Machine learning for chemical and process engineering: introducing data-centric thinking into Chemical Engineering curricula

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Although the teaching of machine learning and data analytics is transforming engineering across various fields, it still plays a limited role in chemical engineering education programs in Italy and internationally.

This presentation will offer an overview of the seven-year course "Machine Learning for Process Engineering," which is part of the M.S. in Chemical and Process Engineering curriculum at the University of Padua. It will discuss the course content, teaching approach, and strategies for engaging students. The course provides a hands-on, application-oriented introduction to statistical modelling, supervised and unsupervised learning, and dimensionality reduction modelling for process understanding. It also covers data-driven process monitoring, soft sensing, and the design and analysis of experiments. All topics are contextualized through real-world industrial case studies.

While these disciplines are not yet core components of traditional chemical engineering education, they are becoming essential for navigating the complexity of modern industrial systems, which are increasingly shaped by variability, big data, and the demand for greater efficiency, quality, and sustainability. Accordingly, this presentation aims to foster discussion about the strategic role of artificial intelligence and data-driven methodologies in shaping the education of future chemical and process engineers and to explore opportunities for curricular innovation and professional development through integrating these emerging disciplines.

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