SMAI (CSE 471)
Spring-2019
Assignment-6
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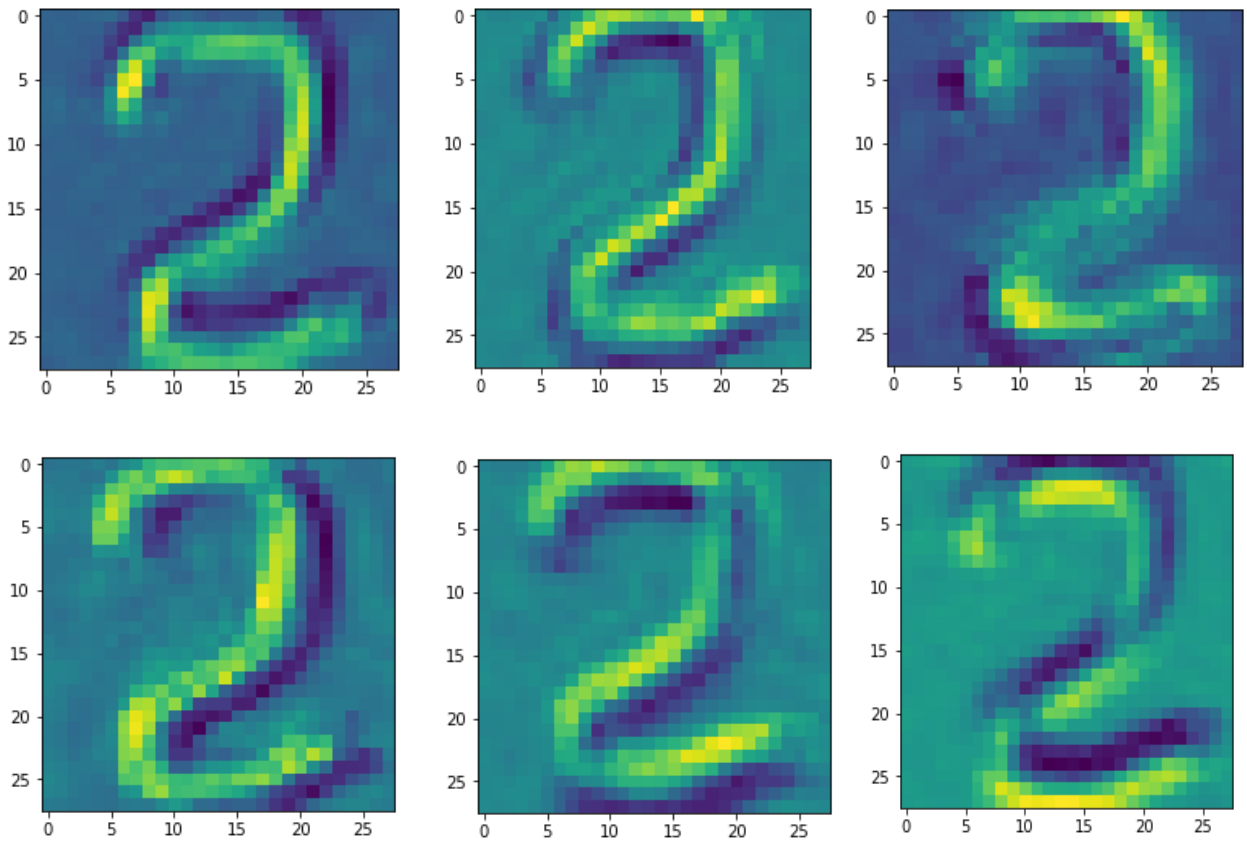
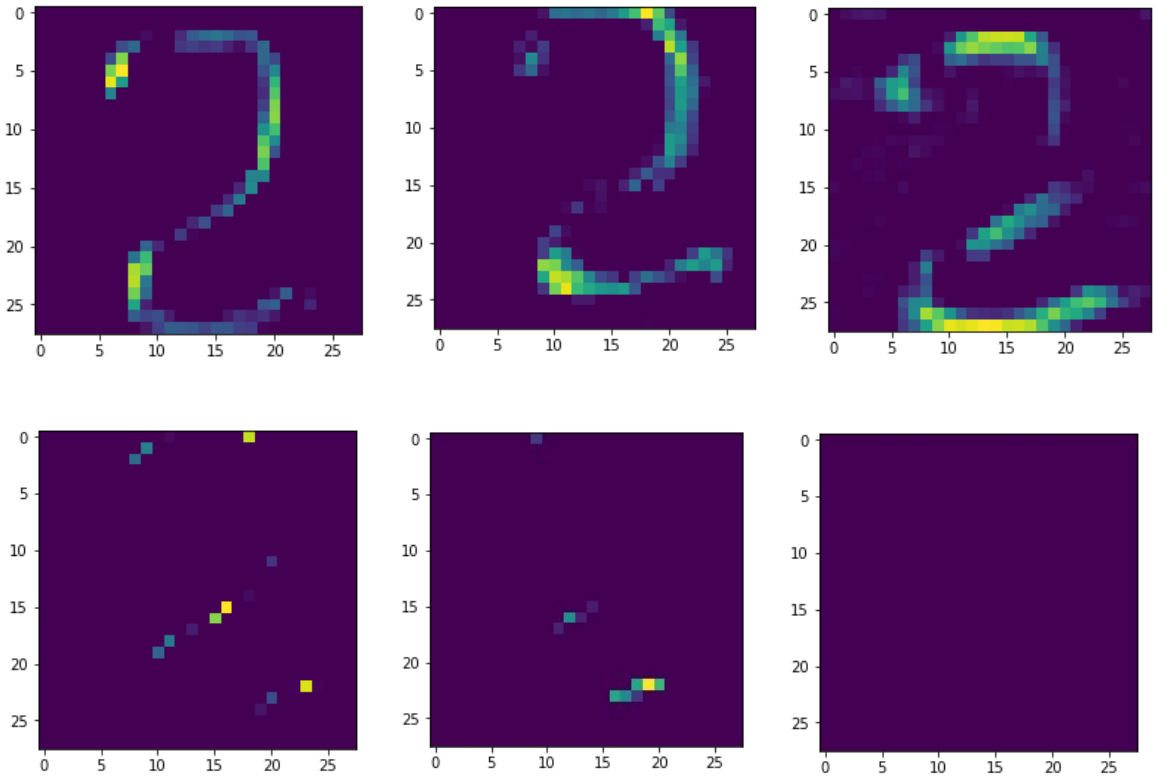
Q1.

Input Image:

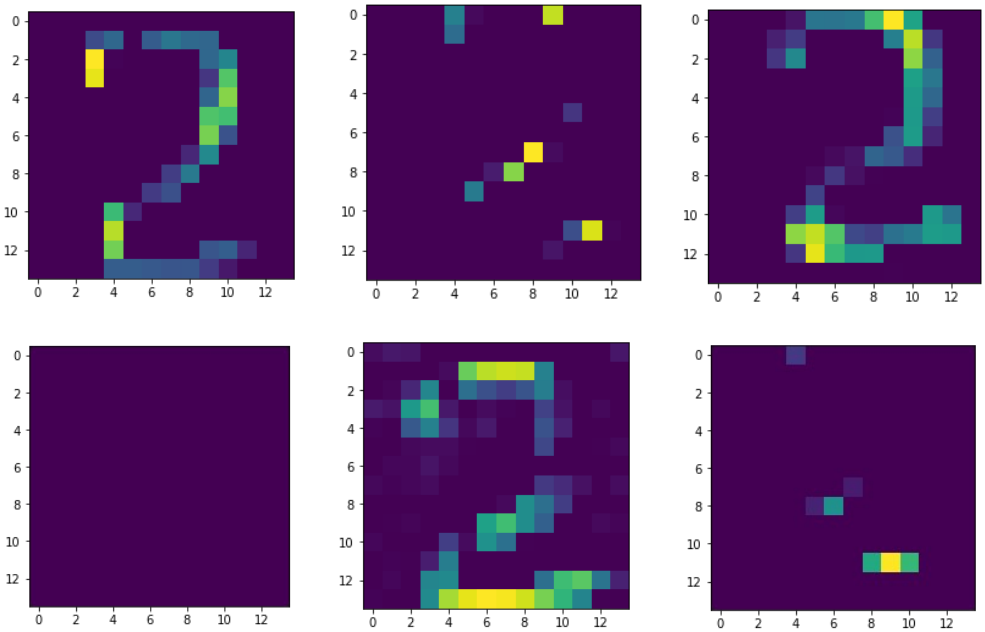
Convolution Layer 1:



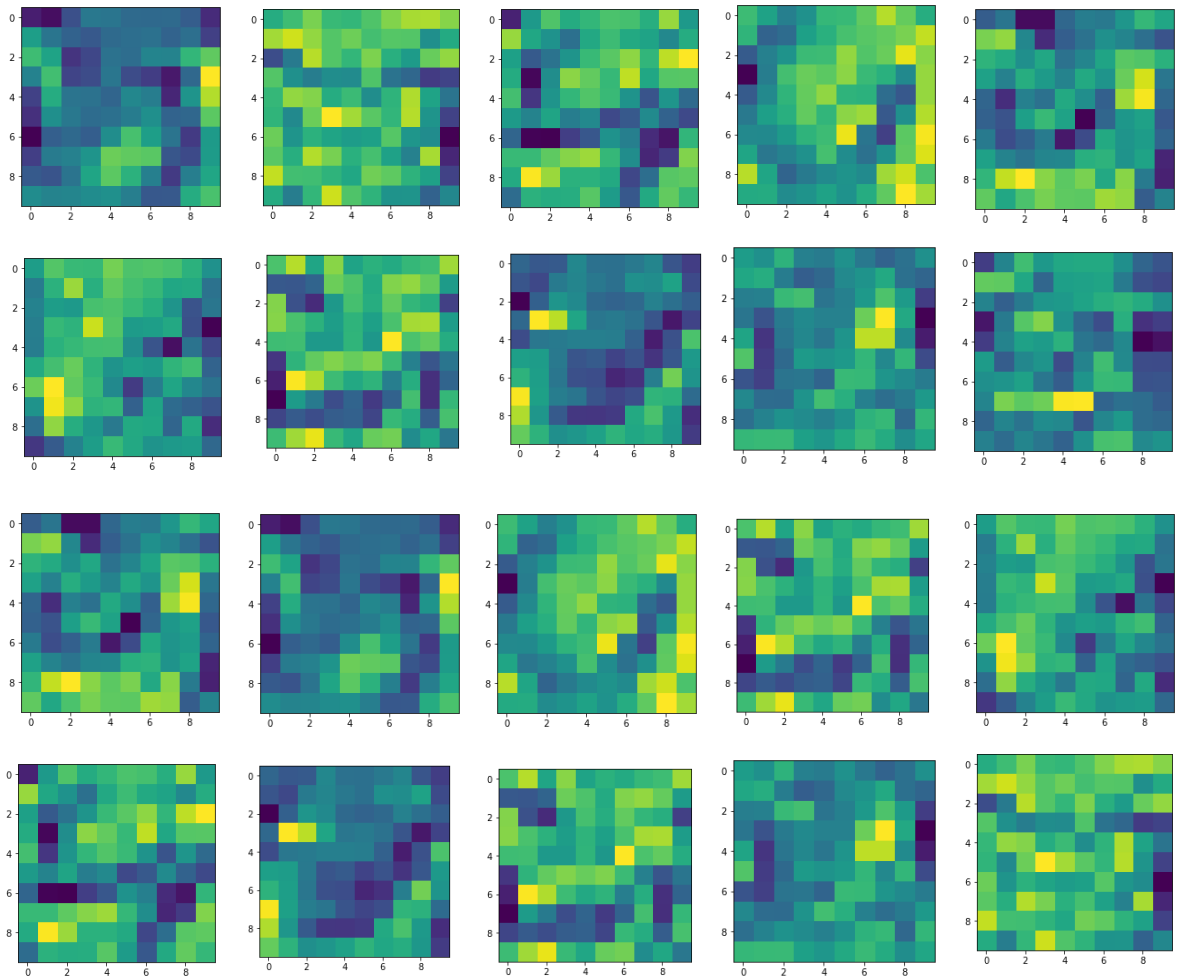
After applying Relu



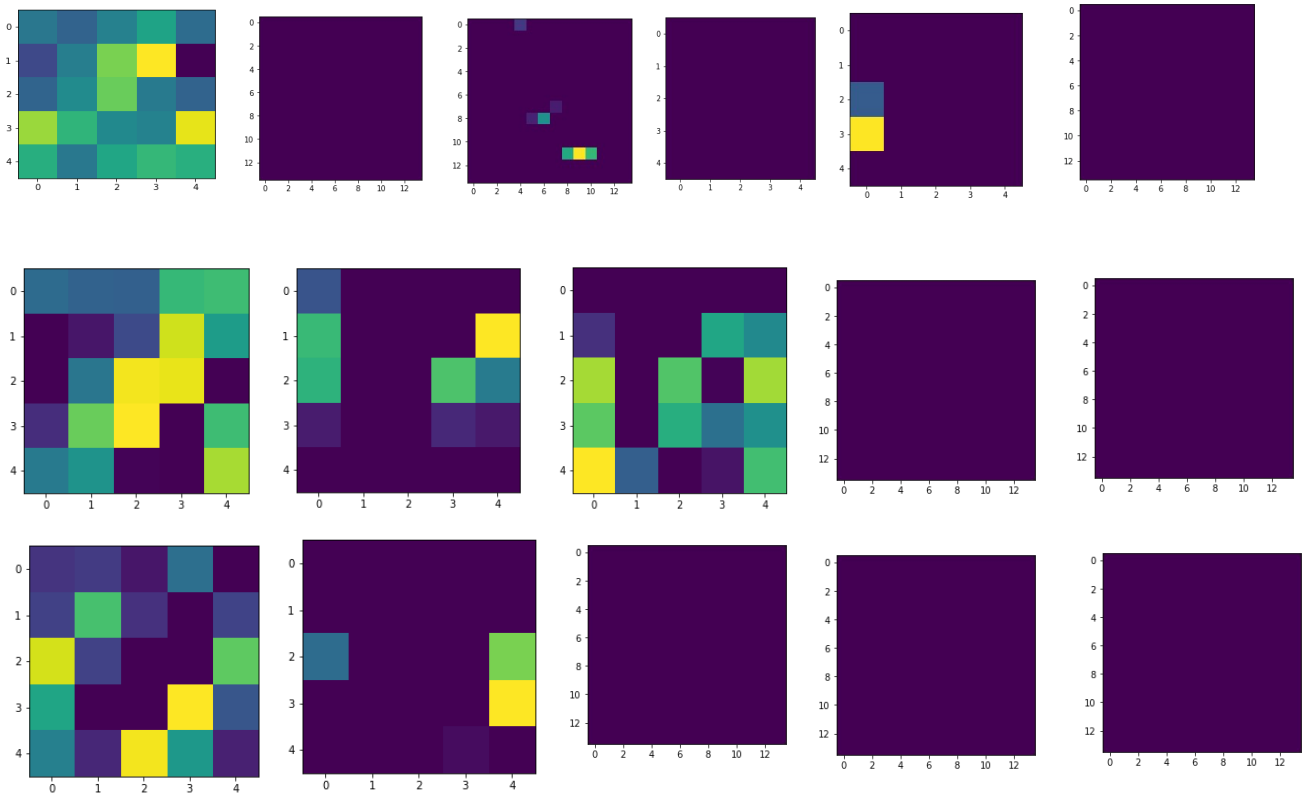
After Applying Max-Pooling:



After Applying convolution layer2:



After Applying Max-Pooling



Q2:

For 32 X 32 X 3 IMAGE:

1. 6 * 5 * 5 * 3 + 6 = 456
2. 0
3.

   Parameters in Convolution Layers = 6 * 5 * 5 * 3 + 6 + 16 * 5 * 5 * 6 + 16 + 120 * 5 * 5 * 16 + 120 = 50992

   Parameters in Fully Connected Layers = 120*84+84*10+84+10 = 11014

   Prameters in Pooling Layers = 0

   Parameters in Final Activation Layers = 84 * 10 + 10 = 850

   Therefore maximun parameters is present in Fully connected layers

4. Memory consumption in Convolution layers:

   6 * 5 * 5 * 3 + 6 + 16 * 5 * 5 * 6 + 16 + 120 * 5 * 5 * 16 + 120 = 50992

   Memory consumption in Fully Connected layers:

   120 * 84 + 84 *3 + 84 * 10 + 10 *3 +10 + 84 = 11296

   Therefore memory consumption is more at Convolution layer than fully connected layers

5.

   Sigmoid activation function at last layer:

```
[[0.48174375]
[0.4401385 ]
[0.50446579]
[0.56598868]
[0.57122724]
[0.53894703]
[0.5047376 ]
[0.6246973 ]
[0.5664035 ]
[0.50467928]]
```

```
Relu activation function at last layer:

[[0.0075168 ]

[0.        ]
[0.        ]
[0.        ]
[0.40829796]
[0.        ]
[0.38072802]
[0.        ]
[0.03093909]
[0.00190568]]
```

```
TanH activation Function at last layer:

      [[-0.25962512]

      [ 0.01113481]
      [ 0.25746297]
      [ 0.33825446]
      [-0.0848849 ]
      [ 0.4425563 ]
      [ 0.20659612]
      [-0.52925016]
      [-0.09303605]
      [-0.21691101]]



SoftMax activation function at last layer:

      [[0.10779026]

      [0.05577597]
      [0.10371298]
      [0.170547  ]
      [0.0576154 ]
      [0.0540173 ]
      [0.05515447]
      [0.08895847]
      [0.13173045]
      [0.17469771]]
```

Q3.

Following is the architecture used to train on CIFAR10 dataset:

Convolution Layer with filter size 3 X 3, activation function = Relu

Batch Normalization

Max Pooling with pool size 2 X 2 and stride 2 X 2

Dropout with dropout rate: 0.2 (0.2 is hyperparameter)

Convolution Layer with filter size 3 X 3, activation function = Relu

Batch Normalization

Max Pooling with pool size 2 X 2 and stride 2 X 2

Dropout with dropout rate: 0.3 (0.3 is hyperparameter)

Convolution Layer with filter size 3 X 3, activation function = Relu

Batch Normalization

Max Pooling with pool size 2 X 2 and stride 2 X 2

Dropout with dropout rate: 0.4 (0.4 is hyperparameter)

Flatten

Fully Connected Layer with size 50 (50 is hyperparameter)

Fully Connected Layer with size 50 (50 is hyperparameter)

Fully Connected Layer with size 10 (10 is number of ouput class labels)

Optimizer used : MomentumOptimizer with learning rate 1e-03, Nesterov momentum = 0.9