Ryszard Szupiluk, Tomasz Ząbkowski, Krzysztof Gajowniczek

Independent Component Analysis for ensemble predictors with small number of models

In this paper we develop an independent component analysis (ICA) approach for ensemble predictions. Its main idea is based on decomposition of the prediction results into underlying independent components. Some of these components may be associated with the target value and some of them can be treated as noise or interference. Elimination of noises, termed as destructive components, should result in prediction improvement. The process can be perceived as data filtration aimed to reveal hidden noises in a way that is typical for blind source separation techniques. Standard filtering using ICA involves the components separation into source signals (separation step), the identification and elimination of noise components, and then inverse procedure with respect to separation (remixing step).

One of main problems in this concept is proper destructive component identification and its transformation. In the simplest case for small number of model we can perform full computational search with each basis component elimination and checking its impact on final prediction. Unfortunately in practice we can’t expect that our components are pure destructive or constructive, especially taking into account small number of models. Therefore, filtration processes should be applied rather than elimination. In prediction context with historical data for target modelling such filtration can be realized as supervised learning.

The term ensemble or aggregation is a consequence of the fact that the final result is a combination of individual results from different models. Unlike the other popular ensemble methods like bagging or boosting, there are no assumptions to both, the form of aggregated models and the criteria for model assessment. In other words, we can aggregate models (more specifically, the results of their prediction) regardless to specific criterion. Another advantage of the presented method is its effectiveness of improving the prediction results with a relatively small number of aggregated models.