3. Explain the concept of filter kernels in convolutional neural networks (CNNs), and how altering kernel size and weights influence feature extraction and model performance?

Answer: **Filter or kernel** in the convolutional neural networks are the small matrix of weights that slide on the image and perform the process of convolution. This filters are performed on the CNN, which help to detect the features in the input image.

A kernel when slides over the input image, at each position, the filter performs an operation on the part of the image it's currently on. This involves the element-wise multiplication of the filter's weights and the pixel values in the image, followed by summing these results, which is called the convolution.

When we train this cnn, the filters detect the different features like edges, pattern etc. So filter are nothing but feature detector.

Here is an example of a filter:

In this case loopy filter are detected by the kernel in this different set of numbers.
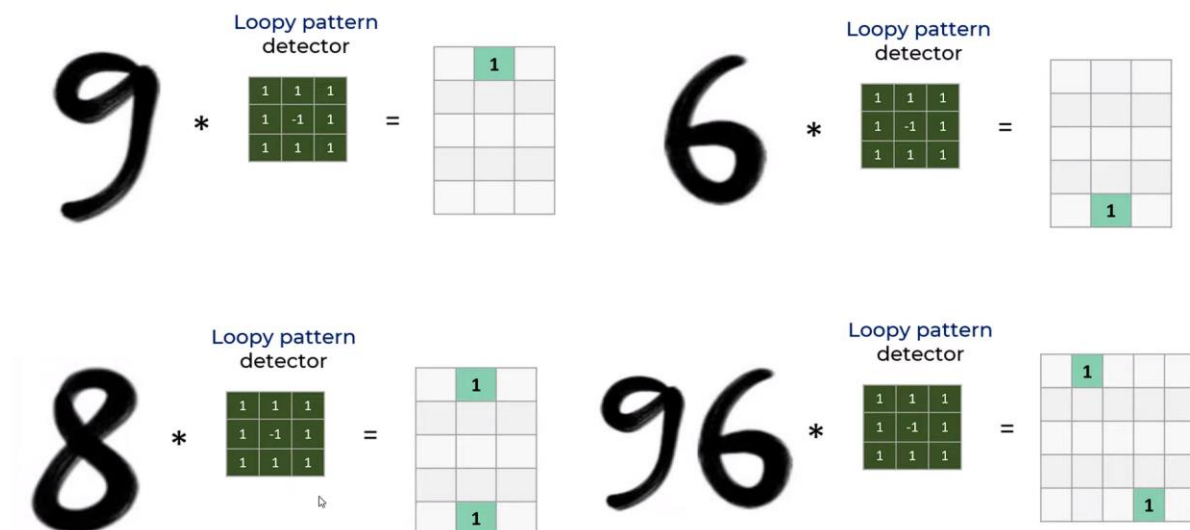
Reference: [Simple explanation of convolutional neural network | Deep Learning Tutorial 23 (Tensorflow & Python) (youtube.com)](#)

kernel size: By increasing the size of kernel, it will focus on the global features and the local details will get supressed when we increase the size of the kernel. By increasing the kernel size, it will help to find higher level abstract details but in case of small kernel, it will focus on the small level details like edges.

Kernel weights: The weights of the kernel helps to extract the well needed features. BY adjusting the proper weights of the kernel, the relevant features can be detected and the problem of overfitting also can be reduced by adjusting the kernel weights.