Evolutionary Algorithms   Winter 2017/2018

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Organisational Rules for Exam Admission

The lecture is accompanied by exercise sheets. At the beginning of each exercise lesson, the exercises are *voted for*. By voting for an exercise, one expresses one's willingness to present something about it. (Suggestions for a solution will be discussed, they need not be correct right away.) To the exam will be admitted who

1. voted for *at least* half of the exercises *and*
2. presented something for *at least* two exercises.

Exercise Sheet 1

Exercise 1   Theory of Evolution

The biological theory of evolution is heavily criticized, for example, by the so-called *Creationists* (who believe that the creation report as it is given in the Bible is *literally* correct). Among others, they put forward the following argument: "The theory of evolution cannot explain the complexity of life forms, because it is based on random trial and error. In analogy, it claims that it is possible to build a Volkswagen Beetle by filling a large box with a lot of scrap metal, and then shaking the box long enough. However, it is pretty obvious that this is no way of building cars. The existence of things as complex as cars, let alone living organisms, can be explained only by assuming that there is a(n intelligent) creator."

Which parts of this argument are correct, which are false? What would you reply to a Creationist who states this argument? Why do evolutionary algorithms work (even though an analogous argument can be put forward against them)?

Exercise 2   Theory of Evolution

Another argument of the Creationists: Many living creatures — mainly animals, but also several plants — reproduce in a sexual fashion. This has clear disadvantages w.r.t. the number of children / the amount of offspring: in one reproductive cycle, two parents create only one child (or only one set of children), while asexually reproducing living creatues produce two (or two sets of) children. Since in the theory of evolution progeny and reproductive ability are decisive factors (maximizing the number of children / the amount of offspring), sexual reproduction could never have developed. However, it clearly exists, and therefore the theory of evolution must be false.

Which parts of this argument are correct, which are false? What would you reply to a Creationist who states this argument? Can you think of evolutionary advantages of sexual reproduction?

Exercise 3   Theory of Evolution

Yet another argument of the Creationists: "The theory of evolution cannot be correct, because it cannot explain the complexity of living organisms. Merely look at the eye of mammals, e.g., the human eye: it consists of many different parts (retina, vitreous body, lense, pupil, muscles, with which it can be moved etc.), all of which have to fit and work together. This fit an working together can easily be explained by a(n intelligent) creator, not, however, by the random operation of evolution, since the individual parts of an eye do not provide an advantage without the corresponding others. Therefore the eye cannot have developed slowly, step by step, as the theory of evolution claims."

Which parts of this argument are correct, which are false? What would you reply to a Creationist who states this argument? What follows from this argument for evolutionary algorithms?

Exercise 4   Mendel's Laws

Collect some information (e.g., by searching the WWW/Internet) about Mendel's Laws of heredity. What do these laws state? How are these laws explained by genetics? Do Mendel's Laws also hold for /apply to evolutionary algorithms?