EBNet
Environmental Biotechnology

UKRI Engineering and Physical Sciences Research Council

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ENVIRONMENTAL BIOTECHNOLOGY NETWORK

AI and ML in the Bioeconomy WG

AI & ML in the Bioeconomy (AI&ML WG)

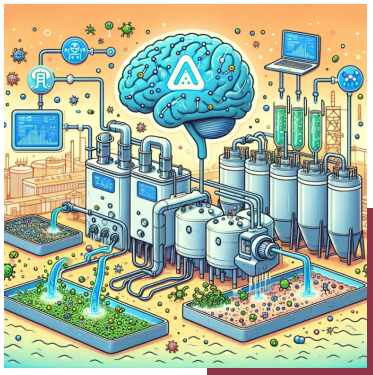

Led by Dr Oliver Fisher and Prof Rachel Gomes, University of Nottingham

The bioeconomy continues to grow, offering an alternative to fossil resources and facilitating the transition to net zero, circular economy and/or industrial symbiosis. However, bioprocesses have complex dynamics and are subject to disturbances, which makes modelling them challenging yet necessary for process understanding, model-based optimisation and scale-up. This is further compounded when utilising waste-based feedstocks, which have variable composition and characteristics in time and space. Artificial intelligence (AI) and machine learning (ML) represent solutions for tackling emerging challenges in bioprocesses, such as resource specification and availability, parameter dimensionality, nonlinearity, risk mitigation, and complex metabolisms. Multivariate data analysis, deep learning, reinforcement learning, and other novel machine learning techniques start to complement and replace traditional data analysis approaches to accelerate bioprocess development and application.

As AI and ML are increasingly deployed within the bioeconomy, it is important to understand the social impact of their use. This WG also aimed to understand the equality, diversity and inclusion considerations of using AI and ML to progress bioprocesses development and application.

ACTIVITY SYNOPSIS

This WG ran a very popular webinar in early 2024: *Unlocking AI and Machine Learning's Potential for Environmental Biotechnology*. Group members also worked on the £1.4M EPSRC grant on *Artificial Intelligence Enabling Future Optimal Flexible Biogas Production for Net-Zero* led by the University of Surrey. Several papers have been published, one jointly with the Process Integration and Sustainability Assessment (PISA) WG.



WG Publications

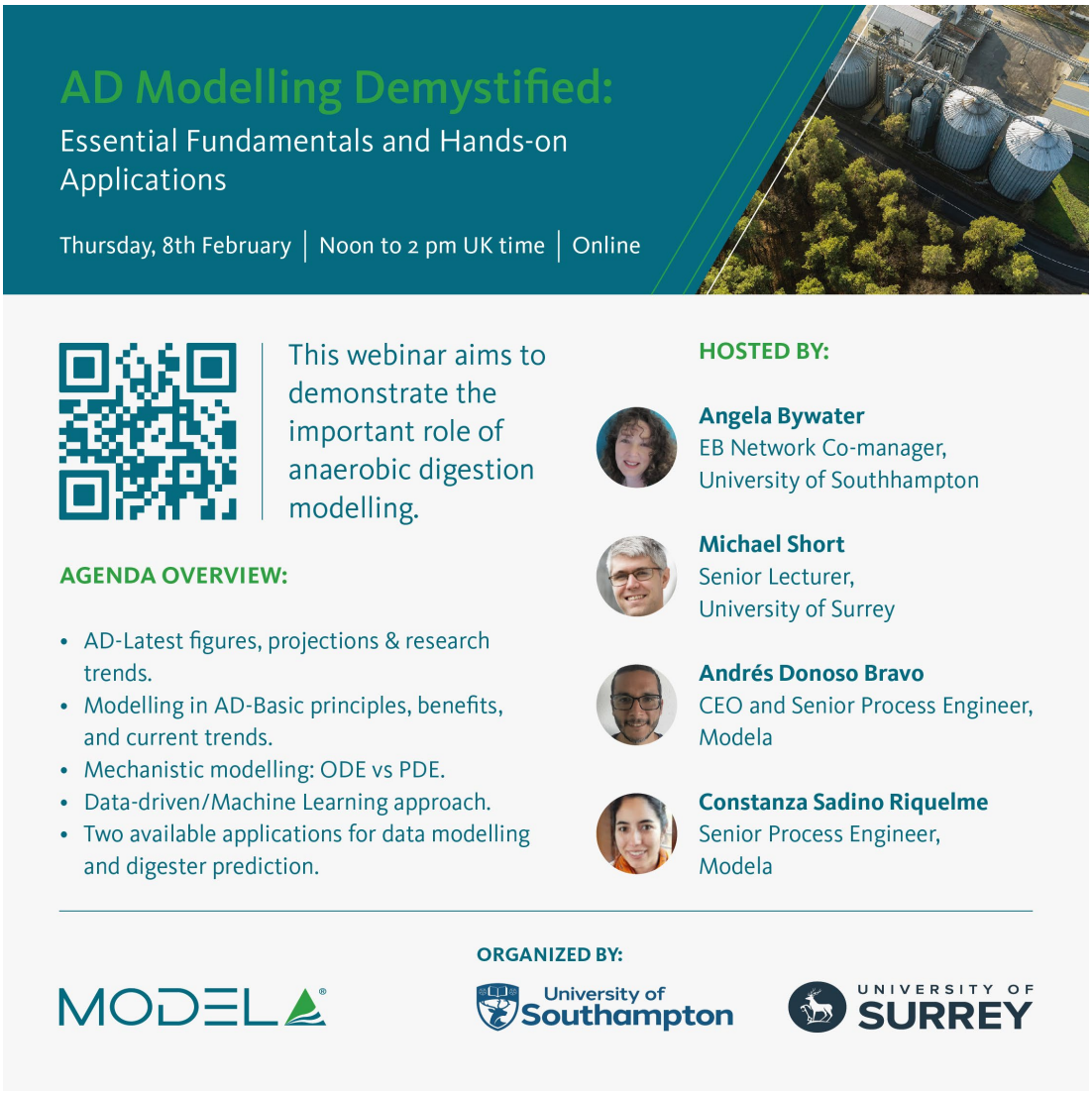
Breaking barriers to modelling biotechnologies with machine learning
By: Fisher, O. J., Short, M., Zhang, D., Guo, M., & Gomes, R. L. (2025). Resources, Conservation and Recycling, 215, Article 108071. https://doi.org/10.1016/j.resconrec.2024.108071

Biogas Beyond Boundaries: Novel Algebraic Equations for Global Warming Standardization in Anaerobic Digestion Systems with Critical Life Cycle Analyses
By: Zhang, R., Sadhukhan, J., Zhang, D., Short, M., McKechnie, J., Liu, Y., Bywater, A., Murali, R., Nnorom, M.A., Dolat, M. and Guo, B.,. Available at SSRN 4745165.
http://dx.doi.org/10.2139/ssrn.4745165

Novel Life Cycle GHG Formulations of Anaerobic Digestion Systems Aligned with Policy
By: Zhang, R., Sadhukhan, J., Zhang, D., Short, M., McKechnie, J., Liu, Y., Bywater, A., Murali, R., Dolat, M., Zhang, D. and Zarei, M.,. Available from SSRN 4837715.
http://dx.doi.org/10.2139/ssrn.4837715

ACTIVITY SYNOPSIS ctd

Presentation by EBNet Network manager Angela Bywater in conjunction with the AI4AD project



WG Publications ctd

Publications by WG members involved in the AI4AD project

Dynamic feed scheduling for optimised anaerobic digestion: An optimisation approach for better decision-making to enhance revenue and environmental benefits. Dolat, M., Murali, R., Zarei, M., Zhang, R., Pincam, T., Liu, Y.Q., Sadhukhan, J., Bywater, A. and Short, M., 2024. *Digital Chemical Engineering*, *13*, p.100191.

Optimal feed scheduling and co-digestion for anaerobic digestion sites with dynamic demands. Dolat, M., Murali, R., Zhang, R., Zarei, M., Zhang, D., Zhang, D., Sadhukhan, J. and Short, M., 2024. In Computer Aided Chemical Engineering (Vol. 53, pp. 1705-1710).

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