→ Why FCN Not Good

Lecture #27 ⇒ CNN (Convolutional Neural Network)

- Deep Learning (study of Neural Network)
- study the basic neural network (in previous lecture)
- hyperparameters (can not learn from data) and parameters (learn during data)
- Calculator phase
  - forward pass → inference (prediction) → loss calculate
  - backward pass (deep neural network actually learn on base of loss value)

⇒ Limitations of Simple Neural Network

(FCN ⇒ fully connected Neural)

image is huge array of numbers.

in simple neural network each neuron is connected to its next layers.

increasing each neuron again that is connected with all other neurons in its next layer.

so it will be very huge even if image is very low

- Simple neural network treat all pixels in an image equally.
- Can not effectively capture the local pattern and structures in images

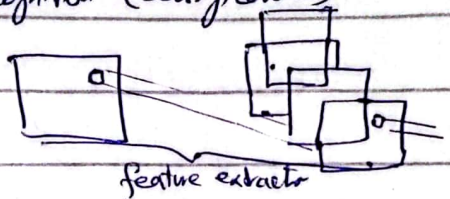
Fully connected connections :- number of weights increased drastically

Features ⇒ image are full of important part called feature.
it can be edge, texture, shapes or even faces.

⇒ CNN (for images & videos)
neuron perform convolutional operation.
Ls To perform convolution we need filter.

∴ for tasks like image recognition (classification)

Basic structure



convolutional layer

detect features like edges, texture & patterns in an image.

Convolutional operation

- was using in image processing
- so this operation used

"applies filters to the input image to create featuremaps.

filters are small matrices that slides over the input image & detect patterns.

usually ReLU (Rectified Linear Unit) that introduces non-linearity.

- we apply filter on image
- example - vertical edge detector

1	0	-1
1	0	-1
1	0	-1

- instead of converting image into single 1D Array we are now (in FCN)
- picture is its in structure & we apply filter on it (matrix - special number)
- learning filter (CNN) finding weight (FCN)

How can I find filter

every neuron is a convolutional neuron which means

ہر نیوران (input image) پر (convolution) اپلائی کرے گا اور جو رزلٹ آئے گا فلٹر کا وہ اگلی لیئر کے نیوران کو جائے گا اور فلٹر اپلائی کرے گا ۔

اس طرح کرنے سے وہ (feature map) کہلاتا ہے

(Feature Map) ← جو image کے اوپر فلٹر اپلائی کرنے کے بعد رزلٹ آتا ہے ۔

یعنی (map of particular feature)

Filter: Vertical Edge Detection

Effect:- when apply on image ⇒ map of all vertical lines

filter / kernel / feature detector

3×3

1	0	-1
1	0	-1
1	0	-1

What we learn

Initial goal → input image, feature extract
↳ filters applied
↳ gives feature maps (as output)
(that contain features of images)

یعنی وہ لیئرز (feature) نکالتی رہتی ہے اور آگے بھیجتی رہتی ہے... اس طرح کرتے کرتے آخر میں ہمارے پاس (Pooling) وہ ہے جس میں اس feature کی summary نکال کر آگے پاس کرتی ہے۔

input → convolution → pooling
(feature extraction)

✓ ابتدائی لیئرز میں (simple feature) نکالے
✓ اس سے اگلی لیئرز میں اُن (simple feature) کو ملا کر اور تھوڑے (complex) Feature نکالے۔
✓ اس سے اگلی لیئرز نے پچھلی feature کو دیکھ کر مزید (complex) نکالے
✓ اور آخر میں اس کی Base پر ہم فائنل رزلٹ دیکھ لیتے ہیں۔

Summary

Convolutional Neural Network

- important parts
  - (i) Convolutional layer (Take image as input, simple apply convolution and extract features)
  - (ii) Pooling layer (Take feature as input and forward summarized feature map to next)
  - (iii) Flatten layer (last pooling layer ka input ko 1D converted)
  - (iv) Head → Neural Network (A fully connected Neural network) جو (flatten layer) کو لے کر F.C. کے (output) دیتا ہے۔