

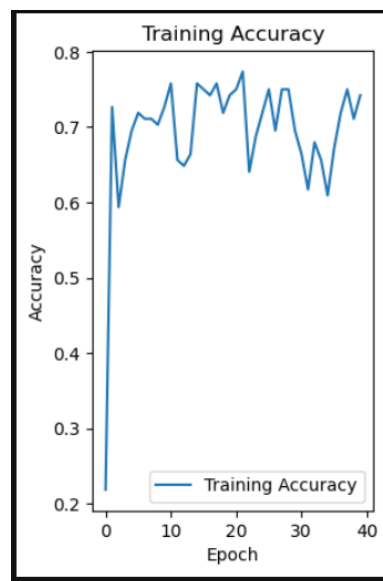
DLCV Assignment 1 - Report

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Q1. Single Layer Classifier

Observation and Analysis

- Bias is an important factor as it in cases can boost the performance by a good margin
- Calculating gradient doesn't always mean to calculate the whole thing . For instance the gradient of softmax can easily be calculated as $\text{softmax} \cdot (1 - \text{softmax})$ for same index weights
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▼ Hyperparameter tuning:

- ▼ Best Epoch Size = 20
- ▼ Best Batch Size = 64
- Though our Test accuracy is comparatively less but it can be significantly boosted by increasing the layers
- Test Accuracy: 71.87%

- Linear Classifier of Scikit Learn has a better accuracy of 92.35% on the test dataset
- Best Performing Class : 0 (Checked on the whole test data set)

Q2. Scalar Backpropagation

Observations and Analysis

- We are calculating the gradient of the final function value w.r.t to all the sub function elements
- This is the result:

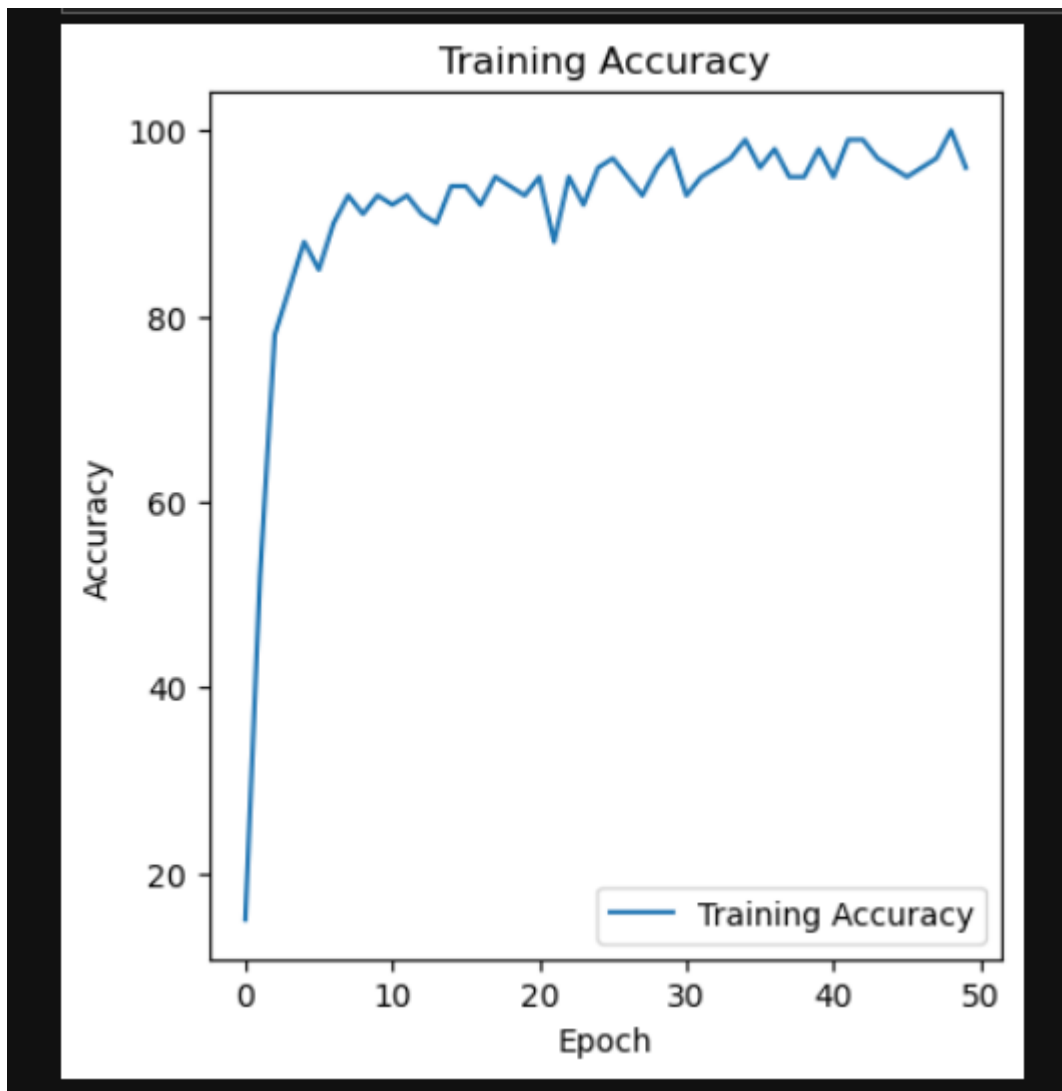
```
For x: 2 , y: 4 , z: 1
  Grad x :0.2846421796101843 , Grad_y :0.20461351747185724 ,
  Grad_z:-0.13146678792954025
  For x: 9 , y: 14 , z: 3
    Grad x :-0.8242369830366254 , Grad_y :0.27347444058067727
    , Grad_z:0.01973207463139951
    For x: 128 , y: 42 , z: 666
      Grad x :-7.204614010398276e-16 , Grad_y :-3.99665615590812
      1e-16 , Grad_z:0.0
      For x: 52 , y: 14 , z: 8
        Grad x :8.763013355310581e-16 , Grad_y :-1.214470463820248
        4e-16 , Grad_z:-3.998051646950293e-22
```

Q3. Linear Classifier

Observations and Analysis

- Mean accuracy has increases in this case for the same MNIST dataset
- Accuracy is a bit on the higher side , most probably the model is overfitting and regularizer is needed
- In the hidden layers we are using ReLU. ReLU and its derivative both being simple to calculate makes the computation easy

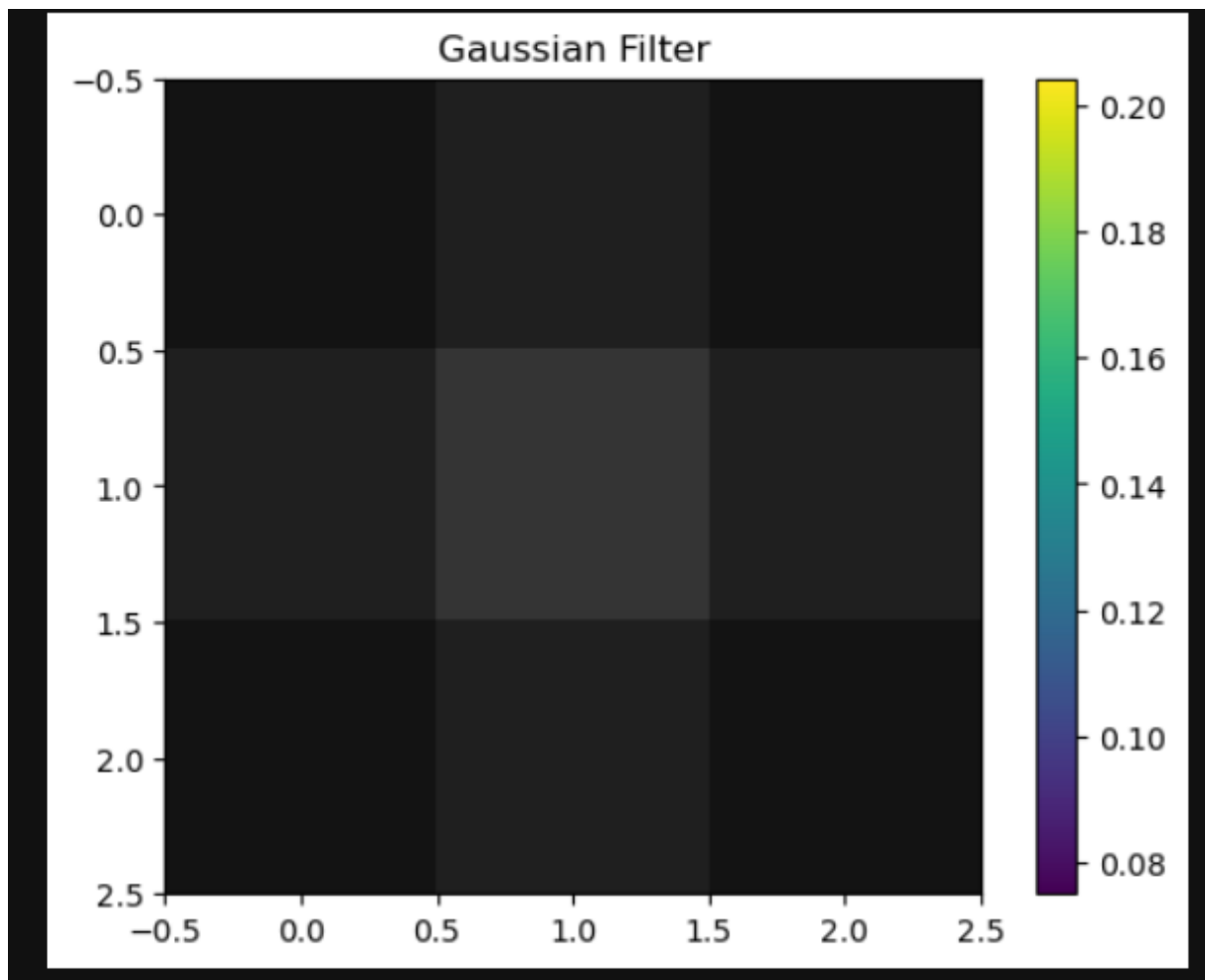
- Here also we are using a cross entropy loss because we are using softmax activation and it goes better with multiclass classification



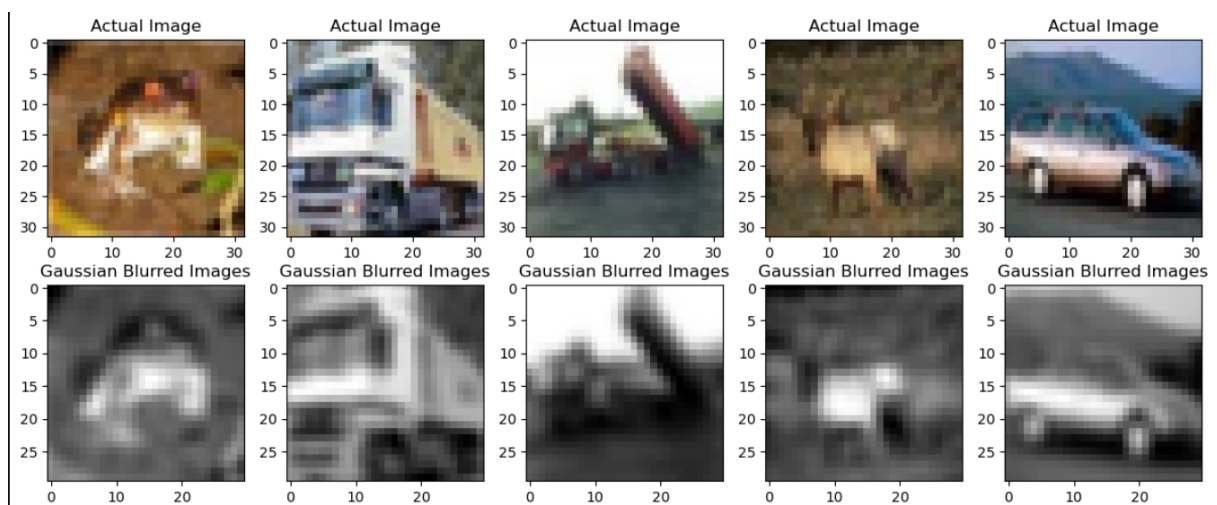
Q4. Convolution Module with Numpy

Observation and Analysis

- This is the gaussian blur filter



- Tried this question with a custom box filter also but using a gaussian filter keeps the image a bit smooth and preserves a bit of more details



Q5. Training a Convolution Layer

Observation and Analysis

- The L2 distance between C and C0 is 5661470.045074505