

Q1> What is a Convolutional Neural Network (CNN)?

ANS.

A Convolutional Neural Network (CNN) is a type of deep neural network specially designed to process image and spatial data.

It is a specialized type of Feed-Forward deep learning network designed to process data with grid-like topology, such as images and videos.

CNN's automatically extracts hierarchical features from raw input through convolution and pooling operations, making them highly effective for image classification, object detection and visual pattern recognition.

Layers in CNN:-

1. Input Layer: Accepts grid-structured input (e.g., image)
2. Convolution Layer: Applies filter/kernels that slide over the input to extract local features like edges or textures.
3. Activation (ReLU): Adds non-linearity to enable complex pattern learning.
4. Pooling Layer: Reduces spatial dimensions, retaining important features and lowering computation.
5. Flatten: Converts multi-dimensional feature maps in a vector.
6. Fully Connected Layer: Performs Final Classification or Regression.

• Application:-

1. Image Recognition,
2. Face Detection
3. Medical Imaging,

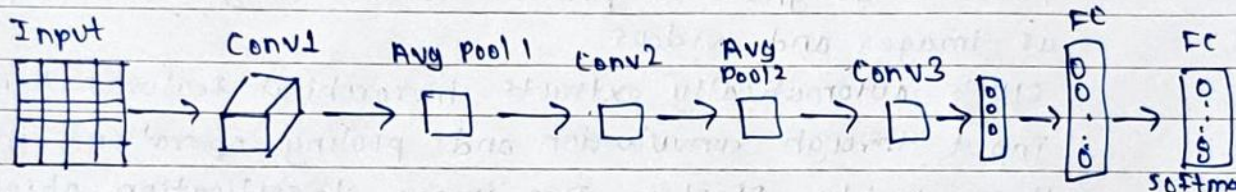
→ CNN Automatically extract features and is widely used in computer vision tasks.

Q2> Explain the following with diagrams :-

i. LeNets and AlexNet.

ANS. LeNet-5 :-

- Developed by Yann LeCun
- One of the earliest CNN's (used for Digit recognition)



Structure :-

- Input (32x32)
- Conv → Pool → Conv → Pool
- Fully connected Layers
- Output

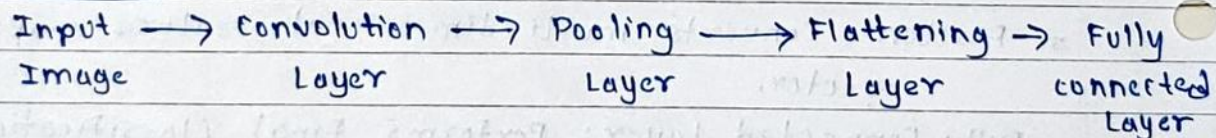
Features :-

- Simple and Shallow
- Works well on small dataset.

AlexNet :-

- Developed by Alex Krizhevsky
- Won ImageNet Large Scale Visual Recognition Challenge 2012

Structure :-



- 5 convolution Layers.
- 3 Fully connected Layers.
- Uses ReLU and Dropout.

Features :-

- Deep Network (8 Layers)
- GPU Training
- High Accuracy
- Uses Dropout and ReLU Activation Function

ii) GoogleLeNet and VGGNet

ANS. ① VGGNet:

- Developed by Visual Geometry Group.

Features:

- 3X3 convolution Filters.
- Deep Network (16 or 19 layers)
- Simple and Uniform structure.

Limitation:

- High computational cost
- Large number of parameters.

② GoogleLeNet (Inception Network)

- Developed by Google.
- It uses inception modules (Parallel Filters)

Features:-

- 1X1, 3X3, 5X5, convolutions together.
- Fewer parameters than VGG.
- Efficient computation.

iii) ResNet and MobileNet

ANS. ① ResNet (Residual Network)

- Introduced residual Learning.
- Skips connections (shortcut links)

Features:

- Solves vanishing gradient problem.
- Very Deep Network (50+ Layers)

It is used in High-end systems.

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② MobileNet:

- Designed for mobile and embedded devices.
- It uses Depthwise separable Convolution.

Features:-

- Lightweight
- Fast
- Low Computation.

It is used in Mobile Devices.