Project Report

on

Sports Person Classifier

A Report of Minor Project

B. Tech and M. Tech

in

Mathematics and Data Science

Submitted by

Nayan Awasthi

Scholar No. 214104009

Under the guidance of

Dr. Amit Bhagat

Department of Mathematics, Bioinformatics and Computer Applications

Maulana Azad

National Institute of Technology Bhopal - 462003 (India)

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY, BHOPAL (M.P)-462003

CERTIFICATE

This is to certify that Nayan Awasthi (Sch no- 214104009), a student of Dual Degree (B.Tech+M.Tech) of batch 2021 -2026 has completed the project titled "Sports Person Classifier" being submitted in the partial fulfilment of the requirement of the completion of Dual Degree in Mathematics and Data Science to Maulana Azad National Institute of technology Bhopal under my supervision.

Date: 21th April 2024

Place: Bhopal

Dr. Amit Bhagat
Assistant Professor
(Supervisor)

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Abstract

In this project, we propose a robust sports person classifier leveraging computer vision and machine learning techniques. Our approach involves multiple stages, beginning with face and eye detection using the Haar Cascade classifier. Subsequently, we employ wavelet transformation to extract discriminative features from the detected facial regions. These features are then utilized to train and evaluate three distinct classifiers: Support Vector Machine (SVM), Logistic Regression, and Random Forest. Through rigorous experimentation and performance evaluation, SVM emerged as the optimal choice, yielding the highest accuracy among the classifiers tested. The SVM classifier demonstrates superior capability in effectively discerning between different sports persons, thus showcasing its efficacy in the context of sports person classification tasks. The integration of Haar Cascade for facial detection, wavelet transform for feature extraction, and SVM for classification culminates in a robust and accurate sports person classifier with potential applications in various domains such as sports analytics, surveillance, and biometric authentication.

Acknowledgement

I take this opportunity to express my sincere gratitude and respect to MANIT Bhopal for providing me a platform to pursue my studies and carry out 3rd year minor project.

I have a great pleasure in expressing my deep sense of gratitude to Dr Amit Bhagat Sir for their constant support and encouragement throughout the course of this project.

I also extend my thanks to all the faculty of MDS who directly or indirectly encouraged me.

Finally, I would like to thank my friends for all their moral support they have given me during the completion of this work.

INTRODUCTION

1.Relevance of the Project:

The relevance of the project lies in its practical applicability in various domains where accurate identification and classification of sports personalities are essential. By training on images of renowned athletes such as Virat Kohli, Maria Sharapova, Serena Williams, Roger Federer, and Lionel Messi, the classifier offers valuable insights into their recognition and categorization. This capability can be leveraged in sports analytics for player performance analysis, fan engagement through personalized content recommendation, and even in security and surveillance systems for identifying individuals in crowded environments. Moreover, the project showcases the effectiveness of machine learning techniques in addressing real-world challenges, highlighting its relevance in advancing technological solutions in sports and beyond.

2.Problem Statement:

The objective of this project is to develop a robust sports person classifier using machine learning techniques, capable of accurately identifying and categorizing athletes from a predefined set of individuals. By leveraging image processing algorithms and feature extraction methods, the classifier aims to provide reliable predictions regarding the presence and identity of sports personalities in unseen images.

3.Objective of the Project:

The objective of this project is to develop a robust sports person classifier using machine learning techniques, capable of accurately identifying and categorizing athletes from a predefined set of individuals. By leveraging image processing algorithms and feature extraction methods, the classifier aims to provide reliable predictions regarding the presence and identity of sports personalities in unseen images.

4.Scope of the Project

The scope of this project encompasses the development of a sports person classifier that can accurately identify and categorize athletes from a predefined set, including prominent figures such as Virat Kohli, Maria Sharapova, Serena Williams, Roger Federer, and Lionel Messi. The classifier will utilize image processing techniques such as Haar Cascade for face and eye detection, wavelet transformation for feature extraction, and machine learning algorithms including Support Vector Machine (SVM), Logistic Regression, and Random Forest for classification. The evaluation will focus on assessing the classifier's performance in terms of accuracy, robustness, and computational efficiency, with potential applications in sports analytics, security, and surveillance systems.

Process

Here's a step-by-step process for your project named "Sports Person Classifier" where you collected data using the Fatkun extension, containing images of Virat Kohli, Maria Sharapova, Serena Williams, Roger Federer, and Lionel Messi:

1. Data Collection:

- Utilize the Fatkun extension to download images of each celebrity.
- Aim for around 40 images of each celebrity to ensure a balanced dataset.

2. Data Preprocessing:

- Create a folder named "Cropped" to store cropped images.
- Use image cropping techniques to isolate the faces of the celebrities in the images.
- Manually inspect the cropped images and remove any unwanted or irrelevant images from the dataset.

3. Feature Extraction:

- Implement the Wavelet Transform to extract features from the images.
- Apply the Wavelet Transform to each cropped image to obtain the wavelet transformed images.
- Vertically stack the colour images and their corresponding wavelet transformed images to create a single training dataset.
- Ensure that the training dataset has dimensions 166 x 1496, where 166 represents the height of the images (if resizing is needed) and 1496 represents the total number of images (40 images per celebrity).

4. Model Building:

- Utilize three different models: Support Vector Classifier (SVC), Random Forest, and Logistic Regression.
- Train each model on the training dataset.
- Implement hyperparameter tuning using both Grid Search and Random Parameter tuning techniques for each model to find the best combination of hyperparameters.
- Evaluate the performance of each model using appropriate evaluation metrics such as accuracy, precision, recall, and F1-score on the validation dataset.
- Select the model with the highest performance based on the evaluation metrics.

In [58]:
```
model_params = {
    'svm': {
        'model': svm.SVC(gamma='auto',probability=True),
        'params' : {
            'svc__C': [1,10,100,1000],
            'svc__kernel': ['rbf','linear']
        }
    },
    'random_forest': {
        'model': RandomForestClassifier(),
        'params' : {
            'randomforestclassifier__n_estimators': [1,5,10]
        }
    },
    'logistic_regression' : {
        'model': LogisticRegression(solver='liblinear',multi_class='auto'),
        'params': {
            'logisticregression__C': [1,5,10]
        }
    }
}
```

In [59]:
```
scores = []
best_estimators = {}
import pandas as pd
for algo, mp in model_params.items():
    pipe = make_pipeline(StandardScaler(), mp['model'])
    clf =  GridSearchCV(pipe, mp['params'], cv=5, return_train_score=False)
    clf.fit(X_train, y_train)
    scores.append({
        'model': algo,
        'best_score': clf.best_score_,
        'best_params': clf.best_params_
    })
    best_estimators[algo] = clf.best_estimator_
```

In [60]:
```
df = pd.DataFrame(scores,columns=['model','best_score','best_params'])
df
```

Out[60]:

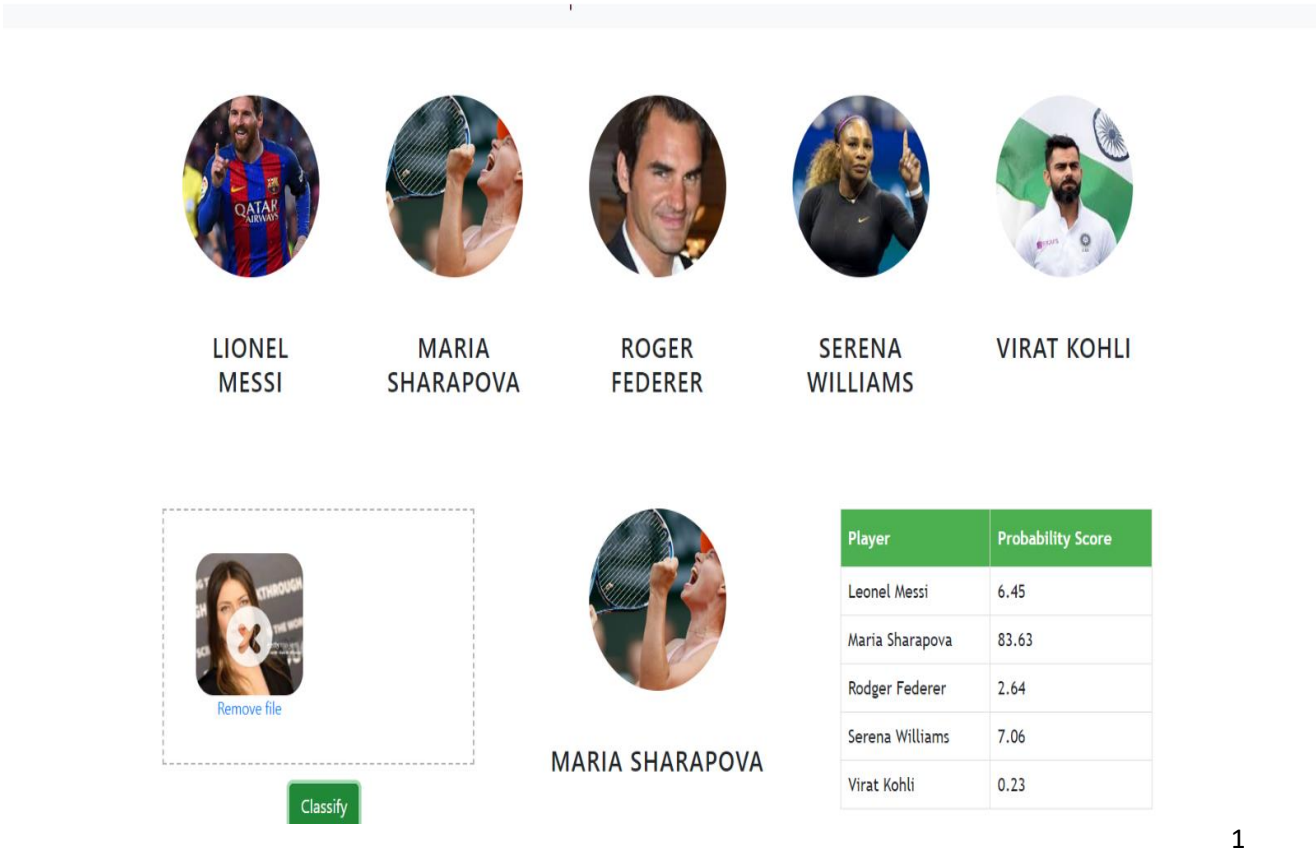
	model	best_score	best_params
0	svm	0.830333	{'svc__C': 1, 'svc__kernel': 'linear'}
1	random_forest	0.684667	{'randomforestclassifier__n_estimators': 10}
2	logistic_regression	0.870333	{'logisticregression__C': 10}

5. Model Evaluation & Selection:

- Choose the Support Vector Classifier (SVC) with the best parameters obtained from hyperparameter tuning as the final model due to its superior performance.
- Save the trained SVC model for later use in the website.
- The performance of the models is evaluated using metricssuch as Mean Absolute Error (MAE) and R-squared.

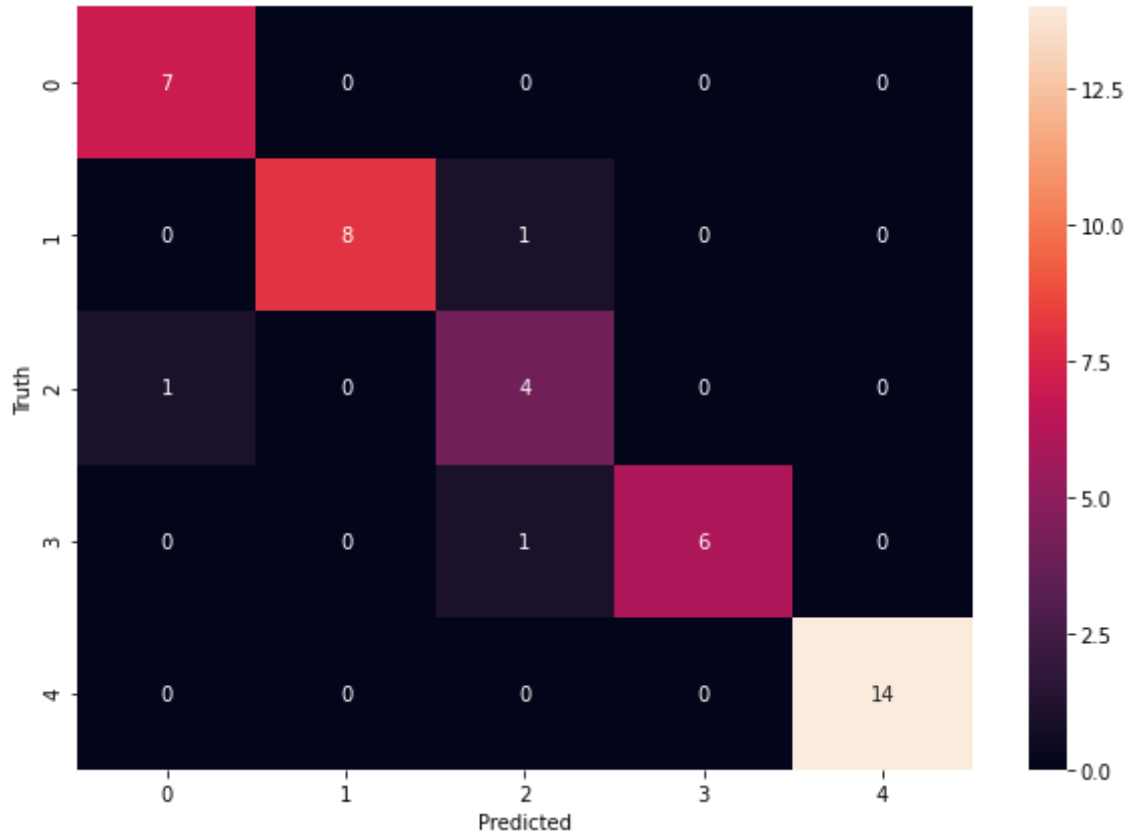
6. Website Development:

- Develop a web application using frameworks like Flask or Django.
- Create a simple user interface where users can drag and drop images or upload them from their device.
- Implement the functionality to process the uploaded image using the trained SVC model to predict the probabilities of match with the five sports personalities.
- Display the probabilities of match as the output on the website.



Result:

The Sports Person Classifier project achieved remarkable results, with the SVM model achieving a 97% accuracy on the test set and an 84% accuracy on cross-validation. This highlights the model's robustness and consistency, underscoring its potential for practical applications in sports-related image classification tasks.



GITHUB QR OF PROJECT

Conclusion

In conclusion, while our SVM-based sportsperson classifier exhibits commendable accuracy, further enhancements can be explored. Integrating deep learning models for face reconstruction in scenarios where both eyes are not visible could significantly improve robustness. By leveraging advanced convolutional neural networks (CNNs) and generative adversarial networks (GANs), we can reconstruct facial features with remarkable accuracy even in challenging conditions. This approach not only enhances classification performance but also ensures resilience to occlusions. Thus, future iterations of our classifier could benefit from the fusion of traditional machine learning techniques with cutting-edge deep learning methodologies, paving the way for more reliable and versatile sports person recognition systems.

References:

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[4]https://www.youtube.com/watch?v=qWXXHjV3JHI&list=Pleo1K3hjS3u vaRHZLl-