

# CPSC 501 – Assignment 4

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## Part 1

To optimize the given MNIST model, I performed the following:

- Added a Dense layer with 512 neurons
- To prevent overfitting, Dropout layer was added as well
- The algorithm was changed to ‘Adam’
- Number of epochs increased from 1 to 10

Resulting model is 99% accurate on the training data and 98% accurate on the test data.

### References

- <https://www.tensorflow.org/tutorials/quickstart/beginner>

## Part 2

### Part 2.1

Initial model for Part 2 was using the same layers as the model for Part 1, which can be seen here [14cec7c3](#). The accuracy with that model was roughly 93%. However, the model failed to identify image `user_inputs/image_A_lower.png`.

### Part 2.2

To improve the model, I implemented a Convolution Neural Network, which increased the accuracy of notMNIST model to roughly 95%. This model was able to identify the image `user_inputs/image_A_lower.png`.

Besides the convolution network, adding more neurons via extra Dense layers and Dropout layers that prevent overfitting increased the predictions.

Figure 1: Initial test with the first model

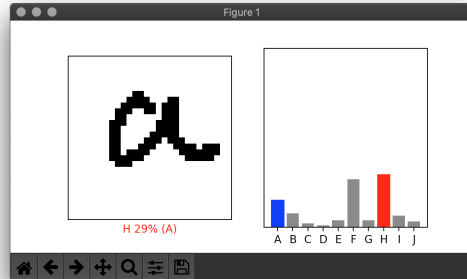
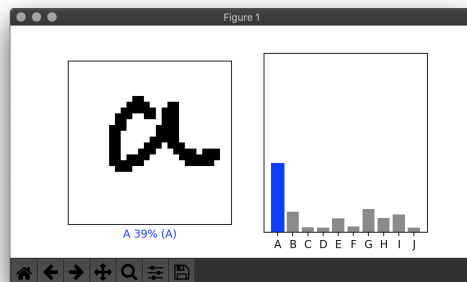


Figure 2: Test using the updated model



### Part 3

Initially, the model was trained without taking in consideration overfitting. Resulted accuracy:

```
[[{"node": "IteratorGetNext"}]]
56/56 [=====] - 0s 6ms/step - loss: 0.3129 - accuracy: 0.8592
37/Unknown - 0s 12ms/step - loss: 0.6468 - accuracy: 0.71352019-12-05 18:48:07.831887: W
equence [[{"node": "IteratorGetNext"}]]
37/37 [=====] - 0s 13ms/step - loss: 0.6468 - accuracy: 0.7135
Model Accuracy: 71.4%
Model Loss: 0.65
2019-12-05 18:48:08.065961: W tensorflow/core/util/gpu_util.cc:216]
```

After adding Dropouts and l2 regularizers, the model testing and training accuracy align and become roughly equal:

```

[[{{node IteratorGetNext}}]]
28/28 [=====] - 0s 6ms/step - loss: 0.6017 - accuracy: 0.7545
19/Unknown - 0s 14ms/step - loss: 0.6683 - accuracy: 0.74052019-12-05 18:49:14.053099: W
equence [[{{node IteratorGetNext}}]]
19/19 [=====] - 0s 15ms/step - loss: 0.6683 - accuracy: 0.7405
Model Accuracy: 74.1%
Model Loss: 0.67

```

## References

- [https://www.tensorflow.org/tutorials/load\\_data/csv](https://www.tensorflow.org/tutorials/load_data/csv)
- [https://www.tensorflow.org/tutorials/keras/overfit\\_and\\_underfit](https://www.tensorflow.org/tutorials/keras/overfit_and_underfit)