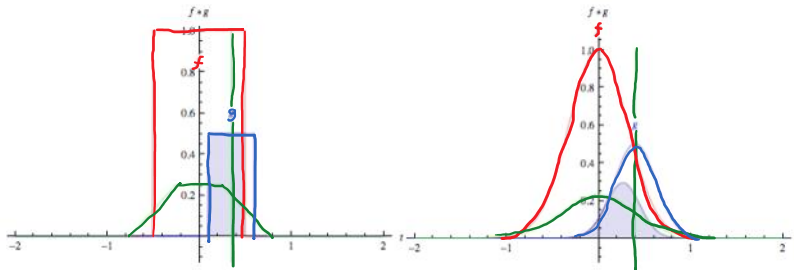


Week 9: Convolutional NN

Sunday, April 3, 2022 4:58 PM

The Convolution Operation

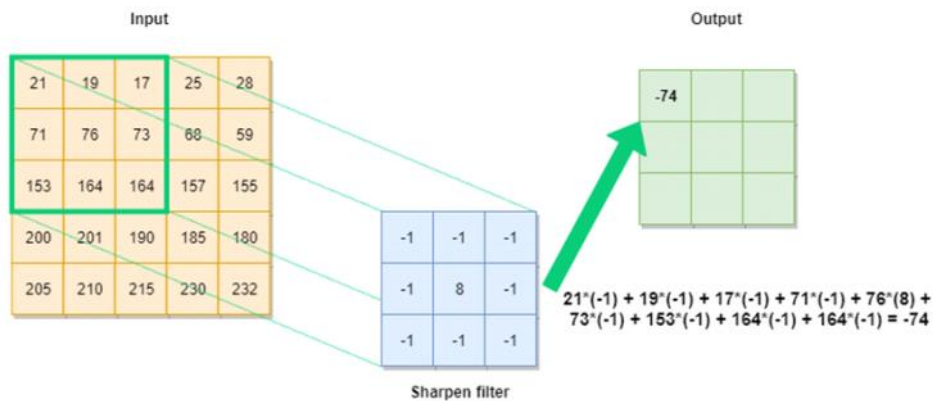
- A convolution is an integral the amount of overlap of a function "g" as it is shifted over another function "f"
- It blends one function with another.



Above is the convolution of a boxcar and Gaussian function. The green curve shows the convolution curve of the blue and red functions as a function of t , with the vertical line being the position of t . The shaded area is precisely the convolution:

$$\underbrace{[f * g](t)}_{\substack{\text{the convolution} \\ \text{of } f \text{ and } g}} = \int_0^t f(\tau) g(t-\tau) d\tau$$

Anyway, the concept thus can be seen in image processing mainly: a Kernel (g function) can be blend in an image (f function) over time t , which would mean to blend it along each pixel of said image.



AIGeekProgrammer.com © 2019

Traditional vs Convolutional

A whatsapp profile picture is of size $192 \times 192 \times 3$. If we plug an image into a Neural Network, that means we need to turn the pixel matrix into a vector and that vector becomes the input.

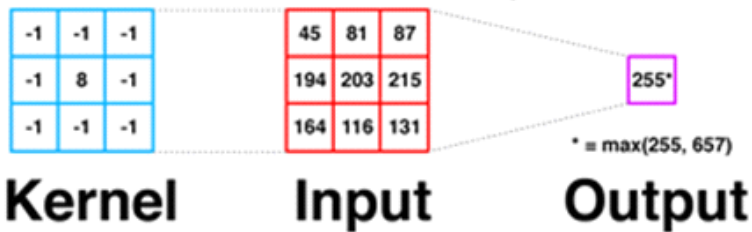
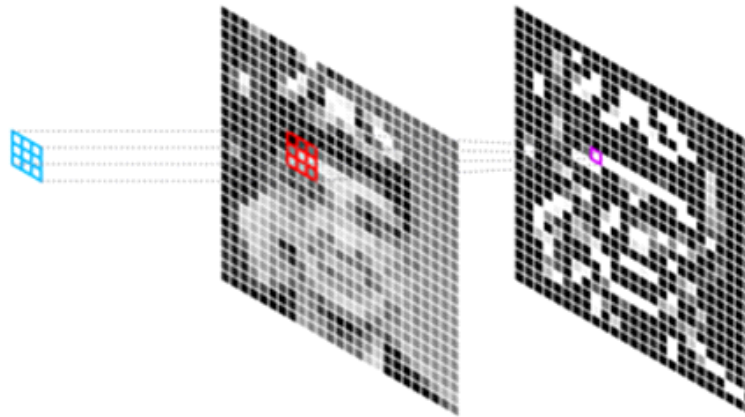
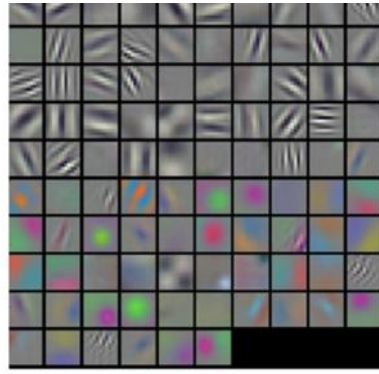
→ In a traditional NN:

→ the image would turn into an input vector of size 110,952.

→ In a convolutional NN:

→ Since the image is too big to be treated as input, a convolutional NN requires "filters" to generate "features" of the image, these filters are called kernels:

these are predefined kernels that extract features when a convolution over the image is done.



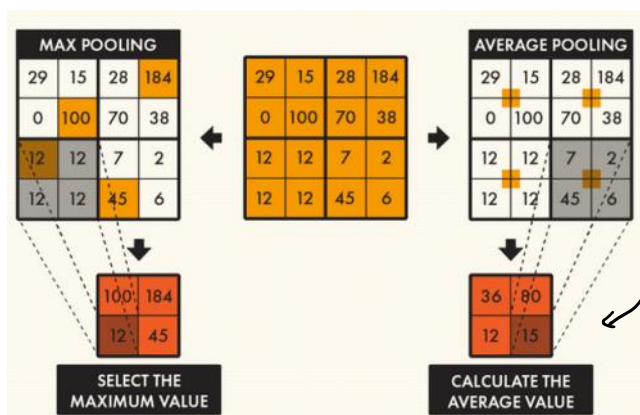
Convolutional Feature maps

→ Extracts characteristics of the filter's output such as:

- Average
- Norm
- Weighted averages
- Neighbour Information

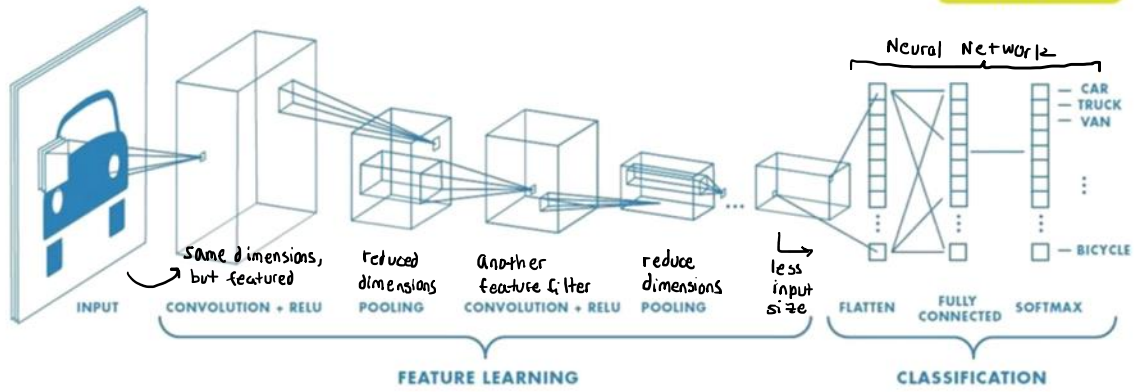
Convolutional Pooling

→ A building block for CNN, which progressively reduce the amount of parameters in the network (less input size vector). MAX POOLING and AVERAGE POOLING are the most common approach used.



both reduce the dimensions of the image (better for the NN)

CNN Architecture



Activity:

1. Generate a written number in an image of size 28×28
2. Turn it into a vector/matrix to be processed by the model of the CNN generated.
3. Use `model.predict` to see if it is correctly classified.