



OPEN ACCESS

EDITED AND REVIEWED BY
Fengqi You,
Cornell University, United States

*CORRESPONDENCE
Leo Chiang,
hchiang@dow.com

SPECIALTY SECTION
This article was submitted to
Computational Methods in Chemical
Engineering,
a section of the journal
Frontiers in Chemical Engineering

RECEIVED 28 September 2022
ACCEPTED 10 October 2022
PUBLISHED 28 October 2022

CITATION
Chiang L, Reis M, Shuang B, Jiang B and
Valleau S (2022), Editorial: Recent
advances of AI and machine learning
methods in integrated R&D,
manufacturing, and supply chain.
Front. Chem. Eng. 4:1056122.
doi: 10.3389/fceng.2022.1056122

COPYRIGHT
© 2022 Chiang, Reis, Shuang, Jiang and
Valleau. This is an open-access article
distributed under the terms of the
[Creative Commons Attribution License
\(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or
reproduction in other forums is
permitted, provided the original
author(s) and the copyright owner(s) are
credited and that the original
publication in this journal is cited, in
accordance with accepted academic
practice. No use, distribution or
reproduction is permitted which does
not comply with these terms.

Editorial: Recent advances of AI and machine learning methods in integrated R&D, manufacturing, and supply chain

Leo Chiang^{1*}, Marco Reis², Bo Shuang¹, Benben Jiang³ and
Stephanie Valleau⁴

¹Dow Chemical Company, Midland, MI, United States, ²Department of Chemical Engineering, University of Coimbra, Coimbra, Portugal, ³Department of Automation, Tsinghua University, Beijing, China, ⁴Department of Chemical Engineering, University of Washington, Seattle, WA, United States

KEYWORDS

AI, machine learning, manufacturing, process monitoring, deep learning

Editorial on the Research Topic

Recent advances of AI and machine learning methods in integrated R&D, manufacturing, and supply Chain

In the Industry 4.0 era, chemical process industry is embracing the broad adoption of Artificial Intelligence (AI) and Machine Learning (ML) methods and algorithms. This Research Topic aims to highlight state-of-the-art research in the fields of R&D, Manufacturing, and Supply Chain management. The papers demonstrate how AI/ML developments are contributing to speed up the product development cycle and how the industry is operating towards breakthrough performances in safety, reliability, and sustainability. The Research Topic is composed by four papers, covering different corners of the spectra of methodologies, processes and problems, as can be appreciated by the following short descriptions of each contribution.

Webb et al., addressed the problem of exploring process databases to make robust diagnosis of the relevant modes, which can either be different operational conditions or faults. The authors explore dimensionality reduction (PCA, UMAP) and clustering methods (*K*-means, DBSCAN, and HDBSCAN). The article is therefore aligned with the current interest in exploiting data for improving process operations.

In a similar application domain, Ma et al., demonstrated how nonlinear methods (such as LSTM neural networks) can integrate with linear methods (such as PCA) to optimize the decoking frequency in an industrial cracking furnace. The article is a testimony of successful AI and ML applications in manufacturing.

In the scope of industrial process monitoring, Ji et al., designed and demonstrated a multi-scale method based on time-frequency analysis (wavelet packet decomposition) and feature fusion (support vector data description). This work goes beyond the use of single scale features,

by traditional algorithms. The article is well aligned with emerging research exploring data-driven approaches in process monitoring.

Finally, [Vermesan et al.](#), investigated an important problem of real-time monitoring and maintenance for industrial manufacturing control and diagnostics. The authors developed an AI based edge processing real-time maintenance system, which integrates condition monitoring, fault detection and diagnosis using ML algorithms including deep neural network, random forest, and SVM. The article provided a success case of applying AI and ML to manufacturing processes.

We hope this rich mix of contributions spikes the readership's curiosity to read the papers in this Research Topic and develop their own ideas to address the challenges laying ahead.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

Authors LC and BS were employed by the company Dow Chemical Company.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.