# tCS3641 Homework 03 Summer 2024

# Neural Network Agent

**Total Points: 75**

Be as brief as possible and use your own words when describing concepts.   SHOW ALL WORK for Questions requiring calculations and algorithms. IMPORTANT!!! - See bottom for instructions on submitting code (I need it in text format!).

Q-1: Provide your information:

**// Student name:**

**// Student ID:**

**// The assignment #:**

**//**

**// Signature of source code author: (you can replace text here typing your name)**

**5 points**

Q-2: Implement a 4-Input, 1-Output Perceptron Neural Network (Slide 58-65 of 06\_2LayersANN) with an Input bias Neuron to classify image data as Image = *{ Dim, Bright } | Dim = -1, Bright = 1*, using the training dataset training.csv and test.csv.

– If a 4-pixel image contains 2, 3 or 4 white pixels, it is “Bright”

– If a 4-pixel image contains 0 or 1 white pixels, it is “Dim”

Where pixel member of { 0, 1} | 0 = black, 1 = white

Sample in train.csv

1,0,0,0, Dim

1,1,1,0, Bright

0,1,1,0, Bright

**Sample output example for Q-2:**

./perceptron

epoch1:

epoch2:

…

epoch35:

20 test samples evaluated, Result:

0,0,0,0, Dim

0,1,0,1, Bright

1,1,1,1, Dim

…. Etc….

0,0,0,1, Dim

Accuracy: 95%

Provide the build instructions and source code in a separate ***text*** file in D2L (i.e. one of .py, .cpp, .c, cs, .java, or other language file in text or even just .txt with your code in it; see bottom of assignment)

**35 points**

Q-3: Submit screenshot of running code printing test.csv values with classification (see sample output).

**10 points**

Q-4: Evaluate the ground-truth values for the 20 sample test.csv and use the results to determine the confusion matrix True Positive, True Negative, False Positive, False Negative (Negative = Dim, Positive = Bright}

Confusion Matrix Classed Positive Classified Negative

Truth Positive TP = ­\_\_\_\_\_\_\_\_\_ FN = ­\_\_\_\_\_\_\_\_\_

Truth Negative FP = ­\_\_\_\_\_\_\_\_\_ TN = ­\_\_\_\_\_\_\_\_\_

**10 points**

**Q-5: Rerun the training and test trials but change bias in bias neuron to one untried value of {-1, 0, 1} and then again for the other untried bias value. You should now have trials on bias = 1, bias = 0, bias = 1. What changes (if any) in the accuracy/convergence etc.?**

**15 points**

**You may, if you wish, word-replace the values of “dim” with 0 and “bright” with 1 it that makes it easier. Experiment with using fewer than the 100 data points, or you can create your own data for training/testing [see attached c code for example]. However for the final evaluation use the supplied train.csv and test.csv and all 100 sample and 20 test data points.**

**gendata.cpp A sample code for generating data.**

**train.csv - File contains 100 training data points with ground truth for training.**

**test.csv - File contains 20 testing data points without ground truth for testing.**

**test\_with\_truth.csv Same as test.csv but has truth values for evaluating confusion matrix.**

**Submission Guidelines:**

* No handwritten submission is accepted, always submit answers as text within this or similar document file with any support images embedded in the file.
* **EXCEPTION**: If asked for source code implementation you can submit those individually and as separate files in ASCII format in their original file format .cpp, .java, .py, .cs etc. or even as a .txt file will be acceptable. Do not insert code into the submission document file. It ruins spacing which makes .python and some languages (perl, awk etc.) difficult to test build.
* Do not submit ZIP files… ever… for anything in D2L. The system is extremely unhelpful with regards to those filetypes and grading.
* You may include your freehand drawing/image and handwritten scans in the submission. However, the writing and images must be clearly legible. Though, it is best to present non-handwritten submissions, generally, as is done in the professional setting.
* If asked, show all work/calculations/graphs etc. in the determination of the problem.
* **Please complete your entire work in a single Word Document and Save the file as: yournetid\_CS3502\_Assignment01.docx (e.g. ogarcia5\_CS3502\_Assignment01.docx.) and upload your file in D2L.**
* Please observe the submission due date and time. After the due date there is a 50% penalty for the next 24 hours. Any submission after 24 hours of the due date will be graded at 0%.
* If you include a reference or an image taken from other sources, please cite them appropriately. APA is preferred but cite them so they can be found. **NOTE: verbatim copying or even paraphrasing is plagiarism so if the source used constitutes your answer rather than simply *supporting* the answer, it will be considered invalid. This is especially true of source code implementation answers.**
* If you resubmit, please make sure to attach the file again. Your latest submission before the due date will be the one graded.