Coursework commentaries 2015–16

CO3311 Neural networks

Coursework assignment 2

General remarks

This coursework assignment follows the familiar format of having two questions. The first requires in depth reading of some of the literature of neural networks, this time on the topic of self-driving cars. The second requires an investigation of how backpropagation might work when the required outputs are scaled. It was disappointing to see that a number of students only managed to answer one question. Clearly, answering just the first question which carried only 25 per cent of the marks gives a guaranteed fail on this assessment (potentially rescued in combination with the mark for coursework assignment 1).

Comments on specific questions

Question 1

This question looked at a topical issue of transport safety and congestion. For example, Ford has claimed that it will be mass producing self-driving vehicles in only a few years' time. It is to be hoped that within only a few years, issues of congestion and safety will have been all but solved by the use of these vehicles. The question asked students to look at progress made in this application area by the use of artificial neural networks. Focus was to be on the technical details, rather than the headline or newspaper-type information. 'Hard results' were asked for. The question also recommended that an introductory section and conclusions be included. Good answers did this while poor answers tended to be unstructured. Good answers introduced the problem, giving figures of scale in terms of road casualties and costs as well as quantifying costs, in time and money, of congestion. Good answers gave a variety of applications but all focussed on making self-driving cars a viable possibility. Some poor answers strayed from self-driving vehicles while others talked about technologies other than neural networks. The best answers put the applications in context, explaining how the neural networks fit into the overall system that allows cars to drive themselves. Many answers tended to be much less detailed than required and often lacked information about the neural networks used, providing little more than could be gleaned from newspaper-type articles alone. More focussed research will provide material from which you can build a strong answer. Finally, the question asked for an explanation of how students found the sources they used. Good answers noted how one article leads to others, and touched on relevancy. Some suggested that citation indices might give a forward search through time. Poor answers dismissed this part with words to the effect that they searched using Google or the library databases.

It is worth highlighting here that students are expected to seek out up-to-date materials. Much neural network theory dates back to the 1980s and 1990s but in applications we are looking to see what the current state is

and although an historic perspective is an excellent start, we do expect as up-to-date a view as possible to be given.

Question 2

This question aimed to look in depth at a particular issue for neural networks: the scaling of data. In particular, this required investigation of how scaling of the output required might affect convergence. Some students seemed to have misunderstood what this scaling entailed.

Five artificial data sets were provided and students were asked to use backpropagation networks with three units and see if differences in performance could be detected depending on a scaling of the outputs.

Good answers demonstrated a systematic approach, well explained and in sufficient detail that it could be reproduced by others using only the answers provided by students.

Part a) of the question required students to train a network five times using random starting weights and a learning rate of .1. Here we were also introducing the idea of replication or repeatability, an essential feature of good experimentation. Good answers included a discussion of convergence and stopping criteria. Poor answers just gave results with little or no discussion.

Having done the 'control' part (a) of the work, part b) asked for this to be repeated after scaling (multiplying) the required output by .75, .5, .25 and .1. Good answers gave a systematic presentation of the results and how they compared with those for part a). A variety of comparisons were used, and students commented about the variability or trends that they observed. Again, poor answers just reported results, with little or no attempt to understand what was going on.

When plotting errors and stopping time it is important that the basis of the calculations is given. This was a common omission. Many answers seemed to have negative errors, without explanation of what these meant. Normally when using errors as stopping criteria we use absolute values of these, and often they are averaged over an epoch. Few answers gave complete information about this aspect of their work

General summary

Good answers followed the advice given in the questions and in the CO3311 subject guide. Poor answers lacked technical details and often ignored much of the advice given in the course materials.