

Advanced AI Project Report

Table of Contents :

- Problem Statement & Dataset
- Preprocessing & Feature Extraction
- Model Training & Validating
- Model Testing & Results
- Conclusion

Problem Statement & Dataset

Problem Statement:

The problem statement in this text is that a web-based company aims to customize its site to target TripAdvisor users more effectively for advertising revenue. The specific challenge is to categorize images based on the objects present in them. The company wants to check each image for the presence of one of the four specified objects: People, Buildings, Landscapes, and Food.

Dataset:

Dataset consists of 800 image :

- 200 image of buildings
- 200 image of people
- 200 image of food
- 200 image of landscape

Dataset split into :

- 75% Training images (150 image / Class)
- 10% Validation images (20 image/ Class)
- 15% Test images (30 image / Class)

Preprocessing & Feature Extraction

Preprocessing :

- Images are read by open cv library (cv2)
- Images are read as gray scale images
- Images converted from list to numpy arrays
- Labels are encoded to [Buildings = 0 , Food = 1 , Landscape = 2 , People = 3]
- Training Data are saved [Images, labels, descriptors] and shuffled to avoid overfitting.
- Mega-histogram is standard scalar transformed after filling

Feature extraction:

Bag of words (BOW) Algorithm is used to extract features from images

- Extracting keypoints and Descriptors using SIFT(Scale Invariant Features Transform) Algorithm .
- Extracted descriptors inserted in numpy Vstack.
- Kmean clustering object is created with specific number of clusters.
- The Vstack of descriptors is given to the Kmean object for Training Kmean object to get array of descriptors after clustering
- Initializing mega-histogram (Dictionary of all images) number of rows of list is images number and number of columns of list is number of clusters, as numpy list of zeros .
- The mega-histogram is filled by Descriptors predicted values from Kmean clustering
- Each image now has its own vocab (Dictionary).

Model Training & Validation

Support Vector Machine (SVM) Algorithm:

Multi class SVM Algorithm is used for training process as classifier.

Two different multi class SVM are used to reach the highest accuracy between them

- Different kernels are used (Rbf, poly)
- Each classifier gets Data and labels for training
- Data is the Mega-Histogram (Histogram of each image)
- Labels are given to the classifier after encoding

Validation (Hyperparameters Tuning):

This phase is used for hyperparameter tuning using different values for hyperparameters to reach the highest testing accuracy

Our hyperparameters values reached after tuning are :

- Number of clusters = 12
- For the first classifier (Kernel = rbf) hyperparameters Are gamma = 0.9 and C = 0.6
- For the second classifier (Kernel = poly) hyperparameters are Degree = 3 and C = 1

Model Testing & Results

The two models are tested by 30 image / each class to know which model has better generalization.

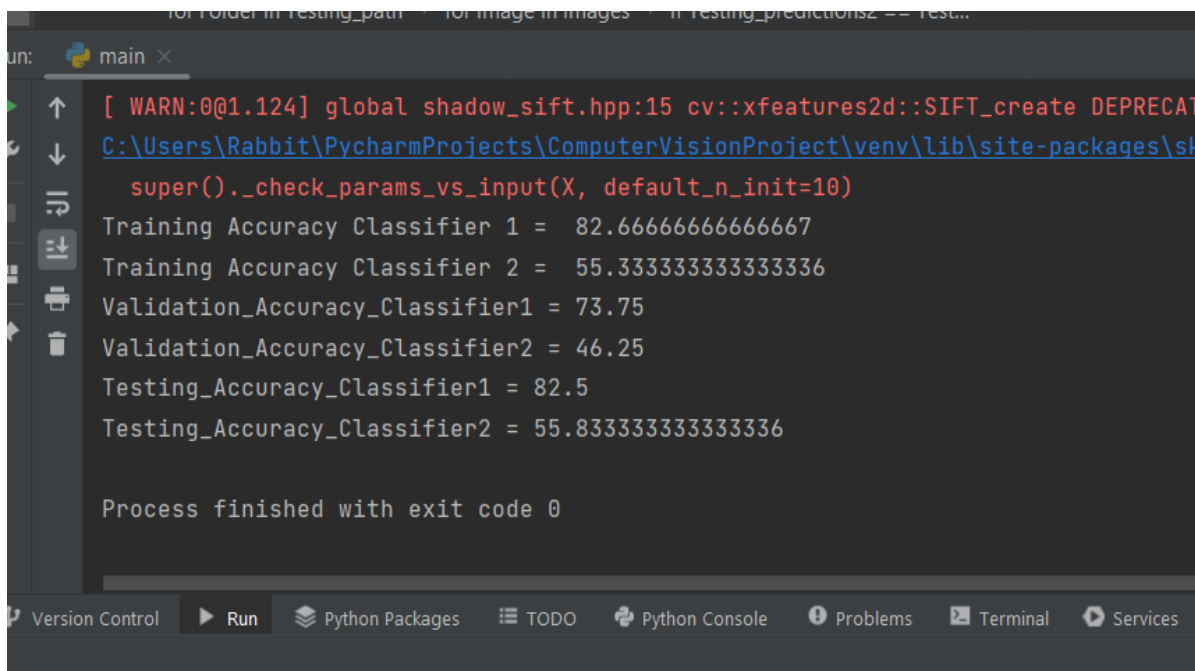
Accuracy is calculated as (Number of images true predicted / Total Number of images)

First Model Accuracy Results:

- Training Result : 82.7 %
- Validation Result : 73.8 %
- Testing Result : 82.5 %

Second Model Accuracy Results:

- Training Results : 55.4%
- Validation Results : 46.3%
- Testing Results : 55.8%



```
for folder in testing_path:
    for image in images:
        if testing_predictions2 == test...

[ WARN:0@1.124] global shadow_sift.hpp:15 cv::xfeatures2d::SIFT_create DEPRECAT
C:\Users\Rabbit\PycharmProjects\ComputerVisionProject\venv\lib\site-packages\sk
super()._check_params_vs_input(X, default_n_init=10)
Training Accuracy Classifier 1 = 82.66666666666667
Training Accuracy Classifier 2 = 55.333333333333336
Validation_Accuracy_Classifier1 = 73.75
Validation_Accuracy_Classifier2 = 46.25
Testing_Accuracy_Classifier1 = 82.5
Testing_Accuracy_Classifier2 = 55.833333333333336

Process finished with exit code 0
```

The screenshot shows a PyCharm terminal window with the following output:

- Training Accuracy Classifier 1 = 82.66666666666667
- Training Accuracy Classifier 2 = 55.333333333333336
- Validation_Accuracy_Classifier1 = 73.75
- Validation_Accuracy_Classifier2 = 46.25
- Testing_Accuracy_Classifier1 = 82.5
- Testing_Accuracy_Classifier2 = 55.833333333333336

The process finished with exit code 0.

Conclusion

1) Machine learning techniques is chosen over deep learning techniques as Dataset is small.

2) First classifier is chosen over the second classifier as it gives better results .