Algorithmic stability and generalization of an unsupervised feature selection algorithm

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Abstract

Feature selection, as an important dimensionality reduction technique, reduces data dimensionality by identifying an essential subset of input features, and it can provide interpretable insights into learning and inference processes. Algorithmic stability is a key characteristic of an algorithm in its sensitivity to perturbations of input samples. In this paper, we propose an innovative unsupervised feature selection algorithm. The architecture of our algorithm consists of a feature scorer and a feature selector. The scorer trains a neural network (NN) to score all the features globally, and the selector is in a dependent sub-NN that locally evaluates the representation abilities to select features. Further, we present algorithmic stability analysis and testify our algorithm has a performance guarantee by providing a generalization error bound. Empirically, extensive experimental results on 10 real-world datasets corroborate the superior generalization performance of our new algorithm over contemporary algorithms. It is worth noting that in terms of the performance of the downstream classifier, the features selected by our algorithm have comparable performance to the original features.

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