

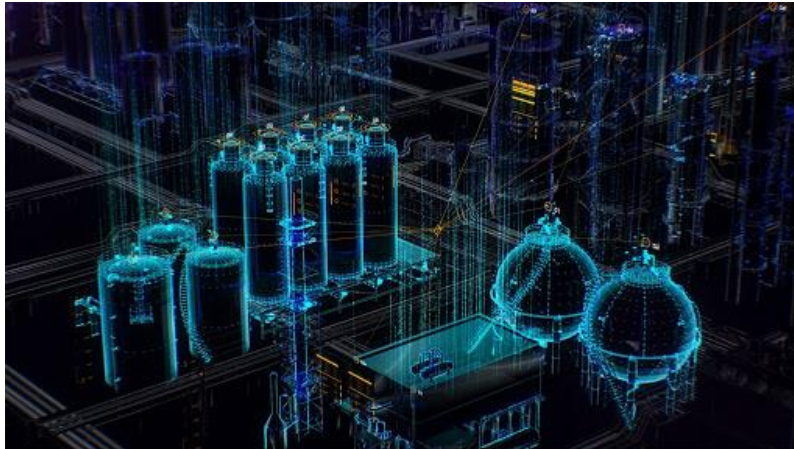
- System models – from digital twins to autonomous systems
- Impact of machine learning on systems modelling
- Systems modelling as an automation challenge

What is the Future of Systems Modelling?

FIPSE-5 Tuesday 28 June 2022
Crete, Greece

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ABB Reader of Autonomous Industrial Systems
Imperial College London

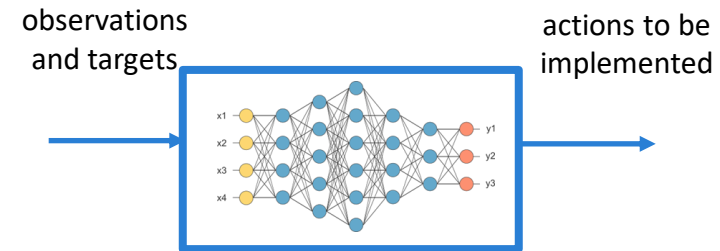
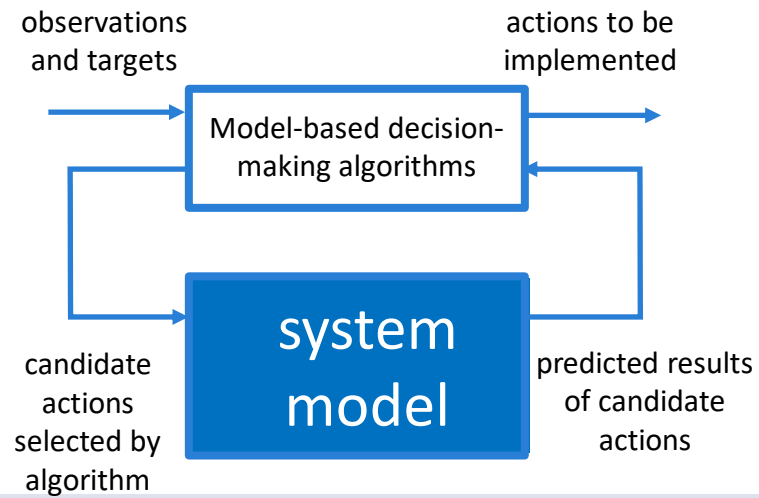
Need for systems models are growing



- Digital twins are more than mathematical models
- But for many use cases – particularly in the process industry – system models are key
 - Predictions, scenario based analysis, optimisation...

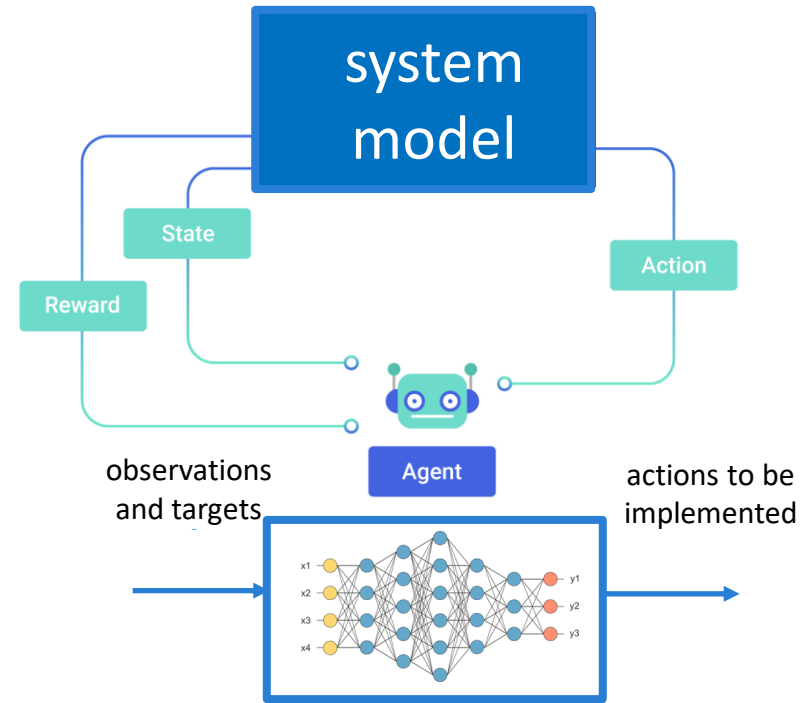
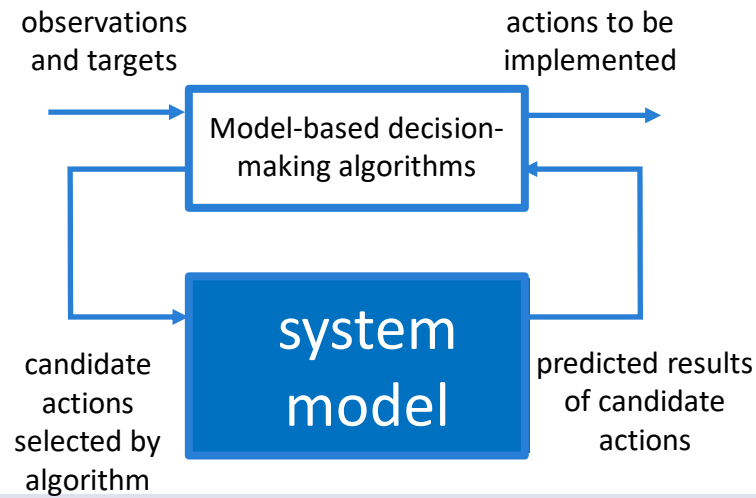
From digital twins..

Need for systems models are growing



..to autonomous systems

Need for systems models are growing



..to autonomous systems

Building and maintaining models



Six months ago



Today

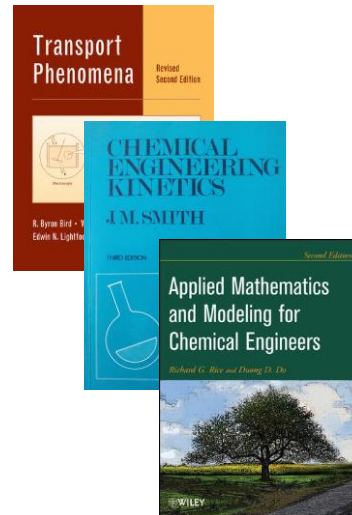
Find the seven differences

Machine learning – new kid on the block

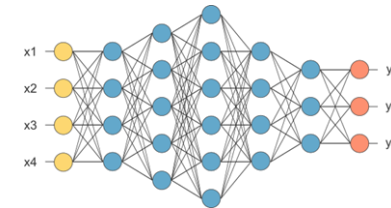
$$x_{t+1} = \underbrace{f(x_t, u_t, \theta)}_{\text{First principles model}} + \underbrace{h(x_t, u_t)}_{\text{Machine learning model}}$$

system
model

=

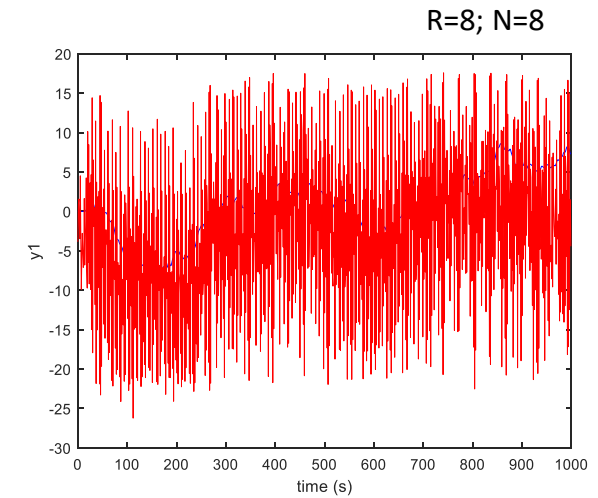
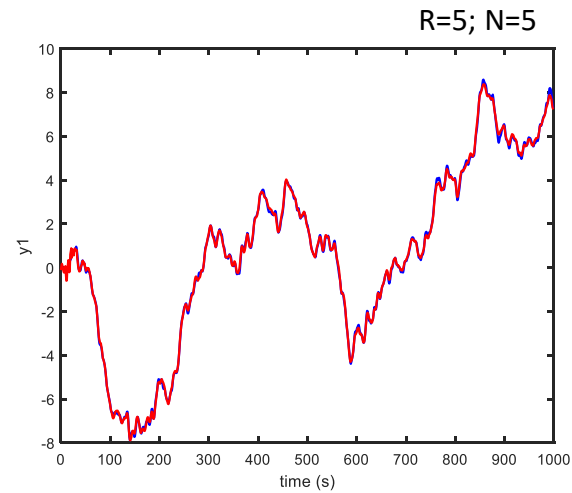
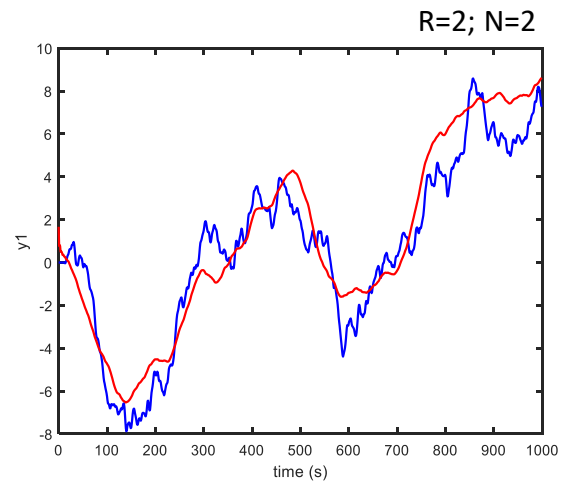


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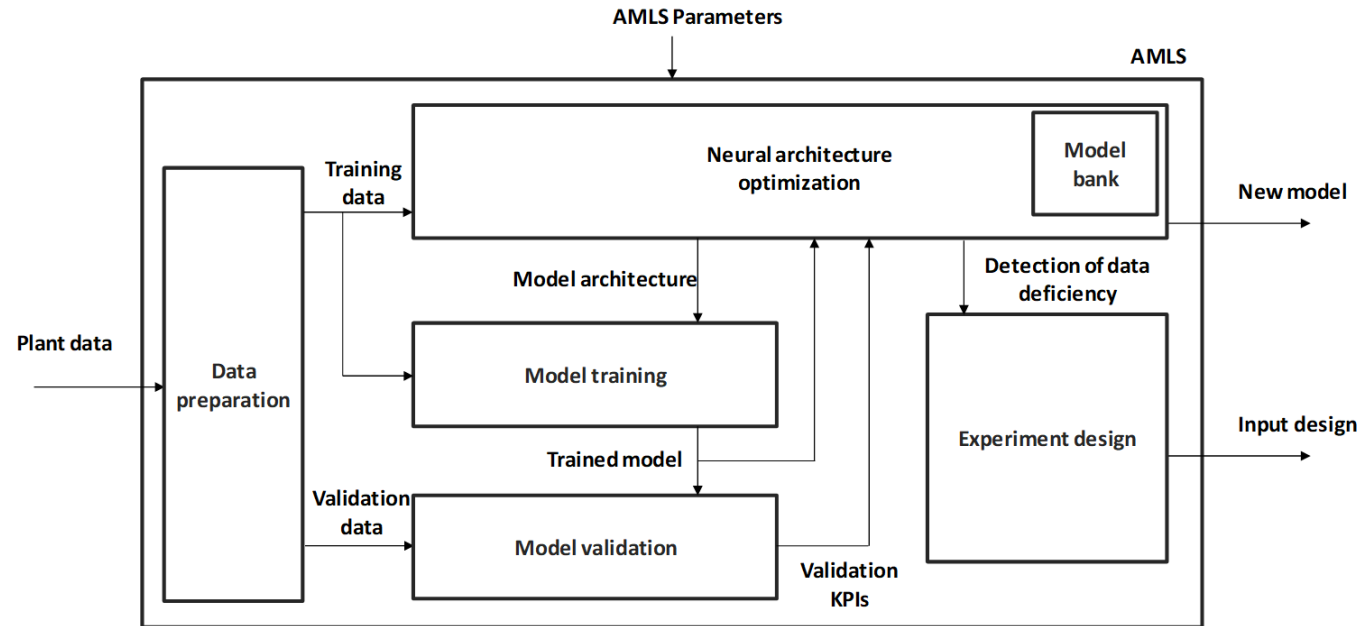


The best of both worlds

ML – many models many hyperparameters

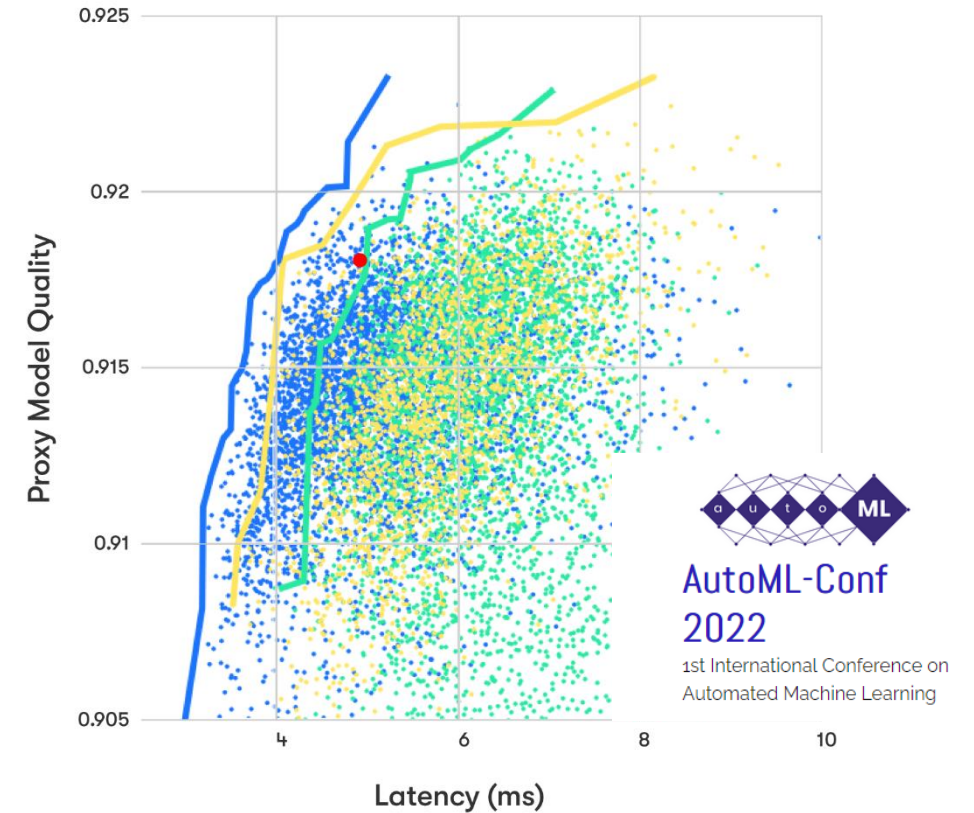
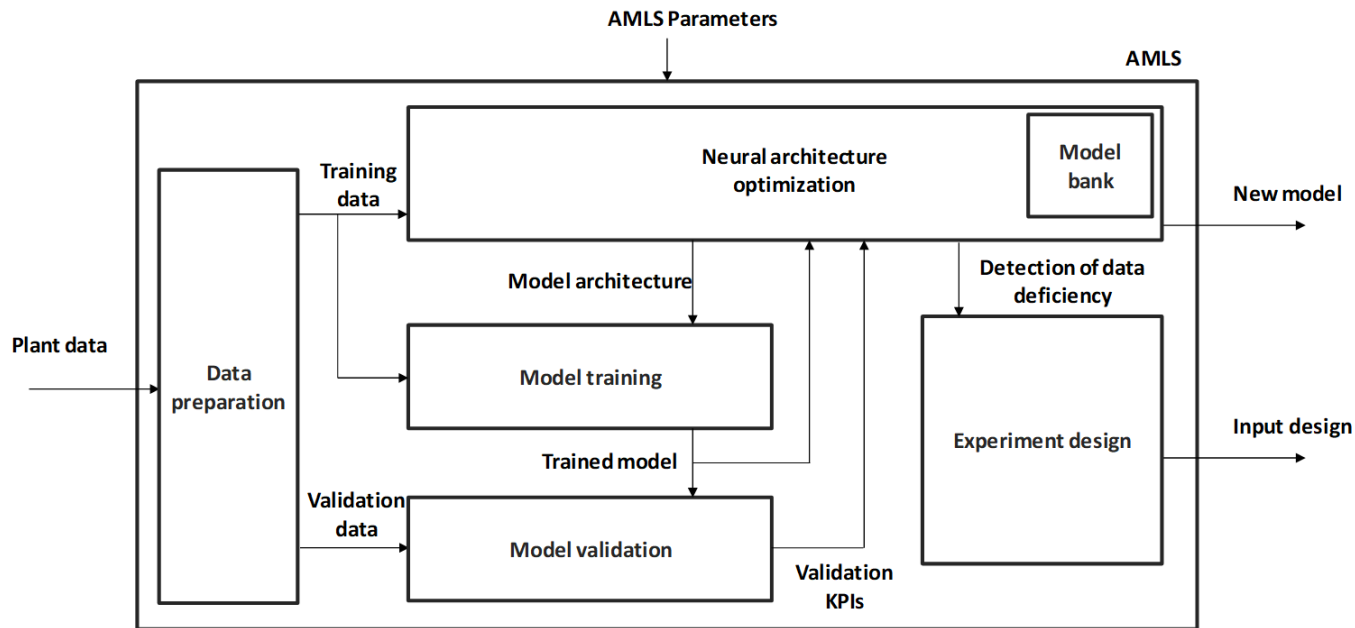


What are we going to do with the model? Real-time control? Soft-sensors? Design optimisation?



Can we make the building of models autonomous?

Making model building autonomous



<https://medium.com/waymo/automl-automating-the-design-of-machine-learning-models-for-autonomous-driving-141a5583ec2a>

Can we make the building of models autonomous?