

of a Pre-Trained Model

EXP No: 13:- Understanding the Architecture

Aim:-

To study and analyze the architecture and Components of pre-trained CNN models such as VGG16, ResNet 50, and Inception V3.

Objectives:-

1. To understand transfer learning using pre-trained deep learning models.
2. To explore layer structure, feature extraction, and fine-tuning techniques.
3. To visualize and analyze learned representations from pre-trained models.
4. To load and summarize model architecture in Tensorflow/Keras.

Algorithm:-

1. Import a pre-trained model with ImageNet weights.
2. Load the model without top layers.
3. Display the model summary to understand architecture.
4. Analyze Convolutional, pooling, and fully connected layers.
5. Use a sample image to visualize model predictions or features.

pseudo Code:-

Import pre-trained model

Load model without top layer.

Display model.summary()

visualize layers & parameters.

Run a sample image through model for prediction

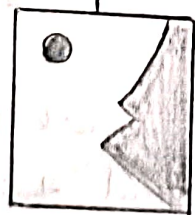
Observations:-

- VGG16 :- Deep Sequential network with 13 Convolutional + 3 dense layers.
- ResNet50 :- Uses skip connections to avoid vanishing gradients.
- Inception V3 :- Employs parallel convolution paths for multi-scale feature extraction
- Each pre-trained model captures hierarchical image features efficiently.

Conclusion:-

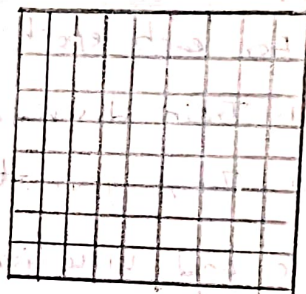
pre-trained models like VGG16, ResNet50, and Inception V3 provide powerful feature extractors trained on large datasets. Understanding their architectures help apply transfer learning, improving accuracy & training efficiency in new tasks.

USAGE OF PRE-TRAINED ARCHITECTURE

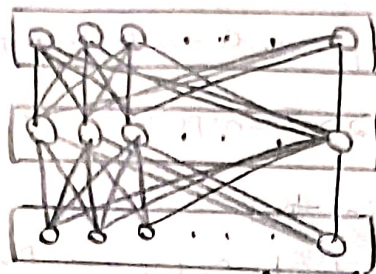


Input Image

Feature extraction process



pre trained deep learning architecture



Extracted features

Output:-

Total parameters : 138357544

Trainable parameters : 138357544

Non Trainable parameters : 0

Layers Names:

Conv01 : Conv2D

bn1 : Batch Normal 2D

relu : ReLU

maxpool : maxpool 2D

layer1 : sequential

layer2 : sequential

layer3 : sequential

layer4 : sequential

avg pool : ~~Adap~~ time avg pool 2D

fc : linear



dltlab13.ipynb ☆ ☁

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```
# lab13_pretrained_model_architecture.py
import torch
import torchvision.models as models

# Load a pretrained model (VGG16)
model = models.vgg16(pretrained=True)

# Print model architecture
print("==== VGG16 Pre-trained Model Architecture =====")
print(model)

# Print only feature extractor part
print("\n==== Feature Extractor Layers =====")
print(model.features)

# Print classifier part
print("\n==== Classifier Layers =====")
print(model.classifier)

# Print total trainable parameters
total_params = sum(p.numel() for p in model.parameters() if p.requires_grad)
print(f"\nTotal Trainable Parameters: {total_params}")
```



```
/usr/local/lib/python3.12/dist-packages/torchvision/models/_utils.py:208: UserWarning: The parameter 'pretrained' is deprecated since 0.13 and may be removed in the future, please use 'weights' instead.
  warnings.warn(
/usr/local/lib/python3.12/dist-packages/torchvision/models/_utils.py:223: UserWarning: Arguments other than a weight enum or 'None' for 'weights' are deprecated since 0.13 and may be removed in the future. The current behavior is equivalent to passing a weight of 'None'.
  warnings.warn(msg)
Downloading: "https://download.pytorch.org/models/vgg16-397923af.pth" to /root/.cache/torch/hub/checkpoints/vgg16-397923af.pth
100%|██████████| 528M/528M [00:01:00:00, 149MB/s]
===== VGG16 Pre-trained Model Architecture =====
VGG{
  (features): Sequential(
    (0): Conv2d(3, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (1): ReLU(inplace=True)
    (2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (3): ReLU(inplace=True)
    (4): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (5): Conv2d(64, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (6): ReLU(inplace=True)
    (7): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (8): ReLU(inplace=True)
    (9): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (10): Conv2d(128, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (11): ReLU(inplace=True)
    (12): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (13): ReLU(inplace=True)
    (14): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (15): ReLU(inplace=True)
    (16): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (17): Conv2d(256, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (18): ReLU(inplace=True)
    (19): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (20): ReLU(inplace=True)
    (21): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (22): ReLU(inplace=True)
    (23): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (24): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (25): ReLU(inplace=True)
    (26): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (27): ReLU(inplace=True)
    (28): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (29): ReLU(inplace=True)
    (30): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  )
  (avgpool): AdaptiveAvgPool2d(output_size=(7, 7))
  (classifier): Sequential(
    (0): Linear(in_features=25088, out_features=4096, bias=True)
    (1): ReLU(inplace=True)
    (2): Dropout(p=0.5, inplace=False)
    (3): Linear(in_features=4096, out_features=4096, bias=True)
    (4): ReLU(inplace=True)
    (5): Dropout(p=0.5, inplace=False)
    (6): Linear(in_features=4096, out_features=1000, bias=True)
```

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===== Feature Extractor Layers =====

```
Sequential(
  (0): Conv2d(3, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (1): ReLU(inplace=True)
  (2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (3): ReLU(inplace=True)
  (4): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  (5): Conv2d(64, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (6): ReLU(inplace=True)
  (7): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (8): ReLU(inplace=True)
  (9): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  (10): Conv2d(128, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (11): ReLU(inplace=True)
  (12): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (13): ReLU(inplace=True)
  (14): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (15): ReLU(inplace=True)
  (16): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  (17): Conv2d(256, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (18): ReLU(inplace=True)
  (19): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (20): ReLU(inplace=True)
  (21): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (22): ReLU(inplace=True)
  (23): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  (24): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (25): ReLU(inplace=True)
  (26): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (27): ReLU(inplace=True)
  (28): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (29): ReLU(inplace=True)
  (30): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
)
```

===== Classifier Layers =====

```
Sequential(
  (0): Linear(in_features=25088, out_features=4096, bias=True)
  (1): ReLU(inplace=True)
  (2): Dropout(p=0.5, inplace=False)
  (3): Linear(in_features=4096, out_features=4096, bias=True)
  (4): ReLU(inplace=True)
  (5): Dropout(p=0.5, inplace=False)
  (6): Linear(in_features=4096, out_features=1000, bias=True)
)
```

Total Trainable Parameters: 138357544