PROJECT REPORT

Real-time applications on Computer Vision Using MATLAB

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

COMPUTER VISION – E3C003

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OBJECTIVE

The objective of this project was to develop a real-time face detection and tracking system using MATLAB and Python. The system is designed to capture a video stream from a webcam, detect and track a user's face in real-time, and visualize the results.

BASIC REQUIREMENTS

Programming Language: MATLAB
Libraries and Tools: Computer Vision System Toolbox,
MATLAB support package for USB webcam
Hardware: Webcam

Algorithm Overview:

The project utilized the following key algorithms and techniques:

i. Haar Cascade Object Detection for face detection.
ii. Feature point detection using the MinEigenFeatures algorithm.
iii. Point tracking with a similarity transformation.

Workflow:

The project can be summarized as follows:

a. Initialization of the webcam, video player, face detector, and point tracker.
b. Capturing the first video frame.
c. A main loop that processes frames in real-time.
d. Frame processing includes face detection and feature point tracking.
e. Visualization of the detected face and tracked feature points on the video frame.
f. Loop continues until the video player is closed or a specified number of frames are processed.

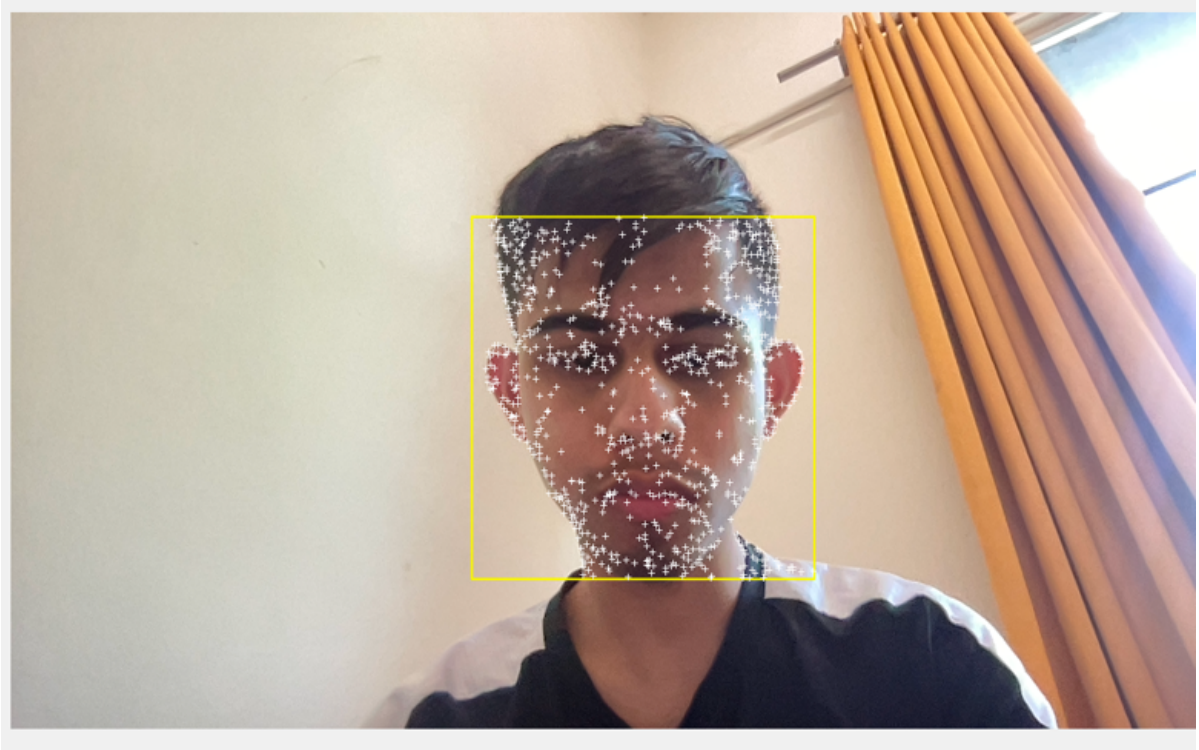

Fig: Sample working Diagram

CHALLENGES

During the project, we encountered several notable challenges. One of the foremost hurdles was ensuring the system's consistent performance under varying lighting conditions. Changes in ambient lighting could affect the quality of the video stream and subsequently the accuracy of face detection and tracking. This required us to explore methods for adapting to different lighting scenarios and optimizing the system's robustness.

In addition, fine-tuning the number of tracked feature points proved to be a critical challenge. To strike a balance between system efficiency and tracking accuracy, we needed to determine the optimal number of points for tracking. This required extensive testing and experimentation to ensure the system performed effectively in real-time.

CONCLUSION

In conclusion, the Real-Time Face Detection and Tracking System represents a significant achievement in the realm of computer vision applications. The project successfully demonstrated the feasibility of using MATLAB and computer vision tools to achieve real-time face tracking. This system has a wide range of potential applications, from human-computer interaction to surveillance and security.

Moreover, the project has paved the way for future developments and enhancements. Recognizing faces is only the beginning, and the system can be further expanded to include features such as face recognition and emotion analysis. As technology continues to advance, our real-time tracking system provides a foundation for cutting-edge applications in the fields of artificial intelligence and computer vision. We look forward to the continued evolution and deployment of this system in various domains, contributing to the advancement of technology and its integration into real-world solutions.