Coursework commentaries 2016–17

CO3311 Neural networks – Coursework assignments 1

General remarks

Key aims were:

a. to allow students to look at a very different model of the neuron, one which is in many ways closer in its working to the neurons found in our brains. [20%]

and

b. to gain experience of running a simple neural network with varying parameters, showing the effects of targets, initial conditions and learning rate, albeit in a very constrained set of examples. [80%]

Although there were two questions for this coursework, it was surprising how many students lost marks by answering only one question. Those who submitted nothing for Question 2 limited their maximum score to just 20%.

Comments on specific questions

Question 1

This required students to write a short (1,000-word) report about spiking neural networks. Some initial sources were given but students were instructed to look further using a range of resources including the online library's database search, and of course, Google Scholar.

There were many good answers that considered a number of authoritative sources and synthesised what they had to say 'as a body of literature' rather than as a sequence of unrelated documents. Weaker answers were typically restricted to limited sources, and showed a lack understanding that the web contains some unreliable sources unsuited for academic writing. A number of headings were given against which students were expected to produce their report. This provided a possible way of structuring the report. Good answers covered each area well and did more than just reproduce the materials that they had read. They showed that they had understood the material, through analysis, discussion, etc. Poor answers were typically short, omitted some sections and gave little thought to the introductory and concluding sections. Good answers also delved into some of the technical details of both the mechanisms used for spiking neural networks and of the applications that they reported on. Poorer answers just gave brief overviews of the mechanisms and the applications.

On the whole scores for this question were (proportionately) significantly lower than those for question two.

Question 2

This required students to simulate a two input sigmoid and investigate the effects of targets, initial conditions and learning rate on its ability to learn a given target set, using either the 2-sigmoid spreadsheet from the course, or software of their choice.

The question explored how a good experiment is designed, with random choices of some variables, controlled values of others and a number of repetitions to mitigate the effects of 'luck'. Examiners were looking for student comment on experimental design, and the need for such repetitions but few did this.

A particular format for a table of results was given which should have made analysis of results and the drawing of conclusions easier for the student. Most students adhered to this format, allowing their results to be compared with those of other students.

Reference was made to course material which give advice on experimental design. Examiners expected experiments to be written up in sufficient detail to allow them to be reproduced by others. Sadly, too many neural networks projects (CO3320) lack discussion on experimental design and adequate analysis of the results.

Many excellent answers to this question were submitted. These looked at the results for trends caused by changes in parameters and the effects of random parameters, typically using graphics to illustrate key findings. Poor answers merely gave a table of results, with little or no attempt at explaining them. Excellent answers also related the target sets to the final learning achieved; many noted that some sets are harder for a neuron to learn than others.

Some very high scores were obtained for this question.

Coursework commentaries 2016–17

CO3311 Neural networks – Coursework assignments 2

General remarks

There is a plethora of software available to learn to apply neural networks, and one aim of this coursework is to require students to investigate the capabilities of one of the reasonably sophisticated systems available. A further aim is to get students to implement a simple recurrent networks type and explore its behaviour.

The 'Caffe' system developed at UC Berkeley offers a good example of the tools freely available on the internet, enabling fast implementation of various types of neural network. Students were asked to review this software, but were not required to use it to build their own models. Of course, they could do so if they wished.

Comments on specific questions

Question 1

This required a review of Caffe covering its use in applications, and its strengths and weaknesses as discussed in the literature.

Good answers introduced a number of applications, summarised the published experiences, and concluded with a synthesis of any consensus about Caffe as a tool. Shortcomings of some answers include relying solely on materials produced by the authors of the software, lack of breadth and lack of technical details about the application. Relying on software authors' reviews of their own products is unlikely to result in a balanced view of its capabilities. Limiting the range of applications limits the usefulness of the review. Lack of technical details prevents readers using the review as an evaluative tool to determine the usefulness or otherwise of the subject of the review.

Note that it is essential to provide citations and references.

Question 2

This involved the implementation of a 4-unit Hopfield network. The simplest way of implementing this was perhaps to modify the spreadsheet supplied as part of the course materials. Equally valid were implementations in Java, C, Python, etc.

Students were asked to test their implementations to check that they were correct. An essential step in this is to check that the output of a simple network whose results are easy to calculate independently were indeed what was expected. It was disappointing to see many answers that omitted explicit mention of such tests. Good answers included a section that gave the expected and actual outputs.

Experiments were to be written up so that they could be reproduced by others. Advice on writing up is provided in the course materials and the question references this. Good answers showed that they had read and heeded this advice by following a careful experimental design and presenting results in a clear manner.

Excellent answers included graphics for results, which included the relative frequencies of the numbers of stable states. Of course, such results depended heavily on the number of examples attempted, but making sense of the results of experimentation is an important skill at this level.

Where spreadsheets were modified, code written etc., good answers included sufficient detail to enable readers to understand the modifications/code and give confidence in the results produced.

As with the first coursework assignment, marks for question one were significantly lower than those for question two. It seems that students put more effort into programming or using software rather than writing up the findings from review of the literature.