Hyperparameter Optimization for Biomedical Image Analysis with Deep Neural Networks

Abstract: The analysis of biomedical images has widespread applications, such as the diagnosis of cancer or diabetes, but often requires expert knowledge. Automating such analysis tasks is, therefore, an active and promising area of research. Recently, deep-learning-based approaches showed remarkable results in automating these tasks. However, deep learning algorithms can be susceptible to their hyperparameters and selecting those manually is a time-consuming and suboptimal process. This thesis addresses the question of whether hyperparameters of deep learning algorithms in the biomedical field can be optimized automatically, such that the performance is improved over manually selected hyperparameter configurations. I present empirical results which suggest that this is indeed the case. In particular, I implemented a cell detection algorithm based on an existing approach [Falk et al., 2019] and used the hyperparameter optimizer BOHB [Falkner et al. 2018] to optimize the hyperparameters of this approach, which compared to a handcrafted hyperparameter configuration, improved the F-score performance by 15%. I further propose a novel loss schedule, which I found to be an influential hyperparameter in the parameter importance study.