Soft sensing method of marine enzyme based on dynamic neural network

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Abstract

Enzyme activity is very important information during marine enzyme fermentation control process while it cannot be detected online by physical sensors. Various soft sensing technologies have been proposed to solve this problem including neural network (NN) soft sensing. However, the current exist NN soft sensing methods are usually static ones and cannot reflect the dynamic characteristics of the fermentation process. To solve this problem, a kind of dynamic neural network (DNN) soft sensing model was proposed in this paper. The model was composed of a series of differentiators to represent the dynamic character and a multilayer feedforward NN to represent the nonlinear relation. The dynamic characteristics of the variables were reflected in the model through the differentiation of the variables and the nonlinear relation was well established through the reasonable structure of the NN. It was verified by the experiment that this kind of DNN soft sensing model obtained better result compared with the traditional static neural network (SNN) one. The relative mean square error (RMSE) of the DNN model is 130.1 g/L, which is less than 1/2 of the SNN model. The max relative error (MRE) of the DNN model is also decreased dramatically from 846.2 g/L of SNN model to 350.2 g/L.