**SREELAKSHMI CV – 21BDA39**

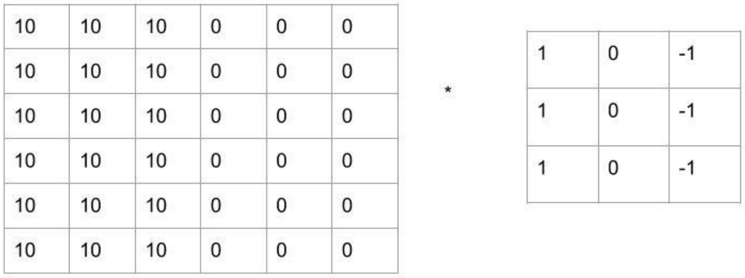
## QUESTION - 2

**What is Stride, Padding & Pooling? Explain with an example.**

### <u>STRIDE:</u>

Stride is a component of convolution neural networks, or neural networks tuned for the compression of images and video data. Stride is a parameter of the neural network's filter that modifies the amount of movement over the image or video. For example, if a neural network's stride is set to 1, the filter will move one pixel, or unit, at a time. The size of the filter affects the encoded output volume, so stride is often set to a whole integer, rather than a fraction or decimal.

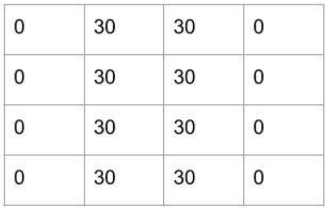
Example : Consider a *6 x 6 image* as shown in figure below. It is to be convoluted with a *3 x 3* filter. The convolution is done using element wise multiplication.



| | | | | | |
|---|---|---|---|---|---|
| 10 | 10 | 10 | 0 | 0 | 0 |
| 10 | 10 | 10 | 0 | 0 | 0 |
| 10 | 10 | 10 | 0 | 0 | 0 |
| 10 | 10 | 10 | 0 | 0 | 0 |
| 10 | 10 | 10 | 0 | 0 | 0 |
| 10 | 10 | 10 | 0 | 0 | 0 |

*

| | | |
|---|---|---|
| 1 | 0 | -1 |
| 1 | 0 | -1 |
| 1 | 0 | -1 |

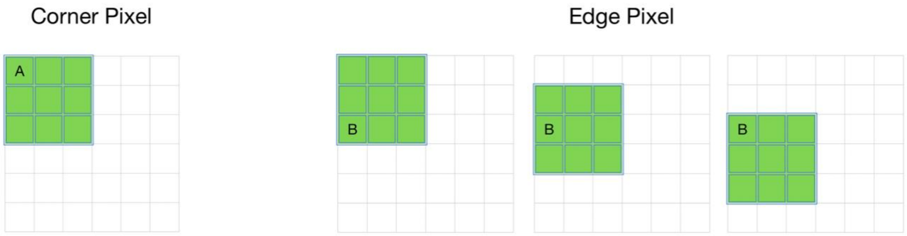


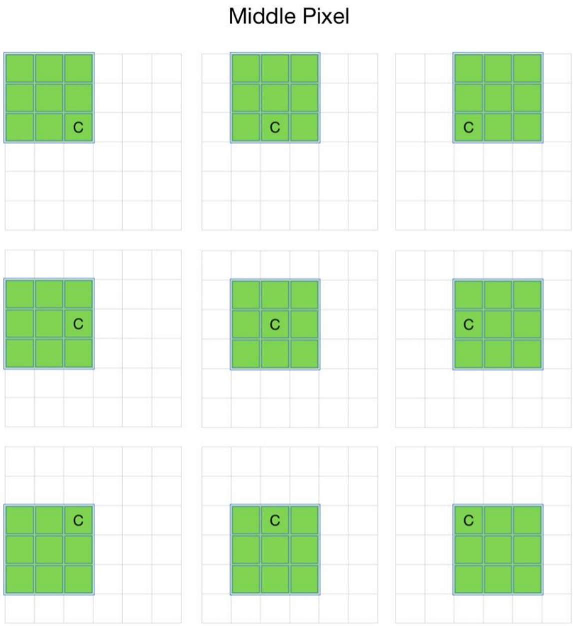
| | | | |
|---|---|---|---|
| 0 | 30 | 30 | 0 |
| 0 | 30 | 30 | 0 |
| 0 | 30 | 30 | 0 |
| 0 | 30 | 30 | 0 |

## PADDING :

Padding is a term relevant to convolutional neural network 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. If, however, the zero padding is set to one, there will be a one pixel border added to the image with a pixel value of zero.

The pixels on the corners and the edges are used much less than those in the middle.
For example,





Clearly, pixel A is touched in just one convolution operation and pixel B is touched in 3 convolution operations, while pixel C is touched in 9 convolution operations. In general, pixels in the middle are used more often than pixels on corners and edges. Consequently, the information on the borders of images is not preserved as well as the information in the middle.

## **POOLING :**

A pooling layer is a new layer added after the convolutional layer. Specifically, after a nonlinearity (e.g. ReLU) has been applied to the feature maps output by a convolutional layer; for example the layers in a model may look as follows:

1. Input Image
2. Convolutional Layer
3. Nonlinearity
4. Pooling Layer

Pooling involves selecting a pooling operation, much like a filter to be applied to feature maps. The size of the pooling operation or filter is smaller than the size of the feature map; specifically, it is almost always 2×2 pixels applied with a stride of 2 pixels.

This means that the pooling layer will always reduce the size of each feature map by a factor of 2, e.g. each dimension is halved, reducing the number of pixels or values in each feature map to one quarter the size. For example, a pooling layer applied to a feature map of 6×6 (36 pixels) will result in an output pooled feature map of 3×3 (9 pixels).

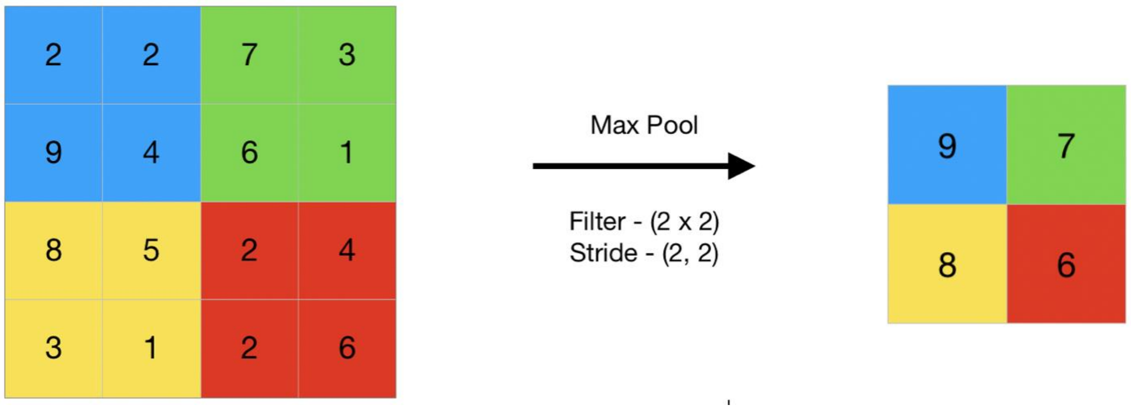
The pooling operation is specified, rather than learned. Two common functions used in the pooling operation are:

- **Average Pooling**: Calculate the average value for each patch on the feature map.
- **Maximum Pooling (or Max Pooling)**: Calculate the maximum value for each patch of the feature map.

Example :

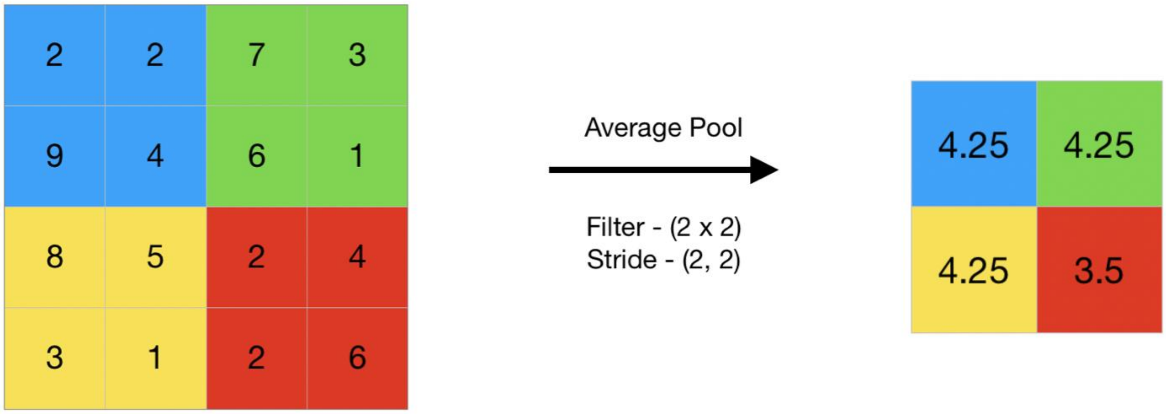
### Max Pooling

Max pooling is a pooling operation that selects the maximum element from the region of the feature map covered by the filter. Thus, the output after max-pooling layer would be a feature map containing the most prominent features of the previous feature map.



### Average Pooling

Average pooling computes the average of the elements present in the region of feature map covered by the filter. Thus, while max pooling gives the most prominent feature in a particular patch of the feature map, average pooling gives the average of features present in a patch.



| | | | |
|---|---|---|---|
| 2 | 2 | 7 | 3 |
| 9 | 4 | 6 | 1 |
| 8 | 5 | 2 | 4 |
| 3 | 1 | 2 | 6 |

| | |
|---|---|
| 4.25 | 4.25 |
| 4.25 | 3.5 |

## REFERENCE :

https://deepai.org/machine-learning-glossary-and-terms/stride

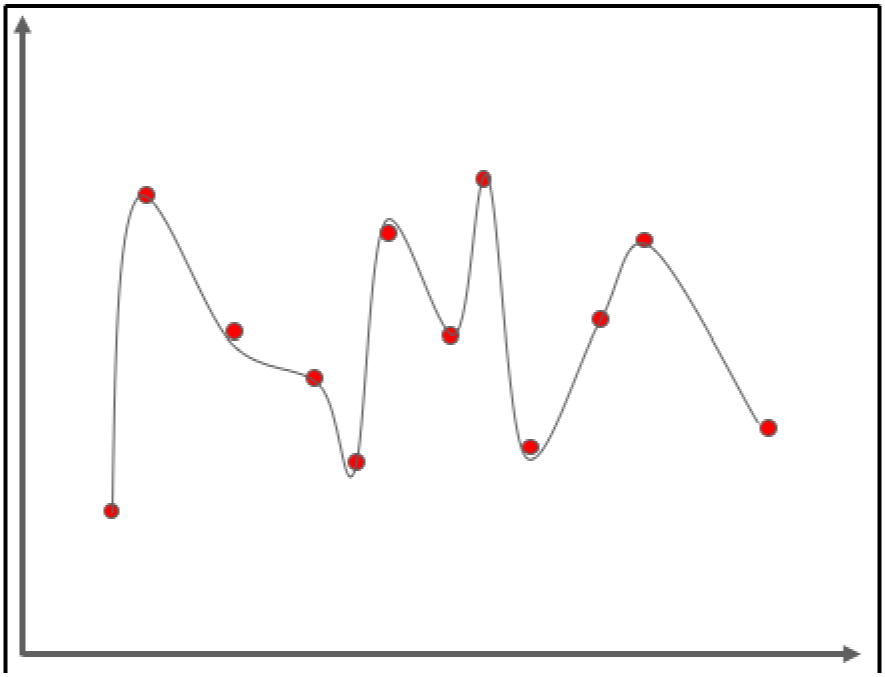
https://deepai.org/machine-learning-glossary-and-terms/padding

https://www.geeksforgeeks.org/cnn-introduction-to-pooling-layer/

QUESTION 4 :

## What is overfitting?

A statistical model is said to be overfitted when we feed it a lot more data than necessary. To make it relatable, imagine trying to fit into oversized apparel.



When a model fits more data than it actually needs, it starts catching the noisy data and inaccurate values in the data. As a result, the efficiency and accuracy of the model decrease.

## How to overcome from overfitting.

**Techniques to reduce overfitting:**

1.Increase training data.

2. Reduce model complexity.

3. Early stopping during the training phase (have an eye over the loss over the training period as soon as loss begins to increase stop training).

4. Ridge Regularization and Lasso Regularization

5. Use dropout for neural networks to tackle overfitting.

## REFERENCE :

https://www.geeksforgeeks.org/underfitting-and-overfitting-in-machine-learning/