# Coursework commentary 2018–19

## CO3311 Neural networks

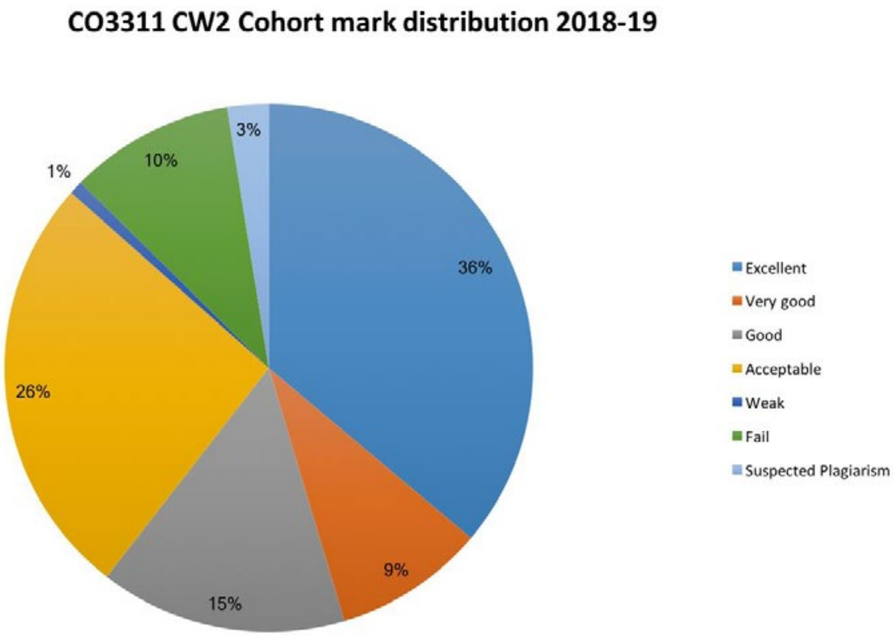
## Coursework assignment 2

### General remarks

As in Coursework assignment 1, it was disappointing to see students throwing away marks by omitting questions. Some answered Question 1 only and others answered just Question 2. Answering only Question 1 reduces the maximum score in this case to only 25 per cent whilst answering only Question 2 reduced the maximum possible marks to 75 per cent.

As the figure shows, most submissions for Coursework 2 achieved *Good* or above, with few failing. Question 1 was not as well answered as the corresponding question in Coursework assignment 1, but marks for Question 2 were significantly higher for this coursework assignment.

See cohort mark distribution for 2018–2019 below:




### Comments on specific questions

#### Question 1

As the current guides were written around 2009 it should not surprise students that a great deal has been achieved over the intervening years. Such progress is rarely uniform and for our subject there has been a heightening of interest in the architecture and applications of ANNs since that time. Question 1 of Coursework assignment 2 aims to give some understanding of developments since the guides were produced. The coursework takes further the work of Coursework assignment 1 by focussing on architectures and applications going all the way back to 2009 rather than the much more limited time span required for Coursework assignment 1.

A subsidiary aim of the coursework was to encourage students to look more deeply into the literature and, in particular, to chase sources backwards a decade through time.

As for Coursework assignment 1, a structure was given for the report, this time with eight headings.

Again, it was specified that an introduction should be included and this is accepted practice. As for Coursework assignment 1 poorer answers ignored this requirement. Some very poor answers said very little about ANNs.

Next, two sections were needed giving the architectures and applications of 2009 and those of 2019. Good answers included technical details of both the problem and the ANNs used. Many poorer answers spoke only in general terms.

The next two sections involved comparing and contrasting the architectures and applications of 2009 and 2019, drawing out their similarities and differences. Both of these are important, and it is not sufficient to list properties of both and expect the reader to deduce the differences, as some poorer answers did.

Some synthesis was required to write the next part which also required some understanding of the reasons for these features. Good answers explained that on top of the usual advances in hardware and software continuing from early computing (as expressed by Moore's law, for example) many steps forward have occurred by innovative use of GPUs, new activation functions, big data, deeper networks, etc. The latter is significant perhaps despite the mathematical results that showed three layers being sufficient.

As always, the last two sections, conclusions and references, were required with the Harvard format for references being specified. One could often tell better from poorer answers by the former's adherence to the advice given and the latter's disregard for at least some of the advice.

Overall good answers stuck to the advice given, talked about ANNs and gave technical details of any experiments, results and conclusions made by the authors of the works cited.

The main weaknesses found during marking were a lack of technical details, too little about the neural networks, their architectures and the results obtained. Many good answers gave a coherent story of the developments that were made during the time in question.

## Question 2

One aim of Question 2 was to contrast the supervised learning of Backpropagation networks with the unsupervised learning of Kohonen networks as used for Question 2 of Coursework assignment 1.

Given the classifications found in Coursework assignment 1, students were asked to train a Backpropagation network to classify the same data. Ideally, they would be comparing and contrasting the results obtained under varying conditions of number of classes and number of hidden units.

Some used the Kohonen units from Coursework assignment 1 as initial Backpropagation units – they gave no justification for this and it seems a strange thing to do and often led to misleading results.

The question hinted heavily at the need for scaling the data and defining target output ranges corresponding to the classes required. Not all answers incorporated these or alternative necessary steps. The result of such an omission was that poor answers achieved little learning.

An alternative strategy (having as many networks as classes) was also suggested. Few chose this alternative.

Answers were to have a description of the measure of errors used to monitor progress in experiments. Many students seemed not to understand the need for careful monitoring of the learning process to control overfitting and to enable efficient choice of learning rate and other parameters of the process. In contrast to Kohonen networks, one might expect the error to decrease to near zero.

As in any write-up of experimental work, a description of the way that the networks were implemented, giving enough detail to enable others to duplicate the work, was required. Good answers did this while poorer ones omitted crucial details. A listing is **NOT** sufficient for this aspect of the work.

Not all answers included the requested program code or Excel spreadsheet for each of the experiments. Without this it is hard to understand cases where results were different from those of others.

Table(s) of results with commentaries on them and with descriptions of any features that students felt notable were also required. Getting used to the practice of pondering results and fitting them into a framework of expectations is a skill needed later for project work. It was hoped that some repetition of experiments, with different initial conditions or learning rates, for example, would be included and indeed some very good answers did this.

Conclusions, list of references, etc., were also required, and were given due weight in good answers. In poorer answers, if they occurred at all, they were haphazard and kept poorly to the standards required.

Poor answers omitted much essential detail and gave little evidence that the work reported was actually done.

Very good answers to this question gave a logical account of the process, including experimental design. Where tentative conclusions were made, good answers described supplementary experiments made to test these.