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A project report on

Real-Time Face Mask Detection

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Title of the Project: ‘Real-Time Face Mask Detection’

ABSTRACT

The "Real-Time Face Mask Detection" project addresses a critical need in the current global health landscape. With the ongoing emphasis on mask-wearing as a frontline defence against contagious diseases, the absence of efficient and automated monitoring tools for mask compliance poses a significant challenge. This project aims to bridge this gap by developing an innovative solution that combines real-time face mask detection with age and gender estimation.

The core objective of the project is to create a system capable of instantly identifying individuals wearing or not wearing face masks in real-time video feeds. Leveraging advanced computer vision and deep learning techniques, the system provides immediate feedback to users, promoting responsible mask usage and enhancing public health awareness. In instances where masks are not detected, the system estimates the age and gender of individuals, contributing valuable demographic insights.

The project's user-friendly interface ensures accessibility to a wide audience, and the system's accuracy and robustness across diverse scenarios and demographics make it a practical tool for public health settings, educational institutions, public transportation, and more. Beyond its immediate impact on mask compliance, the project sets the stage for future developments in real-time health monitoring and responsible behavior promotion.

In summary, the "Real-Time Face Mask Detection" project not only addresses a pressing need for real-time mask compliance but also showcases the potential of technology to enhance public health efforts and raise awareness during health crises and beyond.

INTRODUCTION

In a world facing unprecedented health challenges, technology has emerged as a vital ally in safeguarding public health and safety. The "Real-Time Face Mask Detection with Age and Gender Estimation" project exemplifies the fusion of cutting-edge deep learning and real-time video processing to address a pressing concern – the correct usage of face masks in public spaces. As our global community grapples with health crises, this project strides forward as a beacon of innovation, offering a solution that not only enforces vital safety measures but also provides insightful age and gender estimations, all in real-time. In the following presentation, we explore the intricate workings and profound impact of this remarkable endeavor, shedding light on its importance in shaping a healthier and more responsible world.

PROBLEM STATEMENT:

The ongoing global health crisis underscores the critical importance of adhering to face mask guidelines to mitigate the spread of infectious diseases. However, ensuring universal compliance with mask-wearing protocols in public spaces remains a challenge. This project seeks to address this issue by developing a real-time face mask detection system that not only enforces mask usage but also provides valuable insights into the age and gender of individuals, ultimately contributing to a safer and more responsible society.

SCOPE:

The scope of the "Real-Time Face Mask Detection with Age and Gender Estimation" project encompasses the development of a real-time application designed to capture video from a webcam and instantly assess whether individuals are adhering to face mask guidelines. Beyond mask detection, the system will also include age and gender estimation using the DeepFace module for individuals not wearing masks. The user interface will be designed for accessibility and ease of

use, facilitated by Streamlit. Ensuring the model's accuracy and robustness is vital, particularly in addressing variations in realworld scenarios. Data collection will involve curating a balanced dataset with diverse images, and the visualization aspect will include presenting results, age, and gender estimations on the video feed with intuitive cues. The project aims to contribute to public health awareness by promoting responsible mask usage and is designed with scalability in mind for potential future expansion to larger settings.

SYSTEM ARCHITECTURE

➢ **User Registration and Authentication:**

• Users must register in the system by providing essential details such as username and password.

• Registration requires admin approval before a user can access the system.

• After registration, users can log in with their username and password.

➢ **Real-Time Video Capture and Processing:**

• A user must login with his user name and password to the system after registration.

➢ **Face Detection and Mask Detection:**

• A robust face detection algorithm is integrated to identify faces within each video frame.

• A deep learning model is trained for real-time mask detection, classifying whether individuals are wearing masks.

• Detection results are displayed in real-time on the video feed, indicating whether a mask is detected or not.

➢ **Age and Gender Estimation:**

• The DeepFace module is used for age and gender estimation when no masks are detected.

• Age and gender predictions are overlaid on the video stream to provide real-time insights.

➢ **User Interface:**

• The system features a user-friendly interface developed using Streamlit.

• The interface displays the real-time video feed, detection results, age estimations, gender predictions, and intuitive visual cues.

OBJECTIVE

i. Real-Time Mask Detection: Develop a system that can instantly detect whether individuals are wearing masks in real-time video.

ii. Age and Gender Estimation: Incorporate age and gender estimation using the DeepFace module for unmasked individuals.

iii. Responsive Video Processing: Ensure seamless real-time video processing for immediate user feedback.

iv. Intuitive Visualization: Display detection results and estimations on the video stream with user-friendly cues.

v. Dataset Quality: Gather and preprocess a balanced dataset for effective model training. vi. High Accuracy: Train the model for precise mask detection, age, and gender estimation.

vii. Public Awareness: Promote responsible behavior and public safety by encouraging mask usage.

viii. Scalability: Design for future enhancements and potential deployment in broader settings.

HADEWARE AND SOFTWARE REQUIREMENTS

- Hardware Requirements:

• Webcam: A webcam is essential for capturing real-time video feeds. Ensure it has good resolution and frame rate for accurate detection.

• Computer: A reasonably powerful computer with sufficient processing power and memory (RAM) to handle real-time video processing and deep learning model inference. A dedicated graphics card (GPU) can significantly accelerate deep learning tasks.

• Storage: Adequate storage space for storing datasets, model weights, and the application itself.

• Internet Connection: An internet connection is required for downloading libraries, tools, and datasets during development.

- Software Requirements:

• Operating System: The project can be developed on Windows, macOS, or Linux. Choose the one you are most comfortable with.

• Python: Python is the primary programming language for deep learning and computer vision. Install Python 3.x.

• Development Environment: Choose an integrated development environment (IDE) such as Jupyter Notebook, Visual Studio Code, or PyCharm for coding and project management.

• Libraries and Frameworks:

o OpenCV: For video capture and image processing. o TensorFlow or PyTorch: For deep learning model development.

o DeepFace or other face analysis libraries. o Streamlit or another web application framework for the user interface.

o NumPy, pandas, and other data manipulation libraries.

• GPU Support (Optional): If you have access to a compatible NVIDIA GPU, you can install GPU versions of deep learning frameworks like TensorFlow with GPU support for faster model training and inference.

Conclusion

The "Real-Time Face Mask Detection with Age and Gender Estimation" project has successfully addressed the critical need for promoting public health awareness and responsible mask usage in a technologically-driven manner. The system has demonstrated its effectiveness in real-time face mask detection, age estimation, and gender prediction, providing valuable insights to users. Through a user-friendly interface, it has empowered individuals to make informed decisions regarding mask compliance, thereby contributing to public safety during health crises.

The project has showcased the potential of computer vision, deep learning, and real-time video processing in addressing pressing societal challenges. It serves as a practical example of leveraging technology for the greater good, raising awareness, and fostering responsible behavior.

References

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- Covid-19 Face Mask Detection Using TensorFlow, Keras and OpenCV
- Face mask detection using deep learning: An approach to reduce risk of Coronavirus spread
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