Lecture #28: Convolutional Neural Network (CNN)

previously covered
- ✓ Limitation of simple neural network
- ✓ introduction to CNN
- ✓ Images & features
- ✓ kernel (filter), Convolution operation

Architecture of CNN

image → RGB (Red, green, blue)

(Full of important part — features).
↳ it can be edges, texture, shape or even face

Downstream Task

extract important features which then can be used in any down-stream task like classification, regression etc.

Convolution

"is like special way of looking at data - it's mathematical operation that brings out patterns.

applies filter to image to create feature maps

Strides

determine step size of the filter as it moves across the input data

during convolution operation affecting output size and computational efficiency

Padding ⇒ when do not want to use dimensionality reduction

So input images' dimension retain in feature map.

Kernel / filter

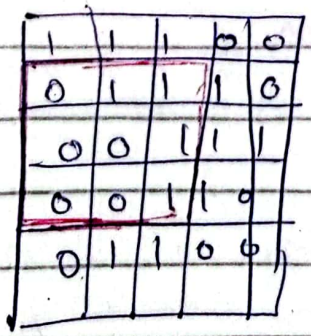
are usually small 2D matrices used for feature extraction through convolution operation

Rotate, zoom in, zoom out etc these are all filters.

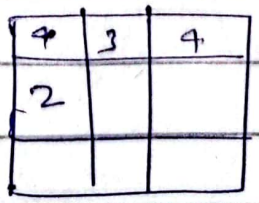
Volume convolution

especially in RGB images

- At each position kernel performs element wise multiplication.
- results are then summed up. to produce single output pixel.



Image



Convolved feature

Edges

Depth (no. of channels)

no of filters in a layer determine depth

Padding

(Technique used to maintain the spatial dimensions of input image after performing convolution operation on feature map)

Types { Zero, one } (value of pixel you fill)

Pooling

(reduction information)

- simplify complex data
- dimensionality Reduction

↳ Reducing dimension of image

↳ (like Summarizing information, keeping what's important)

Pooling = Downsizing + information Summary

most common ⇒ max pooling

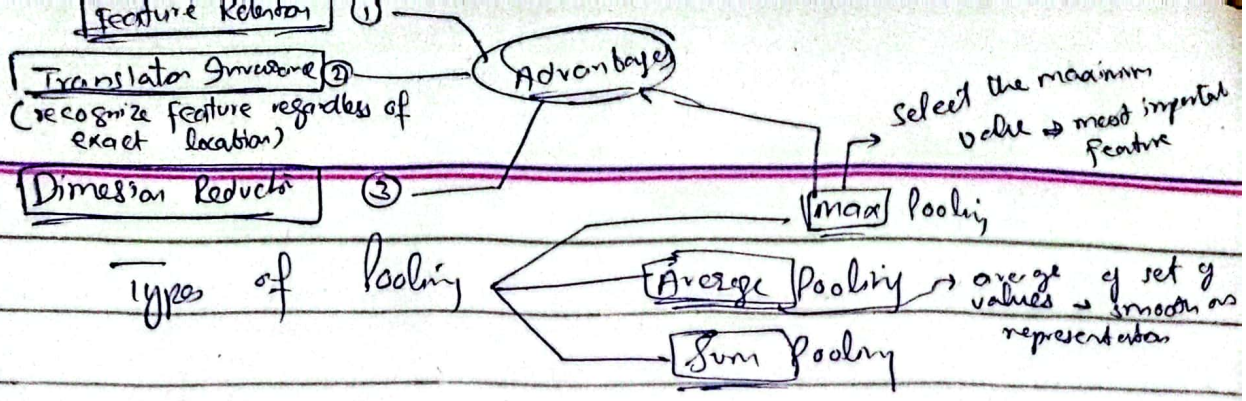
analogies

(i) **Image Compression**

(Pooling is like compressing an image file you loose some detail but the essential are there)

(ii) **Teacher Analogy**

(imagine a teacher summarizing a chapter.
highlight key points (max pooling)
over all summary (average pooling)



CNN Architecture

Type of Neural Network — inspired by how our brain process visual information.

Pixel → edges → contours → object parts → object identity

Practical

- importing library
- load dataset
  - normalize value
  - convert class vector to binary class matrix
- define the CNN architecture
- compile the model
- train the model
- Evaluate the model
