Artist Identification using Deep Learning

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Introduction

Project Objective:

This project aims to develop an artist identification system using deep Learning techniques to address the challenge of automatically identifying and categorizing artworks by their respective artists

Methodologies:

- Data Augmentation
- Transfer Learning

Dataset

The original dataset comprises 8,355 paintings belonging to 50 artists, collected by Icaro and made publicly available on Kaggle.

Andy Warhol: (582 x 578 x 3)

Titian: (800 x 1815 x 3)

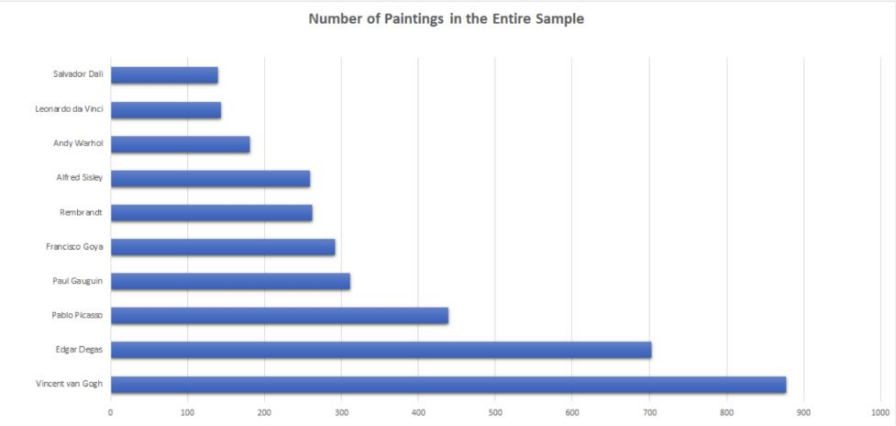
Andrei Rublev: (827 x 1024 x 3)

Vincent van Gogh: (738 x 1024 x 3)

Kazimir Malevich: (975 x 1000 x 3)

Data Processing

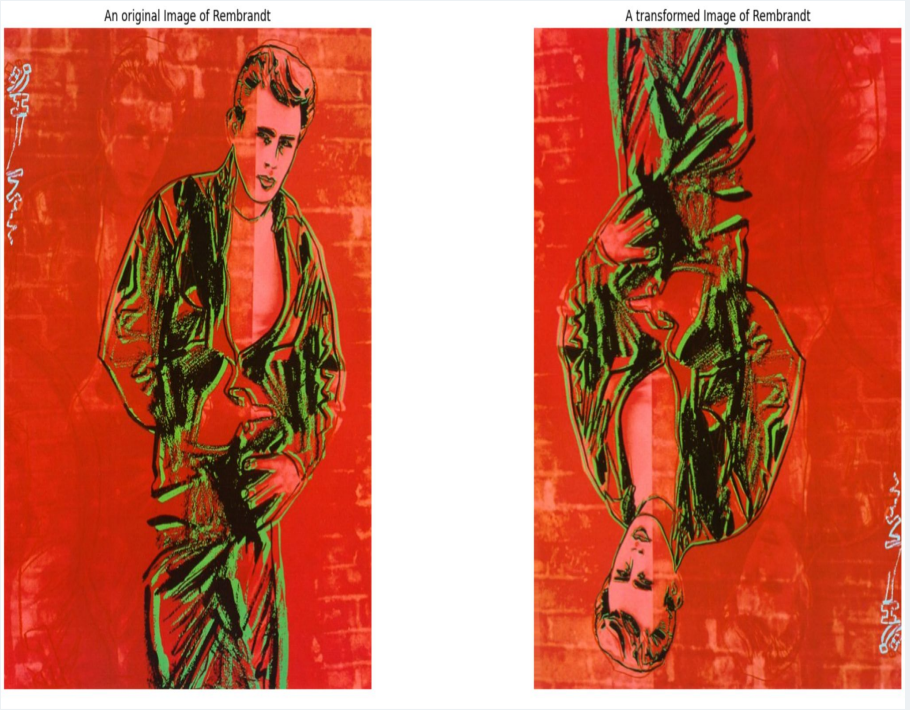
- Dropping Duplicated Images of Authors
- Rename Inconsistent Author Names
- Apply Data Augmentation Techniques
- Handle Data Imbalance Issue



Data Augmentation

Techniques:

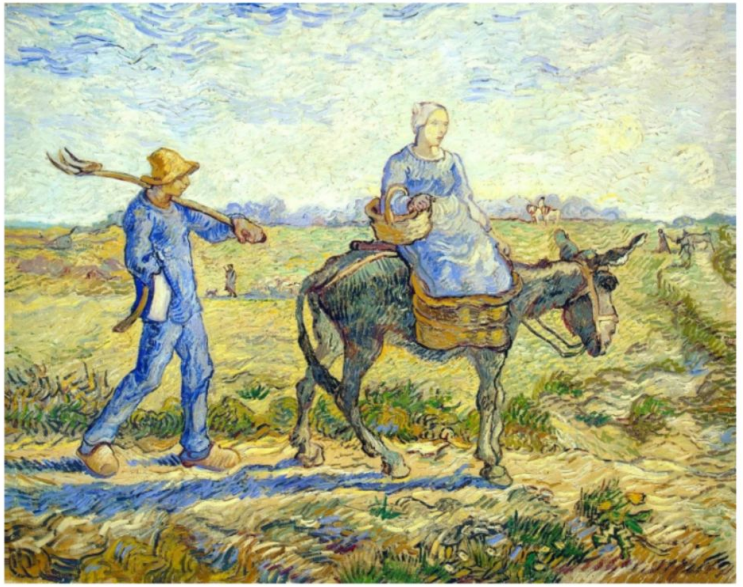
- Shear Range: 5 (Shearing transformations)
- Zoom Range: 0.2 (Zooming transformations)
- Horizontal Flip: True (Horizontal flipping)
- Vertical Flip: True (Random vertical flipping)



Data Augmentation (Cont)

An original Image of Vincent van Gogh

A transformed Image of Vincent van Gogh



Baseline Models

- Built Two Models:
  - Developed two models, one with data augmentation and another without.
- Optimizer:
  - Adam
- Loss Function:
  - Categorical Cross Entropy
- Number of Epochs:
  - 10

Layer (type)	Output Shape	Param #
conv2d_21 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_21 (MaxPooling2D)	(None, 63, 63, 32)	0
conv2d_22 (Conv2D)	(None, 61, 61, 64)	18496
max_pooling2d_22 (MaxPooling2D)	(None, 30, 30, 64)	0
conv2d_23 (Conv2D)	(None, 28, 28, 128)	73856
max_pooling2d_23 (MaxPooling2D)	(None, 14, 14, 128)	0
flatten_6 (Flatten)	(None, 25088)	0
dense_14 (Dense)	(None, 128)	3211392
dropout_8 (Dropout)	(None, 128)	0
dense_15 (Dense)	(None, 50)	6450

Total params: 3311090 (12.63 MB)
Trainable params: 3311090 (12.63 MB)
Non-trainable params: 0 (0.00 Byte)

Transfer Learning

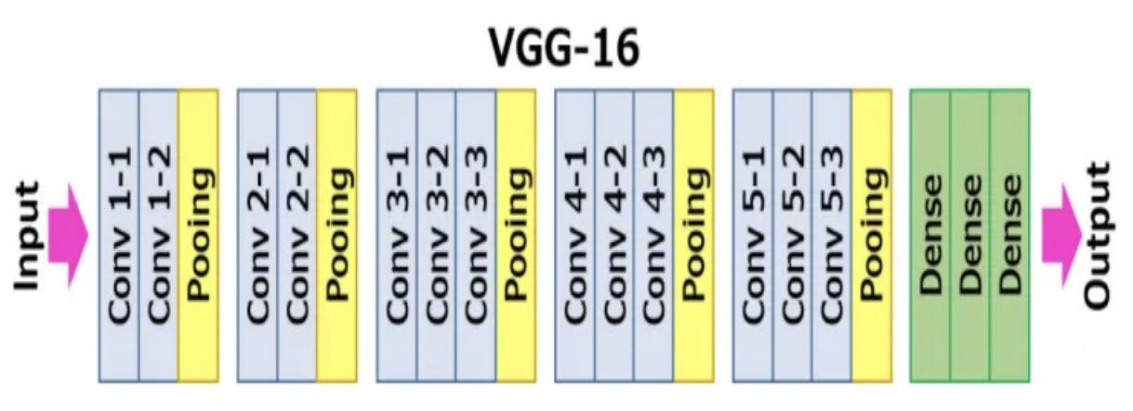
VGG16

VGG16 is a convolutional neural network architecture known for its simplicity and depth, consisting of 16 weight layers, including convolutional and fully connected layers.The VGG16 architecture was proposed by researchers from the Visual Geometry Group (VGG) at the University of Oxford, specifically Karen Simonyan and Andrew Zisserman.

Resnet50

ResNet50 is a deep convolutional neural network architecture that consists of 50 layers, developed to address the challenges of training very deep neural networks. It introduces the concept of residual learning, enabling the training of deeper models by utilizing shortcut connections that skip one or more layers, facilitating the flow of information and mitigating the vanishing gradient problem.

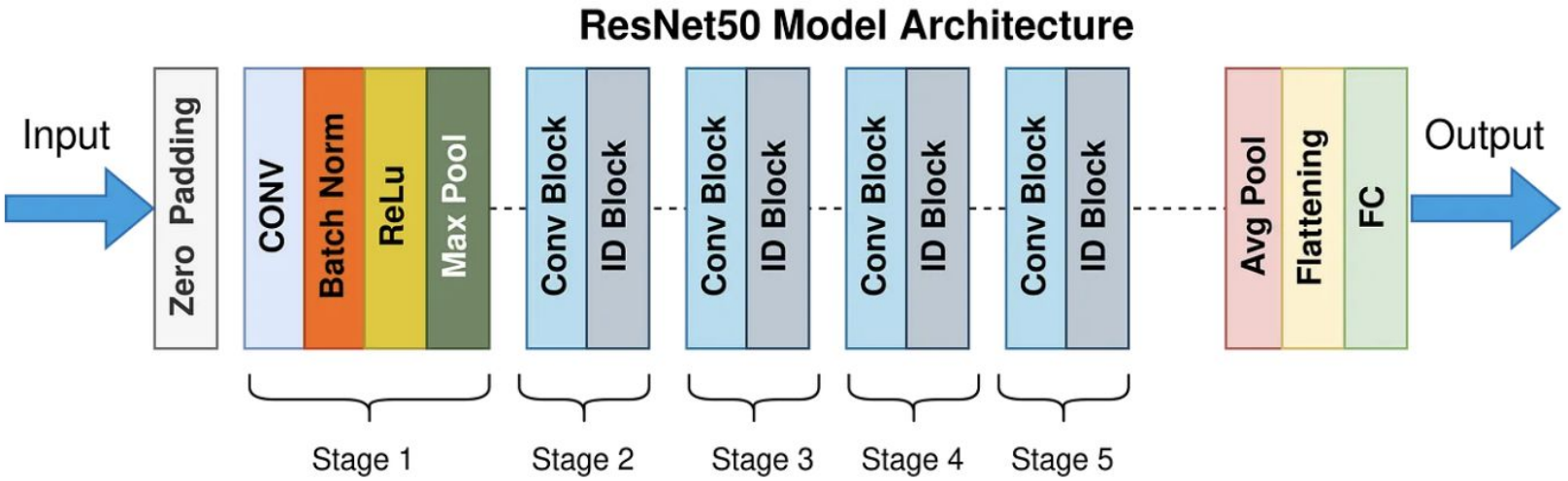
VGG-16 Architecture



Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 224, 224, 3)]	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36928
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	295168
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1180160
block4_conv2 (Conv2D)	(None, 28, 28, 512)	2359808
block4_conv3 (Conv2D)	(None, 28, 28, 512)	2359808
block4_pool (MaxPooling2D)	(None, 14, 14, 512)	0
block5_conv1 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv2 (Conv2D)	(None, 14, 14, 512)	2359808
block5_conv3 (Conv2D)	(None, 14, 14, 512)	2359808
block5_pool (MaxPooling2D)	(None, 7, 7, 512)	0
flatten (Flatten)	(None, 25088)	0
dense (Dense)	(None, 512)	12845568
batch_normalization (BatchNormalization)	(None, 512)	2048
activation (Activation)	(None, 512)	0
dense_1 (Dense)	(None, 16)	8208
batch_normalization_1 (BatchNormalization)	(None, 16)	64
activation_1 (Activation)	(None, 16)	0
dense_2 (Dense)	(None, 11)	187

Total params: 27570763 (105.17 MB)
Trainable params: 27569707 (105.17 MB)
Non-trainable params: 1056 (4.12 KB)

Resnet50 Architecture



Results and Comparisons

	Baseline	Baseline (Augmentation)	VGG16	Resnet50
Train	37%	34%	60%	97%
Test	24%	27%	53%	84%

References

[1] N. Viswanathan, “Artist Identification with Convolutional Neural Networks.” Available: http://cs231n.stanford.edu/reports/2017/pdfs/406.pdf

[2] X. Zhou, “The Power of Transfer Learning in Artist Identification.” Available: https://xingyuzhou.org/documents/transfer-learning.pdf

[3] “Painter Prediction from Artworks with Transfer Learning | IEEE Conference Publication | IEEE Xplore,” Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9384828

Thank you!