

Bio-Inspired AI and Optimization

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1. Introduction to the Course, Its Policies, and Its Motivation
2. Evolutionary Approach to Engineering Design Optimization
3. Population Genetics of Evolutionary Algorithms
4. The Four Forces of Evolution and The Drift Barrier
5. The Basic Genetic Algorithm and Its Implementation
6. GA Wrap - Options for Selection, Crossover, Mutation, & Extensions
7. Evolutionary Computing from Optimization to Programming
8. Genetic Programming, Immunocomputing, & Artificial Immune Systems
9. Immunocomputing Genetic Approaches for Diverse Solution Portfolio
10. Multi-Criteria Decision Making, Pareto Optimality, & Intro to MOEA
11. Multi-Objective Genetic Algorithms WeightVector-Based Approaches
12. Pareto Ranking and Moving from Communities to Meta-Populations
13. From DGAPGA to Niching Methods for Multi-Modal Optimization
14. Niching Methods in Multi-Modal Optimization
15. Introduction to Simulated Annealing and Entropy
16. From Maximum Entropy (MaxEnt) Toward Optimization by Sim Annealing
17. Toward SA Intro to Boltzmann Sampling and Monte Carlo Integration
18. Simulated Anneal. Wrap and Introduction to Ant Colony Opt. (ACO)
19. Ant Colony Opt. (ACO) and Intro. to Bacterial Foraging Opt. (BFO)
20. Bacterial Foraging Opt. (BFO) & Particle Swarm Optimization (PSO)
21. Neural Foundations of Learning
22. Feeding Forward from Neurons to Networks
23. Recurrent Networks and Temporal Supervision

24. Reinforcement Learning -Active Learning in Rewarding Environments
25. Learning without Teacher -Unsupervised & Self-Supervised Learning
26. Spiking Neural Networks and Neuromorphic Computation
27. Complex Systems Models of Computation -Cell. Automata & Neighbors

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