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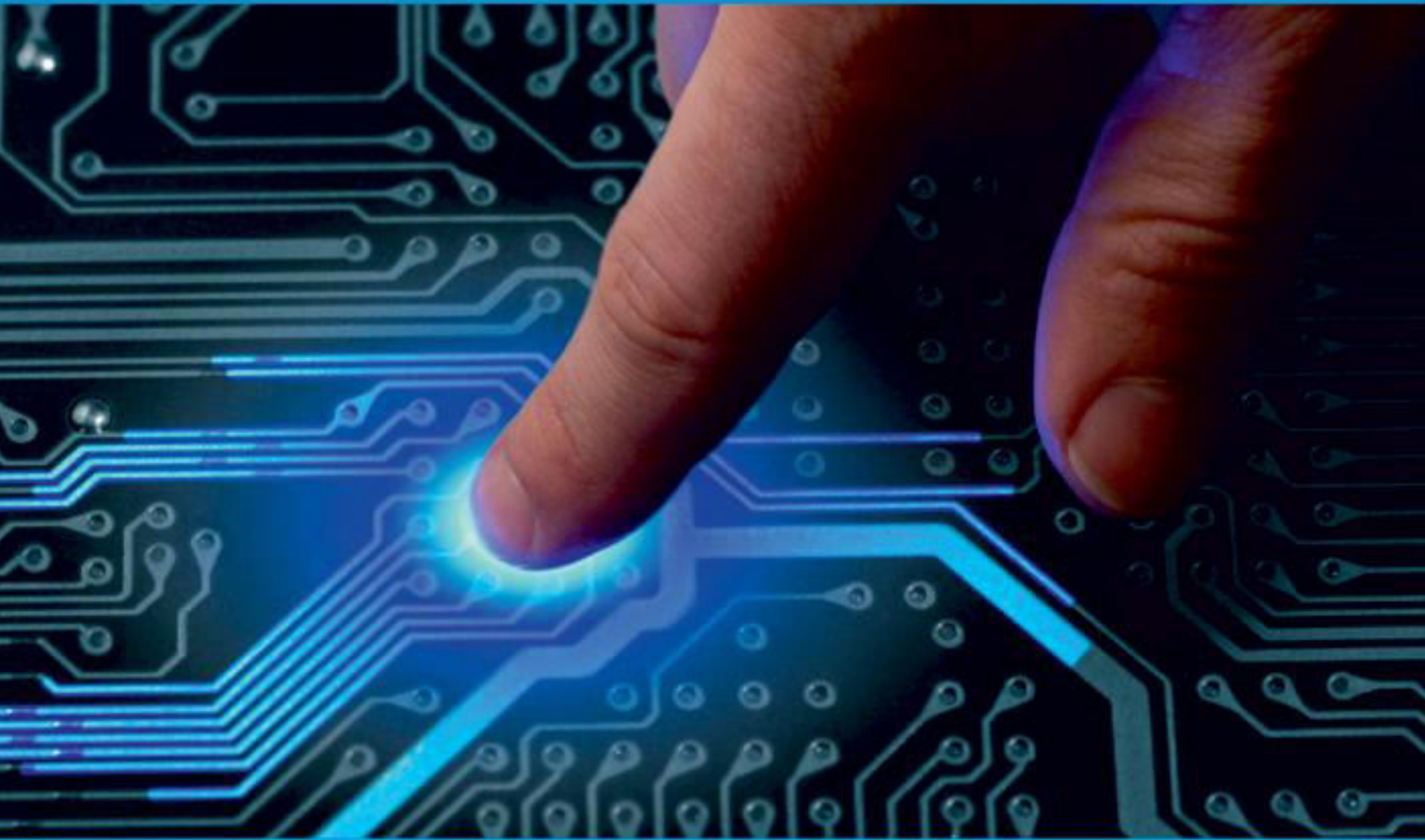

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Smoke Person Detection Using R-CNN

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ABSTRACT: We intend to design a smoke detector that is very efficient in terms of power consumption , durability & sensing and is also cheap compared to the available models in market so that it can be used even at house hold level & thus preventing any casualties at time of any accident with least possible maintenance. Face detection is essential to many face applications and acts as an important pre-processing procedure to face recognition.

OBJECTIVE

The objective is to detect a person and remove the fogg from the image captured by the camera.We provide a review on deep learning based object detection frameworks. Our review begins with a brief introduction on the history of deep learning and its representative tool, namely Convolutional Neural Network(CNN).

I. INTRODUCTION

Computer vision and deep learning *can* be used to detect wildfires:IoT/Edge devices equipped with cameras can be deployed strategically throughout hillsides, ridges, and high elevation areas, automatically monitoring for signs of smoke or fire.Drones and quadcopters can be flown above areas prone to wildfires, strategically scanning for smoke.Satellites can be used to take photos of large acreage areas while computer vision and deep learning algorithms process these images, looking for signs of smoke. That's all fine and good for wildfires — but what if you wanted to monitor your own home for smoke.The answer there is to ***augment existing sensors*** to aid in fire/smoke detection:Existing smoke detectors utilize photoelectric sensors and a light source to detect if the light source particles are being scattered (implying smoke is present).You could then distribute temperature sensors around the house to monitor the temperature of each room. Cameras could also be placed in areas where fires are likely to start (kitchen, garage, etc.).Each individual sensor could be used to trigger an alarm or you could relay the sensor information to a central hub that aggregates and analyzes the sensor data, computing a probability of a home fire.Unfortunately, that's all easier said than done.But, in this project our goal is to detect person and remove the fogg from the image from the camera output that we get on our device.

II. LITERATURE REVIEW

We will be using a image frame to detect smoke in the device camera. From there we'll review or directory structure for the project and then implement SmokeDetectionNet, the CNN architecture we'll be using to detect fire and smoke in images/video.Next, we'll train our Smoke detection model and analyze the person detected in camera frame.Due to object detection's close relationship with video analysis and image understanding, it has attracted much research attention in recent years. Traditional object detection methods are built on handcrafted features and shallow trainable architectures. Their performance easily stagnates by constructing complex ensembles which combine multiple low-level image features with high-level context from object detectors and scene classifiers. With the rapid development in deep learning, more powerful tools, which are able to learn semantic, high-level, deeper features, are introduced to address the problems existing in traditional architectures. These models behave differently in network architecture, training strategy and optimization function, etc. In this paper, we provide a review on deep learning based object detection frameworks. Our review begins with a brief introduction on the history of deep learning and its representative tool, namely Convolutional Neural Network(CNN). Then we focus on typical generic object detection architectures along with some modifications and useful tricks to improve detection performance further. As distinct specific detection tasks exhibit different characteristics, we also briefly survey several specific tasks, including salient object detection,face detection and pedestrian detection. Experimental analyses are also provided to compare various methods and draw some meaningful conclusions. Finally, several promising directions and tasks are provided to serve as guidelines for future work in both object detection and relevant neural network based learning systems.

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III. DESIGN METHODOLOGY

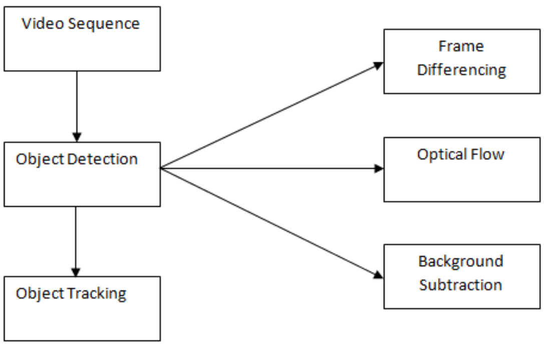
How the person is detected initially?

Face detection is essential to many face applications and acts as an important pre-processing procedure to face recognition, face synthesis and facial expression analysis. Different from generic object detection, this task is to recognize and locate face regions covering a very large range of scales (30-300 pts vs. 10-1000 pts). At the same time, faces have their unique object structural configurations(e.g. the distribution of different face parts) and characteristics(e.g. skin color). All these differences lead to special attention to this task. However, large visual variations of faces, such as occlusions, pose variations and illumination changes, impose great challenges for this task in real applications.

The most famous face detector proposed by Viola and Jones trains cascaded classifiers with Haar-Like features and AdaBoost, achieving good performance with real-time efficiency. However, this detector may degrade significantly in real-world applications due to larger visual variations of human faces. Different from this cascade structure, Felzenszwalb et al. proposed a deformable part model (DPM) for face detection However, for these traditional face detection methods, high computational expenses and large quantities of annotations are required to achieve a reasonable result.Besides, their performance is greatly restricted by manually designed features and shallow architecture.Finally, the fogg is removed from the image captured by device's camera.

IV. SYSTEM DESIGN

Architecture Diagram



To recognize different objects, we need to extract visual features which can provide a semantic and robust representation.

Prior to overview on deep learning based object detection approaches, we provide a review on the history of deep learning along with an introduction on the basic architecture and advantages of CNN.

The steps we follow for detecting .

- First we have to capture the video sequence
- For Object Detection we fallow

1. Frame Differencing
2. Optical Flow

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3. Background Substraction.

Video sequence : In image processing, videos are represented as some hierarchical structure units like scene, shot and frame. In video retrieval, generally, video application must partition a given video sequences into video shots. A video shot can be defined as the video frame sequence that presents continuous action. The frames in video shots are captured from a single operation of one camera. The complete video sequence is formed by joining two or more frames which are considered as input to the object tracking.

OBJECT DETECTION

Every object tracking must requires object detection as first step to identify objects of interest in the video sequences.Object detection is the locating moving object in the consecutive video frames. It can be done using different well known techniques

A. Frame Differencing

It is a technique to check the difference between two consecutive frames. Frame differencing employs the input as two image frames of video and produces the output such as the new pixel value or difference of the pixel values that can be obtained by subtracting pixels value of second frame image from the first frame image. Method is easy and simple to implement but detection of object cannot give accurate result.

B. Optical flow

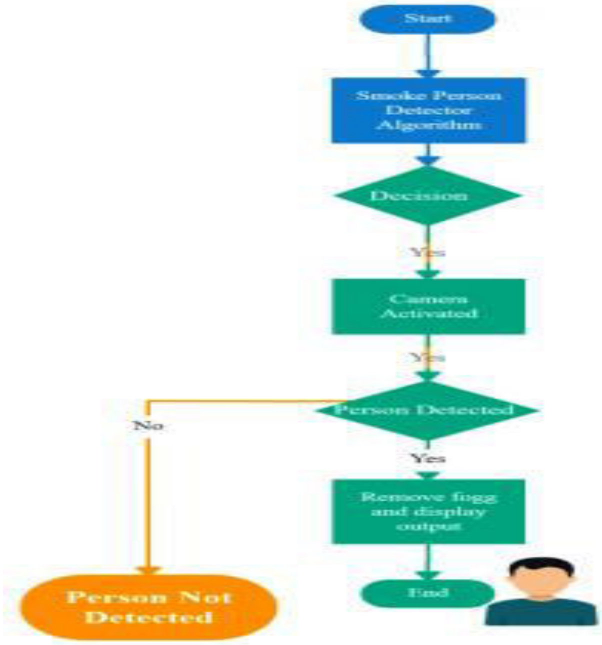
Optical flow is a technique that presents an apparent change in the moving object's location between frames of given video. It employs the motion field that represents the directions and velocity of each point in every frame. It takes more time to detect complex object motion and this technique is more suitable for multiple moving object detection.

C. Background Subtraction Background subtraction method extracts the moving objects or foreground object. For that compare the reference background image to the current image and find the difference in pixel values between consecutive frames. When the difference has detected, classify that object as moving object. Performance of the background subtraction is well for static background and deals with the multiple moving objects.

OBJECT TRACKING

Object tracking is the process of segmenting object of interest from the given video sequences or consecutive frames. Tracking is the difficult problem in image processing due to loss of information, complex object motion or irregular shape of object, noise in image, real time requirements and occlusion

V. FLOWCHART



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The flowchart of R-CNN, which consists of 3 stages:
(1) extracts bottom-up region proposals,
(2) computes features for each proposal using a CNN, and then
(3) classifies each region with class-specific linear SVMs.
Step 1:- As the beginning of we need to use smoke person detection algorithm that is nothing but two layers hierarchical lazy smoking detection algorithm that out perform more over we evaluate various smoking variations to gather with similar activities that can be confused with smoking.

- After using this algorithm we need to perform activation camera to detect smoke.
- In our fire sense project an automate early waring system integrating multiple sensors to remotely monitor area of archarlogical and cultural interest for the risk of fire and extreme weather condition was developed.

Step 2:- The system integrates various sensor including optical camera, infrared camera as different wavelengths passive infrared (PIR) sensor a wireless sensors network of temperature , humidity sensors of local weather stations on the deployment site.

- The signal and measurements collected from these sensor are transmitted to the control centre which employs intelligent computer vision and pattern recognition algorithms as well as date fusion technique to automatically analyz and combine sensor information and detect the presence of fire (or) smoke .

Step 3:- Till now we are done with smoke detection algorithm and camera activation and their process.

- After completing these steps we have to decide whether the person detected (or) not from the image which we got from camera's.
- If we get detected the person in the image we need to undergo image processing, morpnological process and object recognition to remove the fog and display the output clearly.
- After we completing these steps we get a clear pictures of the image and get to know the number of peoples and objects in the image which are all covered by fog (or) smoke.

VI. IMPLEMENTATION

Generic object detection aims at locating and classifyingexisting objects in any one image, and labeling them withrectangular bounding boxes to show the confidences of existence.The frameworks of generic object detection methodscan mainly be categorized into two types.One follows traditional object detection pipeline, generatingregion proposals at first and then classifying each proposal intodifferent object categories. The other regards object detectionas a regression or classification problem, adopting a unified framework to achieve final results (categories and locations)directly. The region proposal based methods mainly includeR-CNN [15], SPP-net [64], Fast R-CNN [16], Faster R-CNN[18], R-FCN [65], FPN [66] and Mask R-CNN [67], some of which are correlated with each other (e.g. SPP-net modifies RCNNwith a SPP layer). The regression=classification basedmethods mainly includes MultiBox [68], AttentionNet [69],G-CNN [70], YOLO [17], SSD [71], YOLOv2 [72], DSSD[73] and DSOD [74]. The correlations between these twopipelines are bridged by the anchors introduced in Faster RCNN.Details of these methods are as follows.

Hierarchical feature representation, which is the multilevelrepresentations from pixel to high-level semantic featureslearned by a hierarchical multi-stage structure [15],[53], can be learned from data automatically and hiddenfactors of input data can be disentangled through multi-level nonlinear mappings._ Compared with traditional shallow models, a deeperarchitecture provides an exponentially increased expressive capability._ The architecture of CNN provides an opportunity tojointly optimize several related tasks together (e.g. Fast RCNNcombines classification and bounding box regressioninto a multi-task leaning manner)._ Benefitting from the large learning capacity of deepCNNs, some classical computer vision challenges can be recast as high-dimensional data transform problems andsolved from a different viewpoint.

VII. APPLICATION

- To detect person in smoke.
- Fire Detection.
- Deep learning.
- IoT/Edge devices equipped with cameras.
- Satellites can be used to take photos.

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Outcome

To run the smoke person detector app.

This network utilizes **cv2,numpy,matplotlib,time** as libraries for effective detection of person and removal of fogg which have the following advantages:-

- Is more efficient**,** as Edge/IoT devices will have limited CPU and power draw.
- Requires less memory**,** as again, Edge/IoT devices have limited RAM.
- Requires less computation**,** as we have limited CPU horsepower.
- Can perform better than standard convolution in some cases**,** which can lead to a better fire/smoke detector.

VIII. CONCLUSION

Person Smoke Detector are great because they detect person and remove the fog from the camera output that we get on our device.To detect person in smoke thee most famous face detector proposed by Viola and Jones trains cascaded classifiers with Haar-Like features and AdaBoost, achieving good performance with real-time efficiency.

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