EVOLUTIONARY AND GENETIC ALGORITHMS, EVOLUTION OF COMPLEX NETWORKS AND GENE REGULATORY MODELS VERSUS DARWINIAN MECHANISMS

Summary

Darwinian mechanism can be clearly understood and its power can be easily observed in exact form of 'Evolutionary Algorithms'. In the first step a simplest algorithm is considered (without 'crossing-over') to make clear definitions. Fitness is defined as the similarity to an arbitrarily chosen ideal. This method substitutes simulation of long period of object life for measuring its death probability. Typically much more powerful is Genetic Algorithm. It contains additionally a crossing-over mechanism, which allows a set of evolving objects to be a magazine of alternative, simultaneously collected properties. As optimization algorithm, it is typically faster than algorithms without crossing-over.

Basic effects of evolution of complex networks, which can describe living objects, are discussed using Kauffman (Boolean) networks. The best parameters of network allowing adaptive evolution can be found near transition between order and chaos; Kauffman formulated the hypothesis known as 'life on the edge of chaos'. Kauffman suggests that spontaneous order (the biggest in this area) is a large part of observed order in living objects. This Kauffman's hypothesis is currently the strongest attack on area explored by Darwinian mechanisms. Although Kauffman's hypothesis for his gene regulatory model is experimentally confirmed by measuring stability, I am convinced that negative feedbacks are not taken into account sufficiently. For comparison, the gene regulatory model based on Banzhaf's idea is shortly described.