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Real-Time Face Mask Detection Using Opencv And Deep Learning

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Abstract

In today's rapidly evolving urban environments, public safety and hygiene have become top priorities. Face masks are widely used in hospitals, factories, laboratories, and crowded public spaces to protect against airborne pollutants, infectious diseases, and hazardous particles. Detecting whether individuals are wearing masks in real-time has become essential for enforcing compliance in such critical areas. This research presents a deep learning-based system for real-time face mask detection using OpenCV, TensorFlow, Keras, NumPy, and MobileNetV2. The model classifies live video stream input into two categories: 'Mask' and 'No Mask', highlighting detected faces with bounding boxes and confidence scores. This system can be deployed in smart surveillance, healthcare institutions, and industrial environments to ensure adherence to safety protocols. We also integrate a PostgreSQL database to log unmasked face detections for administrative tracking and reporting.

Keywords: OpenCV, Deep Learning, Face Mask Detection, CNN, MobileNetV2, Real-Time Surveillance

1. Introduction

The use of face masks has extended beyond the context of pandemics and is now essential in various sectors for health and safety. In industrial zones, construction sites, hospitals, and public transportation, monitoring whether individuals wear protective masks is vital for compliance and risk mitigation. Manual supervision is not scalable, which highlights the need for an automated face mask detection system. This research proposes a real-time, AI-powered system that can be integrated with surveillance cameras to identify individuals who are not wearing masks and optionally log such instances in a database for record-keeping or further action.

2. Literature Review

1. Adusumalli et al. (2021) developed a mask detection system using OpenCV and TensorFlow, achieving high accuracy and incorporating email alerts.
2. Suresh et al. (2021) implemented a CNN-based system reaching 97% accuracy for masked faces.
3. Mengistie & Kumar (2021) applied MobileNetV2 and data augmentation for high accuracy detection.
4. Shamrat et al. (2021) proposed an IoT-integrated model achieving over 99% validation accuracy.
5. Das et al. (2020) designed a CNN model with accuracy up to 95%.
6. DS et al. (2021) validated their system on video and image feeds with 99% accuracy.

3. Methodology

3.1 Dataset Collection: The dataset was sourced from Kaggle and enhanced with additional images.
3.2 Preprocessing: MobileNetV2 was used for feature extraction.
3.3 Training: CNN model was trained using binary cross-entropy.
3.4 Detection: OpenCV's faceNet detected faces in real-time.
3.5 Logging: PostgreSQL stored 'No Mask' detections with timestamps.

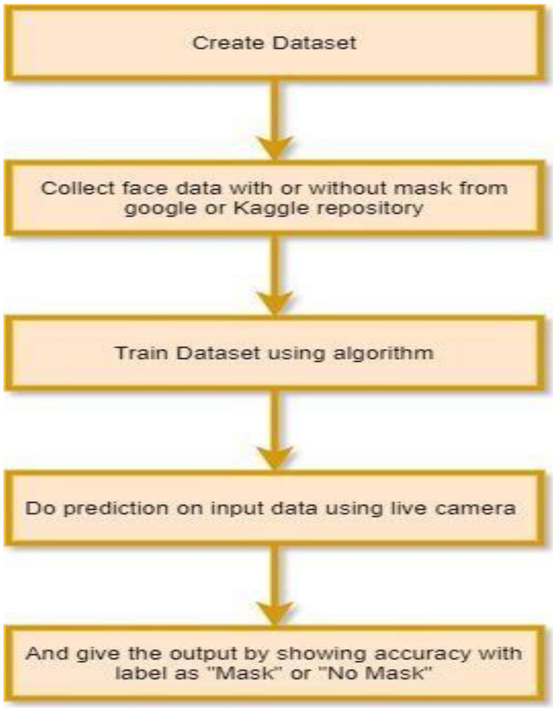

Fig. 1: Flowchart for training module

4. Algorithm

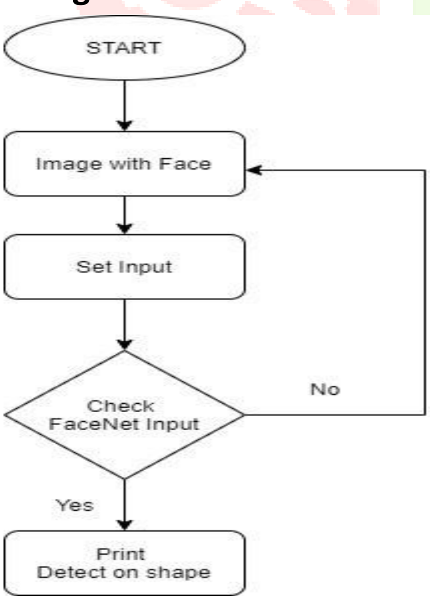

Fig.2: Input Model

5. System Architecture

Modules include:
- Input Module: Captures video stream
- Detection Module: Classifies using MobileNetV2
- Output Module: Draws bounding boxes with labels
- Database Module: Logs non-compliant cases

6. Results & Accuracy

Training Accuracy: 98.2%
Validation Accuracy: 97.5%
Real-Time Speed: ~30 FPS
Database Logging: Timestamped entries with metadata

7. Conclusion

The proposed system is efficient and scalable. It achieves high accuracy and is practical for safety-critical environments.

8. Future Work

- Cloud integration
- Multi-class mask types
- Edge device deployment
- Optional facial recognition

9. References

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