


# Chapter 2

## Bio-Inspired Algorithms– Based Machine Learning and Deep Learning Models in Healthcare 6.0

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### **ABSTRACT**

*Recent advancements in deep learning (DL) and machine learning (ML) have opened doors for revolutionary applications in healthcare, with better patient care, diagnosis, and treatment. Bio-inspired algorithms, drawing inspiration from natural processes, have gained attention for their potential to enhance ML and DL models in this field. This paper explores current research directions and challenges in utilizing bio-inspired algorithms for advancing healthcare ML and DL models. We investigate their applications and facilitating feature selection, while acknowledging limitations such as scalability, interpretability, and robustness to noisy healthcare data. Ethical considerations surrounding their use in sensitive healthcare contexts are discussed. Through interdisciplinary collaboration and innovative algorithmic approaches, we strive to overcome these challenges and fully unlock the potential of bio-inspired algorithms in healthcare, ultimately aiming to revolutionize healthcare*

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*delivery for improved patient outcomes, personalized treatment strategies, and more accurate diagnoses.*

## 1. INTRODUCTION

Computer techniques that take cues from natural phenomena, procedures or actions noticed in biological systems are referred to as bio-inspired or nature-inspired algorithms these algorithms leverage the principles governing the functioning of various natural systems to resolve complex refinement and search problems. They are widely useful in a wide range of fields such as optimization, machine learning, robotics, and computational biology. Some of the key bio-inspired algorithms like Genetic Algorithms, Particle Swarm Optimization, Ant Colony Optimization, Artificial Immune Systems, and Swarm Intelligence (**Kar, 2016**) are discussed below.

### Genetic Algorithms (GA)

- Driven by natural selection and genetics, GA simulates the evolutionary basics of survival of the fittest.
- Solutions are represented as chromosomes (often binary strings), Along with a population of solutions that evolves over generations through processes like selection, crossover, and mutation.
- GA is used in optimization problems where the search space is vast and complex, such as in engineering design, scheduling, and financial modeling.

### Particle Swarm Optimization (PSO).

- PSO uses a population of particles to search across a search space in quest of the best answer. It is inspired by the social behavior of fish schools and bird flocking.
- Based on its own experiences and those provided by its neighbors, each particle modifies its position.
- PSO is used in optimization problems, particularly in continuous and multidimensional search spaces, such as in engineering design, neural network training, and robotics.

### Ant Colony Optimization (ACO).

- ACO mimics the collective behavior of ants in determining the shortest path between their nest and a food source, which is inspired by the foraging activity of ants.
- ACO algorithms use Pheromone pathways deposited via ants to mark good paths, guiding other ants to explore promising routes.

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