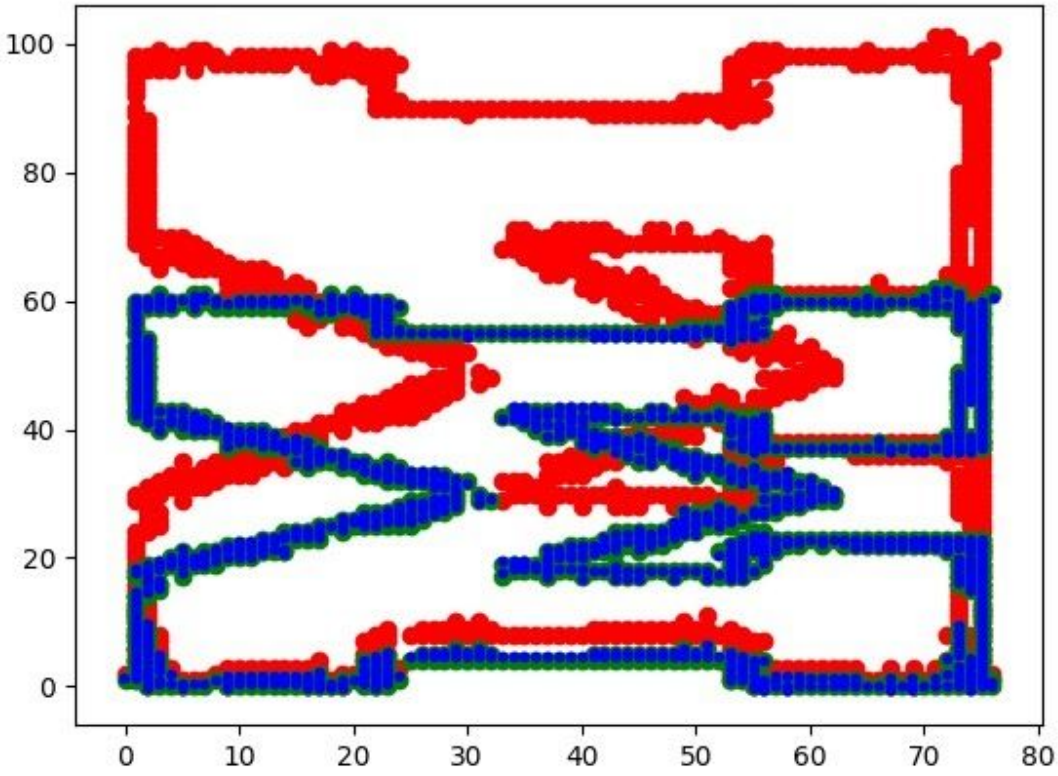
## Question 1

1) N/A
2) For this model, I ran 10000 iterations with $5e^{-6}$ as the learning rate. My *W* is shown above the graph.

```
[[ 1.00008704e+00 -5.47056447e-03]
 [ 6.73291402e-05  6.14059193e-01]]
```



## Question 2

As described by the spec, this was a one layer neural net. I used the ‘fc_forward’ function & the ‘fc_backward’ function. The model’s hyperparameters were as follows:

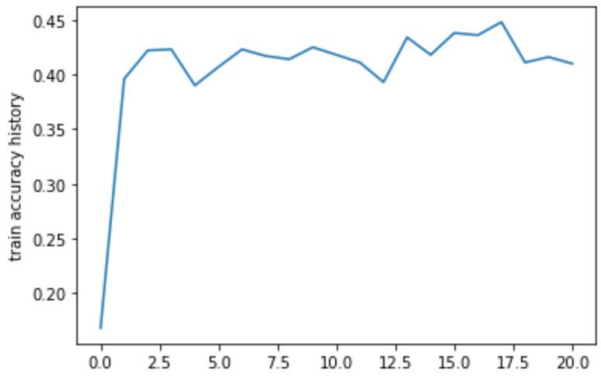
- *Learning_rate = 4.4e$^{-3}$*
- *Decay = 0.8*
- *Epochs = 20*
- *Batch_size = 118*

This model achieved a test accuracy score of 39.7% (hopefully this meets the 40% requirement lol).

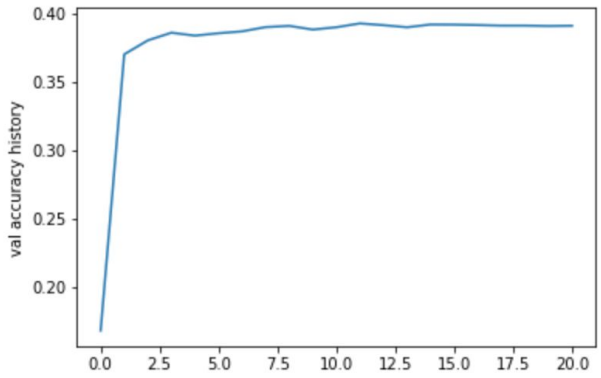
```
Test accuracy: 0.3972
Train accuracy history: [0.168, 0.396, 0.422, 0.423, 0.39, 0.407, 0.423, 0.417, 0.414, 0.425, 0.418, 0.411,
0.393, 0.434, 0.418, 0.438, 0.436, 0.448, 0.411, 0.416, 0.41]
Val accuracy history: [0.1681, 0.3699, 0.3801, 0.3857, 0.3836, 0.3853, 0.3867, 0.3898, 0.3907, 0.388, 0.3897
, 0.3925, 0.3912, 0.3897, 0.3917, 0.3916, 0.3913, 0.3909, 0.3909, 0.3906, 0.3908]
```

The training accuracy history and val accuracy are plotted below (where epochs are the x-axis).

```
Text(0, 0.5, 'train accuracy history')
```




```
Text(0, 0.5, 'val accuracy history')
```



## Question 3

As described by the spec, this was a two layer neural net. The architecture went as follows:
for forward, fc forward, relu forward, fc forward, softmax loss.
for backward → fc backward, relu backward, fc backward.

The hyperparameters were also also follows

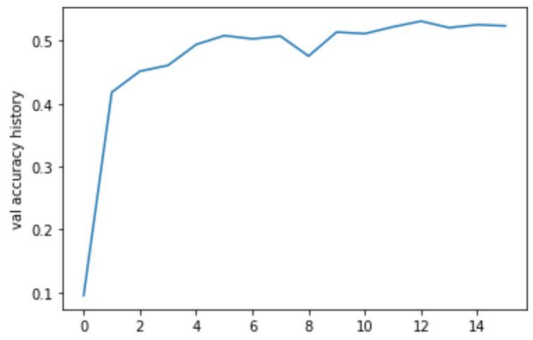
- *Learning_rate = $9e^{-2}$*
- *Decay = 0.9*
- *Epochs = 15*
- *Batch_size = 118*
- *Hidden dimensions = 200*

This model achieved a test accuracy score of 52.55%.

```
Test accuracy: 0.5255
Train accuracy history: [0.11, 0.417, 0.474, 0.522, 0.543, 0.579, 0.613, 0.604, 0.547, 0.654, 0.661, 0.702,
0.718, 0.711, 0.7, 0.742]
Val accuracy history: [0.0952, 0.4181, 0.4515, 0.4608, 0.4939, 0.5081, 0.5029, 0.5073, 0.4756, 0.5138, 0.511
2, 0.522, 0.5311, 0.5207, 0.5254, 0.5237]
```

The training accuracy history and val accuracy are plotted below (where epochs are the x-axis).

```
Text(0, 0.5, 'val accuracy history')
```




```
Text(0, 0.5, 'train accuracy history')
```