



# Neural Networks Using Genetic Algorithms

Richa Mahajan & Gaganpreet Kaur

IJCA - 2013

Lucas Aversari  
Renan Gomes Barreto

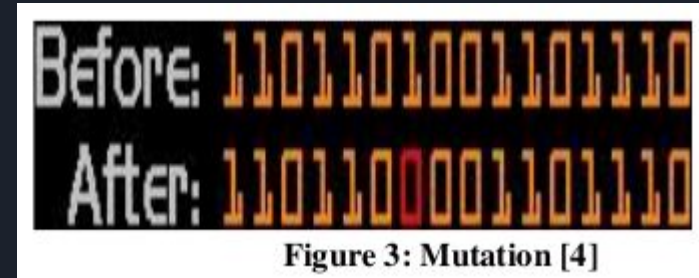
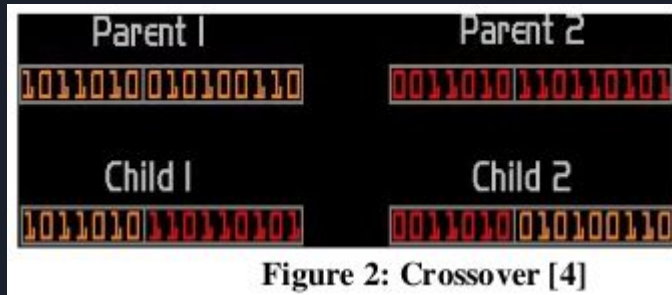


# Introdução

- Combinar algoritmos genéticos com redes neurais leva às chamadas redes neurais evolucionárias
- Algoritmos genéticos podem ser usado no treinamento ou na escolha da topologia de redes neurais
  - Melhor forma de calcular os pesos
  - Melhor forma de interligar os neurônios da rede

# Algoritmos Genéticos

- População de strings binários relacionados e ranqueados pela função de “fitness”
- Métodos de seleção, *crossover* e mutação



# GA em Redes Neurais

- No treinamento:

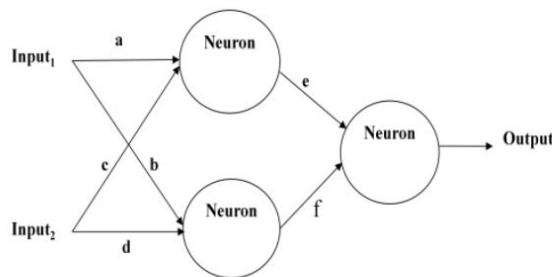


Figure 5:

Simple Neural Network

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



Figure 6: String or Chromosome

Figure 6 depicts the value of chromosome obtained from simple neural network as figure 5.

## b) How to evaluate Fitness

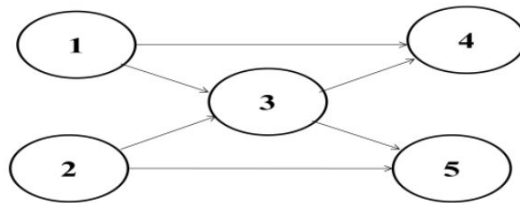
Fitness is measured by calculating the error (target – output) (i.e.  $fitness = 1/error$ ) - the lower the error the higher the fitness.

Os pesos podem ser evoluídos pelos métodos genéticos para se adequar melhor ao *fitness*

# GA em Redes Neurais

- Na topologia:

Consider a simple neuron network. If there is a connection of one neuron with other neuron, it will be represented by 1 otherwise 0.



**Figure 7: Simple Neural Network**

From figure 7, consider the connections from neuron 1. These may be represented by the string shown below:

0 0 1 1 0

The first zero represents the fact that neuron 1 is not connected to itself. The second zero means that neuron 1 is not connected to neuron 2. The third digit, which is 1, means that neuron 1 is connected to neuron 3; and so on.

The complete network may be represented by the matrix shown in figure 8.

0 0 1 1 0	Neuron 1
0 0 1 0 1	Neuron 2
0 0 0 1 1	Neuron 3
0 0 0 0 0	Neuron 4
0 0 0 0 0	Neuron 5

A matriz de conexão pode ser convertida em um string, sendo modificado e testando diferentes topologias para maximizar o *fitness*



# Conclusão

1. GA helps to generate better population from good parents, these results close to global optimum.
2. Important character of GA, it is robust.
3. They works well in various fields as:
  - a) In pattern matching
  - b) Speech recognition, text-to-speech
  - c) Machines that are able learn
  - d) Optical character recognition (OCR)
  - e) Fraudulent credit card detection (VISA)
  - f) Image compression

## 6.2 Cons:

1. It remains a 'black box' which once fed with inputs produces an output. However, their excellent result record might compensate for that deficiency.
2. A second drawback is that inputs have to be altered before being fed to the network.
3. It is fail to depict followings:
  - a) Which network (architecture) to use?
  - b) How many hidden layers?
  - c) How many neurons?
  - d) What activation functions should I use?
  - e) What cost function is the most appropriate?
  - f) Which training algorithm to apply?