Probabilistic Modelling and Reasoning
School of Informatics, University of Edinburgh
Instructor: Prof Chris Williams
September 2012

Assessment By formal examination (80%) and one assignment (20%).

Online material is available through the course web page at http://www.inf.ed.ac.uk/teaching/courses/pmr.

Resources
The course textbook is “Pattern Recognition and Machine Learning” by Christopher M. Bishop, Springer (2006).

Syllabus

• Introduction
• Probability
  – random variables, joint, conditional probability
• Discrete belief networks and inference
• Continuous distributions, graphical Gaussian models
• Learning
  – Maximum Likelihood parameter estimation
  – Bayesian methods for parameter estimation
• Decision theory
• Hidden variable models
  – mixture models and the EM algorithm
  – factor analysis
  – ICA, non-linear factor analysis
• Dynamic hidden variable models
  – Hidden Markov models
- Kalman filters (and extensions)
- Bayesian Learning of Belief Networks
  - Model comparison
- Inference in discrete belief networks: the Junction Tree Algorithm
- Undirected graphical models
  - Markov Random Fields
  - Boltzmann machines
- Information theory
  - entropy, mutual information
  - source coding, Kullback-Leibler divergence