Master Thesis

Evolutionary Algorithms for the Estimation of Kinetic Parameters in Stochastic Biomedical Models

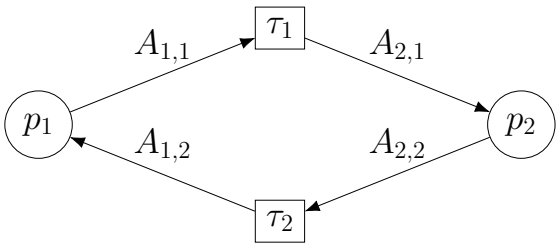
Keywords

Machine Learning, Evolutionary Algorithms, Stochastic Models, Petri Nets, Intensive Care, Sepsis

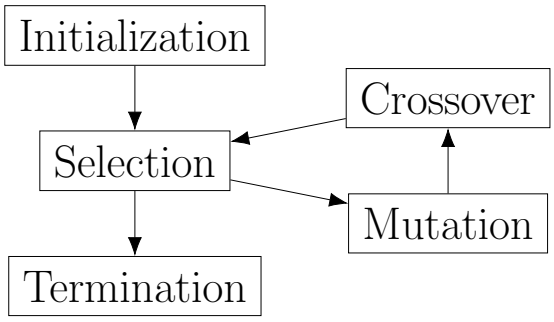
Description

Artificial intelligence and machine learning play an increasingly important role in medical and biomedical applications. One reason for this is that more and more medical data is being collected and made available to researchers. Furthermore, the high computing power available today ensures that computationally complex algorithms can be developed and executed. One of the most important tasks today is the development of AI solutions that can detect diseases based on measured data and recommend treatment for doctors.

One approach is the modeling of patient data using stochastic models such as **Stochastic Petri Nets** (SPNs). These models represent data over time and take into account a stochastic transition of states, which is often very well suited for medical applications. In this thesis the kinetic parameters of SPNs shall be reconstructed from data. For this purpose, **evolutionary algorithms** will be used. These algorithms are based on the theory of evolution: From a set of starting solutions the best ones are selected, combined and assembled to form a new generation of solutions. This process is repeated until the solution is sufficiently good or a stop criterion is reached.



(a) A stochastic Petri net



(b) Scheme of an evolutionary algorithm

Goal

- Research on Stochastic Petri Nets and Evolutionary Algorithms
- Development of an evolutionary algorithm for estimating the kinetic parameters of SPNs
- Evaluation of the algorithm on already known Petri nets and on real medical data (Application: **Sepsis** data from **intensive care medicine**)

Requirements

- Basic knowledge on mathematical optimization
- MATLAB/Python programming skills (Python preferred)

Contact

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