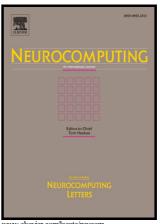
## Author's Accepted Manuscript

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www.elsevier.com/locate/neucom

PII: S0925-2312(16)31167-5

http://dx.doi.org/10.1016/j.neucom.2016.10.005 DOI:

NEUCOM17617 Reference:

To appear in: *Neurocomputing* 

Received date: 28 July 2015

Revised date: 26 September 2016 Accepted date: 7 October 2016

Cite this article as: Weiming Shao and Xuemin. Tian, Semi-supervised Selective Ensemble Learning Based On Distance to Model for Nonlinear Soft Senso Development, Neurocomputing, http://dx.doi.org/10.1016/j.neucom.2016.10.005

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Semi-supervised Selective Ensemble Learning Based On Distance to Model for

Nonlinear Soft Sensor Development

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**Abstract:** 

Data-driven soft sensors have been widely used in process systems for delivering online estimations of hard-to-measure yet

important quality-related variables. However, in many data-driven soft sensor applications, the process may be strongly nonlinear,

and the number of labeled samples is limited, which are two major difficulties in developing high-accuracy soft sensors. To cope

with this issue, a novel soft sensing method based on semi-supervised selective ensemble learning strategy is proposed. In the

proposed method, the process is initially localized by an adaptive process state partition approach, where the information of

unlabeled samples can be incorporated. Subsequently, a new distance to model (DM) criterion is defined for selective ensemble

learning, which can overcome the drawback of the k nearest neighbor method. The newly defined DM criterion along with the

incorporation of unlabeled samples can help to describe the relationships between query samples and local models more accurately,

and therefore is able to provide higher estimation accuracy. The parameters of the proposed method are finalized automatically by

the particle swarm optimization technique. The proposed method is investigated using three real-life benchmark datasets, and the

simulation results demonstrate the effectiveness of the proposed method in dealing with nonlinear regression problems in the

process system and in the urban pollutant monitoring area.

Keywords: nonlinear soft sensor, semi-supervised ensemble learning, selective ensemble learning, distance to model, adaptive

process state partition, particle swarm optimization.

1. Introduction

In process industries, a large amount of hardware sensors are installed to provide data for the purpose of

monitoring and control [1]. However, many quality-related key variables can not be measured online by these

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