Deep Neural Network Regression as a Component of a Forecast Ensemble

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Marquette University's GasDay Project specializes in short-term load forecasting of natural gas demand. Traditionally, this forecasting is done using artificial neural networks and linear regression. These two forecasts are used as components of an ensemble that adjusts its weights based on recent residuals of each component. For example, if the linear regression forecaster is consistently outperforming the artificial neural network, then the weight placed on the linear regression forecast is greater. Despite the quality of this ensemble forecaster, literature would suggest that including addition quality forecasters would improve this ensemble.

In many fields, deep neural networks are being used to replace standard backpropagation neural networks and other machine learners in solving time series and classification problems and often have found good solutions. In a related paper, the authors have shown that deep neural networks (DNN) often outperform either the linear regression or standard artificial neural network components on the short-term energy load forecasting problem. This paper examines the viability of using DNNs as component models in the GasDay ensemble.

The ensemble of interest is evaluated using weighted MAPE on 90 natural gas data sets and compared to the current GasDay ensemble as well as ensembles with other candidate component models. The DNN-enhanced ensemble performs better on this metric than the other ensembles evaluated. In addition, the weights given by the ensemble are evaluated to see how often each of the components receives the greatest weighting. Although the DNN component

usually has the greatest weight, it rarely has a majority weight. This is to be expected based on the performance of each of the component models.