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Hear Smoking

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ABSTRACT

With the development of Internet technology and the improvement of network quality, online videos have become increasingly popular. In particular, online live broadcast has become a hotspot in recent years, and smoking behavior in these broadcasts is harmful to smokers and the surrounding environment. Therefore, it is necessary to detect and thereby effectively control smoking behaviors in video content. Traditionally, smoking images are detected based on the detection algorithms of cigarette smoke. Given the limited resolution of live broadcast videos, cigarette smoke is not visually apparent in the video content. This paper proposes a smoking image detection model based on a convolutional neural network, referred to as Hear Smoke , which automatically detects smoking behaviors in video content through images. This method can detect smoking images by utilizing only the information of human smoking gestures and cigarette image characteristics without requiring the detection of cigarette smoke, showing high accuracy and superior performance for real-time monitoring.

1- INTRODUCTION

With the advancement of Internet technology and network quality, online videos, especially live broadcasts, have surged in popularity. Platforms like Twitter, Facebook, Periscope, and Inke have enabled amateur broadcasters to stream content globally.

Given the harmful effects of smoking, it is crucial to detect smoking behaviors in video content automatically. This study introduces Hear smoke, a CNN-based model designed to identify smoking behaviors in video images. Pre-trained on a large dataset, Hear Smoke converts fully connected layers into convolution layers during detection, improving its ability to identify small targets efficiently.

Existing System

Online live broadcast has become a hotspot in recent years. Social apps such as Twitter and Facebook and mobile personal livecast (MPL) services have emerged and received much attention. It is well known that smoking behaviors are harmful to both smokers and the surrounding environment. Therefore, it is necessary to use images to automatically detect whether there are smoking behaviors in video content.Although this method can achieve smoking identification through smoke classification, the threshold in the algorithm is empirically set and its value will change with the background, leading to high false detection rates and poor applicability

Proposed System

Hear Smoke is a CNN-based model designed to automatically detect smoking behaviors in video content. It utilizes GoogLeNet architecture and optimizes feature extraction using nonsquare convolution kernels. The model is pre-trained on a large dataset similar to the target images, enhancing its detection accuracy. During detection, fully connected layers are converted into convolution layers to improve the identification of small, localized targets while maintaining high efficiency in real-time video analysis.

2- REQUIREMENTS ANALYSIS

Functional Requirements

1. **User Operations**

These are functionalities available to regular users on the platform:

1. Signup and Login

Users can register an account using an email address, social login (Google, Facebook), or mobile number.

- Secure login via password, OTP, or two-factor authentication.

2. **Video Upload and Streaming**

- Upload pre-recorded videos for smoking behavior analysis.
- Stream live videos, with real-time smoking detection.

3. **Detection Results**

View real-time alerts for detected smoking behaviors in uploaded or live- streamed videos.

- Access detailed analysis reports, including timestamps and flagged frames.

Non-Functional Requirements

Security: Implement robust security measures to protect users data.

Scalability: Ability to handle a growing number of users and increasing data volumes.

Usability: User-friendly interface that is easy to navigate.

Maintainability: Code maintainability and readability for ease of future updates. **Performance :** Ensuring fast response times for all operations, including chat, file uploads, and search functions

Hardware Resources

The hardware requirements are designed to ensure smooth development and testing of the platform, especially for tasks like real-time collaboration and database operations.

Processor:

• Intel i5 (10th Generation or equivalent AMD processor).

• Ensures sufficient computational power for development tasks. RAM:

• **16 GB:** Adequate for running the IDE, local servers, and other tools simultaneously without performance degradation.

Storage:

256 GB SSD: Provides faster read/write speeds for smooth operation of the development environment and databases.

Software Resources

• Programming Language / Platform : Python

• IDE : pycharm / jupyter

• Data visualization and Data Handling Libraries:

- Pandas are a popular Python library for data analysis. It is not directly related to Machine Learning. It provides many inbuilt methods for groping, combining and filtering data.
- NumPy is a very popular python library for large multi-dimensional array and matrix processing, with the help of a large collection of high-level mathematical functions.
- Matplotlib is a very popular Python library for data visualization. It particularly comes in handy when a programmer wants to visualize the patterns in the data.
- Seaborn is a Python data visualization library that is based on Matplotlib and closely integrated with the NumPy and pandas data structures.

3- DESIGN

Architectures

Design architecture refers to the overall structure and framework of a system, outlining how its components interact, communicate, and work together to meet functional and non-functional requirements. It serves as a blueprint for the system's development, ensuring it is scalable, maintainable, and efficient.

System Architecture:

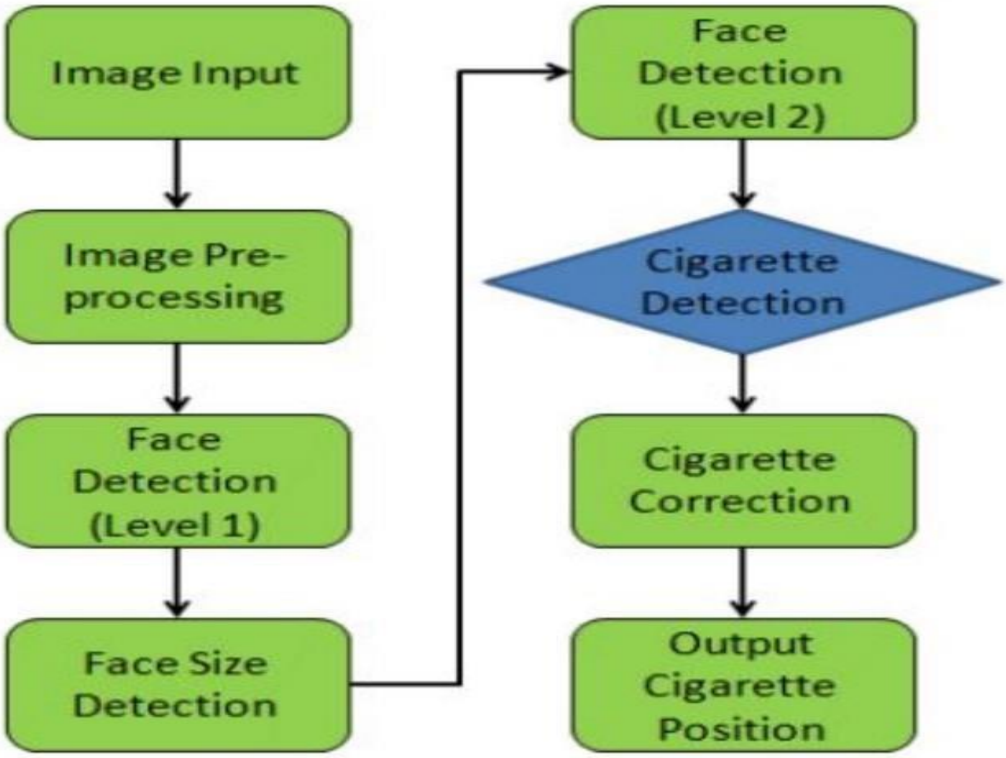

Figure System Architecture

Technical Architecture:

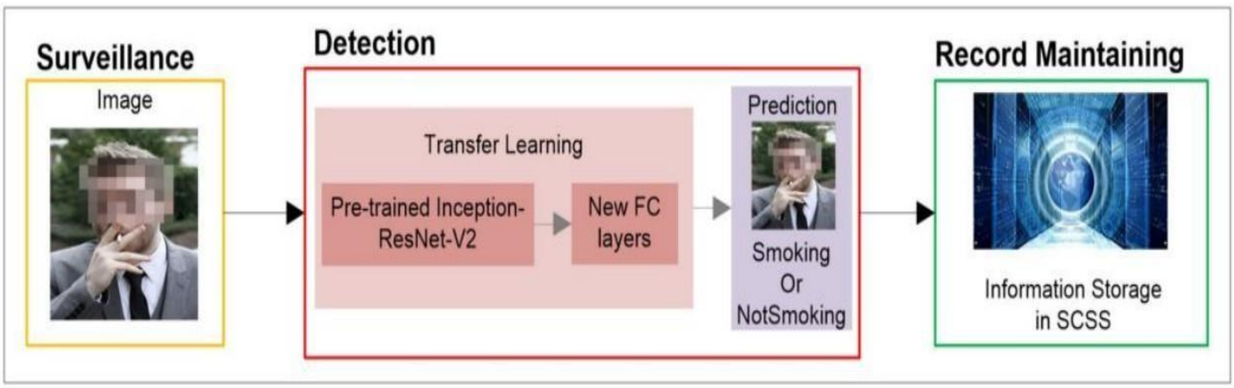

Figure 2 Technical Architecture

4- IMPLEMENTATION

The CNNs in deep learning have been widely used in image detection. The features to be extracted through CNNs for image recognition no longer need to be defined manually, and the feature extraction is achieved via automatic fitting through training. Each convolution operation can be regarded as a process of feature extraction, in which the weights of the convolution kernels are not preset but are continuously updated through training until the model converges, when the weights constitute the optimal feature extraction scheme. SmokingNet, a detection model based on CNNs, optimizes the characteristics of smoking images based on GoogLeNet and enhances the ability of feature extraction of the target images using non-square convolution kernels. This model is pre-trained with a super-large data set similar to target images prior to model training, and the trained model is used to detect smoking images. A. Training Samples and Testing Samples In the detection of smoking images based on CNNs, the entire sample set is divided into three parts: training samples and validation samples in the training phase and testing samples in the testing phase. Moreover, the sample set is divided into positive and negative samples—a positive sample is an image showing smoking behaviors, whereas a negative sample is a background image. 1) Positive samples Positive samples are collected from online smoking videos and the smoking videos made by our research group. Positive samples are acquired for training by playing these videos frame by frame. When a smoking frame appears, the image containing the complete cigarette is manually captured using a screenshot tool. The screenshot tool is specifically developed for this collection task based on the computer vision library OpenCV. The screenshot tool contains a candidate box. In addition, as all image samples are to be scaled to squares of the same size during the training phase, the candidate frame of the screenshot tool is always square, i.e., the saved training samples are all images with an aspect ratio of 1:1, so that image stretching can be avoided during the training phase to ensure the quality of the training samples.

Modules Image Acquisition

The first step of the Smoking Detection system is image acquisition. High-quality Human Smoking images need to collection from public places.

The entire sample set is divided into three parts: training samples and validation samples in the training phase and testing samples in the testing phase. Moreover, the sample set is divided into positive and negative samples—a positive sample is an image showing smoking behaviors, whereas a negative sample is a background image.

Dataset Collection

A Knowledge-based dataset is created by proper labelling of the collected images with unique classes.

Image Processing

The obtained images that will be engaged in a preprocessing step are further enhanced specifically for image features during processing. The segmentation process divides the images into several segments and utilized in the extraction of Smoking features from dataset.

Feature-Extraction

This ection involves the convolutionary layers that obtain image features from the resize images and is also joined after each convolution with the ReLU. Max and average pooling of the feature extraction decreases the size. Ultimately, both the convolutional and the pooling layers act as purifiers to generate those image characteristics.

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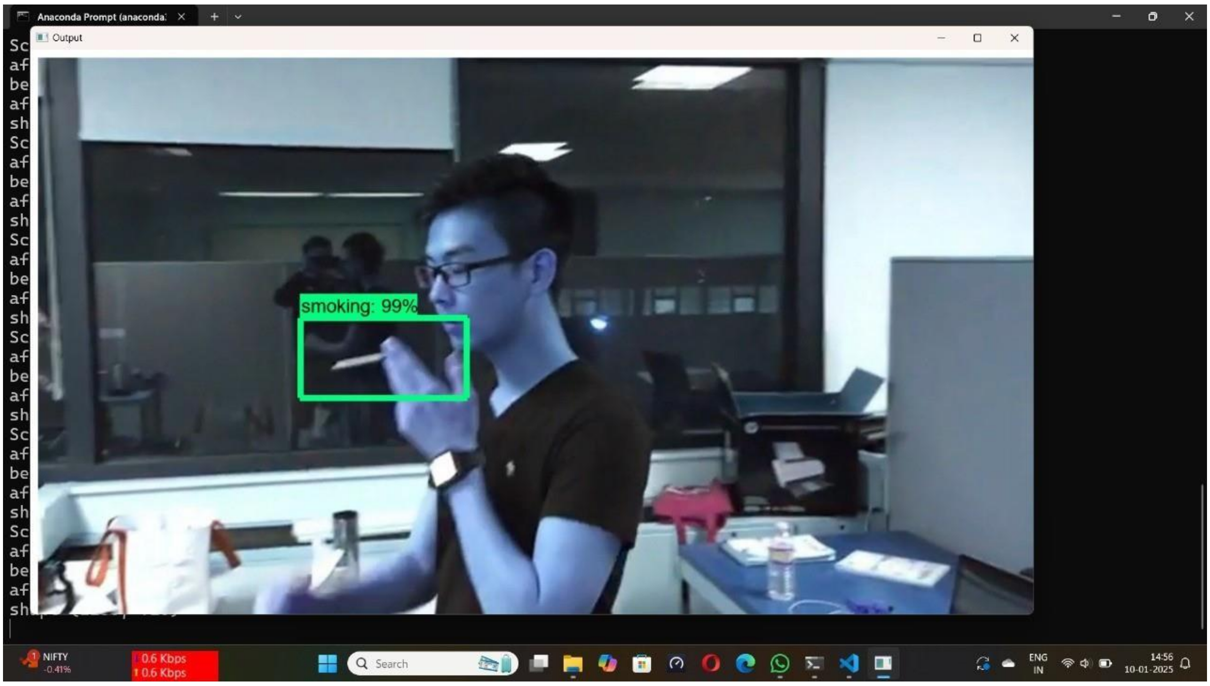
5- SCREENSHOTS

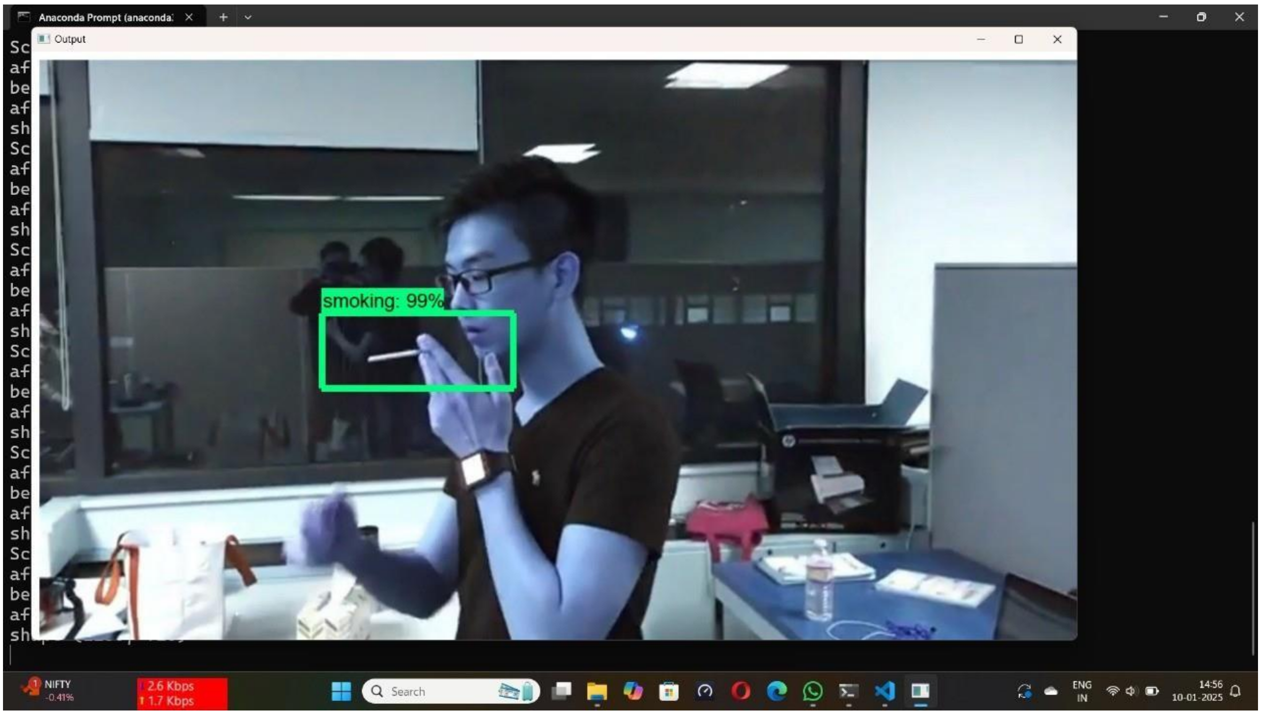
(a) Dark background

(b) Side face pose

(c) Small visibility of cigerette

(d) Multi-subject enviornment


Anaconda Prompt (anaconda
Output
smoking: 99%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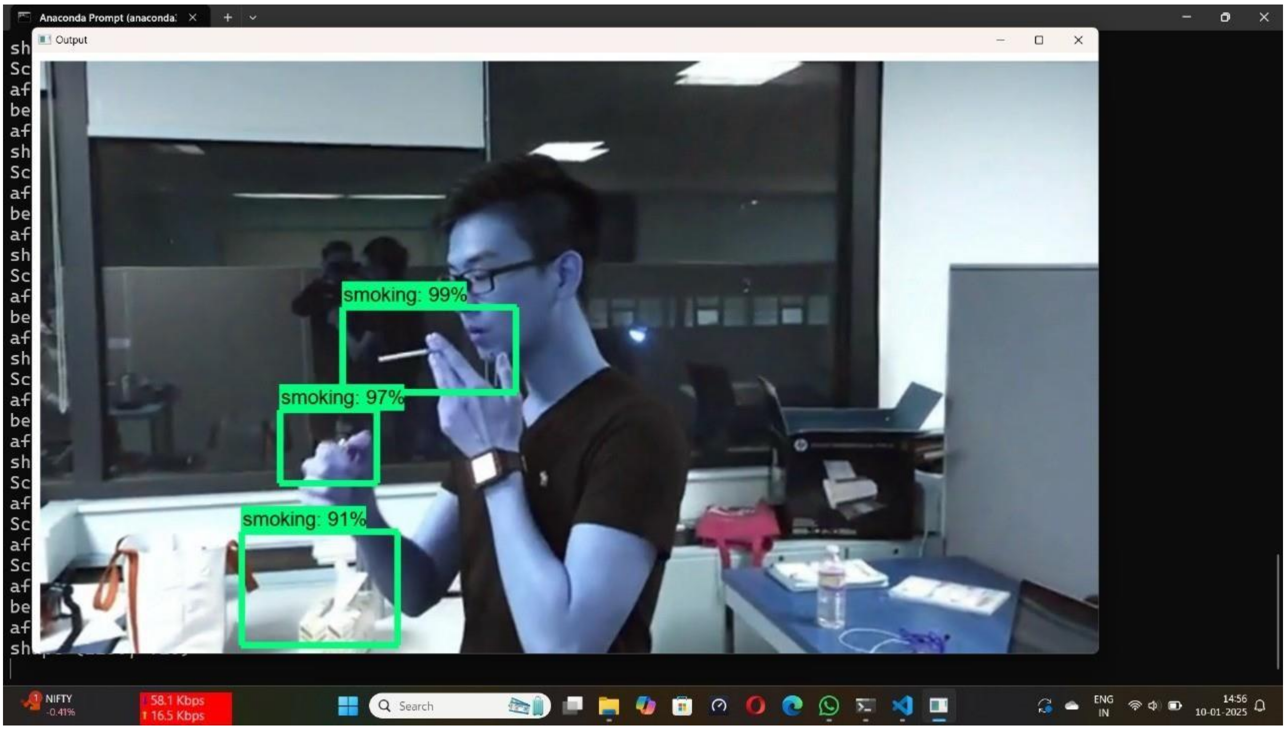

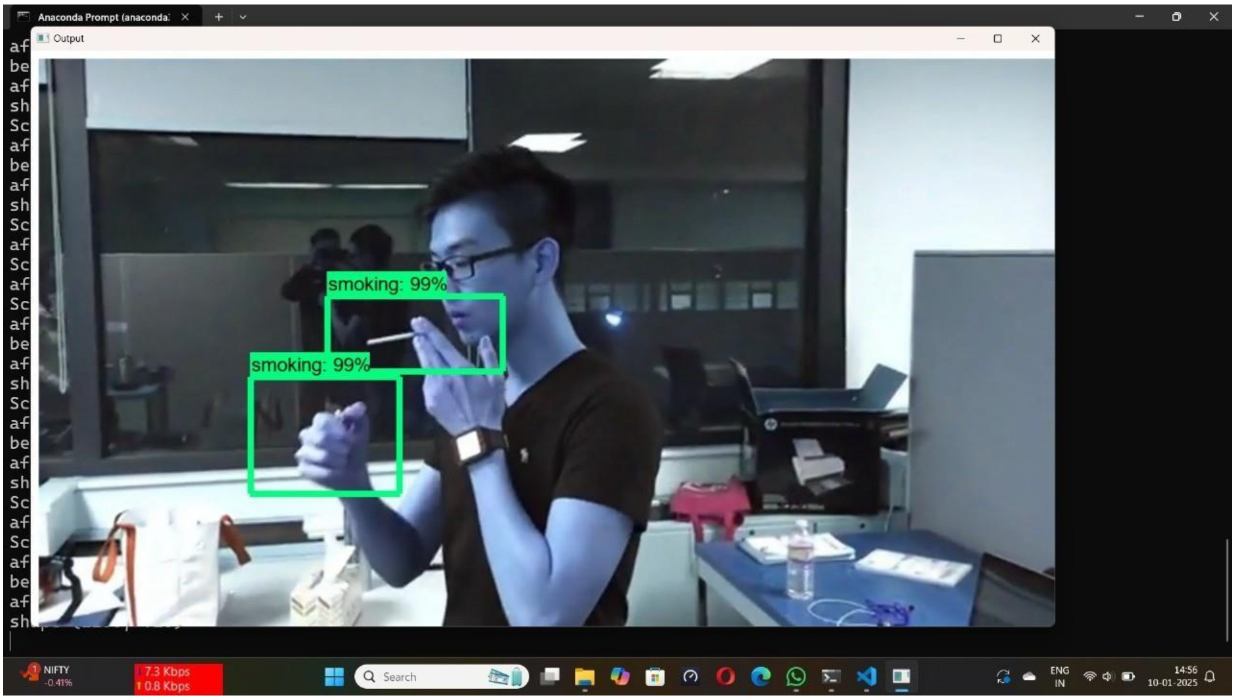

6- CONCLUSION AND FUTURE SCOPE

In this study, we design and implement a deep learning model, i.e., Smoking Detection system, which is specially optimized for smoking images. In addition, we conduct large- scale model training and testing sample collection with respect to smoking as a specific detection target. Based on GoogLeNet, the detection accuracy of smoking images is enhanced by improving the network structure and using special convolution layers to better extract the characteristics of smoking images. In addition, specific pre-training models are selected for SmokingNet based on detailed analysis of the characteristics of smoking images, and subsequently, the training parameters and training process are elaborated. Finally, the detection performance of SmokingNet is tested by comparison with those of other deep and shallow learning models. The experimental results show that, compared with the classical deep learning models, Smoking Detection system shows significantly improved detection performance with precision and recall over one percent higher than those of the second best model and with a detection efficiency as high as 80 FPS, indicating that SmokingNet is fully capable of achieving real-time detection of smoking images during live webcast.

Future Scope:

Future enhancements for the Smoking Detection System include improving detection capabilities for complex scenarios and enabling real-time video monitoring. The system will expand to support mobile and desktop platforms, optimize AI models for better performance, and enhance user feedback mechanisms. Finally, advanced reporting and analytics features will provide deeper insights into detection trends.

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