Deep Learning

Programming Assignment 2

April 7, 2019

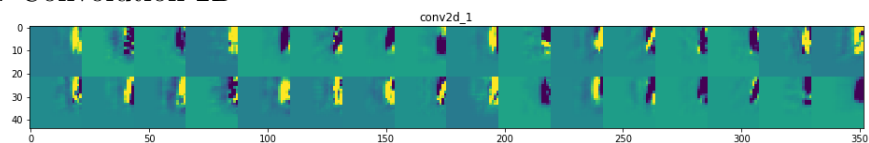| Group Members	
Name	**Roll No.**
Akul Gupta	B16006
Arpit Batra	B16047
Ayush Meghwani	B16127

Faculty Mentor - Prof. Aditya Nigam.

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1 Visualizing Intermediate Layer Activations
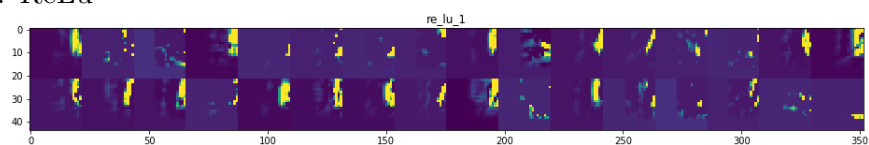
1.1 Section-1

1.1.1 Line
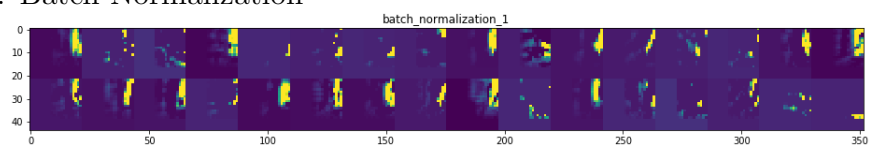
1. Image-01

   - Layer-1: Convolution 2D

   - Layer-2: ReLu

   - Layer-3: Batch Normalization

   - Layer-4: Max Pooling 2D

2. Image-02

   - Layer-1: Convolution 2D

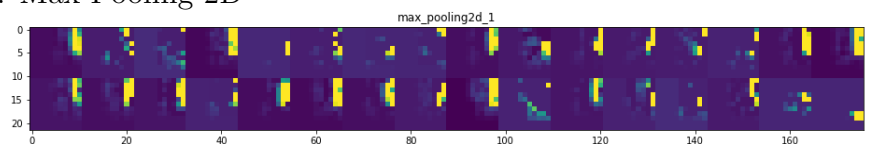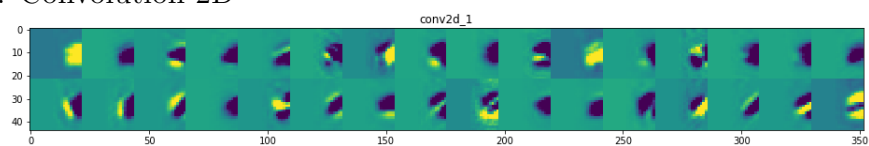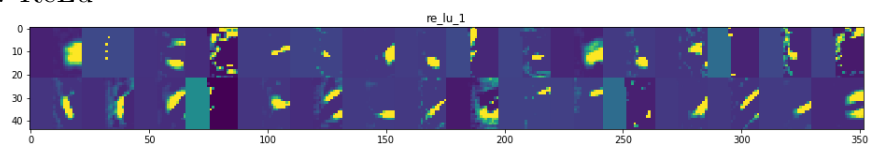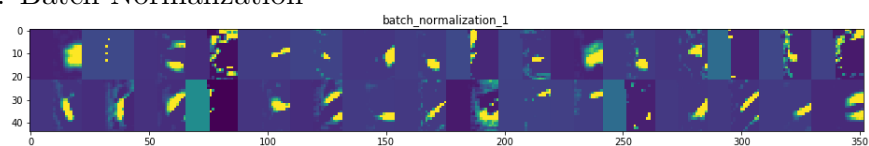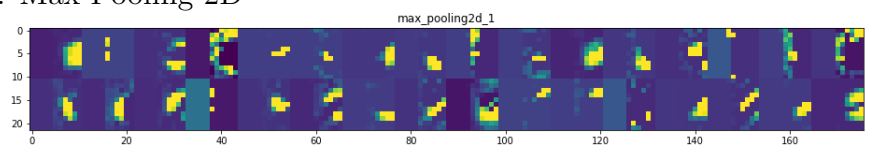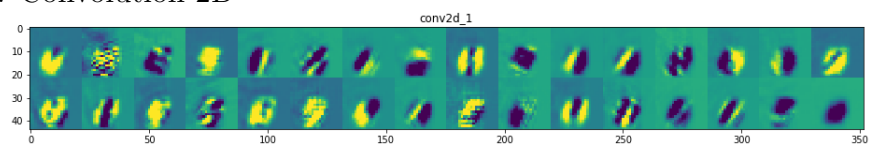   - Layer-2: ReLu

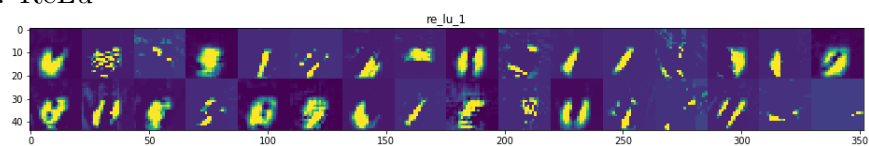- Layer-3: Batch Normalization

- Layer-4: Max Pooling 2D
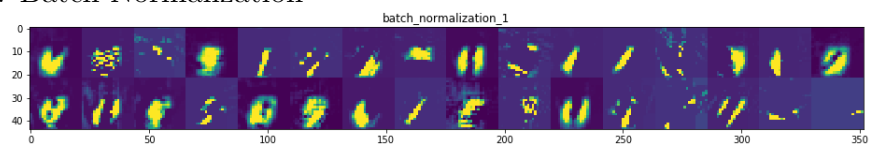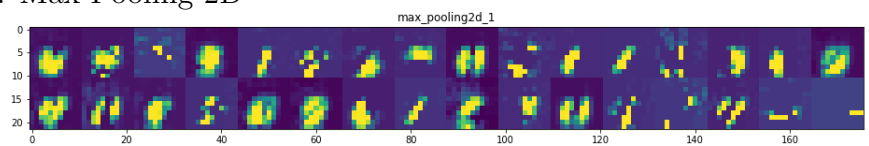

3. Image-03

- Layer-1: Convolution 2D
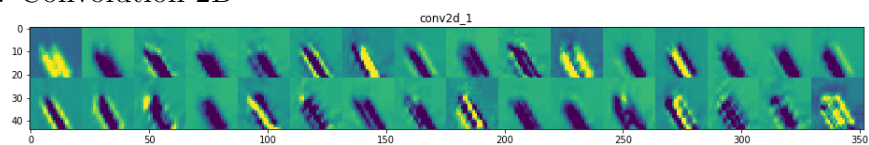

- Layer-2: ReLu

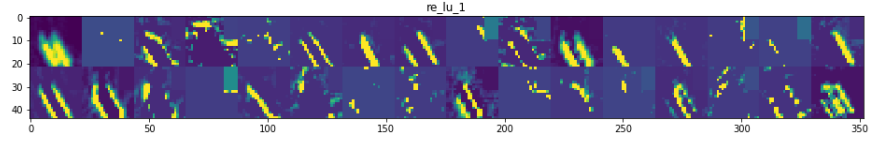- Layer-3: Batch Normalization

- Layer-4: Max Pooling 2D

4. Image-04

- Layer-1: Convolution 2D

4

- Layer-2: ReLu

- Layer-3: Batch Normalization

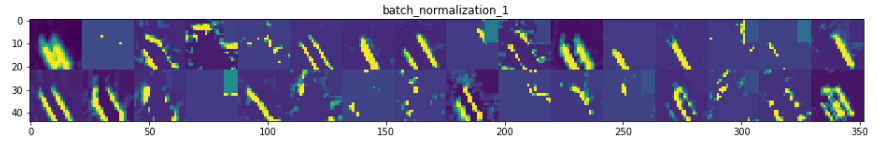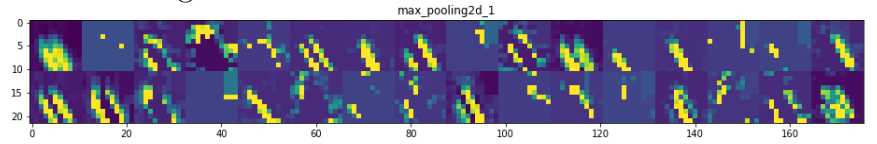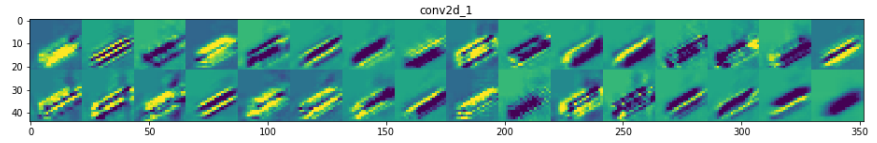

- Layer-4: Max Pooling 2D
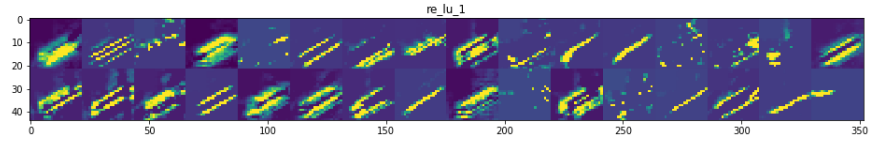

5. Image-05

- Layer-1: Convolution 2D

- Layer-2: ReLu

- Layer-3: Batch Normalization

- Layer-4: Max Pooling 2D

6. Image-06

- Layer-1: Convolution 2D

- Layer-2: ReLu

- Layer-3: Batch Normalization

- Layer-4: Max Pooling 2D
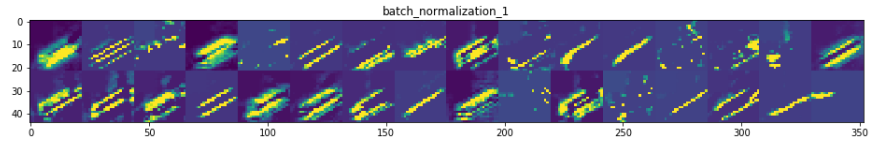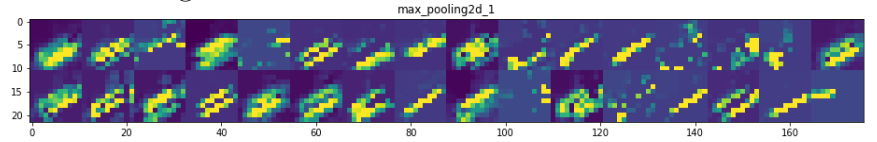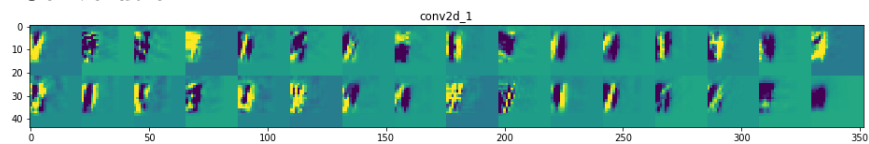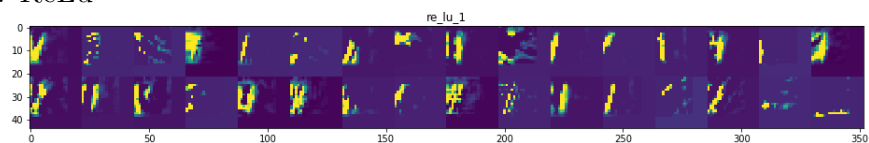

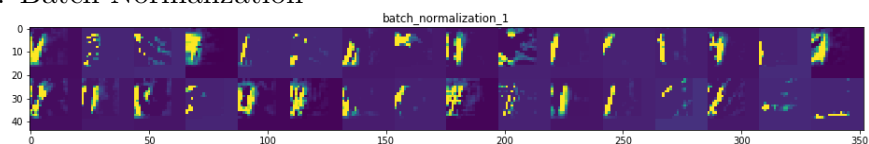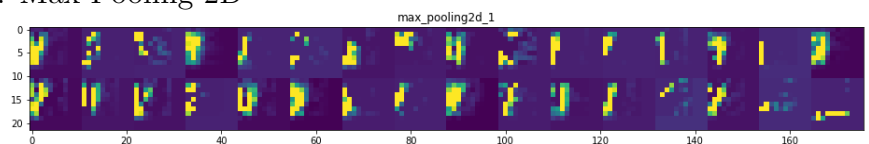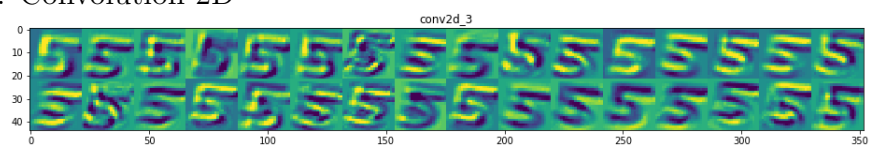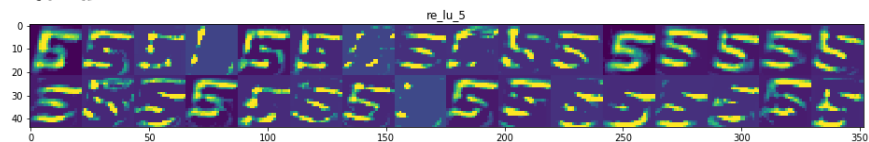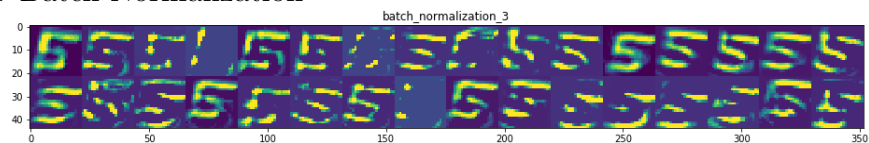### 1.1.2 MNIST

1. Image-01

- Layer-1: Convolution 2D

- Layer-2: ReLu

- Layer-3: Batch Normalization

- Layer-4: Max Pooling 2D

max_pooling2d_3

2. Image-02

   - Layer-1: Convolution 2D

conv2d_3

   - Layer-2: ReLu

re_lu_5

   - Layer-3: Batch Normalization

batch_normalization_3

   - Layer-4: Max Pooling 2D

max_pooling2d_3

3. Image-03

   - Layer-1: Convolution 2D

conv2d_3

   - Layer-2: ReLu

re_lu_5

- Layer-3: Batch Normalization

- Layer-4: Max Pooling 2D

4. Image-04

- Layer-1: Convolution 2D

- Layer-2: ReLu

- Layer-3: Batch Normalization

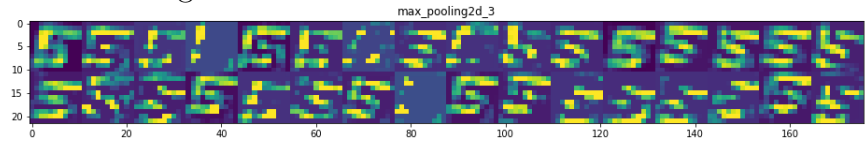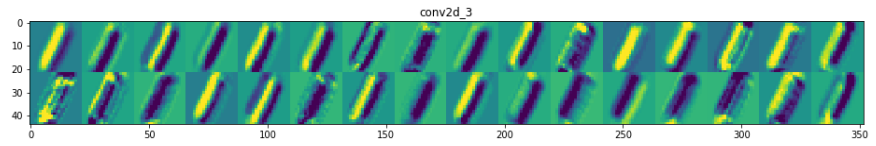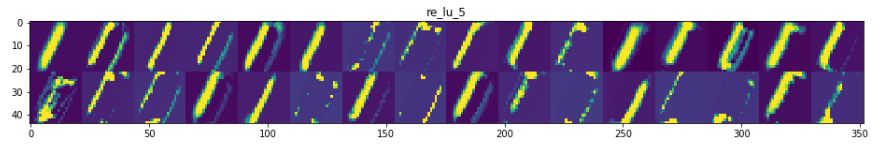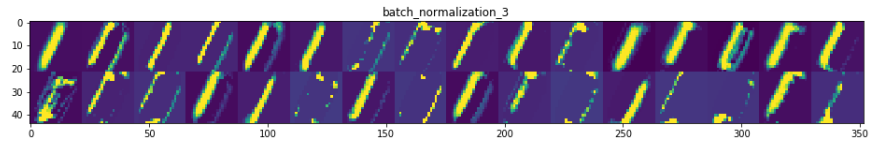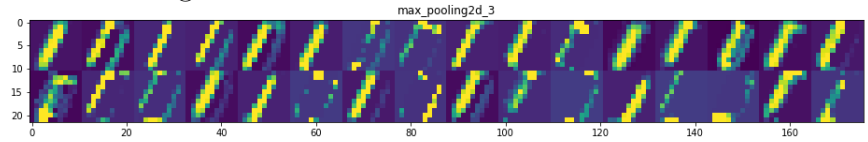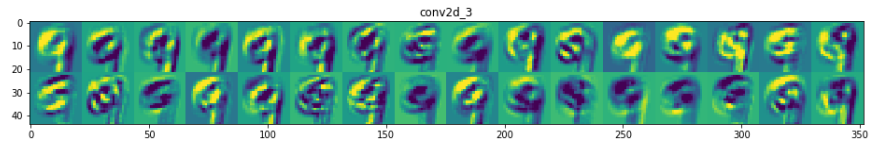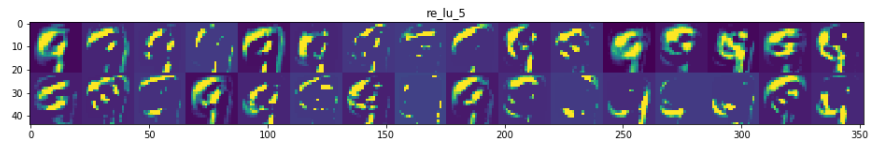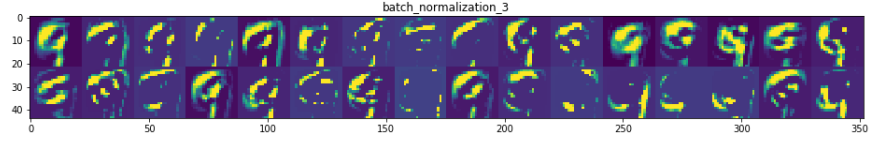- Layer-4: Max Pooling 2D

5. Image-05

- Layer-1: Convolution 2D

- Layer-2: ReLu

- Layer-3: Batch Normalization

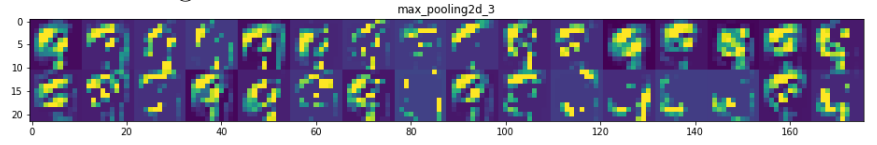- Layer-4: Max Pooling 2D

6. Image-06

- Layer-1: Convolution 2D

- Layer-2: ReLu

- Layer-3: Batch Normalization
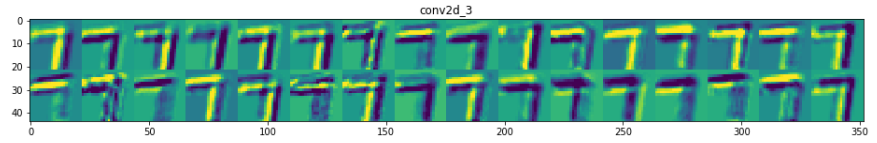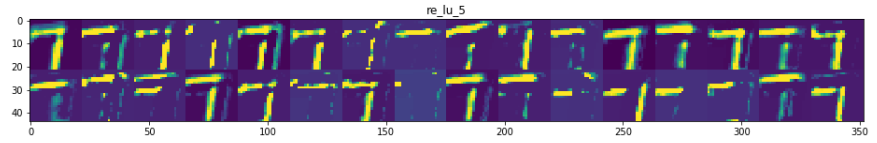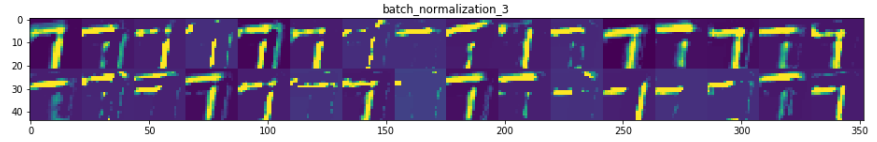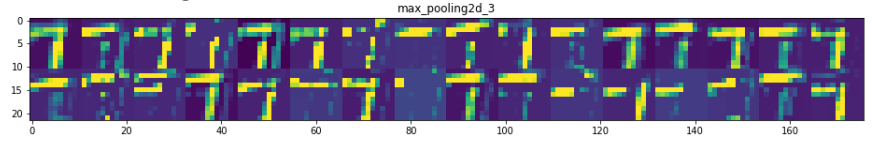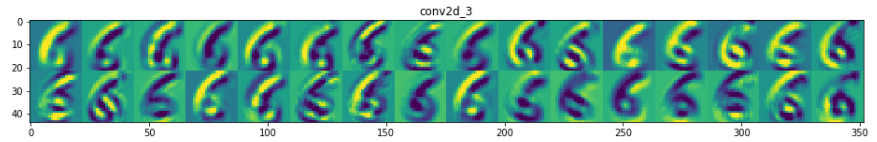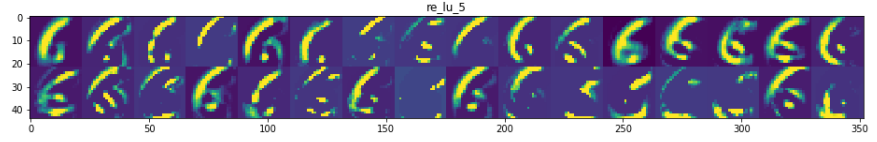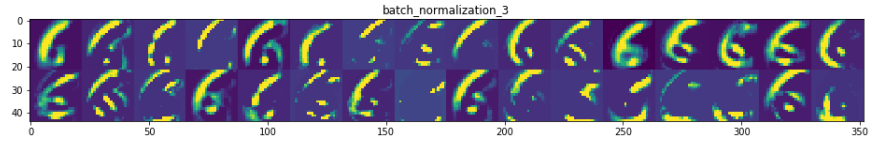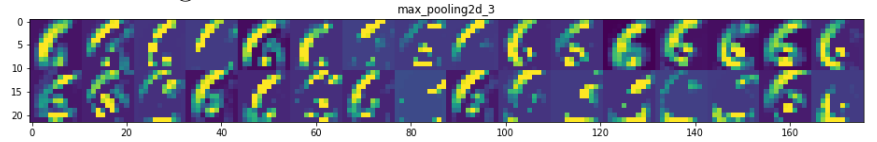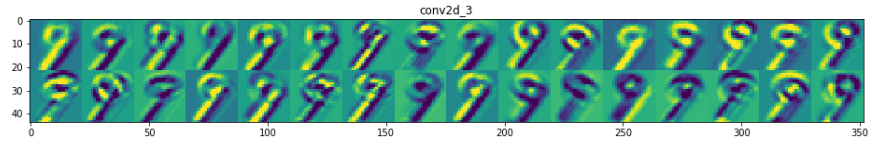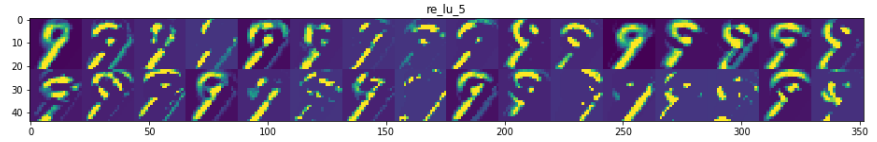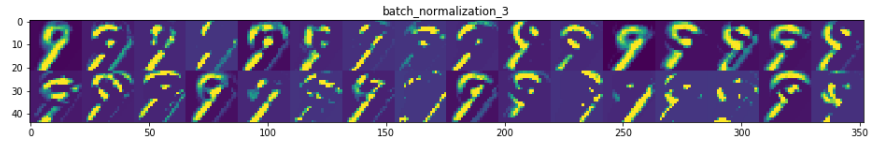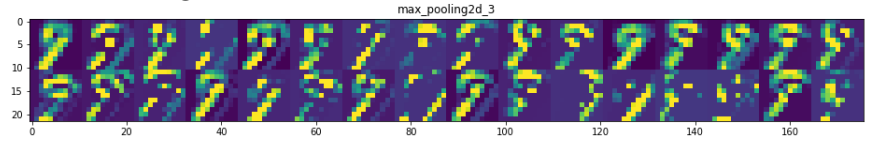

- Layer-4: Max Pooling 2D

1.2 Section-2

1. Image-01

- Layer-1: Convolution 2D

conv2d_1

- Layer-2: ReLu

re_lu_1

- Layer-3: Batch Normalization

batch_normalization_1

2. Image-02

- Layer-1: Convolution 2D

conv2d_1

- Layer-2: ReLu

re_lu_1

- Layer-3: Batch Normalization

batch_normalization_1

3. Image-03

- Layer-1: Convolution 2D

conv2d_1

- Layer-2: ReLu

- Layer-3: Batch Normalization

4. Image-04

  - Layer-1: Convolution 2D

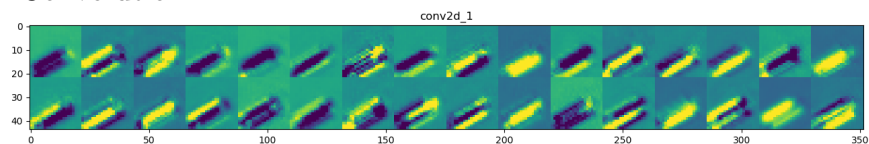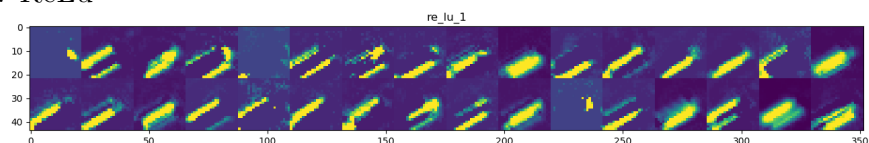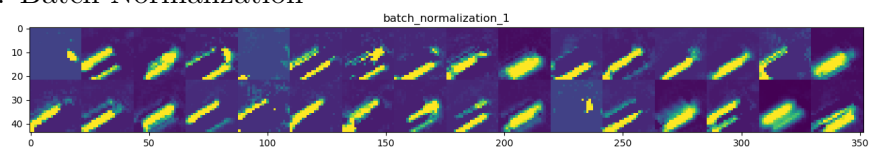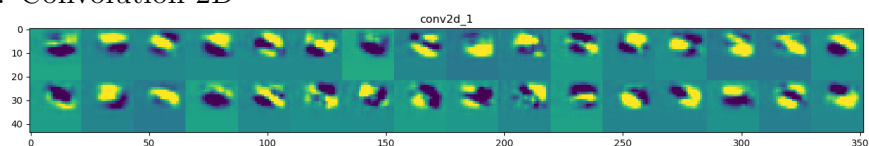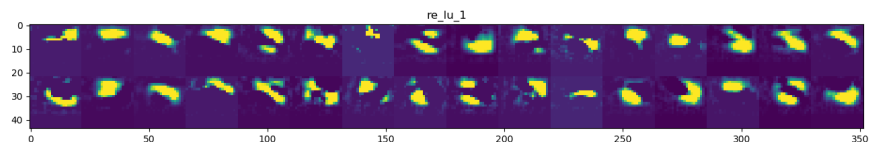

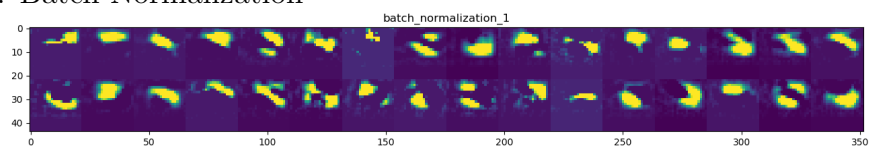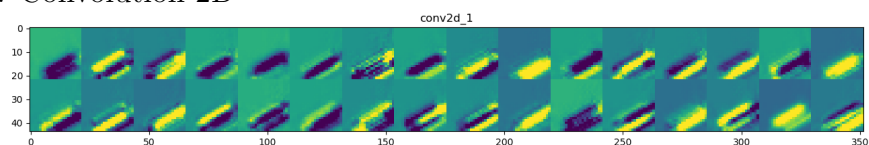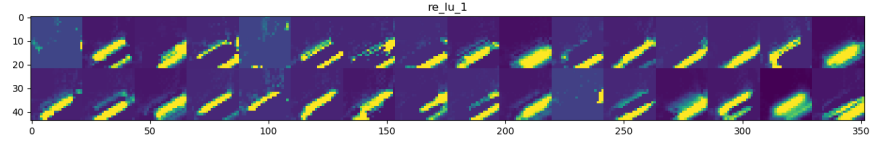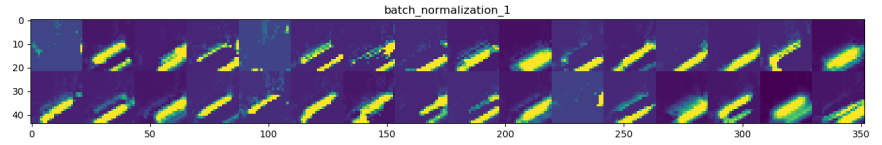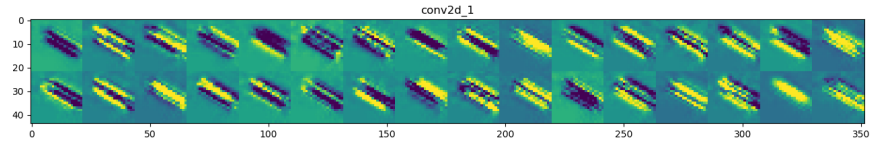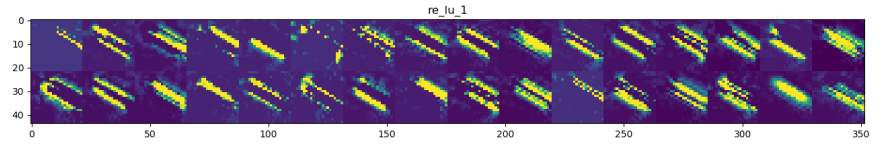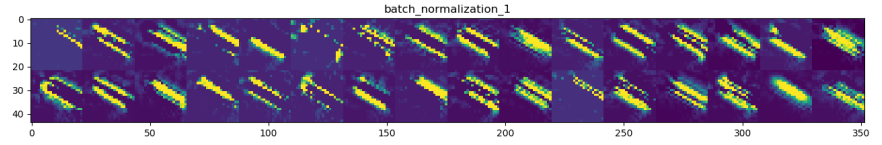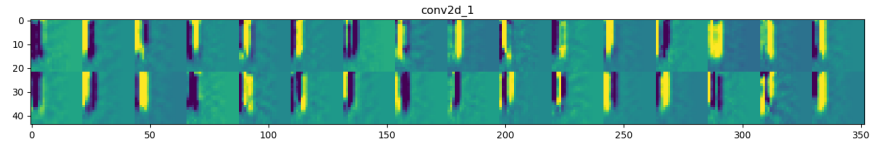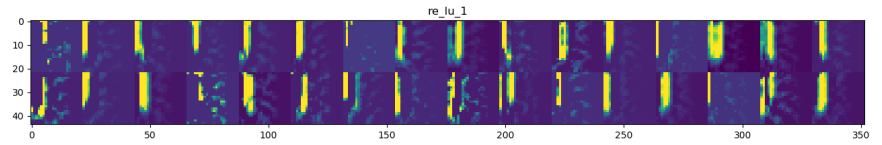 - Layer-2: ReLu
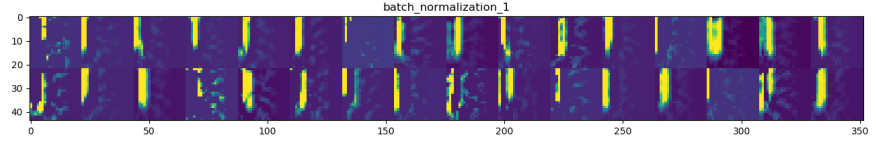

  - Layer-3: Batch Normalization

5. Image-05

  - Layer-1: Convolution 2D

  - Layer-2: ReLu
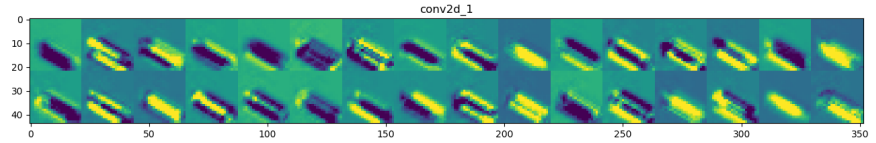
- Layer-3: Batch Normalization
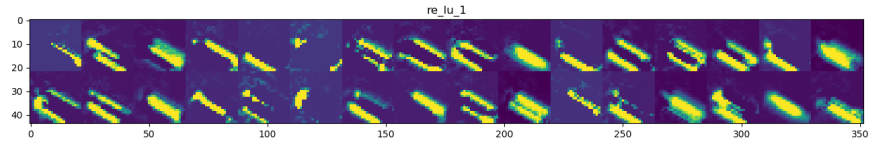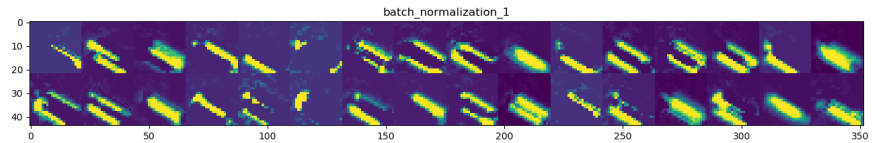

batch_normalization_1

6. Image-06

- Layer-1: Convolution 2D

conv2d_1

- Layer-2: ReLu

re_lu_1

- Layer-3: Batch Normalization

batch_normalization_1

1.3 Inferences

- Every filter results in different output from the first Convolutional layer.

- After ReLu is applied green color is completly lost because all negative numbers are taken 0 which is most probably represented by blue color.

- This is because after ReLu most of the green area becomes blue

- After ReLu we loss some details.

- Batch Normalization has no observable change.

- Max Pooling makes the image more blurry as the size is decreased.

- Output of Convolutional layers in Section 1 and Section 2 for line data is different because the model ahead of Convolutional layers is different which makes filters different during training.
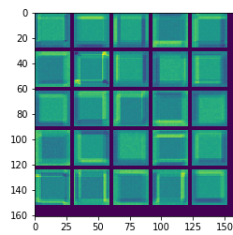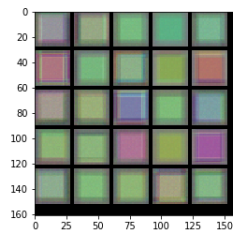
2 Visualizing Convnet Filters

2.1 Section-1

2.1.1 Line
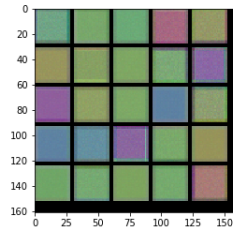
2.1.2 MNIST

2.2 Section-2

2.3 Inferences

- These are 25 of the 32 filters of the first convLayer

- Filters for Section2 for Lines has more details compared to that for first.

- In filters for MNIST data, all have same color, while this is not the case with Lines.
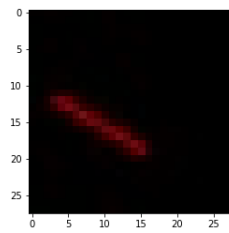
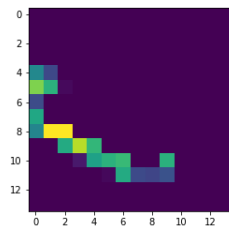# 3 Visualizing Heatmaps of class activations
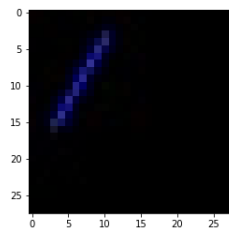
3.1 Section-1

3.1.1 Line

1. Image-01

   - Image

   - Heatmap
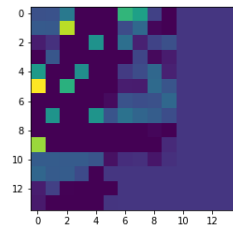

2. Image-02

   - Image
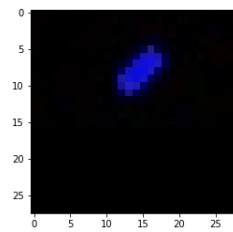

   - Heatmap
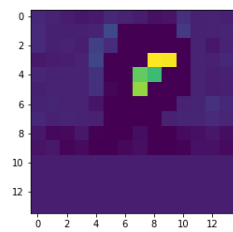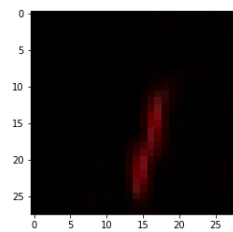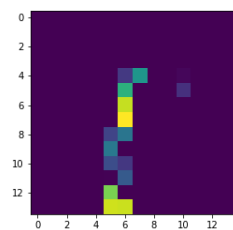
3. Image-03

- Image

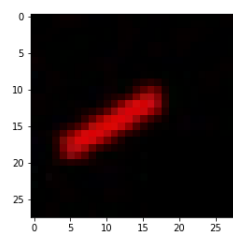- Heatmap
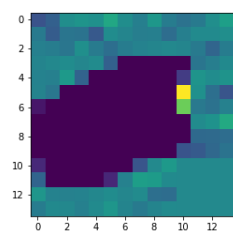

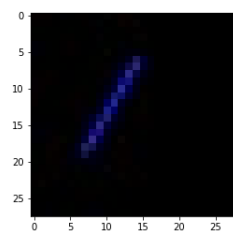4. Image-04

- Image

- Heatmap

5. Image-05
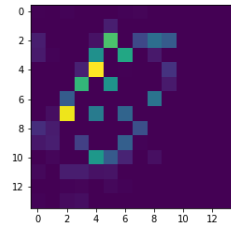
    - Image

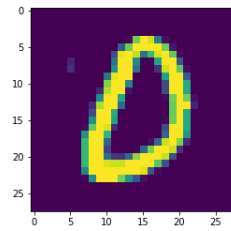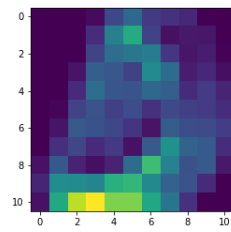
    - Heatmap

6. Image-06

    - Image

    - Heatmap

3.1.2 MNIST

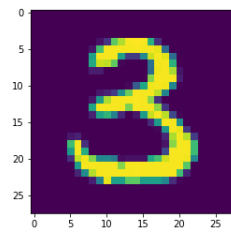1. Image-01

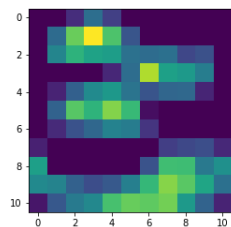   - Image

   - Heatmap

2. Image-02
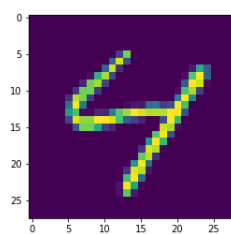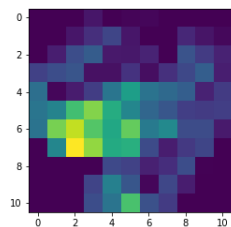
   - Image

- Heatmap

3. Image-03

   - Image

   - Heatmap

4. Image-04

   - Image

   - Heatmap

5. Image-05

   • Image

   • Heatmap

6. Image-06

   • Image

   • Heatmap

3.2   Section-2

1. Image-01

   - Image

   - Heatmap
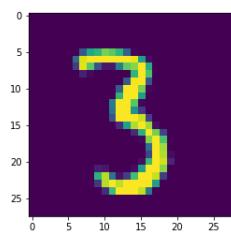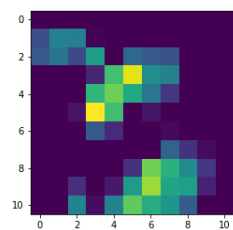

2. Image-02

   - Image

- Heatmap

3. Image-03

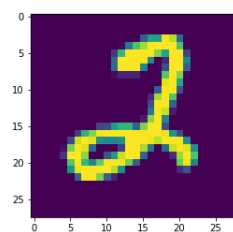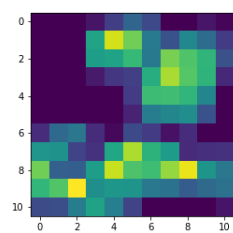   - Image

   - Heatmap

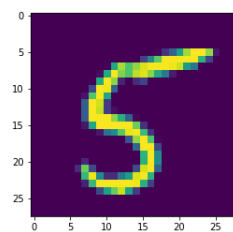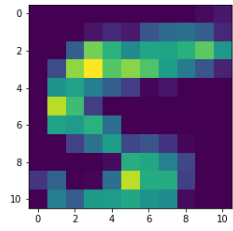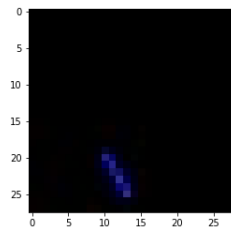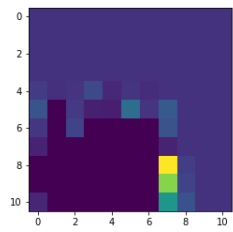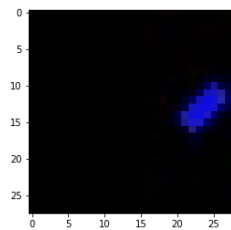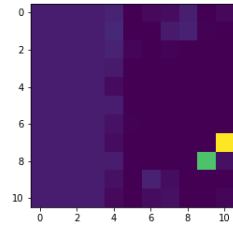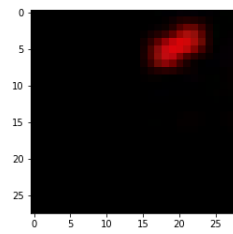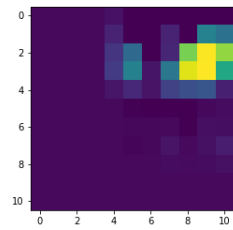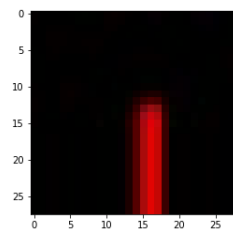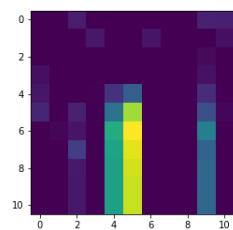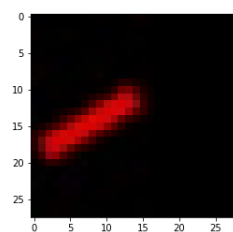4. Image-04

   - Image
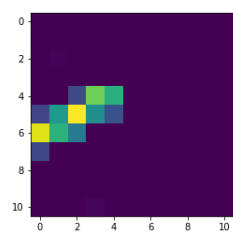

   - Heatmap

5. Image-05

    • Image

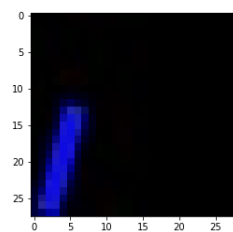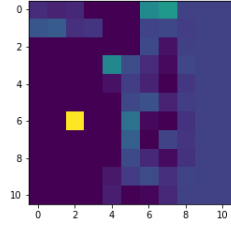
    • Heatmap

6. Image-06

    • Image

    • Heatmap

3.3 Inferences

- All the line heatmaps are corresponding to the first class which is horizontal red line with less thickness.

- All the MNIST heatmaps are with respect to digit 1.

- Images where there is more resemblance with the respective class, whose heatmap is drawn shows yellow region.

- Empty regions are generally unaffected.

- Not only the object but its boundaries also see to have a countribution.