Speaker: Elizaveta Semenova (Imperial College London)

Date: 06/02/2026 at 13:15 in 4 West 1.7 (Wolfson Lecture Theatre)

Title: Pre-trained deep generative surrogates aiding Bayesian inference

Abstract:
Recent advances have demonstrated the potential of deep generative models, such as variational autoencoders (VAEs), to encode Gaussian Process (GP) priors or their finite realizations, thereby creating deep generative surrogates. These learned generators can serve as drop-in replacements for original priors within Markov Chain Monte Carlo (MCMC) methods, significantly enhancing inference efficiency. However, this approach loses information about the original priors' hyperparameters, rendering hyperparameter inference impossible and the learned priors less distinct. To overcome this limitation, a new method called PriorCVAE has been developed. By conditioning the VAE on stochastic process hyperparameters, PriorCVAE enables the joint encoding and inference of both hyperparameters and GP realizations. Notably, PriorCVAE is model-agnostic, making it suitable for a wide range of applications, including encoding solutions to ordinary differential equations (ODEs) or stochastic process realisations. This talk will begin with an overview of spatial statistics before introducing the PriorVAE method for encoding prior realizations. I will discuss the advantages and limitations of PriorVAE, which will lead into the introduction of PriorCVAE and the broader concept of deep generative surrogates. Finally, I will introduce the deepRV model, demonstrate practical applications of all three, and highlight promising directions for future research.