



Image Classification using DS

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ABSTRACT –

In recent years, computer vision systems have placed a strong emphasis on the recognition and classification of the variety of materials that can be found in our surroundings. The ability to train architectures to extract characteristics for this difficult task has been made possible by recent advancements in neural networks, which have been used in a deep process to understand the identification of materials in various photographs. This project uses and Support Vector Machine (SVM), Random Forest classifier, Logistic Regression in order to classify materials and analyze the results. One of the main objectives of the smart classification and identification is the technique in the modern world and to make human life easier in terms of comfortable and accurate in finding the things. A module named pywavelets, Open Cv and seaborn these packages imported in programming helps in easy access to the repository and eliminating anomalies occurring during the execution. This article presents a comprehensive survey on various attributes and kinds of images that are to be considered for classification.

SVM or Logistic regression and how it very is when you try to use a deep learning here in terms of project architecture we will build a model first hypertune exported to a file then will run a Python flask server around it and our website will make a call to that Python flask server now this project is a classification project.

Keywords –Python, SVM, Data Science, Jupyter Notebook, Image Classification, Data collection & cleaning.

I. INTRODUCTION

The image classification includes image pre -processing, image sensors, object detection, object segmentation, feature extraction and object classification. The Image Classification system consist of a database that contain predefined patterns that compare with an object to classify to suitable category. Image Classification is an vital task in various fields such as remote sensing, biometry, biomedical images, and robot navigation [4]. These are captured and accordingly processed. In Supervised classification, some pixels are known grouped and gives the label to classes. This process is known as training. After that classifier uses trained pixels for classify other images In Unsupervised classification, pixels are grouped with the help of their properties. This process is known as clustering and groups are known as a cluster. In this user decide how many clusters he wants to implement. The unsupervised classification is used when no trained pixels are available.

Image classification is the process of a computer accurately predicting the class an image falls under. It will calculate the probability of an image being part of a particular class, such as ‘cat’ or ‘dog’, returning the most likely class as a prediction. Today, image classification is used in facial-recognition software, medical imaging, and machine vision applications around the world. In Image classification different methods are used: Decision Tree, Artificial Neural Network (ANN), Support Vector Machine (SVM), Logistic regression, Random Forest Classifier etc.

For using data science platform Anaconda is a free and open-source distribution of the programming languages Python and R. The distribution comes with the Python interpreter and various packages related to machine learning and data science. It also includes a Jupyter Notebook, a shareable notebook that combines live code, visualizations and text which we need for our Project purpose.

Project on image classification over and goal is to build a website where you can drag and drop an image of a sports person and it will tell you which sports person that is now we are restricting our image classification to only 5 classes we have selected 5 sports celebrities. in this Data collection and data cleaning is done and downloading images manually from google takes lot of time so by using Chrome extension tool which is Fatkun makes easier to download images from google the size we want. Also for eyes and face detection haar cascades and opencv packages are necessary to import

II. Literature Review

Image classification is an important step in the object detection and image analysis. The output of the image classification step can be the final output or the intermediate output. A lot of image classification techniques have been proposed till date. Various studies have been conducted in order to conclude about the best satellite image classification technique. It is hard to decide any one technique as the best technique among all, because the results and its accuracy depend on a number of factors [2].

Over the last few decades, there is a constant modification in the conventional methods as well as invention of new image classification techniques in order to get maximum accurate results. Each of the classification technique has its own advantages and disadvantages. The research now concentrates on combining the desired features of these techniques in order to increase the efficiency.

The paper by Jianxin Wu et al. [1], the challenge of image classification from a big dataset is the subject of the recent research work. The support vector machine (SVM) classifier show to be very useful in image classification.

Monica Bianchini et al. [3] also discusses the artificial neural network classification technique.

Cheng-HsuanLi et al. [5] discuss, A Spatial-Contextual Support Vector Machine for Remotely Sensed Image Classification.

III. Methodology/Experimental

- **Classification –**

The images are classified based on the extracted characteristics into predefined categories by using suitable methods that evaluate the image pattern with images which inside the database.

- **Image Classification Steps –**

Image Classification includes following steps:

a. Image Acquisition: acquire the images for image processing. Image acquisition is the process of converting an analogue image into digital form. Image acquisition is always the first step in a workflow sequence because images are needed for processing. Image processing starts by acquiring an unprocessed picture, a step that's always necessary before other work can be done on it.

b. Image Pre-Processing: Image data Pre-Processing, which converts image data into a form that allows machine learning algorithms to solve it. It is often used to increase a model's accuracy, as well as reduce its complexity. There are several techniques used to pre-process image data. Examples include; image resizing, converting images to grayscale, and image augmentation. In preprocessing image transformation, noise removal, at morphemically correction techniques are used.

c. Feature Extraction: In machine learning, pattern recognition, and image processing, Feature extraction involves reducing the number of resources required to describe a large set of data. Extracting the important characteristics of the image. Feature extraction is a part of the dimensionality reduction process, in which, an initial set of the raw data is divided and reduced to more manageable groups. These features are easy to process, but still able to describe the actual data set with the accuracy and originality.

- **Requirements –**

1. Python Language
2. Anaconda
3. Jupyter Notebook

- **Modules/Packages to import –**

1. PyWavelets
2. Open Cv
3. Seaborn
4. matplotlib

- **Extensions for downloading images –**

1. Fatkun Chrome Extension

- **Training models that we are use –**

1. Support Vector Machine (SVM)
2. Random Forest Classifier
3. Logistic Regression

1. **Support Vector Machine (SVM) –**

A support vector machine (SVM) is a supervised machine learning model that uses classification algorithms for two-group classification problems.

2. **Random Forest Classifier –**

The Random Forest or Random Decision Forest is a supervised Machine learning algorithm used for classification, regression, and other tasks using decision trees.

3. Logistic Regression –

Logistic regression is a statistical model that in its basic form uses a logistic function to model a binary dependent variable.

• Comparison of Image Classification Methods –

The table shows the advantages and disadvantages of the image classification methods.

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Method	Advantages	Disadvantages
1. Support Vector Machine (SVM)	<ul style="list-style-type: none"> · Deliver unique solution. · Very capable than other methods. · evade over-fitting 	<ul style="list-style-type: none"> · High algorithm complexity · Run slowly
2. Random Forest Classifier	<ul style="list-style-type: none"> • more accurate than most of the non-linear classifiers. • This algorithm is also very robust 	<ul style="list-style-type: none"> • No interpre -tability, overfitting can easily occur. • need to choose the number of trees manually.
3. Logistic Regression	<ul style="list-style-type: none"> • Probabilistic Approach gives information about statistical significance of features. 	<ul style="list-style-type: none"> • The assumptions of logistic regression.

Table 1: Advantages and Disadvantages of Image Classification

• Methods / Steps –

1. Download Anaconda and open Jupyter Notebook
2. Import Modules/Packages that needed
3. Download images of 5 sports celebrities using Chrome extention and store it in different folders
4. Give Folder path and store crop images using Code
5. Data Collection and Data Cleaning of images Should done. After this check manually and delete images that we don't want
6. Create dictionary in code and assign values to such as 0,1,2,3,4 to sports celebrities
7. Then try different models for model training such as SVM, logistic regression, Random Forest Classifier and then check accuracy for each one and choose best one
8. train our model and then hypertune it then save our model to a file and will try to Python flask server around it which will be serving to our website.

IV. Results and Discussions

• Detecting Face and eyes using Open CV Python Library

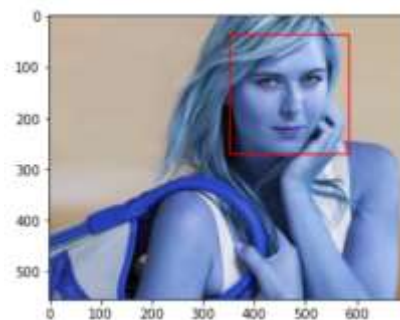


Fig.3.1 Face Detection

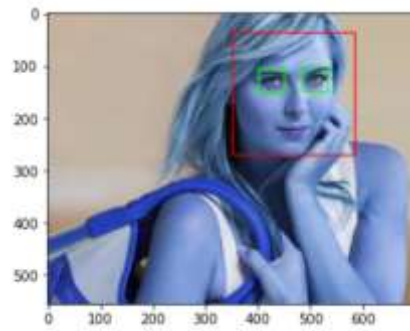


Fig.3.2 Face and Eye Detection

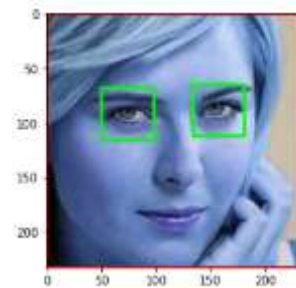


Fig.3.3 Cropped Image

- Precision and recall classification report

	precision	recall	f1-score	support
0	0.86	0.67	0.75	9
1	0.83	0.91	0.87	11
2	0.75	0.86	0.80	7
3	1.00	0.70	0.82	10
4	0.55	0.75	0.63	8
accuracy			0.78	45
macro avg	0.80	0.78	0.77	45
weighted avg	0.81	0.78	0.78	45

Fig.3.4 Classification Report

- Different Models and their scores out of 1

	model	best_score	best_params
0	svm	0.804558	{'svc_C': 1, 'svc_kernel': 'linear'}
1	random_forest	0.676353	{'randomforestclassifier_n_estimators': 10}
2	logistic_regression	0.803989	{'logisticregression_C': 1}

Fig.3.5 Models and their scores

- Plotting Confusion matrix by using Seaborn Python Library as X-axis is Predicted and Y-axis is Truth.

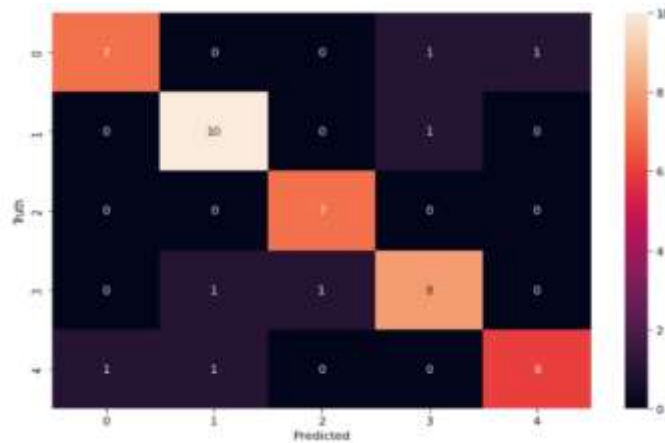


Fig.3.6 Confusion matrix using Seaborn

V. Limitations

The main limitation is that if the object size is smaller than the pixel size, then it can not be applied efficiently because then one pixel can contain two or more objects. Also it is time consuming and there is lack of qualified professionals. If the eyes or face is obstructed it will shows error. once the system is damaged the image will be lost. Also Intra-Class Variation, Scale Variation, View-Point Variation, Occlusion, Illumination are the main challenges in image classification.

VI. Future Scope

Image Classification has huge scope as it improving day by day. using data science and machine learning Image classification is very easy we just need the knowledge of Data Science and Python. Image classification plays an important role in remote sensing images and is used for various applications such as environmental change, agriculture, land use/land planning, urban planning, surveillance, geographic mapping, disaster control, and object detection and also it has become a hot research topic

VII. Conclusion

Doing this project and only you will learn a lot of important concepts in data science and machine learning but you will get a feel of how projects are executed in big companies in a typical corporate environment will use images which are scraps from Google. Also in these we see different type of data science as well as python libraries for enhancing user's experience. Also going through different models we can see accuracy and precision of different models like SVM, Logistic Regression, Random forest classifier etc. There are many ways in which these techniques are classified and categorizing these techniques into supervised and unsupervised is the most common way. The comparison of these techniques on the basis of efficiency largely depends on the type of data they are being used for. This paper summarizes the information about commonly used image classification techniques. This will help the researchers to select the most appropriate classification technique according to their requirements. This paper gives the concise knowledge on some supervised classification methods used in Image Classification. The most common approach for image classification is non-parametric. This survey provides the some diverse classification method with their some limitations.

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