06-32167 and 06-32212 Neural Computation

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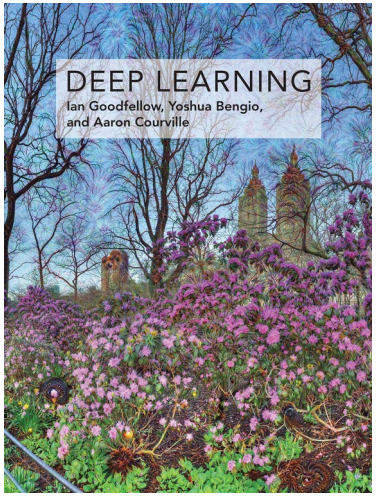
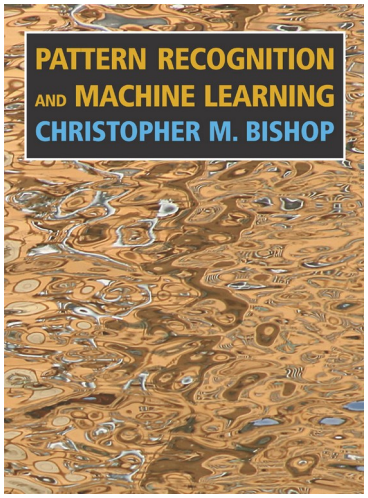
Education Aims

- Introduce some of the fundamental techniques and principles of neural computation
- Investigate some common neural-based models and their applications
- Present neural network models in the larger context of state-of-the-art techniques of automated learning

Recommended Texts

- Deep Learning, Goodfellow et al., MIT Press, 2016 (online and in School Library)
- Pattern Recognition and Machine Learning, Bishop, Springer, 2007 (in Main Library)
- Several other references (see Resources on Canvas)





Teaching Environment

- Python programming language
- Jupyter notebooks
- PyTorch (or TensorFlow)

Assessment

- 06-32167 Neural Computation (3/H)
  - 1.5 hr written examination (80 %)
  - Continuous assessment (20%)
- 06-32212 Neural Computation (ext) (4/M)
  - 1.5 hr written examination (80 %)
  - Continuous assessment (20 %)

Coursework (for both modules)

- One group coursework
  - Real-world application of Neural Networks
  - Deliverables: Source code and report submitted on Canvas
  - Counts 20 % towards final mark
  - Released mid Nov, submission deadline end of term
- Separate coursework descriptions for the two modules
- Compulsory Kaggle competition

Canvas page

Lecture notes and Jupyter notebooks

- Announcements about the module
- Question and Answer Forum
  (more on this later)
- Links to teaching resources
  (books, online resources, etc.)
- Submission of coursework

https://canvas.bham.ac.uk/courses/38479

Discussion Group on Canvas

- All questions about the module should be posted on the Canvas Q/A forum
- Each group assigned a Teaching Assistant (4 TAs in total)
- Questions of a confidential nature should be sent via email to either
  - p.k.lehre@cs.bham.ac.uk
  - j.duan@cs.bham.ac.uk

Contact Hours (changes possible)

- Lectures
  - Tuesdays, 12-13
    Haworth 203
  - Thursdays, 4-5
    Arts Main Lecture 120
- Lab Sessions
  - Wednesdays, 11-12
    Lower Ground Floor 04 Lab, School of CS
- Office Hours
  - Per Kristian: Tuesdays, 3-5 pm Office 207, School of Computer Science
  - Jinming: Fridays, 3-5 pm Office 108, School of Computer Science

Student Representatives

- 3-5 people selected by students
- 3-4 meetings with module convener and assistant
- two-way interaction between staff and students

=> Please choose representatives by Thursday!

Main Topics (may be adjusted)

- Intro to ML
- Linear Regression
- Maximum Likelihood
- Stochastic Gradient Descent
- Feed Forward Neural Networks

  Backpropagation algorithm
- Softmax
- Optimisation
- The Biological Brain
- Universal Approximation Theorem
- Regularisation
- Convolutional Neural Networks

Pre-requisites

- Mathematics
  - Multivariate calculus
    - Functions
    - Derivatives
    - Gradients
  - Linear algebra
    - Vectors and matrices
    - Operations on these
  - Probability theory
    - Random events
    - (Conditional) probability
    - Random variables and expectation
- Programming
  - Basic programming skills
  - Python or other imperative programming language
  - Mathematical and image libraries (e.g., numpy)