Spam Classification Using AIML Techniques

Abstract

This project focuses on detecting the presence or absence of face masks in real-time images using Artificial Intelligence and Machine Learning (AIML) techniques. In light of global health emergencies such as the COVID-19 pandemic, automatic face mask detection has become essential in ensuring public safety and enforcing preventive measures. The proposed model utilizes image processing, deep learning, and convolutional neural networks (CNN) to accurately identify individuals who are or are not wearing face masks.

Introduction

Face mask detection is a computer vision task aimed at determining whether people are wearing masks in images or video frames. During the COVID-19 pandemic, this became a critical application for public safety monitoring in airports, hospitals, schools, and other public spaces. Manual monitoring is not scalable; hence automated solutions are necessary. AI models, especially CNN-based architectures, can efficiently classify and localize masked and unmasked faces in real-time, with high accuracy and low latency.

Problem Statement

To develop an accurate and real-time system capable of detecting whether a person is wearing a face mask using image or video input. The system should generalize across diverse backgrounds, face angles, mask styles, and lighting conditions. It must maintain high precision and recall to minimize false positives and false negatives.

Literature Review

Early face mask detection methods involved manual inspection and basic object detection algorithms. With the advancement of deep learning, particularly convolutional neural networks (CNNs), accuracy and scalability have significantly improved. Research shows that models like MobileNetV2, ResNet50, and YOLO

are effective for real-time image classification and object detection. Various studies have explored transfer learning and fine-tuning of pretrained models to detect face masks more efficiently.

Methodology

The methodology follows a structured AIML approach:

1. Dataset Collection: Public datasets such as the Face Mask Detection Dataset from Kaggle, containing labeled images of people with and without masks.

2. Data Preprocessing: Resizing images, normalization, data augmentation, and face detection using OpenCV.

3. Model Building: A CNN architecture based on MobileNetV2 is used, with transfer learning from ImageNet weights.

4. Training: The model is trained using categorical cross-entropy loss and Adam optimizer.

5. Evaluation: Performance metrics include accuracy, precision, recall, F1-score, and confusion matrix.

Implementation

Implementation is done using Python, TensorFlow, Keras, and OpenCV. The process includes:

- Loading and preprocessing datasets.
- Building the CNN using MobileNetV2 with custom layers.
- Training the model and saving weights.
- Real-time webcam integration using OpenCV.
- Annotating video frames with mask detection results.
- Optional deployment as a Flask web app.

Results and Discussion

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The model achieved a test accuracy of over 97%, with precision and recall above 95%. Real-time performance was robust under various lighting and angle conditions. MobileNetV2 provided a good balance of speed and accuracy, suitable for real-time applications and deployment on low-resource devices. The confusion matrix showed minimal misclassifications.

Conclusion

Face mask detection using AIML provides an automated and effective tool for public safety monitoring. With high accuracy and deployment flexibility, such models can be implemented in crowded places for real-time surveillance. Future improvements could involve multi-face tracking, emotion recognition behind masks, or integration with thermal screening.

References

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