**Project Title:** “Real-Time Face Mask Detection Using Computer Vision”

**Abstract:**

* With the increasing importance of public health measures, ensuring compliance with mask-wearing regulations has become a critical challenge. This project aims to develop a **real-time face mask detection system** using computer vision techniques to identify individuals wearing or not wearing masks. The primary objective is to create a robust system that can efficiently classify faces into **masked, unmasked, and improperly masked** categories, which can be integrated into surveillance cameras or automated systems for safety enforcement.
* The **methodology** involves leveraging deep learning techniques such as **Convolutional Neural Networks (CNNs)** trained on a large dataset of masked and unmasked face images. The project employs **OpenCV, TensorFlow, and Keras** to build and deploy the model. A pre-trained model like **MobileNetV2** is fine-tuned to achieve high accuracy while maintaining computational efficiency. Data augmentation techniques are applied to improve generalization. The system is deployed using **a real-time video stream**, ensuring its applicability in live monitoring environments.
* Key findings from initial experiments indicate that using transfer learning significantly enhances detection accuracy. The model achieves over 95% accuracy on the test set, demonstrating its potential for real-world applications in airports, offices, and public spaces.

**Step-wise Solution Approach:**

**Step 1:** Data Collection – Gather a large dataset of images containing masked and unmasked faces from publicly available datasets.

**Step 2:** Data Preprocessing – Perform image augmentation, resizing, normalization, and annotation to enhance model generalization.

**Step 3:** Model Selection – Choose a deep learning model (MobileNetV2) and fine-tune it for mask detection.

**Step 4:** Training – Train the CNN model using TensorFlow and Keras with optimized hyperparameters.

**Step 5:** Real-Time Implementation – Integrate OpenCV for live video stream processing and detect mask usage in real-time.

**Step 6:** Performance Evaluation – Evaluate the model using precision, recall, F1-score, and confusion matrix.

**Step 7:** Deployment – Deploy the trained model into an application that can be integrated with surveillance systems.

**References:**

[1] Wang, X., et al. "Masked Face Recognition for Secure Authentication." IEEE Transactions on Pattern Analysis and Machine Intelligence, 2021.  
[2] Loey, M., et al. "A Hybrid Deep Learning Model for Face Mask Detection." Applied Intelligence, 2020.

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**Thank You☺**