kernDeepStackNet: An R package for tuning kernel deep stacking networks
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Kernel deep stacking networks [1] (KDSNs) are a novel method for supervised learning in biomedical research and belong to the class of deep learning methods. Deep learning uses multiple layers of non-linear transformations to derive higher abstractions of the input features [2]. These can more efficiently represent complex dependencies of joint distributions [3]. Training of deep artificial neural networks is a non-convex optimization problem, which may result in local optima and slow convergence. Kernel deep stacking networks are a computational faster alternative, which are based on solving multiple convex optimization problems by combined kernel ridge regressions with random Fourier transformations.

Tuning of KDSNs is a challenging task, as there are multiple hyper parameters to tune. We propose a new data-driven tuning strategy for KDSNs using model based optimization (MBO) [4]. The performance criterion is RMSE on cross validation samples, and noisy Kriging is used as surrogate model. New design points are chosen by maximisation of the expected improvement criterion.

Numerical studies show, that the MBO approach is substantially faster than traditional grid search strategies. Further analysis of real data sets demonstrate, that tuned KDSNs are competitive to other state-of-art machine learning techniques in terms of prediction accuracy. The fitting and tuning procedures are implemented in the R package kernDeepStackNet.

References
4 Welchowski, Schmid, 2016, A framework for parameter estimation and model selection in kernel deep stacking networks, Artificial Intelligence in Medicine, Volume 70, Pages 31–40

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