

Face Recognition with Email Alert System

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Abstract

This project presents the design and implementation of a real-time facial recognition system integrated with an intelligent alert mechanism via email. The core objective is to develop an efficient, cost-effective surveillance tool using open-source technologies, enabling automatic monitoring and notification when unauthorized individuals are detected.

The system is built using Python and the OpenCV library, and it incorporates a Local Binary Pattern Histogram (LBPH) algorithm for facial recognition. The process starts with data collection through a webcam, followed by face detection using Haar Cascade classifiers. Once sufficient data is collected, the system trains a facial recognition model, which is later used to identify faces in real-time video feeds.

When an unrecognized face is detected, the system performs multiple actions: it logs the event with timestamps, stores the image of the intruder, and sends an email alert to the system administrator along with the captured face. This multi-modal response enhances both situational awareness and digital record-keeping.

This report not only highlights the system's technical architecture but also evaluates its limitations, such as sensitivity to lighting and pose variations, and outlines possible enhancements including deep learning models, liveness detection, and multi-camera integration. Overall, the project demonstrates the viability of deploying intelligent surveillance systems using accessible and modular technologies.

1 Introduction

This project automates face recognition and surveillance using computer vision. It features:

- Dataset generation using a webcam
- Training a face recognizer
- Real-time recognition
- Logging of entries
- Sending alerts via email when unknown faces are encountered

CERTIFICATE

CERTIFICATE

I hereby certify that the work which is being presented in the project dissertation entitled, “Face Recognition With Email alert system”, in fulfillment of the requirements for the award of degree of Master Of Computer Application in Savitribai Phule Pune university is an authentic record of my own work carried out under the supervision of PROF. Nitin Patil sir.

The matter presented in the report has not been submitted for award of any other degree of this or any other University.

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This is to certify that the above statement made by the candidate is correct and true to the best of my knowledge.

PROF. NITIN PATIL

SAVITRIBAI PHULE PUNE UNIVERSITY

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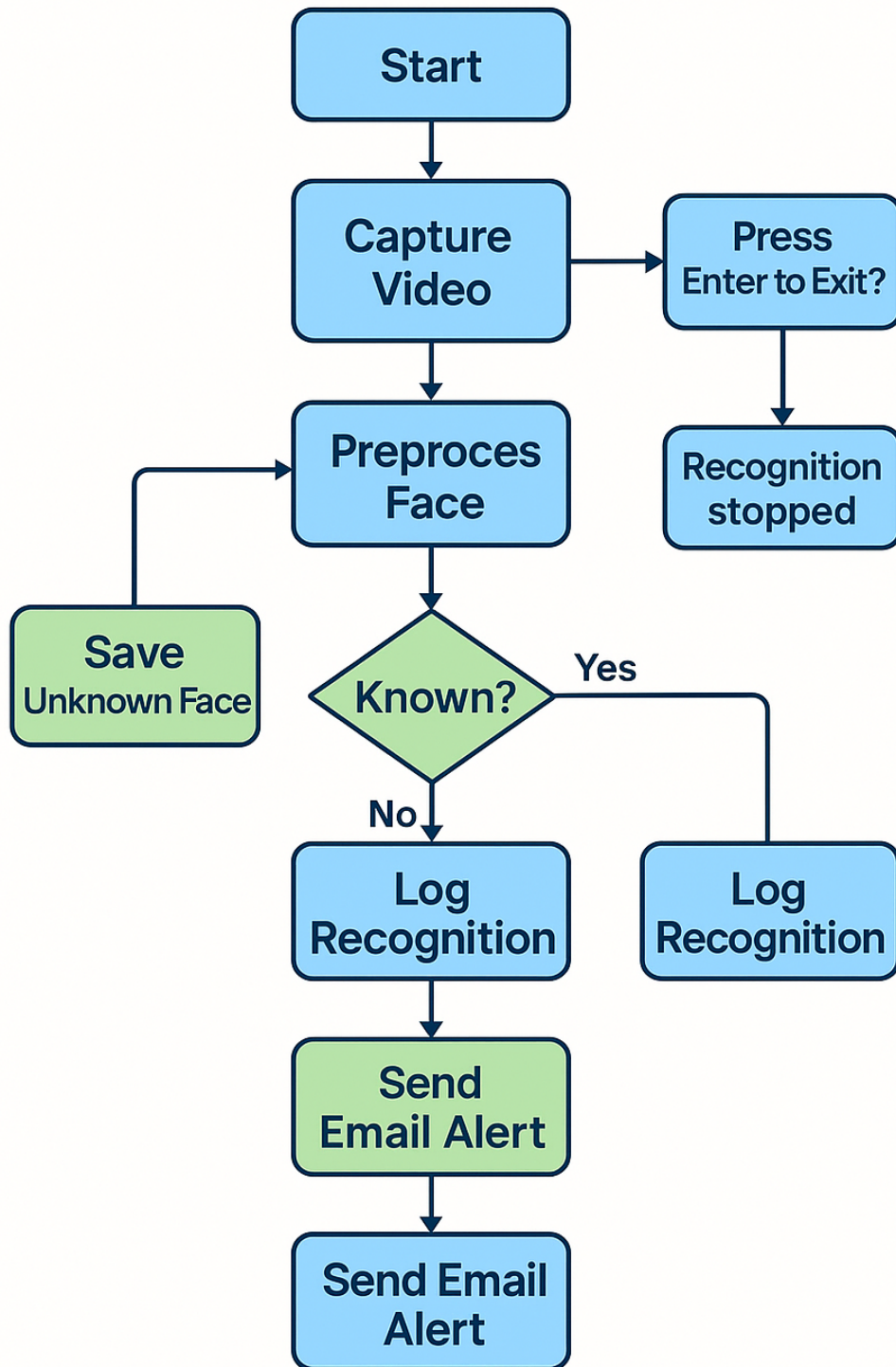
We take this opportunity to express our heartfelt gratitude to all those who have contributed to the ongoing progress of our project. First and foremost, we extend our sincere appreciation to our project guide Prof. Nitin Patil sir, for their valuable guidance, feedback, and unwavering support. Their expertise and encouragement have been indispensable in shaping our work and guiding us towards our objectives. We are truly grateful for their dedication and mentorship throughout this ongoing endeavor. Their assistance has been crucial in facilitating our ongoing work and enabling us to make strides towards our goals.

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FLOWCHART - FACE RECOGNITION SYSTEM PROCESS

Face Recognition System – Process Flow



2 Technologies Used

The development of this face recognition and alert system relies on a suite of modern tools, libraries, and protocols that work together to create an efficient, modular, and extensible application. Below is a comprehensive list and explanation of the key technologies utilized:

- **Python 3.x**
- **OpenCV**
- **NumPy**
- **Pillow (PIL)**
- **CSV for logging**
- **SMTP for email alerts**
- **Haar Cascade Classifier**
- **LBPH Algorithm (OpenCV-contrib)**
- **TLS/SSL Email Protocols**

3 How It Works

The system operates in three major phases:

1. Dataset Generation

- Uses Haar Cascade classifier to detect faces.
- Captures multiple grayscale images per user.
- Saves them as user.ID.imgID.jpg in a dataset directory.

2. Model Training

- Uses OpenCV's LBPH recognizer.
- Trains the model with collected dataset images.
- Saves the trained model in XML format.

3. Real-time Recognition and Alerts

- Captures live video feed using webcam.
- Compares faces with trained model.
- Logs recognized faces with timestamp in CSV.
- Saves unknown faces and sends email alerts.

4 Code Snippets

4.1 Face Detection and Dataset Generation

```
def generate_dataset(user_id = 1, sample_count=200):  
    ...  
    while True:  
        ret, frame = cap.read()  
        face = face_cropped(frame)  
        if face is not None:  
            ...  
            cv2.imwrite(file_path, gray_face)
```

4.2 Training the Classifier

```
def train_classifier(data_dir = "data"):  
    ...  
    clf = cv2.face.LBPHFaceRecognizer_create()  
    clf.train(faces, ids)  
    clf.write("classifier.xml")
```

4.3 Recognizing Faces and Sending Alerts

```
def recognize_face():  
    ...  
    if confidence < 50:  
        log_recognition(id)  
    else:  
        save_unknown_face(frame[y:y+h, x:x+w])  
        send_email_alert(image_path)
```

5 Limitations

- **Lighting Sensitivity:** Accuracy decreases in poor lighting or shadows.
- **Pose Variation:** Side profiles or tilted faces may not be reliably recognized.
- **Scalability:** Performance degrades with a growing user database.
- **Security:** Email credentials are hardcoded, unsuitable for production.
- **False Positives/Negatives:** LBPH is prone to errors in complex scenarios.
- **No Liveness Detection:** Cannot differentiate real faces from photos or spoofs.

6 Future Enhancements

- **Deep Learning Integration:** Use FaceNet or Dlib for improved accuracy.
- **Liveness Detection:** Incorporate blink or depth detection.
- **Web/Mobile Interface:** Enable remote management and logging.
- **Cloud Storage:** Store images and logs securely online.
- **Encrypted Email:** Use OAuth2 or secure tokens.
- **Multi-camera Support:** Handle input from multiple sources.
- **Notification Flexibility:** Add SMS or push notifications.

7 Results

During testing, the face recognition system performed reliably under controlled conditions. Known faces were successfully identified with an average confidence score below 50, and unknown faces triggered email alerts with image attachments. The dataset included 200 grayscale images per user, and the LBPH model showed high accuracy for frontal face images.

Recognition latency remained under one second for real-time streaming, and the logging system maintained detailed records in CSV format. Alerts were successfully delivered via email within seconds of an unknown face detection. These results indicate the system's readiness for small-scale deployment in offices, classrooms, or residential setups.

8 Conclusion

This face recognition system with email alerts offers an effective and accessible solution for surveillance and security. Combining image processing, machine learning, and automated communication, it forms a comprehensive security tool. With further enhancements, it can be deployed for attendance systems, access control, or large-scale surveillance.