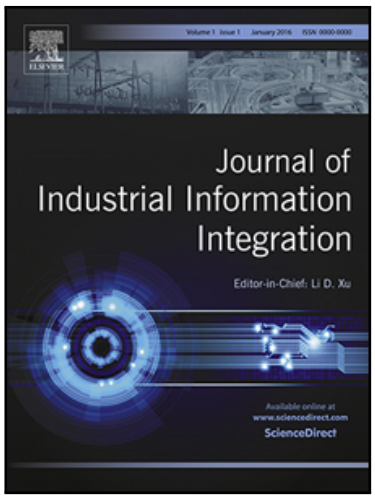

Development of KSVGRNN: A Hybrid Soft Computing Technique for Estimation of Boiler Flue Gas Components

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Development of KSVGRNN: A Hybrid Soft Computing Technique for Estimation of Boiler Flue Gas Components

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Abstract:

In this research paper, a novel hybrid technique named KSVGRNN, which combines a multi-class support vector machine (SVM) and a generalized regression neural network (GRNN), has been developed for obtaining the composition of boiler flue gas mixtures. This hybridization was made by the support of K-means clustering algorithm and grid search technique. In the first phase, K-Means clustering technique has been utilized and the size of the training vectors has been reduced by employing a multiclass SVM. In the second, a GRNN has been trained for estimating the individual gas concentration in the flue gas mixture. The reduction of training vectors through SVM has been shown to improve the generalization capability of GRNN. Grid search has been utilized to obtain the optimal parameters of SVM. This hybrid technique has been validated by measuring its performance by processing volatile organic component (VOC) data acquired from quartz crystal microbalance (QCM) and SnO_2 semiconductor type sensors utilized by other researchers in this domain. Further studies have been carried out to assess the discriminating and estimation capability of the proposed hybrid technique for real-time flue gas data obtained from two different analyzers namely ORSAT® and KANE®. The outcome of these studies, observations and analysis clearly indicate the exceptional performance of the proposed hybrid model in classifying and estimating the flue gas components in the machine (Analyzer) independent manner.

Keywords: Flue gas mixture, PNN, GRNN, Prediction error, Feature selection.