Course descriptor B31XN

Course code	**B31XN**
Course title	Scalable Inference and Deep Learning
Credits	15
School	Engineering and Physical Sciences
SCQF Level	11
Semester	2
Aims	• Introduce state-of-the-art computational methods for performing inference from high dimensional data (Scalable optimisation, Deep Learning and Scalable Bayesian inference) • Investigate applications for imaging, computer vision, machine learning, etc.
Syllabus	**Scalable Optimization** • Parallel and distributed algorithm • Stochastic/randomized algorithms • Applications to high-dimensional problems (e.g. imaging, computer vision, machine learning, graph signal processing, control, etc.) **Deep learning** • Deep feed-forward networks and regularization • Optimization algorithms for training • State-of-the-art neural networks (e.g., convolutional and recurrent neural networks, autoencoders) • Applications to high-dimensional problems (e.g. imaging, computer vision, pattern recognition, etc.) **Scalable Bayesian inference** • High Dimensional MCMC • Variational Bayes • Bayesian deep learning and generative models • Applications (e.g. imaging, uncertainty quantification, etc.)

Learning Outcomes	
Subject Mastery	Critical understanding of the mathematical background for scalable inference algorithms from high dimensional data. Mastery of • Scalable Optimization and applications to imaging, machine learning, control, etc.

	• Deep learning and applications to imaging, computer vision, etc. • Scalable Bayesian inference and applications to imaging, uncertainty quantification, etc.
Personal Abilities	Understanding and practical knowledge of mathematical tools to solve high dimensional problems (i.e. involving large data sets)

Assessment method	100% examination