

**Q1: Is there anything we need to know to get your code to work? If you did not get your code working or handed in an incomplete solution please let us know what you did complete (0-4 sentences)**

My code is complete, however it relies on an upgraded version of numpy (numpy 1.21 works). This is necessary for the [sliding\\_window\\_view](#) function used in my conv\_2d function. Please run the below command (or if you don't want to install it, then use the *run\_docker.sh* to set up a docker container with all the required packages and files).

```
pip3 install --upgrade numpy
```

I would also strongly encourage you to run performance\_test.py as it shows how fast my conv\_2d function is. In some cases it is faster than the tf.conf\_2d function that comes out of the box with tensorflow.

```
(venv) sam@mint:~/Desktop/COSC-440/COSC440_Assignment2/src$ python3 performance_test.py
Starting a performance test with 10 images (each with 1 channels) and a 3x3x1x1 filter
starting timing... (all times below are in seconds)
```

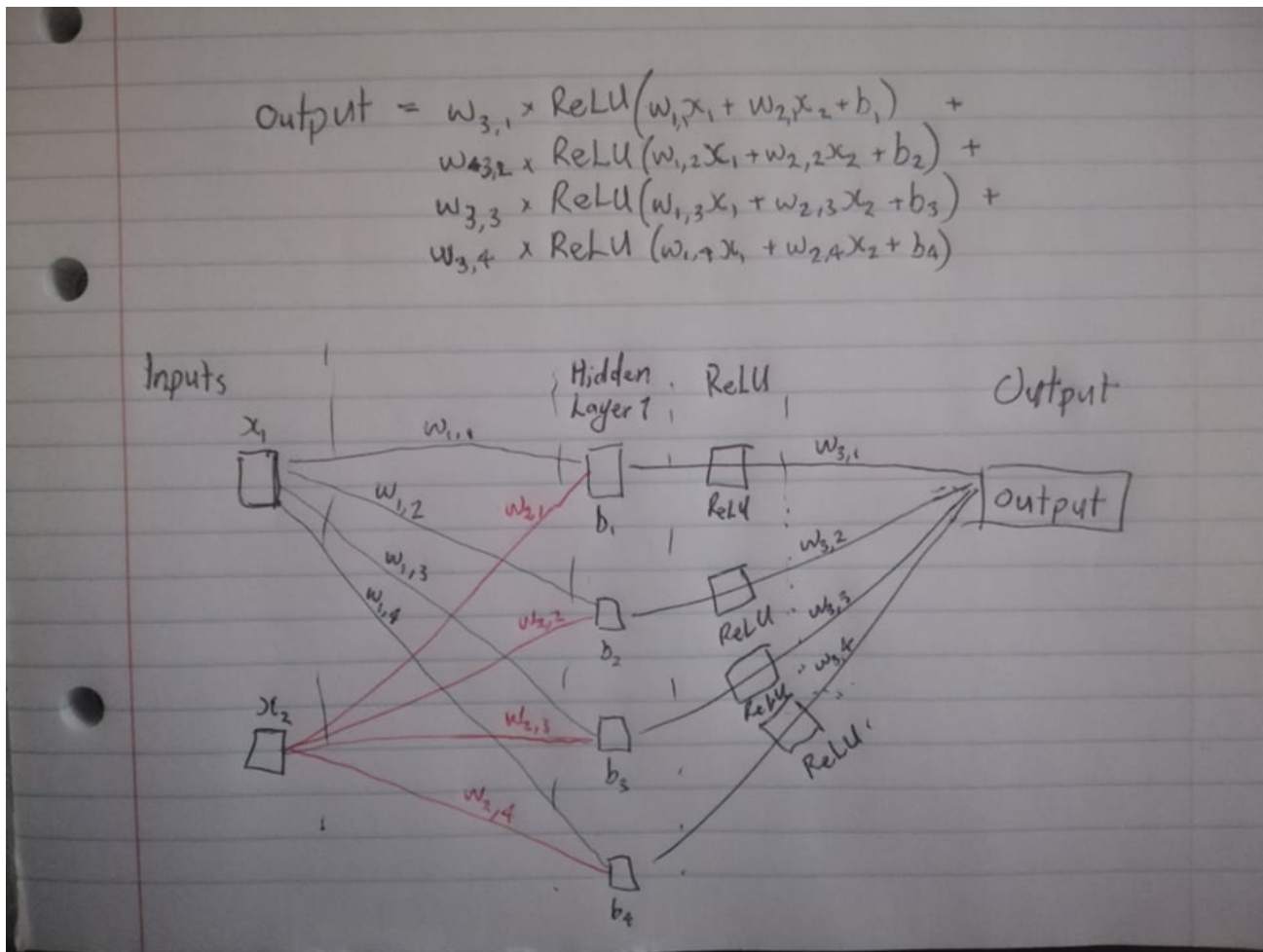
img_size	tf	fast	med	slow
- 5x5	0.0001	0.0002	0.0056	0.2851
- 10x10	0.0001	0.0002	0.0169	2.3309
- 15x15	0.0003	0.0004	0.0728	5.0417
- 20x20	0.0004	0.0003	0.0729	8.9420
- 30x30	0.0007	0.0004	0.1572	N/A
- 50x50	0.0011	0.0011	0.4335	N/A
- 75x75	0.0017	0.0026	0.9910	N/A
- 100x100	0.0028	0.0039	1.8297	N/A
- 150x150	0.0061	0.0079	4.0367	N/A
- 300x300	0.0190	0.0568	N/A	N/A
- 500x500	0.0551	0.1260	N/A	N/A

**Q2: Consider the three following 23x23 images of the digit 3.**

**Which neural net is better suited for identifying the digit in each image: a convolutional neural net or a feed-forward (multi-layer linear+ReLU) neural network? Explain your reasoning. (2-3 sentences)**

A convolutional neural net would be better for this sort of problem. This is because it preforms feature extraction using neural let layers. This allows the neural net to recognise features (such as what's need for handwriting recognition) in a way that is invariant to translation (such as what is present in these 3 images)

**Q3: Write out a mathematical expression in terms of the inputs, using linear layers and ReLUs, that will correctly classify all of these points.**



**Q4: Read about this algorithm, which claims to predict “criminality” based on people’s faces, and was created by researchers in China. (If interested, you can click through to the arxiv link where the researchers publish a response to criticism & media about their original paper).**

**(a) What factors do the researchers claim contribute to “criminality?” (1-3 sentences)**

“Ape like features” in a suspect’s face. This could include sloping forehead, unusually sized ears and various asymmetries.

**(b) What’s one potential confounding variable/feature that their algorithm learned? What’s your evaluation of the “effectiveness” of this algorithm? (2-4 sentences)**

It learned to recognise the distance between the two inner corners of a person’s eyes. Although I have been tested to be 89.5% effective, this was only in one study and it does not mean that it is effective in every scenario. For example it was tested in very restrictive condition and with only one race of people. I believe 89.5% is too low for this to be useful, in fact I believe it would be harmful if used because people would likely have a bias to convict everyone it identified as criminal - including the 10.5% false positives.

**(c) If this algorithm were actually deployed, what are the consequences of this algorithm making a mistake (misclassification)? (1-3 sentences)**

The consequences of this algorithm making a mistake (such as in 10.5% of the tests) could drastically alter a person's life. Although someone is more likely to be a criminal just because the algorithm says so, correlation does not imply causation. I believe any mistake (or even using this at all) could impact the fairness of the justice system as the jury and judge would have an unconscious bias towards agreeing with the algorithm (which was tested to be incorrect 10.5% of the time).