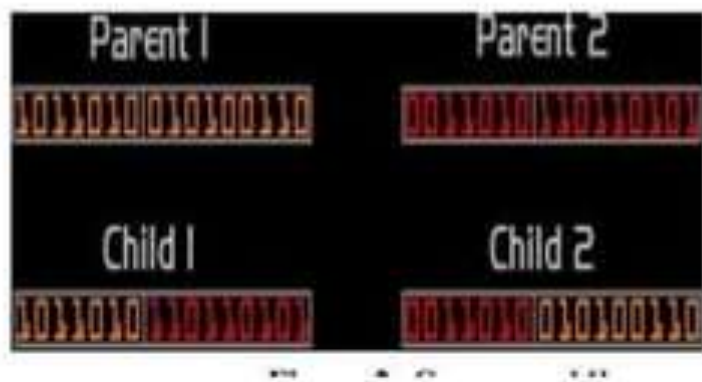
In Genetic algorithms, each solution is generally represented as a string of binary numbers, known as a chromosome.

Genetic algorithm have three main operations :-

- ❖ Reproduction(individual strings are copied according to their fitness. that is having more chances to survive in next generation.)
- ❖ Crossover
- ❖ Mutation



CROSSOVER & MUTATION



- Here the crossover site is 7.
- After bit 7 the value of p-1 and p-2 get interchanged, and the results as child 1 and child 2

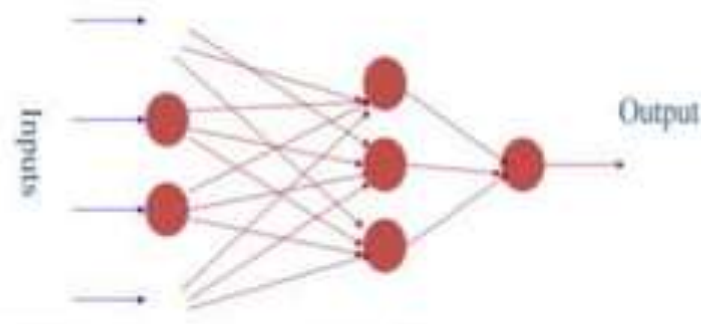


- Mutation is carried out by flipping some digits of a string which generates new solutions.
- Here mutation takes place at bit 7.
- Because of flip/swap the value of bit 7 changed from 1 to 0.



NEURAL NETWORK

- Let us review the basics of a neural networks . A neural network is a Computational model consisting of a number of connected elements knows as neurons.
- This neuron is a processing unit that receives input from outside the network and /or from others neurons . Applies a local transformation to that input and provides a single output signal which is passed on to others neurons outside the network .



Neural
networks



- The main elements or blocks of an artificial neural networks are as follows:
 - a)The computing element
 - b)The connection pattern among the elements
 - c)The process used for training the neural network

An artificial neural network is composed of many artificial neurons that are linked together according to specific network architecture. The objective of the neural network is to transform the inputs into meaningful outputs.



How to apply GA to Neural Networks

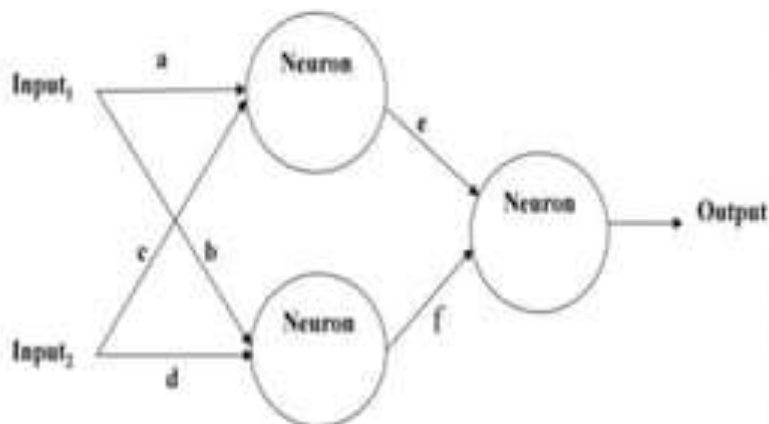
Combining Neural Nets with Evolutionary Algorithms leads to Evolutionary Artificial Neural Networks (EANNs). One can use Evolutionary Algorithms like the GA to train Neural Nets, choose their structure or design related aspects like the function of their neurons.

Using GA to Train Neural Network:

First why one use GA to train Neural Networks: GA will train the network no matter how it is connected - whether it's a feed-forward or a feedback network. Furthermore, it can train general networks which are a mixture of the two types



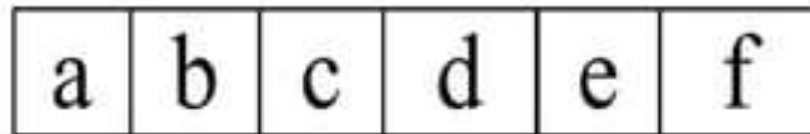
Simple Neuro network



Simple Neural Network

- All the weights in the network are joined to make one string.
- The String is then used in the GA as a member of the population. String represents the weights of a complete

String/Chromosome



chromosome

- Depicts the value of chromosome obtained from simple neural network .




➤ How to evaluate Fitness

Fitness is measured by calculating the error (target – output) (i.e. fitness= 1/error) - the lower the error the higher the fitness.

Example

The target for a network with a particular input is 1. The outputs are shown below, calculate their fitness.

Population

Member	Output	Population Members	Output	Error (T-O)	Positive	Fitness
1	0.4	 1 2 3	0.4	0.6	0.6	1.67
2	0.2		0.2	0.8	0.8	1.26
3	1.6		1.6	-0.6	0.6	1.67
4	-0.9		-0.9	1.9	1.9	0.53

Implementation of GA in travelling salesman problem

The genetic algorithms are more appropriately said to be an optimization technique based on natural evolution. They include the survival of the fittest idea algorithm. The idea is to first 'guess' the solutions and then combining the fittest solution to create a new generation of solutions which should be better than the previous generation

➤ Methodology:

simple GA works by randomly generating an initial population of string ,which is referred as gene pool and then apply

Operators to create new, and hopefully ,better population as successive generations.

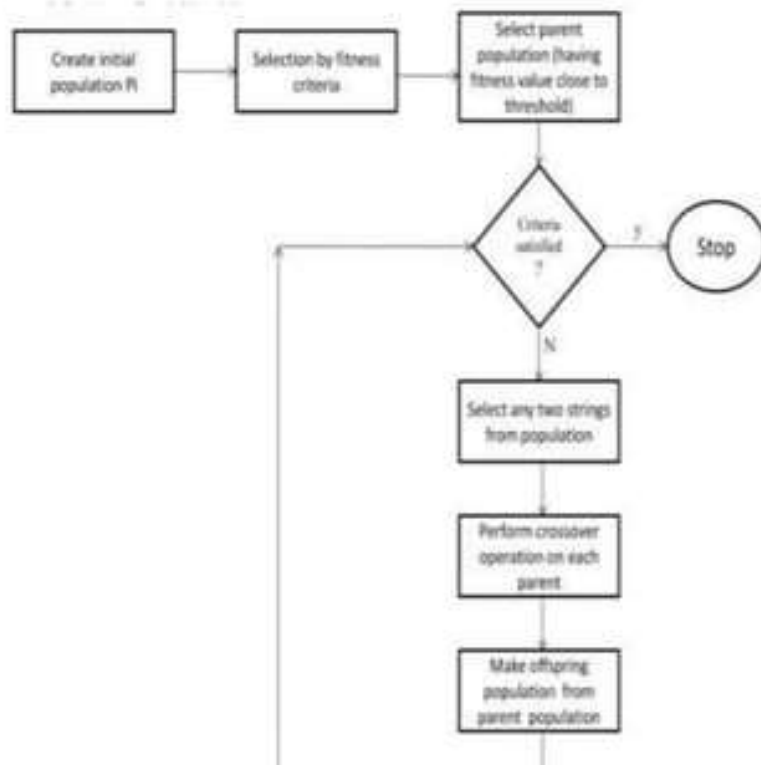
- The first operator is reproduction where string are copied to the next generation with some probability based on their

Objective functions value.

- The second operator is crossover where randomly selected pairs of strings are mated , creating new strings.
- The third operator ,mutation , is the occasional random alteration of the value at a string position.



Flow chart

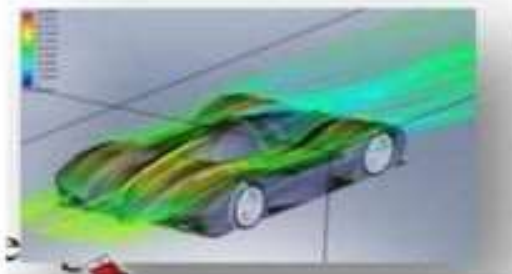


In this flow chart we can see various steps are following while implementing genetic Algorithms to travelling salesman problem. First create initial population, and then evaluate fitness of all the chromosomes by Applying fitness function to it.

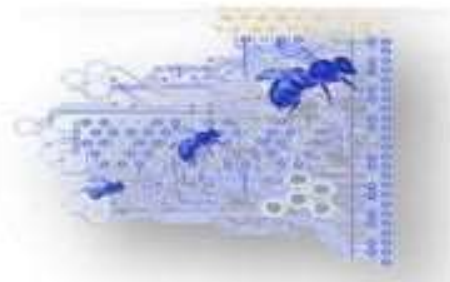


➤ Application area of GA/ Neural network

a)Automotive Design



C)Evolvable Hardware



b)Robotics



d)Biomimetics Invention





Pros

1. GA helps to generate better population from good parents.
2. These results are close to global optimum.
3. Important character of GA, it is robust.
4. They work well in various fields as:
In pattern matching
speech recognition, text-to-speech
Machines that are able to learn
optical character recognition(OCR)
Fraudulent credit card detection(VISA)

Cons

1. It remains a "black box" which once fed with inputs produces an output.
2. However, their excellent result record might compensate for that deficiency.
3. A second drawback is that inputs have to be altered before being fed to the network.
It fails to depict following:
which network to use?
How many hidden layers?



Conclusion

This paper makes an effort to give a review with respect to neural networks, genetic algorithm and how they both work together. Genetic algorithm has three main operators: selection, mutation and crossover. Neural network is computational model having number of processing elements called neurons. These techniques are black box which once fed with inputs produces an output. As genetics and neural networks have a wide real-world application area, also suffers from various cons so in future it will try to work on these limitations. Reference



Questions?

Thank

You !