

Practical No:-3

Aim:- Feeding data to pre-trained neural network and making predictions.

Theory:-

Pre-trained Models:-

- Pre-trained Models are the neural networks that have already been trained on large datasets (e.g. ImageNet) and have learned to extract rich, hierarchical features from images.

VGG16

Architecture & characteristics:-

- Deep & uniform - VGG16 is known for its simplicity and depth. It consists of 16 weight layers (13 convolutional layers followed by 3 fully connected layers) with small 3x3 filters and a consistent architecture throughout the network.
- Feature extraction:-
 - The network stacks convolutional layers to gradually build complex features. The layers capture high-level abstractions, which is why the network is effective in image classification tasks.
- Drawbacks:
 - Although effective, VGG16 has a high number of parameters, leading to increased memory

usage and slower inference times compared to more modern architectures.

(2) ResNet50

Architecture & its characteristics.

(1) Residual learning

- Resnet-50 introduced the concept of residual connections that allow the gradient to flow directly through the network. This helps in training very deep networks by mitigating the vanishing gradient problems.

(2) 50 layers Deep

- As its name implies, ResNet-50 consists of 50 layers. It uses a bottleneck architecture where each block contains 3 layers ($1 \times 1, 3 \times 3, 1 \times 1$) to improve efficiency.

(3) Performance

- The residual connections not only help in deeper network training but also improve generalization.

- ResNet 50 has become a popular choice in many computer vision tasks due to its balance between depth and computational costs.



(3) MobileNet.

Architecture & characteristics.

(1) Light weight design - MobileNet is designed for efficiency, particularly on mobile and embedded devices. It uses depthwise separable convolutions, which factorize a standard convolution into a depthwise convolution & a pointwise convolution.

(2) Reduced computational cost:-

The factorization significantly reduces the number of parameters and the computational complexity, making MobileNet a good choice for applications with limited computational resources.

(3) Trade-offs.

While MobileNet is faster and more efficient, there can be a tradeoff in terms of accuracy compared to heavier models like VGG16 or ResNet-50.

However, for many real-time or resource-constrained applications, this trade-off is acceptable.

Conclusion:-

Leveraging pre-trained models like VGG16, ResNet50, and MobileNet shows how diverse architectures can simplify image classification through transfer learning. Each model balances accuracy, depth, and efficiency differently, highlighting the practical benefit of using pre-trained networks for prediction tasks.