

## NEURAL PARAMETER CALIBRATION FOR LARGE-SCALE SYSTEMS

THOMAS GASKIN

In this talk, I will present research on a novel technique to estimate system parameters using neural networks. By training a neural network to learn differential equation parameters from noisy observations, which can range from steady-state data to time series, predictive and interpretable mathematical models can be fit to the data. The use of deep neural networks further allows inferring functional expressions for the parameters. I will present a wide range of applications, from inferring line failure locations in power grids or learning infection parameters from observing the spread of Covid, to global migration flow patterns and food distribution networks. The method is a unique combination of constrained optimisation and deep learning, which in many situations also allows for meaningful uncertainty quantification. So far, our approach has shown to significantly outperform sampling schemes both in terms of predictive accuracy and computational speed.