Genetic Algorithms in Machine Learning

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Abstract: Genetic algorithms are having a random probability distribution or pattern that may be analysed statistically but may not be predicted precisely. Genetic algorithms are search algorithms which acts on a population of possible solutions and designed on the natural evolution process. The word genetic is derived from Greek word genesis which means "Generation". In the Genetic Algorithm, the solution of the problem is coded as a string of bits or real numbers. Genetic algorithms are the algorithms that are used for optimization and machine learning based on various features of biological evolution. By using Genetic algorithms functional optimization can be done very efficiently.

Keywords: Neural Networks, Artificial Intelligence, Machine Learning, Genetic Algorithms.

I. INTRODUCTION

The advancement of artificial neural networks has created a great impact with having extremely different techniques and approaches to solve and similarly incredible amount of works that have been published about the various techniques in this area, even with genetic algorithms. The main principles to deal with Genetic algorithm are Initial population, Fitness function, Selection, Crossover Mutation. A genetic operator is an operator used in genetic algorithms to guide the algorithm towards a solution to a given problem. There are three main types of operators they are Mutation, Crossover and Selection which is used to connect with one another in order to form the algorithm to be successful.

II. GENETIC APPROACH

1. Why genetic approach is different from Neural Networks.?

The simple difference that exists between Artificial Neural Networks and genetic approach is the neural networks capture the imagination by comparing algorithms with neurons in an animate brain, whereas genetic algorithms appeal to the metaphor which states that one thing is related to another thing and equates those two things not because they actually are the same, but for the sake of comparison of these two things.

III. PSEUDO CODE REPRESENTATION FOR GENETIC ALGORITHM

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START
Generate the initial population
Compute fitness function
REPEAT
Selection
Crossover
Mutation
Compute fitness
UNTIL population has met its required points
STOP
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The genetic algorithm firstly generates the initial population is usually created randomly every individual taken in initial population are characterized as variables which is known as Genes. Genes are joined into a string to form a chromosome. And in next step it computes the fitness function which generates the fitness score to each individual so that the probability will be based on fitness score to evaluate these individuals. The next step will be selection phase is to select the fittest individuals and let them pass their genes to the next generation. And in next step Crossover the goals of individual need to be achieved. And in next step mutation some of their genes can be subjected to a mutation with a low random probability. This implies that some of the bits in the bit string can be flipped.

1. Why artificial intelligence and machine learning is used in genetic algorithms?

Improving algorithms in developed technologies, learning machines can lead to the use of advanced artificial intelligence, machine learning techniques in the future, which will be used in many industries and services. The improvement of algorithms in developed technologies, learning machines can also lead to the approach of these increasingly advanced systems and algorithmic activities in genetic or evolutionary algorithms, i.e. algorithms known from living organisms. Currently, the degree of organization of biological systems, the degree of organization of the central nervous system is considered so complex that for many years man-made artificial systems of neural networks may not match those of biological. However, despite a much lower complexity, genetic algorithms can carry out a comparable number of data processing operations. Currently built quantum computers can perform many times more and faster data processing operations compared to biological neural networks in the central nervous system with a lower level of complexity. In such a way that artificial intelligence and machine learning plays a crucial role in implementing genetic algorithms.

IV. PROCESS FLOW FOR GENETIC ALGORITHM

The below flowchart for genetic programming shows the overall implementation of algorithm in stepwise manner.
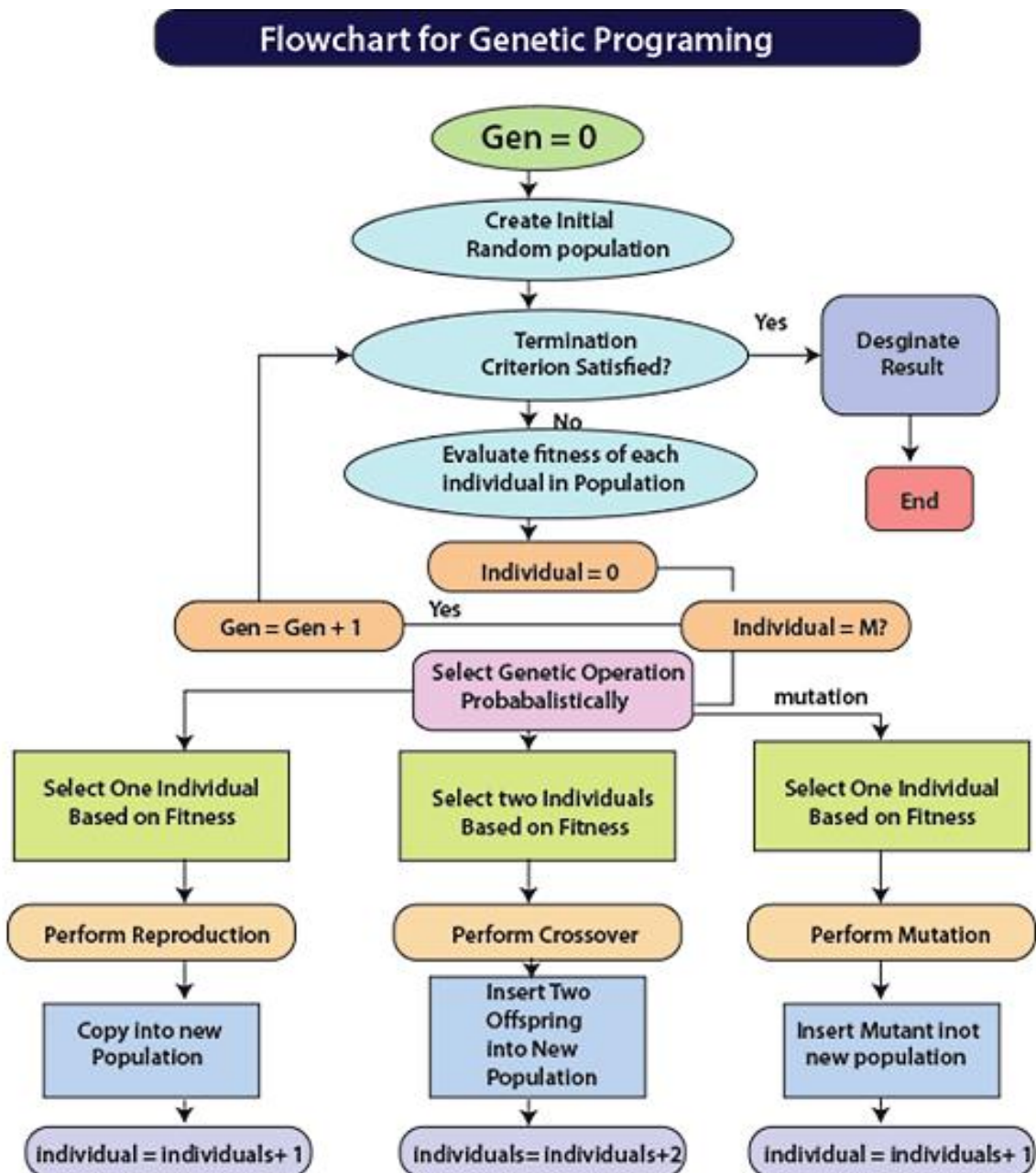
V.   ADVANTAGES OF GENETIC ALGORITHM

- Easy to understand.
- It supports multi-objective optimization.
- Utilizes probabilistic transition rules.
- Works well on mixed discrete functions.
- It is suitable for noisy environments.

VI.   APPLICATIONS OF GENETIC ALGORITHM

- Automotive Design
- Bioinformatics
- Robotics
- Mutation testing
- Financial Planning

1. Automotive Design

The use of numerical optimization methods to partially automate the design process is demonstrated. Genetic algorithm is an optimization technique which is used to determine both the active control and passive mechanical parameters of a vehicle suspension system.
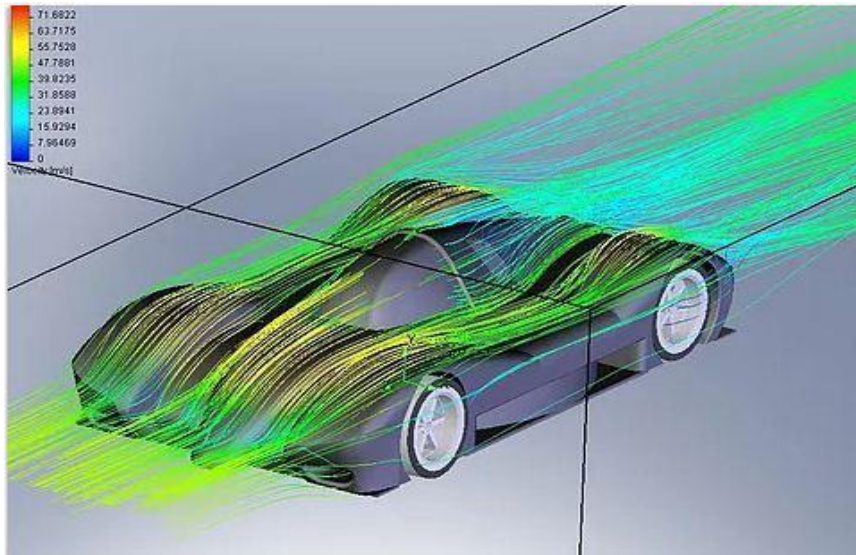

2. Bioinformatics

The Bioinformatics (BI) is a sequence alignment, usually three sequences which can be RNA, DNA and proteins. Because the three or more given sequences can be of large lengths, aligning them by hand can be time consuming and, in some cases, traditionally impossible. Thus, BI comes into use thereby aligning each sequence, and revealing the similar part of the given gene. BI finds great use in bioinformatics where it can be used to predict the protein structure, its function, family or its domain. Thus, with the goal of identifying maximum similarities among the sequences, we can use these approaches and techniques like Genetic Algorithms (GA) and its variant in BI.
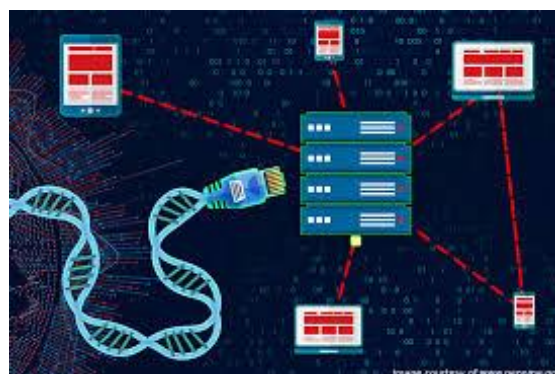
3. Robotics

Evolutionary robotics and Multivariate parameter optimization is Evolving through artificial networks & optimizing connection weights.
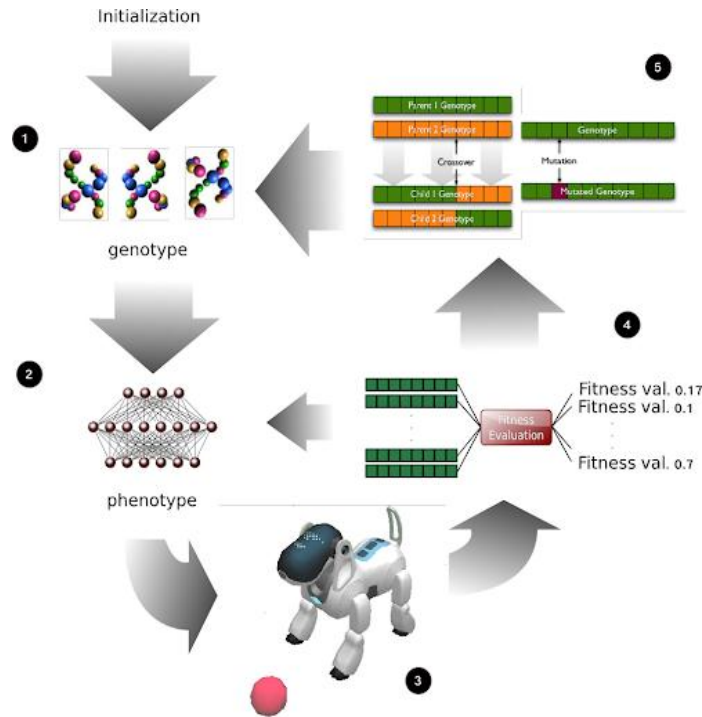
4. Mutation Testing

Mutation testing is a structural testing technique and is also known as fault-based testing. In this testing technique, test cases are designed to detect specific types of faults in a program.
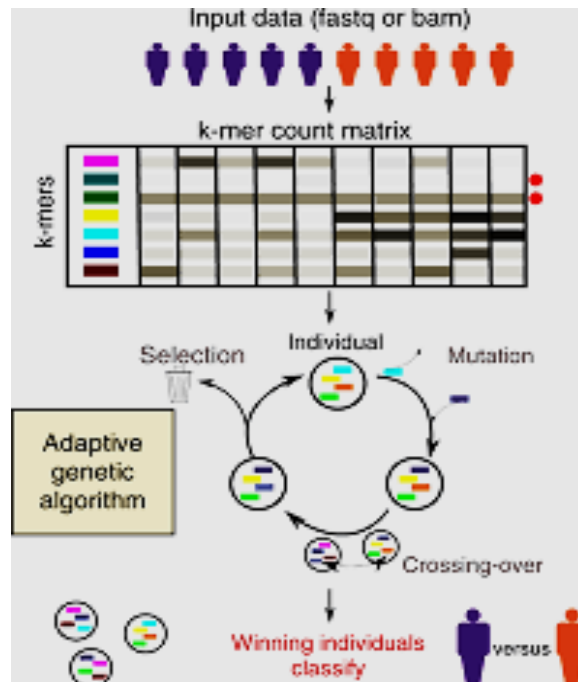
5. Financial Planning

Genetic algorithms are problem-solving methods that mimic the process of natural evolution and can be applied to predicting security prices

VII. CONCLUSION

Genetic Algorithms can be used to solve various types of optimization problems. Genetic Algorithm works on a state space of potential solutions and selects maximum or optimal solution based on the fitness value of candidate solution. Genetic Algorithms avoid the problem of getting stuck at local maxima which is usually faced by Traditional Search techniques.

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