**University of London International Programms**
**CO3311 Neural networks Coursework assignment 1, 2015–16**

**Question 1**

According to Gigacom (2014) both Google and Stanford University have used ANNs to 'explain photos'.

a) In about 50 words, summarise the contents of this source. The summary must be in your own words; do **not** use direct quotes or close paraphrasing.
b) Following links on that site as well as using the search engines and Stanford University's databases, review, in around 1,000 words, the literature on understanding photos.

Your answers should include appropriately cited images or diagrams and focus especially on any technical details that you can find. Your focus must be on the ANN technologies being used.

Gigacom (2014) Google, Stanford build hybrid neural networks that can explain photos: https://gigaom.com/2014/11/18/google-stanford-build-hybrid-neural-networks-that-can-explain-photos/

[25%]

**Question 2**

A unit with sigmoidal activation always produces an output between 0 and 1. In this coursework assignment we are going to look in detail at the possible output as a function of the inputs of simple networks with up to two inputs and up to three units, all with sigmoidal activation.

You may use Excel or any other tool that you wish, so long as you fully document what you do in such a way that others could obtain exactly the same results by following your description.

a) For a single input sigmoidal unit, plot its output as its input varies from -1 to 1. Do this for input weights of 0, .5, -.5, 1 and -1, producing five graphs. In these cases what effect does the bias have? [You may need to experiment to find this.]

Q1a

| Inputs | Weights | Parameters | Form | Value |
|---|---|---|---|---|
| 1 | ? | | | |
| ?a | ? | Net | Σ | ?? |
| | | Activation | σ | AQ1a |

**Figure 2a**

b) Add another input, also varying between -1 and 1. Describe what differences, if any, are made by having the second input. Use graphs if appropriate. Can you explain your observation?

Q1b

| Inputs | Weights | Parameters | Form | Value |
|---|---|---|---|---|
| 1 | ? | | | |
| ?a | ? | Net | Σ | ?? |
| ?b | ? | Activation | σ | AQ1b |

**Figure 2b**

c) In another network use the output of a 1 input sigmoidal unit as input to another 1 input sigmoidal unit. How does the addition of this second unit (in series) affect the output? Think carefully about how you present your results to best show what is happening. You will need to try different values for the four weights involved.

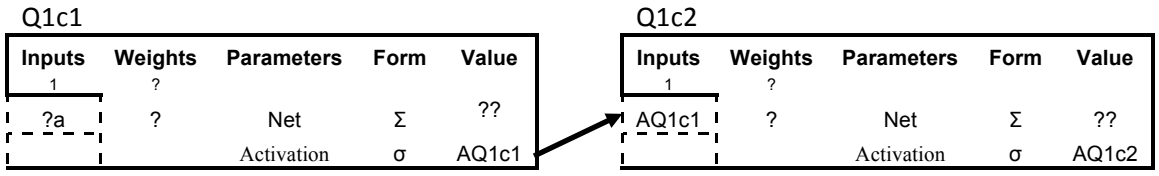


**Figure 2c**

d) A three unit 2-input network with two hidden units is shown below. Look at how the output varies with the **two** inputs – you will need to try different values for the nine weights involved! Do this in a systematic way.

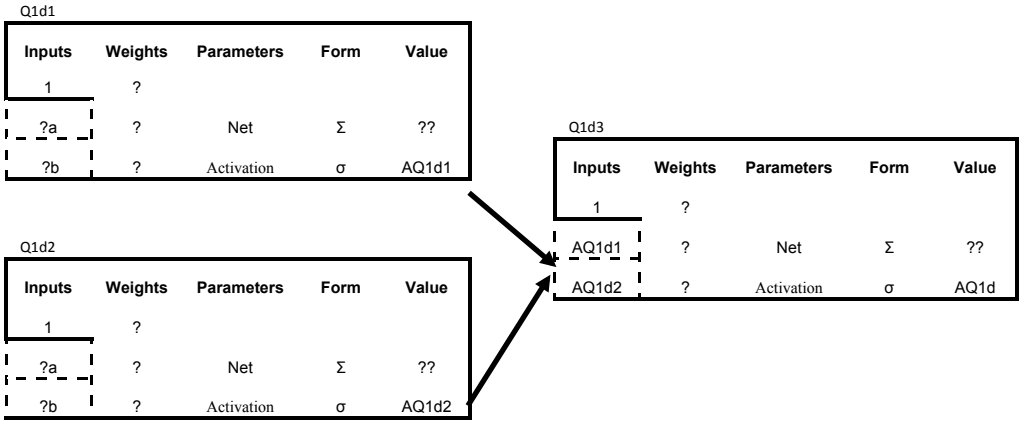


**Figure 2d**

[Hints in Excel you can draw a 'surface' graph of an array that represents values of output (the z-axis) with rows representing different input 1 (or x-axis) values and columns representing different input 2 values (the y-axis). You can, of course, devise your own way of showing what is going on.

Learning rate is not relevant in these questions.]

Write up your experiments carefully so that they could be reproduced by your readers. Look for advice on this in the course materials. Remember the rules on plagiarism and the need to use the Harvard system for references and citations.

[75%]

Submit one compressed file (.rar, .zip, etc.) with all of your work. Include both your SRN and Family name (in that order) at the beginning of its filename.

[TOTAL 100%]

**[END OF COURSEWORK ASSIGNMENT 1]**

**University of London International Programmes**

**CO3311 Neural networks Coursework assignment 2, 2015–16**

**Question 1**

In Question 1 of Coursework assignment 1 we looked at the problem of how photos may be understood. Another 'burning issue' of many societies is that of transport safety and congestion. In fact, it is likely that within only a few years this issue will have been all but solved by the use of self-driving vehicles.

In around 1,000 words describe the application of ANNs to the progress that has been made in this form of transportation. Try to find applications using different types of ANNs if you can.

With the exception of the introduction and conclusions, your focus should be on the technical details of the ANNs used and any 'hard' results that have been obtained.

Write up your findings, including an explanation of how you found the sources you used. Remember the rules on plagiarism and the need to use the Harvard system for references and citations.

[25%]

**Question 2**

The data below (and downloadable from the module's website) contains five training sets for different input/output problems for networks with 3 two-input units.

A 'new strategy' has been proposed that we could use for modelling this data using 3 unit backpropagation networks (with biases and with sigmoidal activations of course). For this we look to see if scaling the required output makes a difference to the speed of convergence – or even to whether it converges or not!

a) For each set of data, train a network 5 times using random starting weights and a learning rate of .1. Run the training until the error no longer improves noting the final error and number of epochs of training required.

b) Repeat a) above after scaling (multiplying) the required output by .75, .5, .25 and .1.

Present your results in ways that you feel best shows what is going on and include a table like figure 2 below.

| Experiment | Data Set | Scaling | Average final error | Average no. of epochs |
|---|---|---|---|---|
| 1 | a | 1 | | |
| 2 | a | .75 | | |
| … | … | … | … | … |
| 25 | e | .1 | | |

Comment on your results, especially if you see any trends/differences between the results for each set.

Write up your experiments carefully so that they could be reproduced by your readers. Look for advice on this in the module materials. Remember the rules on plagiarism and the need to use the Harvard system for references and citations. Submit one compressed file (.rar, .zip, etc.) with all of your work. Include both your SRN and Family name (in that order) at the beginning of its filename.

[75%]

[TOTAL 100%]

**Data for Question 2**

| Set A | | |
|---|---|---|
| ?a | ?b | a |
| 0.307 | 0.098 | 0.509 |
| 0.412 | -0.001 | 0.392 |
| 0.367 | 0.480 | 0.603 |
| -0.168 | -0.124 | 0.594 |
| 0.211 | 0.494 | 0.513 |
| 0.444 | 0.467 | 0.599 |
| 0.426 | -0.349 | 0.366 |
| -0.234 | 0.308 | 0.487 |
| 0.194 | -0.480 | 0.428 |
| 0.352 | -0.218 | 0.439 |

| Set B | | |
|---|---|---|
| ?a | ?b | a |
| -0.521 | -0.835 | 0.787 |
| -0.493 | 0.266 | 0.475 |
| -0.468 | -0.643 | 0.607 |
| 0.941 | -0.169 | 0.393 |
| 0.350 | -0.483 | 0.546 |
| -0.041 | -0.860 | 0.731 |
| -0.209 | 0.681 | 0.590 |
| 0.849 | -0.184 | 0.599 |
| -0.309 | -0.167 | 0.223 |
| -0.509 | 0.823 | 0.447 |

| Set C | | |
|---|---|---|
| ?a | ?b | a |
| -0.654 | -0.380 | 0.516 |
| -0.022 | -0.423 | 0.775 |
| -1.683 | -0.160 | 0.847 |
| 1.302 | 0.471 | 0.750 |
| -0.323 | -0.386 | 0.951 |
| 0.087 | 0.155 | 0.021 |
| 1.046 | -0.045 | 0.811 |
| -1.921 | -0.911 | 0.662 |
| -1.539 | -1.499 | 0.403 |
| 1.725 | 0.499 | 0.762 |

| Set D | | |
|---|---|---|
| ?a | ?b | a |
| 0.079 | 0.204 | 0.747 |
| -0.023 | 0.422 | 0.997 |
| -2.186 | 2.486 | 0.615 |
| 1.864 | -2.142 | 0.079 |
| -1.828 | 0.974 | 0.406 |
| 3.827 | 1.700 | 0.939 |
| 3.810 | 1.101 | 0.814 |
| 0.233 | 1.257 | 0.985 |
| -1.124 | 2.976 | 0.058 |
| 1.287 | 1.092 | 0.751 |

| Set E | | |
|---|---|---|
| ?a | ?b | a |
| 3.772 | 4.746 | 0.999 |
| -3.720 | -3.133 | 0.049 |
| -2.757 | -7.044 | 0.078 |
| -2.431 | -2.036 | 0.975 |
| -0.018 | 3.441 | 0.050 |
| -1.349 | -6.316 | 0.001 |
| -5.049 | -4.209 | 0.007 |
| 7.277 | 1.150 | 0.990 |
| 2.533 | 4.337 | 0.412 |
| -4.621 | -6.868 | 0.917 |

**[END OF COURSEWORK ASSIGNMENT 2]**