Coursework commentary 2018–2019

CO3311 Neural networks

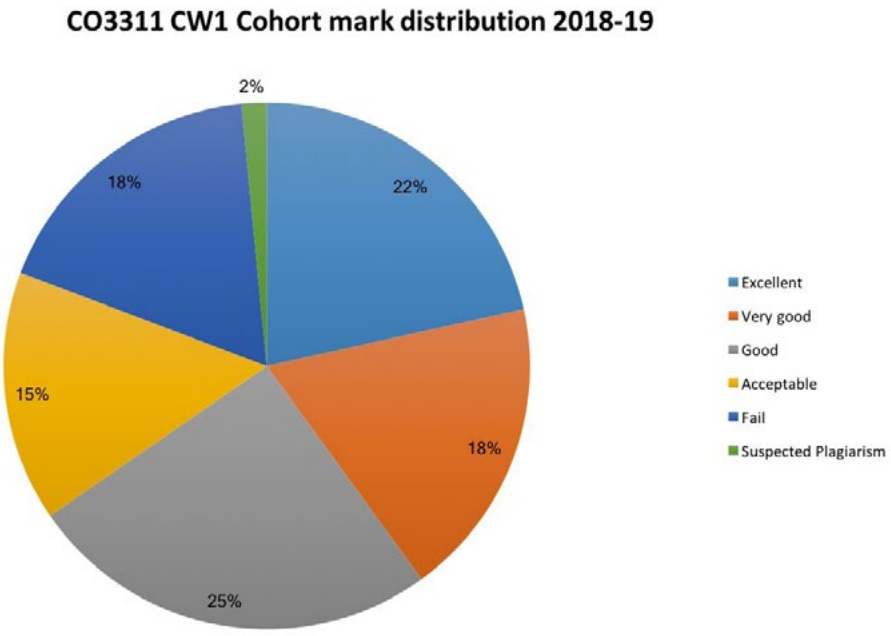
Coursework assignment 1

General remarks

Coursework assignment 1 had two questions. As in previous years, it was disappointing to see students throwing away marks by omitting questions. Some answered Question 1 only and others answered just Question 2. Obviously, answering only Question 1 reduces the maximum score to only 20 per cent while answering only Question 2 reduced the maximum possible marks to 80 per cent. The diagram shows the mark distribution for Coursework assignment 1. There were a good percentage of excellent answers but also a large percentage of fails caused, at least in part, by students omitting to answer one of the two questions.

Those answering Question 1 achieved very good marks on average; the average mark (as a percentage) was lower for Question 2.

See cohort mark distribution for 2018–2019 below:



Comments on specific questions

Question 1

The first question aimed to encourage students to look at very new developments in Artificial Neural Networks (ANNs), considered to be those in the last couple of years.

An important note in the question advises students to '**look at technical, not just "marketing" materials**'. Unfortunately, weaker answers did not heed this advice.

Some choice of topic, within a limited set of initial sources, from an important physics website, was allowed but students were advised to '**choose the topic carefully so that you can find enough material …**'. Again, this advice was not always taken seriously. Often whenever literature work is required, it is up to the student to balance their personal interest in topics with the availability of **suitable** materials. In the case of this question, technical material about the topic pre- and post-2018 was needed for a full answer.

A set of five headings were given and the best answers followed these with perhaps the addition of other relevant ones and changes in section headings to emphasise their contents.

A surprising number of answers omitted an introduction. The question asked for something on the importance of the topic and why it was chosen. Good answers introduced the application and the use of ANNs in that application as well as the reasons why the student chose the topic (interest or importance, for example).

Answers were often written in a style suitable for someone who knows little about ANNs. A better strategy is to aim the work at someone who has studied CO3311, as this saves many words which would otherwise be wasted on trivial issues.

Progress before 2018 was needed and completely new topics with no pre-2018 development gave little scope to excel in this section. This should be progress with the application and in particular, with the use of ANNs in that application.

Poorer answers often wrote at length about the use of ANNs elsewhere, rather than being focussed on ANNs in the application.

Developments in 2018 and 2019 would, in the best answers, have presented writers with the opportunities to show both gradual development as well as any 'quantum leaps' in the topics. Again, focus should be on ANNs in that application rather than just ANNs; or on the application using techniques other than ANNs which some answers gave.

The question also asked for a conclusion section. Good answers gave some idea of what the future might hold for this topic, and said something about possible future developments of ANNs as a tool to solve current problems with the application.

Finally, and no less importantly, a full set of references, in strict Harvard format, should be included as stipulated (see how to avoid plagiarism advice on the VLE). Many answers did not do this, despite the stated requirements. Poor answers used few references (the link given in the question was stated to be a **starting** point).

Many answers were quite shallow in technical terms and some were almost devoid of details of any neural networks being used.

Good answers gave a coherent account of the chosen topic and emphasised how ANNs are being used in the application.

A disappointing number of submissions for this coursework omitted answering this question leading to a loss of 20 per cent in the possible marks for the coursework assignment.

Question 2

The second question was aimed to give students some experience, albeit on a small scale, of experimenting with a neural network in order to tune the number of units and other parameters to those best for the particular, given, data set. An important skill, needed for example for project work, is the ability

to write up experiments in a way that enables readers to efficiently reproduce the work done. Developing this skill was a sub aim of this coursework.

Students were asked to develop a Kohonen network where each unit takes 3 inputs but with a varying number of units. It is often the case that the best number of units needed for a given classification problem is unknown at the start of the task, and adding or subtracting units is used as a means of finding a good set. The question allowed the use of Excel, a programming language or a package of the student's choice, and noted that using a programming language is likely to be easier. It was pleasing to see many different choices being made from Excel, Python, C, Java, etc., as well as standalone ANN packages.

The question stressed the need for testing of any system produced, but this turned out to be the most disappointing part of many answers.

Many answers used logic gates as test subjects without giving any real discussion of how the test would show the system working. Given a set of n binary inputs there are 2^n possible binary maps (and so classes) to the set {0, 1}. As Kohonen networks are unsupervised, it is unclear on what basis a network should choose which of these classes is appropriate. Use of logic gates to test seems odd. When testing unsupervised learning, you can know the expected classes but must not use these in training. Given a set of arbitrary binary inputs, it is unlikely that an unsupervised algorithm will come up with another column that is in any sense 'expected'.

Another odd feature of many answers was the use of graphs of weight change by epoch for knowing when convergence is taking place. While one would expect this to be rapidly decreasing (depending on initial conditions, of course) many graphs had this metric going to zero. Unless the classes are single points, one would not expect this behaviour.

As in the first question some guidance for the write-up was given.

An introduction is almost always useful in setting the scene, but this was often omitted in weaker answers.

A description of the program or spreadsheet, and how they were developed and tested, is also essential in writing up experiments. Good answers gave the major strategic choices made in this development.

Of course, presentation of sets of results is usefully put into a separate section. Tables of numbers are often better put as appendices while summary statistics, graphs, etc., are more appropriate in the main text. Too many submissions gave pages and pages of numbers with too many decimal places and little or no comment.

Results on their own are often of little use. An **analysis of the results** obtained, including any surprising or interesting **observations** made, is essential and almost completes the work. In a clustering example one would expect some representation of the clusters to be displayed graphically and this was done in good answers.

Poorer answers omitted the clusters and instead many displayed the learning curve often presented with Backpropagation networks.

Of course, a conclusion, preferably giving some speculation of new things to try and where to look for better results, completes the work.

Students were given a link to a paper by one of the trailblazers of ANN for a good example of how to write up ANN experiments. It is worthwhile studying a number of such papers to see how professionals write up their work. This may help you to improve your marks.

Resources used for Question 2 ranged from programming languages such as Python, Java and C to spreadsheets and other high level systems. Although it is not important what tools are used, it is important that sufficient technical details are given so that readers can at least in principle reproduce your work. Good answers gave listings as well as commentaries on the tricky parts of the code, etc.

Good answers gave the reader sufficient information to reproduce the work, in addition to well-argued reasoning for conclusions made.