STAT 4012

Artists Identification from Art using Machine Learning and Deep Learning

Group 6

Project Outline

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i Brief Introduction

In our project, we aim to implement image classification to identify the artists from their artworks. We downloaded the dataset from Kaggle and the raw data comprises 50 artists in total and **8 of them** are being selected as the number of artworks is about 200 in between. You could click the below links to preview the data:

1. Raw Data from Kaggle
2. Selected Data

ii Data Pre-processing

Importing the data

1. We will first import the images and **rescale** them into the size of 224×224 which is the most common approach used in image classification.
2. Then, we will randomly split the dataset into a training and test set with an 8:2 ratio. Additionally, we will split the training set into 5 folds for cross-validation, where each fold contains 20% of the training set.

Data pre-processing

As some artworks are paintings on canvas, which can be considered noises in the data, de-noising techniques can be adopted to reduce these noises. Several de-noising methods will be fitted to smooth the images.

We will perform feature engineering with **One hot Encoding**. The labels are originally written in the name of the folder, namely "Alfred_Sisley", "Francisco_Goya", "Marc_Chagall", "Paul_Gauguin", "Paul_Klee", "Rembrandt", "Rene_Magritte" and "Titian", the text labels are now converted into the below format, where 1 is used to the value of the categorical variable.

$$Alfred\_Sisley = [1., 0., 0., 0., 0., 0., 0., 0.]$$
$$Francisco\_Goya = [0., 1., 0., 0., 0., 0., 0., 0.]$$

Data augmentation

In data augmentation, we will try to apply a set of transformations to the images in training set, such as rotating, style-transformation by adding some noises. Therefore, we could create some new images that are variations of the original images but still represent the same object or scene. This could be helpful for preventing overfitting and also improving the performance of the classification models.

iii Deep Learning

Convolutional Neural Network

To better identify the artists from their artworks, we will mainly use Convolutional Neural Networks (CNNs) for image classification. Additionally, we will compare the performance of different types of CNNs. *lea [1]*

iv Model Assessments and Performances

Model Assessments

To better tune our model, GridSearchCV is a very useful tool for optimizing hyperparameters in CNNs for image classification. We aim to use GridSearchCV to tune those hyperparameters such as learning rate, dropout rate and **optimizer (e.g. Adam, SGD, AdaGrad etc.) or even different activations (e.g. ReLu, Softmax, Sigmoid etc.)** to improve the accuracy and performance of the CNN.

On the other hands, the loss function, **categorical cross-entropy** will be used in our project to measure the difference between the predicted probabilities and the actual labels of the images. In other words, we could minimize the categorical cross-entropy so as to make accurate predictions in our CNN models.

Model Performances

After tuning the parameters, we then evaluate our model performances with Confusion Matrix, Accuracy, Precision, Recall and F1 Score etc.

References

[1] Pre trained models for image classification - pytorch, Feb 2023. URL https://learnopencv.com/pytorch-for-beginners-image-classification-using-pre-trained-models/.