Homework #6

Weekly learning objectives are

1. Justify the transition from fully connected layers to convolutional layers. (LO3)
2. Visualize the convolutions for images and signals. (LO3)
3. Analyze convolution operation with the concepts of strides and padding. (LO3)
4. Implement pooling operation to reduce the size of tensors. (LO2, LO3)
5. Observe the early convolutional neural networks: GoogLeNet and AlexNet. (LO3)

In the following questions, you will calculate the convolution and correlation operations **by hand**. Show your work:

1. (WLO2, WLO3) Convolve x={x[0]=1 2 3 4} with h= { h[0]= 1, 2} using the following 1d-convolution formula:
2. Perform the above convolution without flipping the filter h with respect to the origin. Can you comment on the two outputs?
3. (WLO3) Given the 3x3 image

x =

-4 1 -3

3 -2 -3

-4 2 -3

and the filter

h =

1 0 0

0 0 1

0 0 0

1. Calculate the 2d-convolution, y=h\*x. You are free to select the axes.

In the following question, you will use Python.

1. (WLO1, WLO4, WLO5) Build a neural network to recognize Fashion-MNIST images. Your network should have at least 3 convolutional layers.

* Train the network and plot the training and validation loss curves up to 10 epochs to check how your model has improved during training,
* What is the difference between your model and (i) fully connected network, (ii) GoogLeNet and (iii) AlexNet?
* Provide your code and the confusion matrix.

Please upload a single pdf file as usual.