Lecture 1 - Artificial Life and Nature Inspired Algorithms

Artificial life

Is an interdisciplinary research enterprise aimed at understanding life-as-it-is (life as-we-know-it) on Earth and life-as-it-could-be (larger domain of bio-logic of possible life)

1.3 What life is and what it is not: definitions of life

From [Ada98], for an extended discussion see [Life10]:

- **Physiological Definition**: Focuses on physiological functions such as breathing, moving, digesting, etc, to construct a list of requirements that will distinguish living from non-living. *Outdated*.
- **Metabolic Definition**: Centers on the exchange of materials between the organism and its surroundings as the only requirement for it to be alive. *Too narrow?* or *Too general?*
- **Biochemical Definition**: Classifies living systems by their capability to store hereditary information in nuclear acid molecules. *Focuses on DNA/RNA. Too narrow.*
- **Genetic Definition**: Focuses on the process of *evolution* as the central defining characteristic of living systems, without regard to *how* the information is coded (i.e., independently of substrate).
- **Thermodynamic Definition**: Describes systems in terms of their ability to maintain low levels of *entropy* (i.e., disorder) despite a noisy environment [Sch44]. *Too general?*

- **Physics-based Definition**: Life is a property of an *ensemble* of units that *share information* coded in a physical substrate and which, in the presence of noise, manages to keep its entropy significantly lower than the maximal entropy of the ensemble, on timescales exceeding the "natural" timescale of *decay* of the (information-bearing) substrate by many orders of magnitude.