ASSIGNMENT – LAB07

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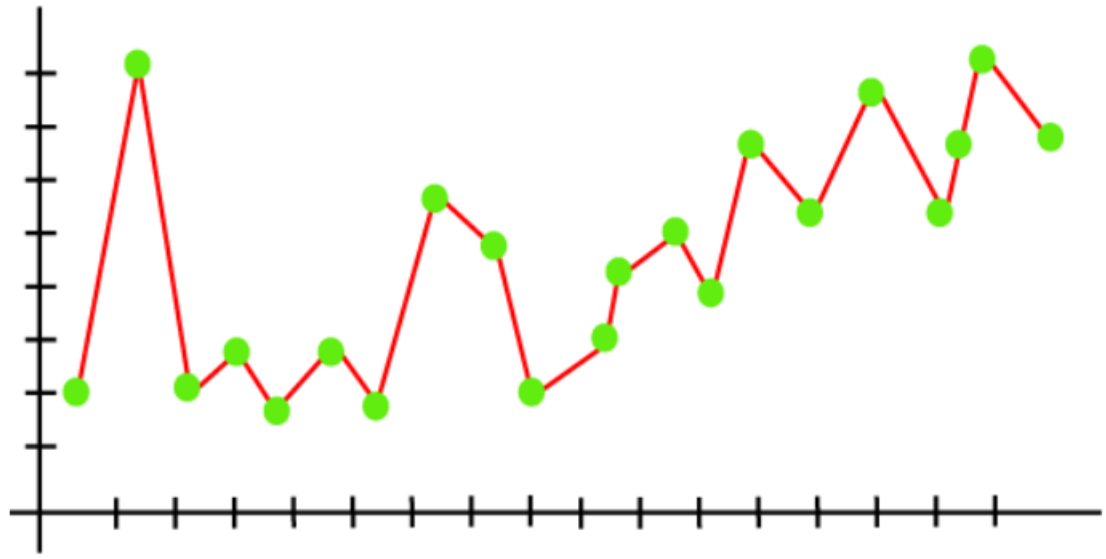
21BDA14

1.What is overfitting? How to overcome overfitting in an ML model?

A statistical model is said to be overfitted when the model does not make accurate predictions on testing data. When a model gets trained with so much data, it starts learning from the noise and inaccurate data entries in our data set. And when testing with test data results in High variance. Then the model does not categorize the data correctly, because of too many details and noise. The causes of overfitting are the non-parametric and non-linear methods because these types of machine learning algorithms have more freedom in building the model based on the dataset and therefore they can really build unrealistic models. A solution to avoid overfitting is using a linear algorithm if we have linear data or using the parameters like the maximal depth if we are using decision trees.

Example: The concept of the overfitting can be understood by the below graph of the linear regression output:



As we can see from the above graph, the model tries to cover all the data points present in the scatter plot. It may look efficient, but in reality, it is not so. Because the goal of the regression model to find the best fit line, but here we have not got any best fit, so, it will generate the prediction errors.

How to avoid the Overfitting in Model

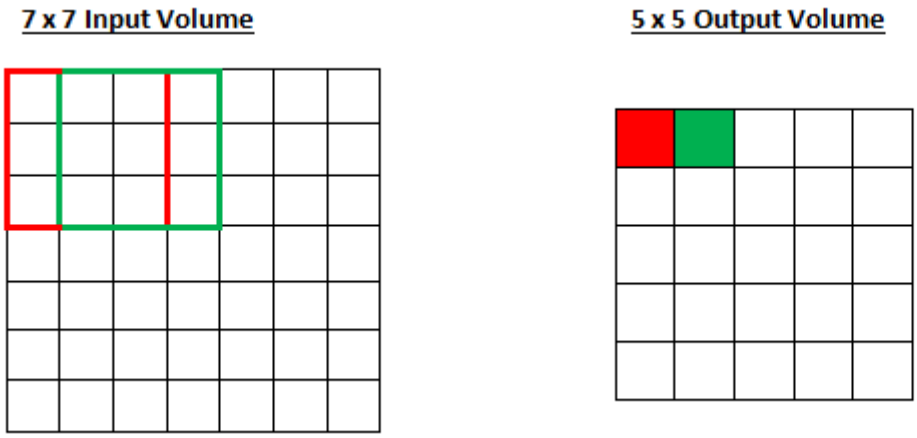
Both overfitting and underfitting cause the degraded performance of the machine learning model. But the main cause is overfitting, so there are some ways by which we can reduce the occurrence of overfitting in our model.

- **Cross-Validation**
- **Training with more data**
- **Removing features**
- **Early stopping the training**
- **Regularization**
- **Ensembling**

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

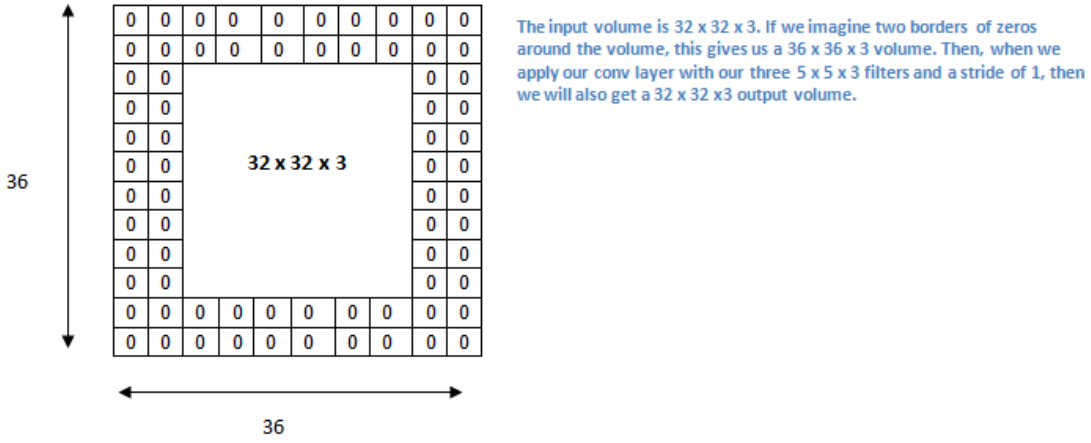
Stride : Stride is a component of convolutional neural networks, or neural networks tuned for the compression of images and video data. Stride is a parameter of the neural network's filter that modifies the amount of movement over the image or video. For example, if a neural network's stride is set to 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.

How does Stride work?



Source

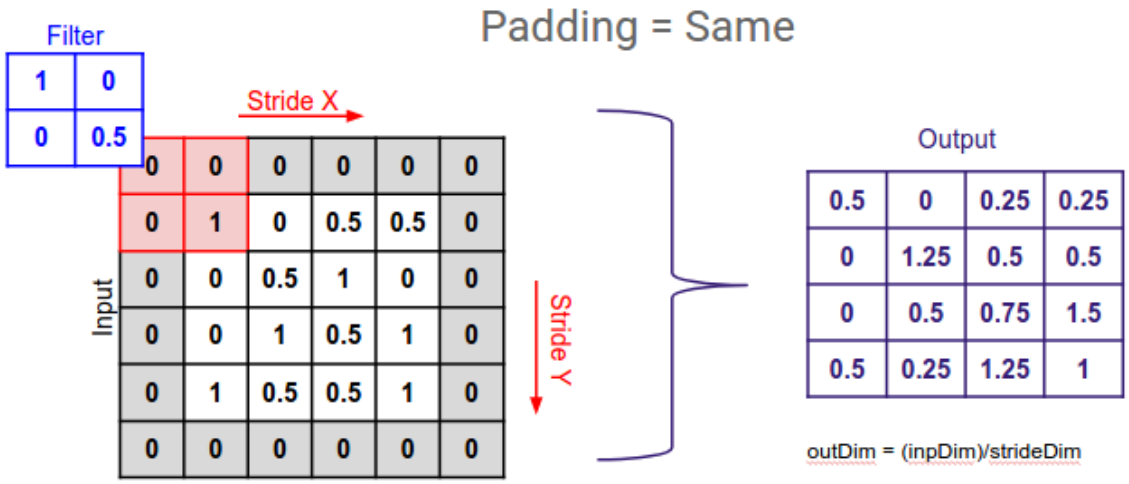
Imagine a convolutional neural network is taking an image and analyzing the content. If the filter size is 3x3 pixels, the contained nine pixels will be converted down to 1 pixel in the output layer. Naturally, as the stride, or movement, is increased, the resulting output will be smaller. Stride is a parameter that works in conjunction with padding, the feature that adds blank, or empty pixels to the frame of the image to allow for a minimized reduction of size in the output layer. Roughly, it is a way of increasing the size of an image, to counteract the fact that stride reduces the size. Padding and stride are the foundational parameters of any convolutional neural network.



Source

Padding

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. 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.



Source

How does Padding work?

Padding works by extending the area of which a convolutional neural network processes an image. The kernel is the neural networks filter which moves across the image, scanning each pixel and converting the data into a smaller, or sometimes larger, format. In order to assist the kernel with processing the image, padding is added to the frame of the image to allow for more space for the kernel to cover the image. Adding padding to an image processed by a CNN allows for more accurate analysis of images.

Pooling

Pooling in convolutional neural networks is a technique for generalizing features extracted by convolutional filters and helping the network recognize features independent of their location in the image.

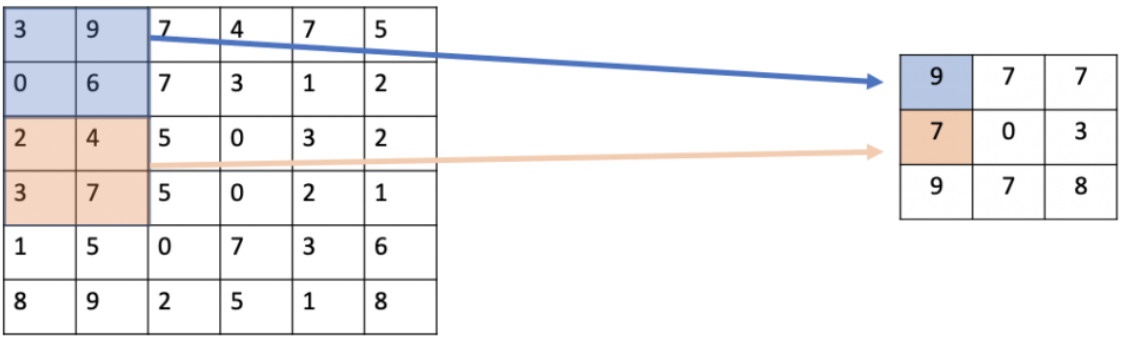
How Does Pooling Work?

The basic procedure of pooling is very similar to the convolution operation. You select a filter and slide it over the output feature map of the preceding convolutional layer. The most commonly used filter size is 2×2 and it is slid over the input using a stride of 2. Based on the type of pooling operation you've selected, the pooling filter calculates an output on the receptive field (the part of the feature map under the filter).

There are several approaches to pooling. The most commonly used approaches are max-pooling and average pooling.

Max Pooling

In max pooling, the filter simply selects the maximum pixel value in the receptive field. For example, if you have 4 pixels in the field with values 3, 9, 0, and 6, you select 9.



Average Pooling

Average pooling works by calculating the average value of the pixel values in the receptive field. Given 4 pixels with the values 3,9,0, and 6, the average pooling layer would produce an output of 4.5. Rounding to full numbers gives us 5.