

# CS6482 Neural Networks

## Details

**Lecturer:** Jonathan Shapiro, rm 2.34, extension 6253, email jls@cs.man.ac.uk.

**Level:** MSc I

**Degree:** MSc in Computer Science, MSc in Advanced Computing, MSc in Computing Science.

**Meetings:** 3–7 February, 9:30 – 5:00 in MSc B of the Computer Science Department.

## Daily Schedule:

9:30 – 11	Lecture 1-2
11:15 – 12:00	Lecture 3
12:15 – 1:00	Lecture 4
2:00 – 5:00	Lab

## Lecture Schedule

### Day 1: Supervised Learning I

**Lecture 1:** Introduction and Motivation

**Lecture 2:** Simple Networks of Neurons

**Lecture 3:** Perceptrons and Multi-layer Perceptrons

**Lecture 4:** Generalization

**Lab:** Learning in feedforward networks using backpropagation.

### Day 2: Supervised Learning II

**Lecture 1:** Validation and Model Selection

**Lecture 2:** Applications of MLPs

**Lecture 3:** Applications and Tricks of the trade

**Lecture 4:** Committees of Networks and Boosting

**Lab:** Cross-validation, model selection, and boosting

### Day 3 Reinforcement Learning

**Lecture 1:** Introduction; learning from immediate rewards.

**Lecture 2 and 3:** Learning from delayed rewards

**Lecture 4:** Applications of reinforcement learning

**Lab:** Reinforcement Learning Lab.

**Day 4** Unsupervised Learning

**Lecture 1:** Unsupervised Learning — Introduction and competitive learning.

**Lecture 2:** Kohonen's algorithm.

**Lecture 3:** Categorization networks which grow when required.

**Lecture 4:** Introduction to Independent Components Analysis.

**Lab:** Competitive learning and SOFM

**Day 5:** Dynamics and Selected Topics

**Lecture 1** Hopfield Model and Optimization

**Lecture 2:** Applications—The Silicon Retina, Hinton and Shallice model of Dyslexia.

**Lecture 3:** Boltzmann Machine and Products of Experts

**Lab:** Start on post-course project.

**Assessment**

There are three parts.

**Laboratory Work** Worth 40%. This includes,

- Labs during the course. There are four labs integrated into the course (afternoons of Mon-Thurs). For each of these, you will turn in a brief write-up. You also need to show me that you did the pre-course work.
- Post-course project. This is a longer piece of laboratory work you do after the course ends.

**Essay:** Worth 27%. I want you to write an essay on the topic of your post-course project. Find some literature on the topic you are investigating, and write about it.

**Exam:** A standard, open-book exam will be given. This is worth 33%.

*All written work is due in the postgraduate office by 4pm on the 28th of March.*

## **More details on the assessed work**

**Collaboration:** You may do the lab work in small groups of two or three, or work individually. If you do work in groups, there are two rules. First, all written work must be done individually. I.e. each member of the group should do a separate write up. Second, state on the report that you did the work in a team, who the members of the were, and what fraction of the work was done by you. Sign this statement.

The essay and the exam must be done independently and without collaboration.

**Lab reports:** For the labs done during the course, the write-ups can be recorded as you do the lab, or rewritten. It is important that you record all decisions that you make, all variables and parameters of your experiments, and what you observed. Of course, any insights which you have should also be recorded.

Use good lab report technique. The labs reports should be written in a way that will be useful to you in the future. Don't assume you will remember what the procedures and the questions were. Record what you did as well as the results. Of course, what you learned should be recorded.

The report on the post-course work should be more extensive, because there is more scope for you to make decisions about what you have done, and these should be described and justified.

You may choose your own topic for the post-course work, but discuss it with me. Some suggestions will also be given.

**Essay:** Write an essay on work related to the work done in your post-course project. Find out what other researchers have done in similar application areas or using similar approaches, describe them and discuss them. A good essay will consider two or more approaches or describe one very substantial work, will put the work in context (what is the problem to which it is contributing), will demonstrate understanding of the work, and will analyze the extent to which it solves the relevant problem.

**Exam:** The exam is open book. You may bring your lecture handouts, any notes made in the lectures, and one textbook. However, you may not bring a computer, so if you make lecture notes on a laptop, print the notes out and bring paper copies. You may bring a calculator which does not store text.