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Extension of existing machine learning parameter search pipeline by new optimization method

Type	Master's / Bachelor's Thesis
Title	The implementation and evaluation of a hyperparameter optimization strategy

Due to the increasing amount of available complex heterogeneous data in the field of medicine, data driven approaches such as machine learning and statistical inference became indispensable for the optimization of a vast variety of processes in precision medicine. Suitable systems can support medical professionals during diagnosis and clinical decision support, being thereby an important step towards personalized medicine.

However, these systems often rely on models, whose states are defined by a point of a high-dimensional parameter space. One important development step is to find a combination of parameters, that optimizes the overall model performance.

Therefore, we implemented a general parameter search pipeline in Python, which trains our models with different parameters in a k-fold cross-validation manner. The results get evaluated and based on a search strategy, new parameters get chosen, which probably lead to better results. Due to the unfeasibility of an extensive search of the whole parameter space, the implementation of a suitable optimization algorithm became indispensable.

The main task of this work will be the integration of such an algorithm into our working parameter search pipeline. The choice of the respective strategy has to be done by the applicant, based on some literature research. Thus, some motivation to read scientific literature independently is a basic requirement.

Afterwards, the search strategy should be evaluated by a suitable test pipeline based on some properly chosen example input data. As a main result, it should get empirically shown, that the new search algorithm outperforms our basic grid searcher regarding run time with a certain loss of result quality. The respective relation could get stated formally, making use of respective approaches from literature, depending on the background of the participant.

Further tasks can be the implementation of minor changes in the existing program architecture and maintenance of the pipeline.
Active participation from the side of the student by stating proper ideas is welcome.

Qualifications

- Fluent in at least one of the following languages: German / English / Spanish
- At the end of some Bachelor's or Master's degree course in a field such as (medical) computer science / engineering
- Experience with the programming language Python and with git
- Experience with multiprocessing in Python is wished, but not required

Contact

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