COURSE DETAILS
Course Code: B31XN
Full Course Title: Scalable Inference and Deep Learning
SCQF Level: 11
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL
Undergraduate: No
Postgraduate Taught: Yes
Postgraduate Research: Yes
Additional Information:

COURSE 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.

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.

LEARNING OUTCOMES – PERSONAL ABILITIES
Understanding and practical knowledge of mathematical tools to solve high dimensional problems (i.e. involving large data sets)

SYLLABUS
Scalable Optimization

- Parallel and distributed algorithms

- 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.)

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