**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**

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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.)

**COURSE RELATIONSHIPS**

N/A

**LOCATION AND ASSESSMENT METHODS**

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