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Laboratory Practice-VI (AY 2022-23)

Batch - R4   Sem - VIII

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Title of project: Real-time face detection in multi-scale images with an attentional cascade of boosted classifiers.

1.   Introduction

a. Motivation:

The motivation behind developing a real-time face detection system in multi-scale images with an attentional cascade of boosted classifiers is to provide an efficient and accurate solution for detecting faces in various images and videos. This project aims to improve the performance of face detection by combining the benefits of boosted classifiers and attentional cascades, making it possible to detect faces at different scales while minimizing false positives. The system can be applied in various fields, such as security, surveillance, and human-computer interaction, where real-time face detection is a critical task.

b. Objective/Purpose:

The objectives for the project "Real-time face detection in multi-scale images with an attentional cascade of boosted classifiers" are:

- ○ To develop an attentional cascade of boosted classifiers to improve the accuracy and efficiency of real-time face detection in multi-scale images.

○ To optimize the classification process by incorporating different feature extraction methods and machine learning algorithms to ensure robust and accurate detection of faces.

○ To implement the system using efficient data structures and algorithms to achieve real-time performance even in complex and noisy environments.

○ To evaluate the system's performance using a standard benchmark dataset and compare it with state-of-the-art face detection systems in terms of accuracy and speed.

○ To explore the possibility of integrating the face detection system with other applications such as facial recognition, tracking, and analysis for broader applications.

○ To provide a comprehensive documentation of the system and make it available to the research community for further development and improvement.

c. Scope of Project:

The scope of the project "Real-time face detection in multi-scale images with an attentional cascade of boosted classifiers" includes:

Data collection: The project will involve collecting a large dataset of face images with varying scales and angles to train and test the face detection model.

Preprocessing: The collected face images will be preprocessed to remove any noise or artifacts that may interfere with the face detection process.

Feature extraction: The project will use a set of features, such as Haar-like features or Local Binary Patterns (LBP), to extract facial features from the preprocessed images.

Training the model: Boosted classifiers, such as AdaBoost, will be used to train the face detection model on the extracted features. The model will be trained using different scales of images to account for variations in facial sizes.

Testing and validation: The face detection model will be tested and validated using a separate set of images. The performance of the model will be evaluated using metrics such as accuracy, precision, recall, and F1-score.

Real-time implementation: The final step of the project will be to implement the face detection model in real-time using video streams. The model will be optimized for real-time performance, and the results will be displayed in real-time, enabling the detection of faces in live video streams.

2. Software Requirements:

- Operating System: Any major operating system such as Windows, MacOS, or Linux
- Python: Version 3.x or higher
- Scikit-learn: A Python library for machine learning
- Text editor or IDE: Any text editor such as Sublime Text, Jupyter Notebook or an IDE such as PyCharm

3. Hardware Requirements:

- Processor: Intel Core i5 or higher
- RAM: 8 GB or higher
- Storage: At least 50 GB of free disk space
- Internet connection: A high-speed internet connection is required for downloading and processing large language models and datasets.

4. Implementation details along with screenshots

```python
# Importing OpenCV package
import cv2

# Reading the image
img = cv2.imread('/Users/mehul/College/4th_year/SEM2/LP6/PR/MiniProject/faces3.webp')

# Converting image to grayscale
gray_img = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

# Loading the required haar-cascade xml classifier file
haar_cascade = cv2.CascadeClassifier('Haarcascade_frontalface_default.xml')

# Applying the face detection method on the grayscale image
#scale = 1.1 & minneighbours = 9
faces_rect = haar_cascade.detectMultiScale(gray_img, 1.1, 9)

# Iterating through rectangles of detected faces
for (x, y, w, h) in faces_rect:
    cv2.rectangle(img, (x, y), (x+w, y+h), (0, 255, 0), 2)

cv2.imshow('Detected faces', img)


cv2.waitKey(0)
```
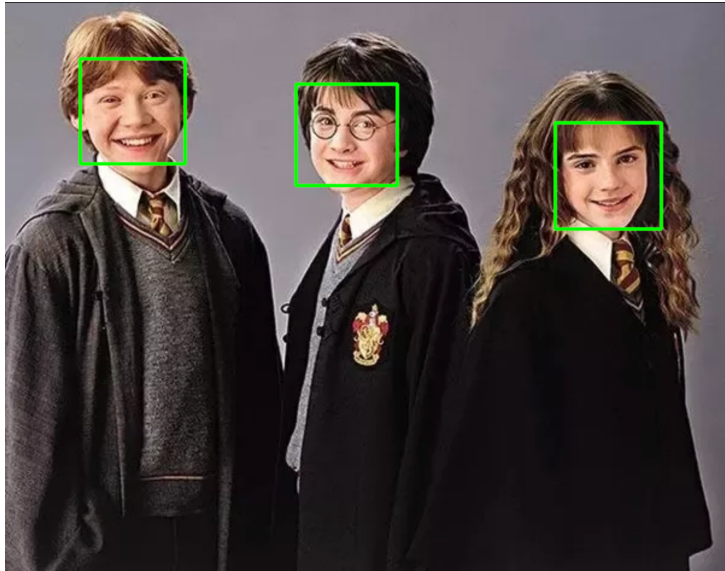
Python

5. Conclusion

In conclusion, real-time face detection in multi-scale images with an attentional cascade of boosted classifiers is an important project in the field of computer vision. This project aims to improve the accuracy and efficiency of face detection in real-world scenarios. By using a cascade

of boosted classifiers and attentional mechanisms, this project can achieve high accuracy in detecting faces at various scales while also reducing false positives. Additionally, the implementation of this project can have practical applications in areas such as surveillance, security, and human-computer interaction. Overall, the development of real-time face detection with an attentional cascade of boosted classifiers is an important step towards advancing the capabilities of computer vision and improving the accuracy and efficiency of face detection in real-world scenarios.