PHD ASSISTANCE Lab

# Understanding of an Evolutionary Algorithms in Artificial Intelligence (AI) 2019

## Where and How to Apply

PhD Research Lab

Industry ⇄ Research

# ARTIFICIAL INTELLIGENCE

# EXECUTIVE SUMMARY:

- Artificial intelligence is a highly advanced innovative solution for a wide range of sectors like banking, agriculture, space, automobile, healthcare, manufacturing

- The AI, the intelligent machine is created to solve real-world challenges like security issues, website designs

- open source framework used for EA are OpenBEAGLE in C++, MOEA Framework in JAVA,

# INTRODUCTION

The word “Artificial Intelligence” or “Artificial Life” relates to the concept of computational simulation of human behaviour. Artificial intelligence is a highly advanced innovative solution for a wide range of sectors like banking, agriculture, space, automobile, healthcare, manufacturing, etc.,(Chen & Wong, 2019). The AI, the intelligent machine is created to solve real-world challenges like security issues, website designs (to nature selection combine the best performing elements and features to produce the most optimal website for conversion) etc. Where, the AI can learn, plan, recognise our speech, solve the problem, manipulate, move objects, detect theft data, filters spam messages, design webpage automatically, etc.

The techniques implemented by artificial intelligence are popularly called approaches; the three approaches of AI are,

- **COMPUTATIONAL INTELLIGENCE**
- **SYMBOLIC AI**
- **STATISTICAL METHODS**

Let us discuss computation intelligence; computation intelligence is achieved through one of the three techniques.

- **FUZZY LOGIC**
- **ARTIFICIAL NEURAL NETWORK (ANN)**
- **EVOLUTIONARY COMPUTATION**

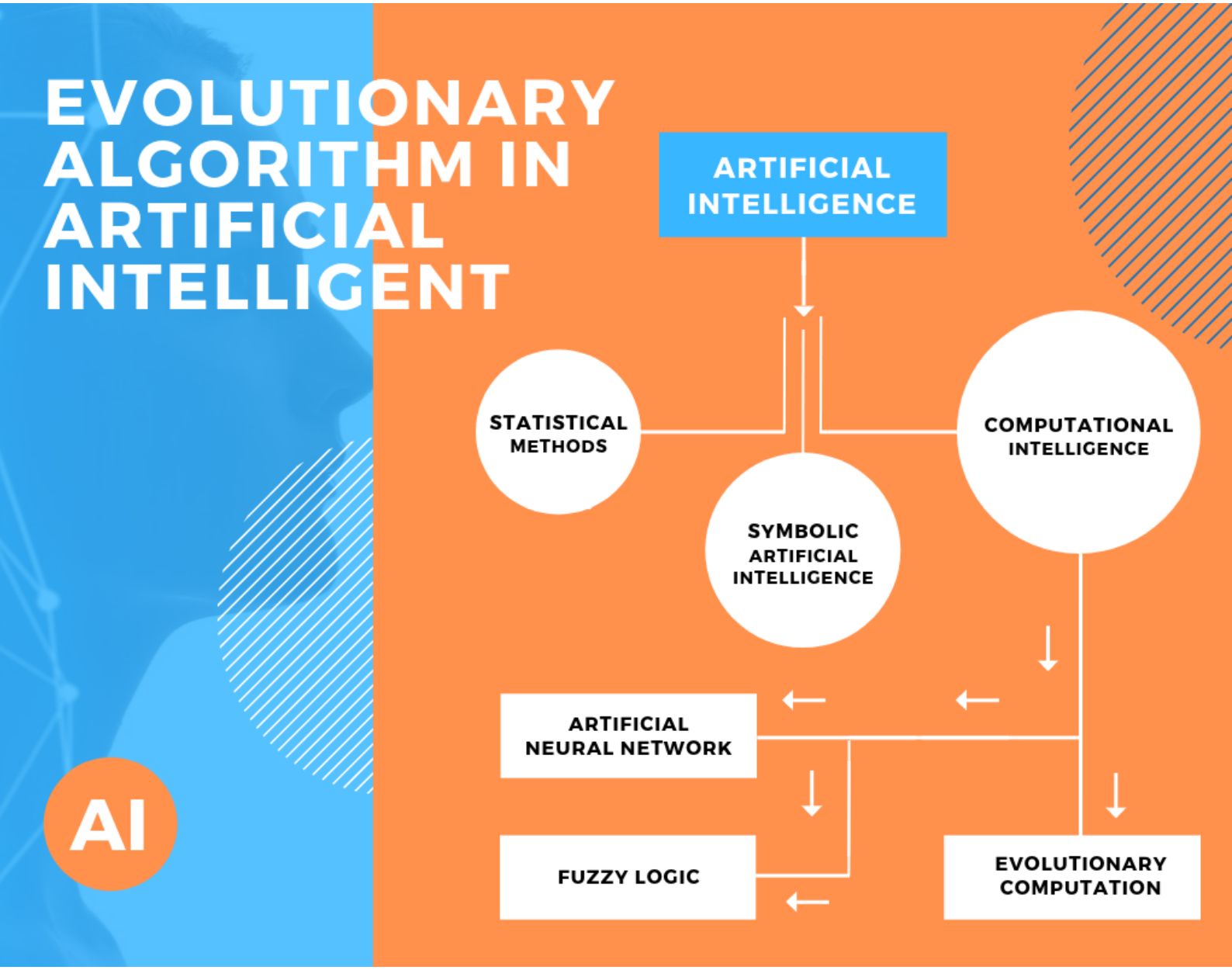



FIGURE 1: EVOLUTIONARY ALGORITHM IN ARTIFICIAL INTELLIGENT

## The details of Evolutionary Computation is given in Figure number: 1

An evolutionary algorithm (EA) in artificial intelligence is a subset of evolutionary computation; it is a metaheuristic optimisation algorithm depends on the genetic population. Evolutionary algorithm deployment methods are based on evolution of the species, it also called as biological evolution. The stages of biological evolution are reproduction, mutation, recombination, and selection. Where the EA is generally based on Charles Darwin's main evolutionary theory. The implementation of the evolutionary mechanisms differs significantly; however, the fundamental concept behind all these differences is similar. Evolutionary algorithms are defined by the presence of a population existence of individuals subjected to environmental stress, resulting in natural selection. It is also called as "survival of the fittest" As a consequence, the average fitness of the population is increased. The organism adaption degree to the environment is measured by the fitness. The greater the fitness, more adaptability and fitness of the organism to the environment. Evolutionary algorithms generally concentrate only on a subset of mechanisms identified through the biological evolutionary process (Câmara, 2015).

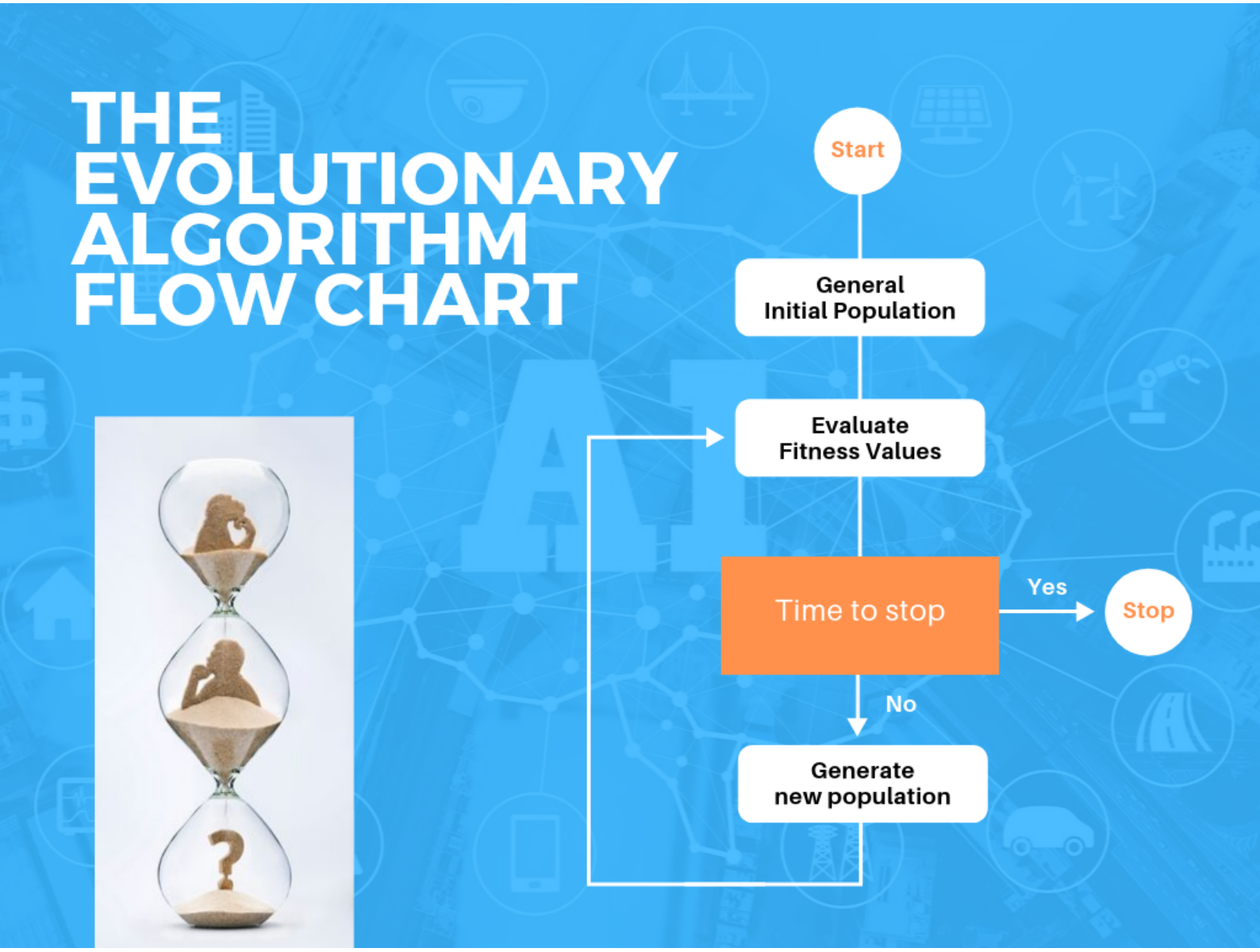



**FIGURE 2. THE EVOLUTIONARY ALGORITHM FLOW CHART**

The working process of the evolutionary algorithm is,

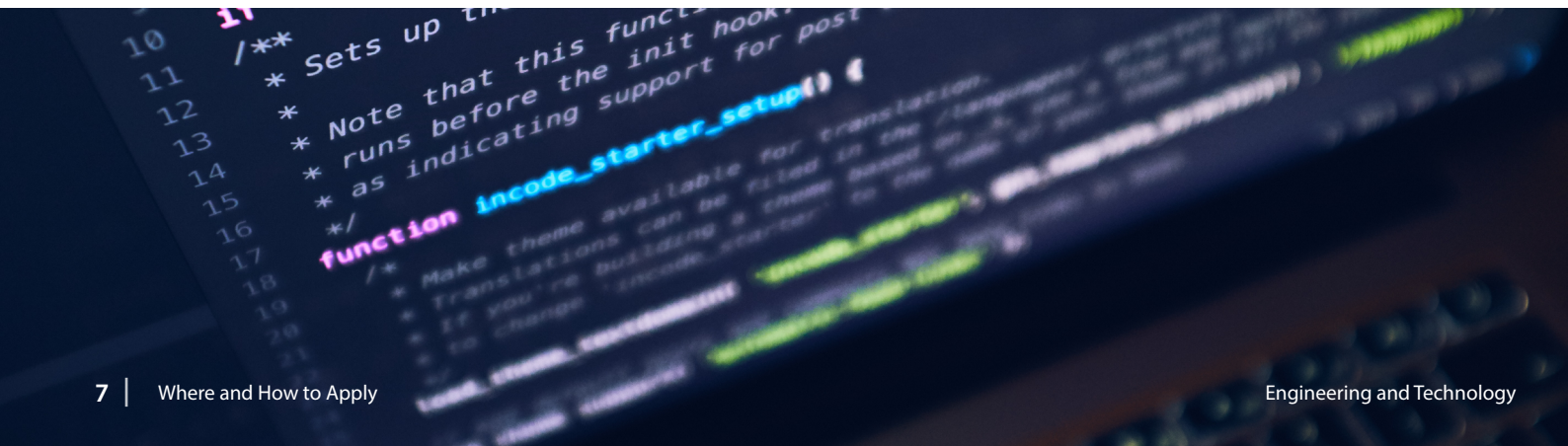
- **Population is initiated**
- **The general fitness is evaluated**
- **The new population is generated.**

**[** The process repeated until it finds the optimal solution **]**

Evolutionary computation is emerging technology, and the few algorithms use evolutionary computation are listed below,

1. Genetic Algorithm (GA)
2. Particle Swarm Optimization (PSO)
3. Differential Evolution
4. Firefly Algorithm
5. Imperialist Algorithm
6. Differential Evolution
7. Mini-Max Algorithm
8. Artificial Bee Colony (ABC)
9. Tabu Search Algorithm (TS)
10. Group Search Optimizer (GSO)
11. Function Of Evolutionary Algorithm
12. Particle Swarm Optimization (PSO)
13. Chemical Reaction Optimization (CRO)
14. Ant Colony Optimization(ACO) Algorithms
15. Expectation Propagation (EP) Algorithms
16. Biogeography-Based Optimization(BBO)
17. Artificial Immune System Algorithm (AIS)
18. Gravitational Search Algorithm (GSA)
19. Artificial Fish Swarm Algorithm (AF)
20. Migrating Birds Optimization (MBO)
21. Intelligent Water Drops Algorithm (IWD)
22. Artificial Bee Colony Algorithm (ABC)
23. Simulated Annealing Algorithm (SA)

Evolutionary Algorithms (EAs) are effective heuristic search techniques dependent on Darwinian evolution with strong flexibility and robustness features to find global solutions to the complicated optimization Issues. They are regulated by various parameters that are essential for the efficient and successful search. Some open source framework used for EA are OpenBEAGLE in C++, MOEA Framework in JAVA, HeuristicLab C#, EvA2 in Java, Evolving Objects in C++, Evolutionary Computation in Java (ECJ), Distributed Evolution Algorithms (DEAP) in Python.



# References

Câmara, D. (2015). Evolution and Evolutionary Algorithms. In Bio-inspired Networking (pp. 1–30). Elsevier. https://doi.org/10.1016/B978-1-78548-021-8.50001-6

Chen, L., & Wong, G. (2019). Transcriptome Informatics. In Encyclopedia of Bioinformatics and Computational Biology (pp. 324–340). Elsevier. https://doi.org/10.1016/B978-0-12-809633-8.20204-5

Martínez, C. M., & Cao, D. (2019). Integrated energy management for electrified vehicles. In Horizon-Enabled Energy Management for Electrified Vehicles (pp. 15–75). Elsevier. https://doi.org/10.1016/B978-0-12-815010-8.00002-8

Meyer-Baese, A., & Schmid, V. (2014). Genetic Algorithms. In Pattern Recognition and Signal Analysis in Medical Imaging (pp. 135–149). Elsevier. https://doi.org/10.1016/B978-0-12-409545-8.00005-4

Yang, X.-S. (2013). Optimization and Metaheuristic Algorithms in Engineering. In Metaheuristics in Water, Geotechnical and Transport Engineering (pp. 1–23). Elsevier. https://doi.org/10.1016/B978-0-12-398296-4.00001-5

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