Subject: 19CSE456

Lab Session: 03

Notes:

1. Please read the assignment notes carefully and comply to the guidelines provided.
2. A report should be prepared for questions available in "Report Section" of this assignment & submitted to TurnItIn. Only one member of the team should upload the report to TurnItIn. The filename should start with the team name / number.
3. The report should not have any content (text, figures, photos etc.) copied from any source outside your work. Please provide results obtained from your experiment to support your statements.

Main Section (Mandatory):

Please use your project data as mentioned below:

- **For images use images reshaped as a vector**
- **For videos, split the video to frames and them treat them as images; ignore the sound in video.**
- **For audio, use the audio as a single dimensional vector; for different length, you may use zero padding.**
- **For text, you may vectorize the text using Bag of words or other such techniques.**
- **Any other form of input, please discuss with your mentor / teacher.**

A1. Convolution Exercise: define a signal X[i] and filters H_L[i] & H_H[i] as given below. Convolve the filters with the signal and observe the outputs. Study the outputs and interpret the impacts of these filters.

```
X = [0,1, 2, 3, 4, 5, 6, 0, 1, 2, 3, 4, 5, 6, 0, 0, 0]

H_L = [0.05,0.2,0.5,0.2,0.05]
H_H = [-1,2,-1]

y_low = numpy.convolve(X,H_L)
y_high = numpy.convolve(X,H_H)
plt.plot(X)
plt.plot(y_low)
plt.plot(y_high)
```

A2. Use the supplied image Neural.JPG. Define the filters as shown below. Convolve the image with the provided filters and observe the filtered output of the image. Interpret the filter effects on the image. You may refer to below code for help.

```
from scipy import signal
from skimage.io import imread
from skimage.color import rgb2gray

im = imread(r"/content/Neural.JPG")
img = rgb2gray(im)*255
```

```
plt.imshow(img, cmap='gray')

img1 = img[40:350,20:350]
plt.imshow(img1,cmap='gray')
plt.show()
fil1 = np.array([[ 0, -1,  0],
                 [-1, 4, -1],
                 [ 0, -1, 0]])

fil2 = np.array([[ 0.2, 0.5,  0.2],
                 [0.5, 1, 0.5],
                 [0.2, 0.5, 0.2]])

fil3 = np.array([[ 0.1,0.1,0.1, 0.1, 0.1],
                 [0.1,0.1,0.1, 0.1, 0.1],
                 [0.1,0.1,0.1, 0.1, 0.1],
                 [0.1,0.1,0.1, 0.1, 0.1],
                 [0.1,0.1,0.1, 0.1, 0.1]])

grad1 = signal.convolve2d(img1, fil1, boundary='symm', mode='same')
grad2 = signal.convolve2d(img1, fil2, boundary='symm', mode='same')
grad3 = signal.convolve2d(img1, fil3, boundary='symm', mode='same')

plt.imshow(abs(grad1),cmap='gray',vmin=np.min(grad),vmax = np.max(grad)
)
plt.show()
plt.imshow(grad2,cmap='gray')
plt.show()
plt.imshow(grad3,cmap='gray')
```

A3. Design and implement a fully connected and dense network to perform classification on your dataset. Train the network with training & validation sets.

A4. Make a plot of training loss and validation loss to check for the regular fit of the trained network.

A5. Test the network with your test set and observe the metrics.

Report Assignment:

1. Update your last week's report with the study of classification using MLP network. The report should provide the following details. [4]
   - Network architecture as a figure
   - Plot of training and validation losses with interpretations of the plots
   - Data Description section should be updated with description of the project data
   - Results should be provided in results section of the document with through discussion of the obtained results.