SPORTS CELEBRITY IMAGE CLASSIFICATION

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Introduction

Sports celebrity image classification is a task aimed at identifying and categorizing images of famous sports personalities. This report outlines the process of building a classification model using machine learning techniques to distinguish between five different sports celebrities based on their facial features.

Dataset Preparation

The dataset used for training and evaluation purposes consisted of images of five famous sports personalities obtained from diverse sources. These images were manually curated and inspected to ensure quality and relevance to the task. The dataset was organized into folders, each corresponding to a specific sports celebrity.

The dataset included images of the following sports celebrities :

1. Virat Kohli: Sport: Cricket, Nationality: Indian, Achievements: Renowned as one of the greatest batsmen in modern cricket, numerous records in international cricket, including multiple ICC awards.

2. Maria Sharapova: Sport: Tennis, Nationality: Russian, Achievements: Multiple Grand Slam singles titles, including Wimbledon and US Open, Olympic silver medalist, former world No. 1.

3. Lionel Messi: Sport: Football (Soccer), Nationality: Argentine, Achievements: Multiple FIFA Ballon d'Or winner, regarded as one of the greatest footballers of all time.

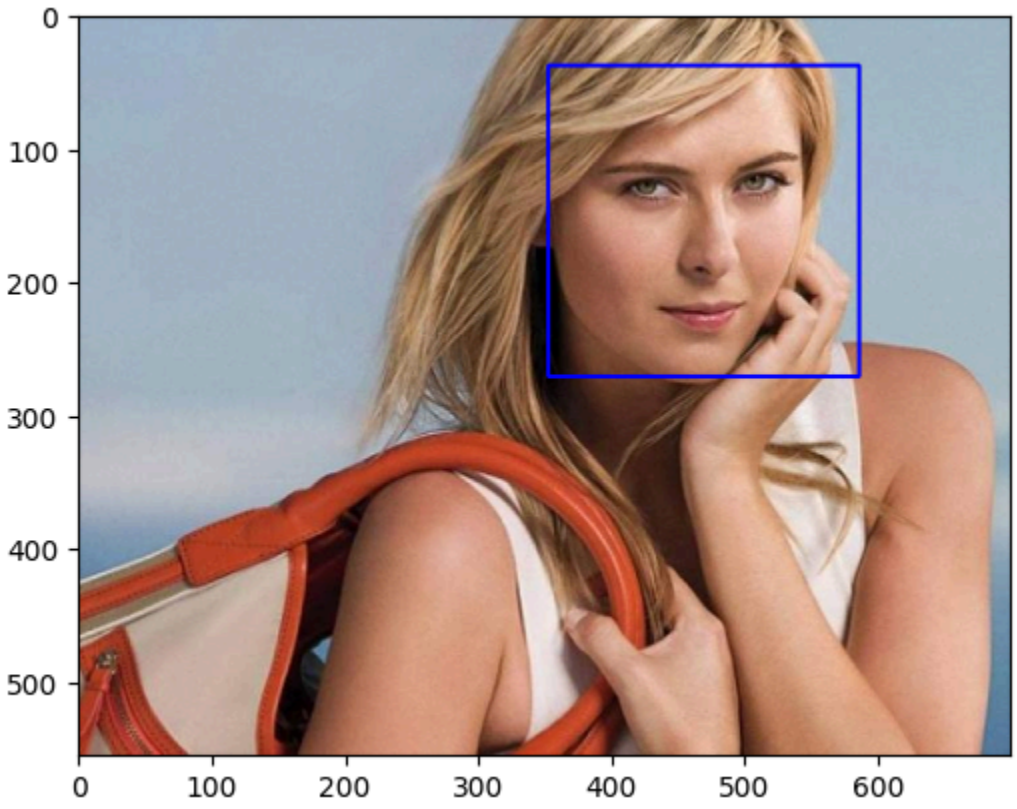
4. Roger Federer: Sport: Tennis, Nationality: Swiss, Achievements: Record 20 Grand Slam singles titles, including Wimbledon and Australian Open, former world No. 1 for a record 310 weeks.

5. Serena Williams: Sport: Tennis, Nationality: American, Achievements: Multiple Grand Slam singles champion, widely considered one of the greatest female tennis players in history.

Preprocessing

Face Detection:

The OpenCV library was utilized to detect faces within each image. This was achieved using a pre-trained Haar Cascade classifier for face detection. The `cv2.CascadeClassifier` class was employed to load the pre-trained cascade classifier for face detection. Following image shows face detection for Maria Sharapova's image.



Eye Detection:

Once faces were detected, the next step involved detecting eyes within each detected face region. This was crucial for ensuring that the faces were not only present but also had at least two detectable eyes. A similar approach was used for eye detection, utilizing a pre-trained Haar Cascade classifier specifically designed for eye detection. The `cv2.CascadeClassifier` class was again utilized to load the pre-trained cascade classifier for eye detection.

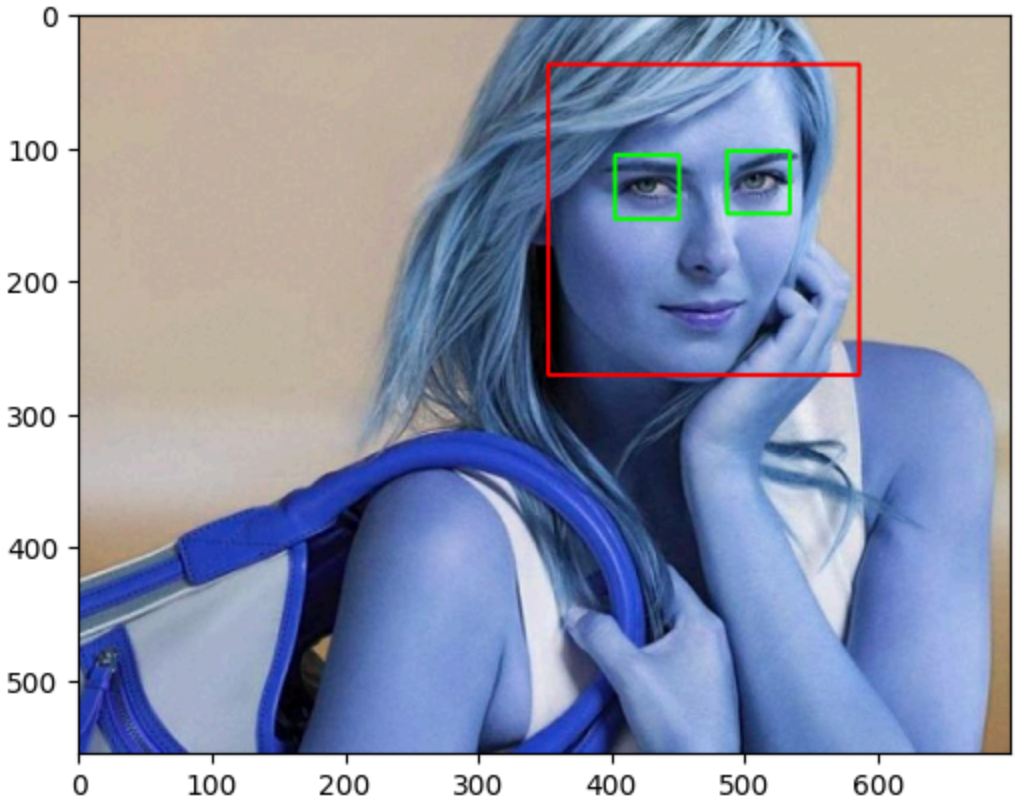
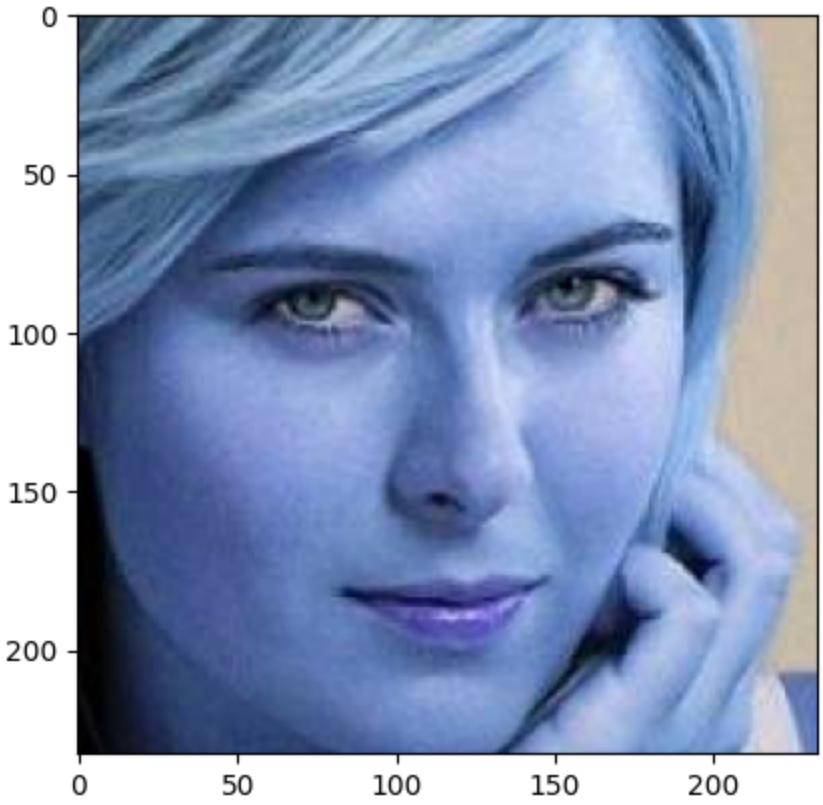


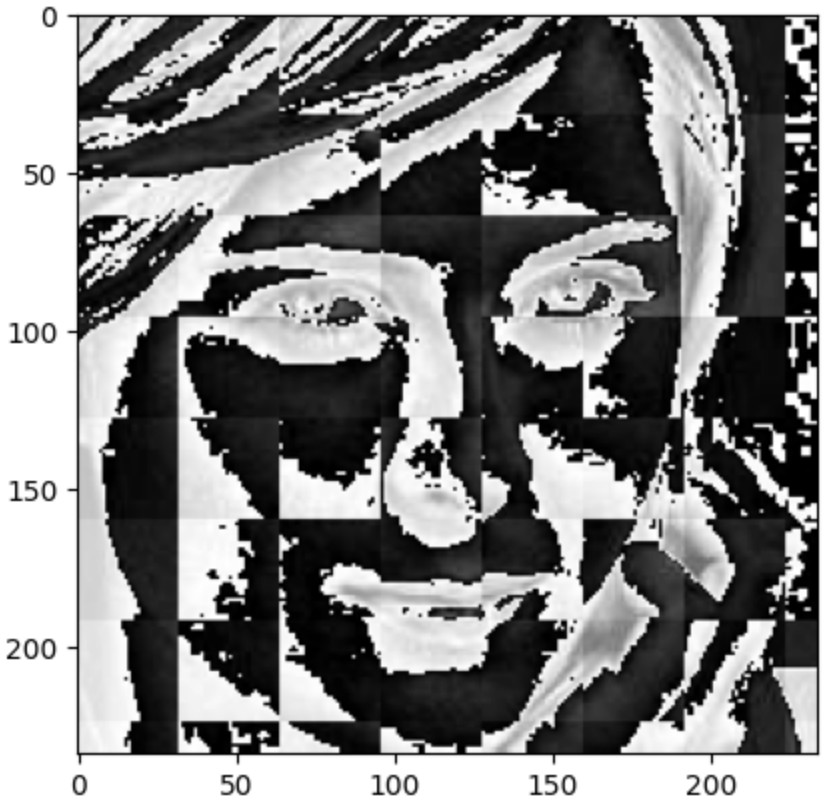
Image Cropping:

For each selected image containing a detected face, the face region was cropped using the bounding box coordinates provided by the face detection algorithm. The OpenCV library was utilized to perform the cropping operation efficiently. To maintain a structured dataset, separate folders were created for each sports personality, namely Virat Kohli, Maria Sharapova, Lionel Messi, Roger Federer, and Serena Williams. After cropping the face regions from the selected images, the cropped faces were organized into their respective folders based on the identity of the sports personality The cropped face region served as the input data for subsequent processing steps, such as feature extraction and model training.



Wavelet Transform

To extract more discriminative features from the facial regions, a wavelet transform was applied. This transformation helped enhance the details of the facial features such as eyes, nose, and lips, making them more prominent for classification purposes. The wavelet-transformed images were then used alongside the original cropped images for feature extraction and model training.



Model Selection and Training:

Three machine learning models were chosen for classification:

Support Vector Machine (SVM):

- Utilized the `SVC` (Support Vector Classifier) model with the Radial Basis Function (RBF) kernel.
- Grid search was performed to tune hyperparameters such as `C` (regularization parameter) and `kernel`.
- The best-performing SVM model achieved an accuracy of approximately 70.21% on the test set.

Random Forest Classifier:

- Employed the `RandomForestClassifier` model, which is an ensemble learning method based on decision trees.
- Tuned the number of estimators (trees) using grid search.
- The accuracy of the random forest classifier on the test set was around 63.83%.

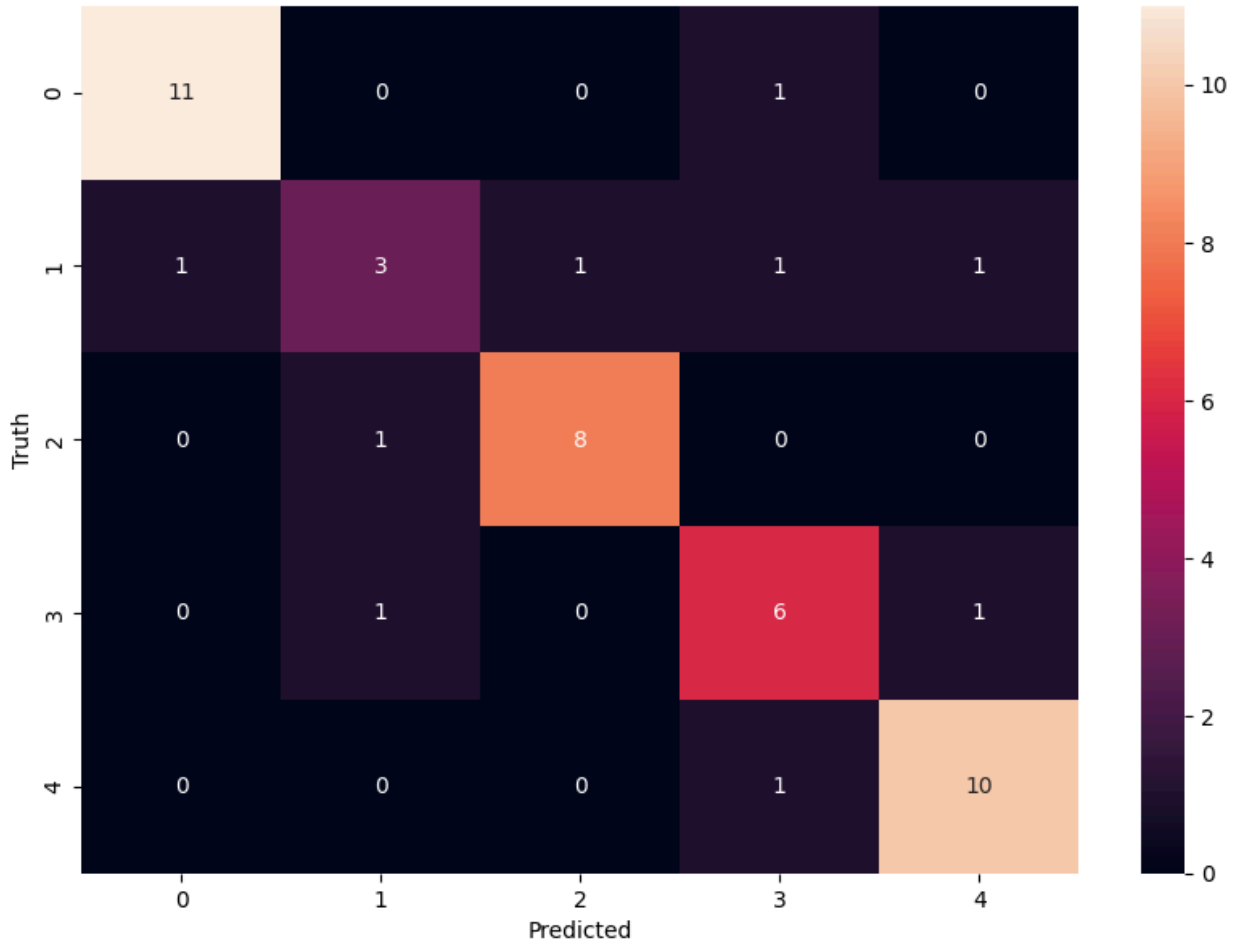
Logistic Regression:

- Used the `LogisticRegression` model, which is a linear classifier.
- Tuned the regularization parameter `C` using grid search.

- Achieved the highest accuracy of approximately 80.85% on the test set among the three models considered.

Each model was trained using a pipeline that included data preprocessing steps such as standardization (scaling) to ensure feature uniformity across samples. Hyperparameters of each model were tuned using grid search. The performance of each model was evaluated using cross-validation to ensure robustness and mitigate overfitting.

Model Evaluation and Interpretation: The trained models were evaluated using various metrics, including accuracy, precision, recall, and F1-score. Additionally, a confusion matrix was generated to visualize the model's performance across different classes. The heatmap generated using the confusion matrix is shown below:



The x-axis and y-axis of the heatmap represent the predicted and true classes, respectively.