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A Deep Learning based Data Driven Soft Sensor for Bioprocesses

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Highlights

- Deep learning is introduced for soft sensor modeling in complex bioprocesses
- Semi-supervised learning improves the efficacy of deep neural networks
- Deep architectures perform better than shallow architectures for large data sets
- Deep learning is a promising modelling technique for highly data driven bioprocesses

ABSTRACT

Developing accurate and robust sensors for nonlinear and highly varying systems is a challenge. Deep learning, an advanced technique to learn deep architectures, has become a popular training strategy while dealing with complex problems. In this paper, Deep learning has been introduced to develop data driven soft sensors for estimating crucial parameters in two fermentation processes, namely, Streptokinase and Penicillin. Additionally, the performance of the developed soft sensor is compared to an SVR based soft sensor. The results clearly indicate that Deep learning is an attractive alternative to traditional techniques for soft sensor modelling as it represents nonlinear systems better, makes full advantage of process data by also incorporating unlabelled data and handles large datasets efficiently. Deep learning proves to be a promising technique for soft sensor modelling in highly data driven complex bioprocesses.

KEYWORDS : Deep learning, Deep Neural Networks, Soft-Sensor, Streptokinase, Penicillin, Fermentation

NOMENCLATURE

S	Substrate Concentrations
s_0	Initial Substrate Concentrations