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Human Face Detection Using Classification Algorithms

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Abstract:

Image classification technology has been emerged one of the exuberant application of machine learning in recent years. Image classification is used to classify and detect the image such as peopleface or non physical items.image classification is also very impactful for barcode detection and face detection.Furthermore, mainly there are two methods available for identification, neural networks and classification algorithms. This paper proposed a classification algorithm method to approach face detection.Additionally in this paper we have used openCV's haar-cascade method to identify and analyse facial structure.Moreover ,numbers of classification algorithms are used to identify and analyse which algorithm gives the best score and performed the hypertuning to check how algorithm stands on several different parameters. On the basis of accuracy and overall performance score of different algorithm, and finally decided the best algorithm for image classification

Keywords **—Image Classification, Face Detection, Classification Algorithm, Computer Vision**

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I. INTRODUCTION

Age of the internet is evolving very drastically, new technologies are emerging wildly like AI,machine learning, neural networks and deep learning. Image identification image classification is one aspect of it. Now machines can identify images by their own intelligence, we can see AR mobile apps, or any disease detection in all applications we use image classification methods.
In human image classification first we identify the face structured and eye structure of face using openCV specifically openCV.harcascade classifier classify the images on the basis of edge features ,line features, centre surrounded.there are
After getting our interest face image. Image should be convert into pywavelet image for that we have used pywavelet transformation.pywavelet image conversion is very important because our model or computer does not understand the colour image

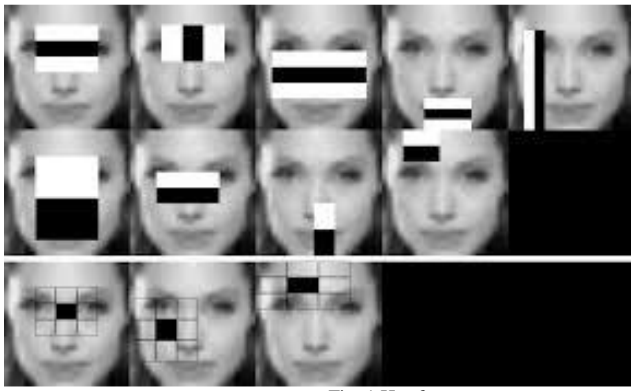

Fig. 1.Har-features

After getting har image we shall start our model training procedure, for image identification.for that we are going to use classification algorithms such as random forest, logistic regression and SVM. By using hyperparameter tuning we can decide which algorithm is giving best score for image identification.we have choice to choose evaluation score or test score we will analyse and choose according to it

II. IMAGE PROCESSING

Image Pre-processing–

In image processing there are several steps which we have to take a look such as data cleaning feature engineering etc.

With the help of open-cv harcascade we first create box around our interest image i.e. around face and around eye

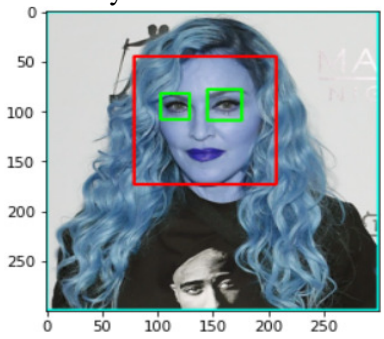

Fig. 2. face output with BOX over face and eye

But we just need face structure and eye we will crop other aspects of picture by roi_color method in matplotlib

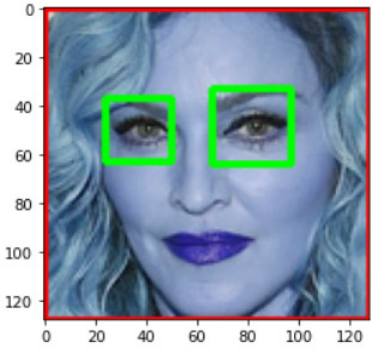

Fig. 3. ROI face output with BOX over face and eye

After getting our interest face image. image should be convert into Py-Wavelet image for that we have used Py-Wavelettransformation. Py-Waveletimage conversion is very important because our model or computer does not understand the color, it only get the binary image there for we have to transform

```
1 im_har = w2d(hey,'db1',5)
2 plt.imshow(im_har, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x2a396e62130>
```

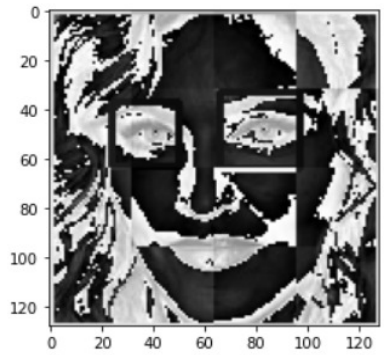

Fig. 4. PyWavelet Transformed image

III. PROPOSED ALGORITHMS

After getting har image we shall start our model training procedure, for image identification.for that we are going to use classification algorithms such as random forest, logistic regression and SVM. By using hyperparameter tuning we can decide which algorithm is giving best score for image identification

A. Logistic regression

Logistic algorithm is one of the algorithm to solve the classification problem, it's kind of similar to linear regression. But in logistic regression we don't fit straight line to data like we do in linear regression,we fit sigmoid curve. image detection comes under the multinomial distribution, as there are two types binomial and multinomial.

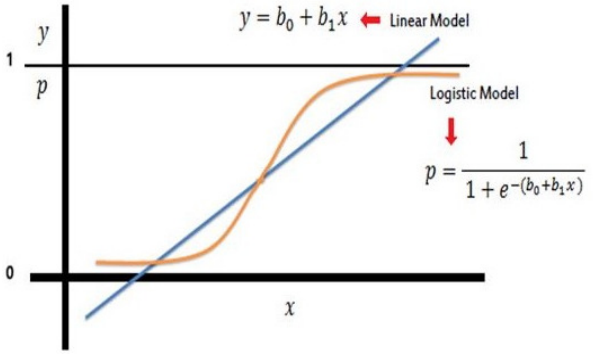

Fig. 5. Logistic Regression sigmoid chart

After fitting the data into logistic regression model

Evaluation Score:

2	logistic_regression	0.621978	{'logisticregression__C': 1}

Fig. 6. Logistic Regression sigmoid chart

Which is below average

Test Score:

```
In [43]:  1 best_estimators['svm'].score(X_test,y_test)

Out[43]: 0.8333333333333334
```

Fig. 7. Logistic Regression sigmoid chart

Which is definitely below average

B. Random Forest

Random forest algorithm is a supervised classification algorithm.we can say Random forest is combination of decision trees. In a random forest it creates a forest by some way and makes it random. Result is depends on the number of trees created in the forest.in simple words random forest builds multiple decision trees in random way and merge them all to get accurate and precise prediction.

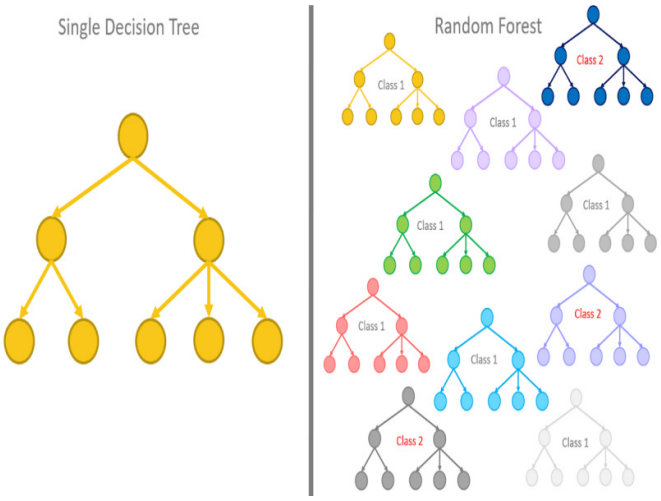

Fig. 8. Random Fores Tree

After fitting data into random forest algorithm we get result.

Evaluation Score:

1	random_forest	0.580220	{'randomforestclassifier__n_estimators': 15}

Fig. 9. Logistic Regression sigmoid chart

Score is not well

Test Score:

```
In [41]:  1 best_estimators['random_forest'].score(X_test,y_test)
          2

Out[41]: 0.6666666666666666
```

Fig. 10. Logistic Regression sigmoid chart

Which is very decent, So we need more improvement in our model so we will going try SVM

C. Support Vector Machine–

Svm or support vector machine is one of the most popular supervised learning algorithm, it is basically used for classification problems. Its also used for regression problems.SVM algorithm create the best liine or decision boundary that can separate multi dimensional or n dimensional space into specific classes so that new data or test data goes into the correct category.this best line or bounndry called a hyperplanee

Svm chooses extreme vectors which helps to create the hyperplane.these extreme vecptrs are called as support vectors ,and hence algorithm is called as support vector machine i.e SVM

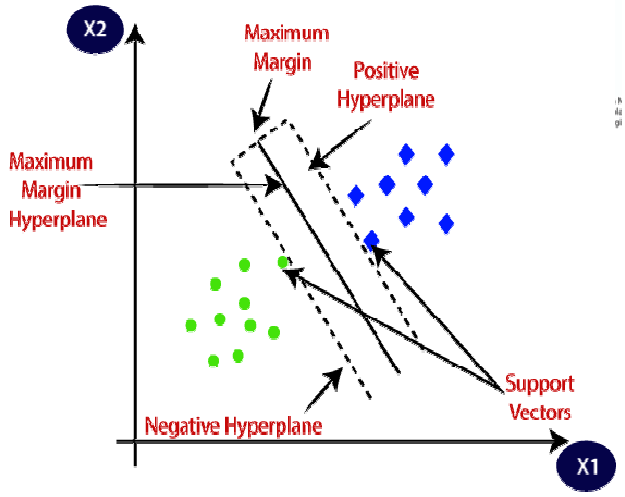

Fig. 11. Support Vector Machine

Evaluation Score:

0	svm	0.680220	{'svc__C': 1, 'svc__kernel': 'linear'}

Fig. 12. Logistic Regression sigmoid chart

Which is very decent

Test Score:

```
In [43]:  1 best_estimators['svm'].score(X_test,y_test)
Out[43]: 0.8333333333333334
```

Fig. 13. Logistic Regression sigmoid chart

Which is comparatively very good

IV. EXPERIMENTS AND RESULTS

After completing all the Experiments and Hyper Parameter tuning our evaluation score.hyper parameter tuning is the best way to see which parameter get us the best result

Table -1 Evaluation Score

	Model	Best_score	Best_Param
0	svm	0.709890	{'svc__C': 1, 'svc__kernel': 'linear'}
1	random_forest	0.619780	{'randomforestclassifier__n_estimators': 10}
2	logistic_regression	0.623077	{'logisticregression__C': 10}

Table -2 Test Score

	Model	Best_score
0	svm	0.833334
1	random_forest	0.666666
2	logistic_regression	0.750000

After getting both evaluation and test score we will select the best one for our model which will definitely be a SVM because SVM's both evaluation and test score is comparatively better than all the others.

We have also use seaborn library for better visualization

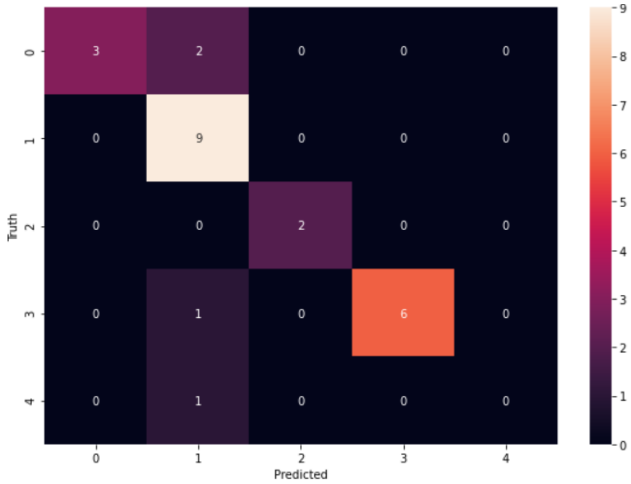

Fig. 14. Classes Comparison Chart

so here in fig we can see there were 2 times truth class value was 0 but it predicted class 1, and same with class 3 and 4 truth value was 1 in both class 3 and class 4 but it predicted class 1 i.e our model is getting confused between class 1 and class 4

V. CONCLUSIONS

Hence, By using three different classification algorithms for human face detection we can conclude that SVM i.e. Support Vector Machine have performed very good for prediction of human facein both evaluation set as well as test set, .the reason behind SVM performed better because Support vector machines have one inbuilt layer which helps with having an explication of the data - the kernel.we can say that SVM classification

algorithm would be the best classification algorithm to classify image and detection of an image.

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