**Assignment\_1**

1.What exactly is a feature?

**Ans: In computer vision a feature is a piece of information about the content of an image; typically about whether a certain region of the image has certain properties. Features may be specific structures in the image such as points, edges or objects.**

2. For a top edge detector, write out the convolutional kernel matrix.

**Ans: The general expression of a convolution is**

**g (x,y) = w \* f(x,y) = (a(summation) dx = -a )( b(summation) dx = -b) w(dx,dy) f (x-dx, y=dy),**

**where g(x,y) is the filtered image, f(x,y) is the original image, w is the filter kernel.**

**In image processing, a kernel**, **convolution matrix, or mask is a small matrix. It is used for blurring, sharpening, embossing, edge detection, and more. This is accomplished by doing a convolution between a kernel and an image.**

3. Describe the mathematical operation that a 3x3 kernel performs on a single pixel in an image.

4. What is the significance of a convolutional kernel added to a 3x3 matrix of zeroes?

**Ans: Convolutional Neural Network is a type of neural network which applies convolution function to the input image many times and that too with different size of filter in a step-by-step manner. In short, it takes input image, applies convolution to it, takes the output and reapplies convolution on that output.**

5. What exactly is padding?

**Ans: Padding is a term relevant to convolutional neural networks as it refers to the amount of pixels added to an image when it is being processed by the kernel of a CNN. For example, if the padding in a CNN is set to zero, then every pixel value that is added will be of value zero.**

6. What is the concept of stride?

**Ans: Stride is the number of pixels shifts over the input matrix. When the stride is 1 then we move the filters to 1 pixel at a time. When the stride is 2 then we move the filters to 2 pixels at a time and so on.**

7. What are the shapes of PyTorch's 2D convolution's input and weight parameters?

**Ans:**

**1. Output height = (Input height + padding height top + padding height bottom - kernel height) / (stride height) + 1.**

**2.Output width = (Output width + padding width right + padding width left - kernel width) / (stride width) + 1.**

8. What exactly is a channel?

**Ans: A "channel" refers to a certain component that defines pixel values in a digital image. A color image, for example is an aggregate of three channels (red, green and blue). The color data of an image is stored in three arrays of values, known as channels.**

9. Explain relationship between matrix multiplication and a convolution?

**Ans: Domain, you simply multiply the signal(X)-which is matrix with Signal(Y), which is also a matrix. So, now you will be able to understand that, Yes convolution is same as matrix multiplication(where matrix X and Y matrix of signal) but ONLY IN FREQUENCY DOMAIN.**