ACCIDENT CRASH DETECTION USING DEEP NEURAL NETWORK

Dr.C.Sujatha, R.Sridhar, B.Sudharsun, R.Thirupathi, G.vengadesh
Professor, Department of Electronics and Communication Engineering, SSM Institute of Engineering and Technology

UG Scholar, Department of Electronics and Communication Engineering, SSM Institute of Engineering and Technology

ABSTRACT--This project proposes an Accident Detection and Alerting System that utilizes the YOLO model for real-time object detection. By monitoring live video feeds, the system can identify potential accidents and generate immediate alerts. The system involves training the YOLO model with a custom datasets to optimize accuracy and performance. Evaluation metrics are used to assess system performance, and the system aims to enhance road safety by reducing response times and facilitating efficient resource allocation.The Accident Detection and Alerting System leverages the YOLO model for real-time object detection to monitor video feeds and swiftly detect accidents. It promptly generates alerts that include crucial information such as the accident's location, timestamp, and a brief description. The YOLO model is trained using a carefully curated datasets to ensure accurate and efficient accident identification. Performance evaluation is conducted using real-world video footage, bench-marking against metrics like precision, recall, and mean average precision. By enabling timely notifications, the system proactively enhances road safety, decreases response times, and facilitates the effective allocation of emergency resources, ultimately contributing to a safer transportation environment.

Keywords: YOLO, CNN, Accident detection

1.INTRODUCTION

Motor vehicle accidents have consistently had serious consequences, including loss of life and property (Durduran, 2010, Gang and Zhuping, 2011). In particular, while the number of traffic accidents is on the relative decline, trafficaccidents are still one of the leading causes of death worldwide (Heron, 2016, Sarraf and McGuire, 2020

Collision Avoidance Systems (CAS):

First, a CAS, which can be installed in motor vehicles, senses the distances between vehicles through sensors, then adjusts the accelerator or automatically applies the brakes for emergency braking (Chang et al., 2010, Milanés et al., 2012a). Installing a front CAS to every motor vehicle is legislated in Europeand Japan, while installing a lane departure warning system to large-sized buses and trucks is legislated in the Republic of Korea (Ministry of Land, Infrastructure and Transport, Republic of Korea, 2018).

The advancement of artificial intelligence, high-tech startup companies (e.g., Drive.ai).

Emergency Road Call Services:

Second, an emergency road call service recognizes traffic accidents automatically and allows immediate rescue after transmission to emergency recovery agencies. This service is very useful, because more than 70 percent of traffic fatalities are drivers and passengers. The death rate can decrease by 6 percent if the time to contact emergency medical service is shortened (White et al., 2011).

Car Crash for Emergency Road Call Services:

Existing systems detect accidents through analyzing sound data or video data. They use machine learning/deep learning techniques, such as support vector machines (SVMs), Gaussian mixture models (GMMs), and learning vector quantization (LVQ) classifiers (1) to determine whether or not video information indicates that an accident has occurred or (2) to classify various sounds (e.g., window breaking, screening, wire skidding) that may occur during an accident.

Global Impact on Road Accidents:

Nowadays, road accidents have become very common. As more and more people are buying automobiles, the chances of road accidents are increasing day by day. Also, people have also become more careless now as compared to earlier times. Not many people follow the traffic rules and in larger cities, there are various modes of transports available, the roads are becoming narrower day by day and the cities have become more crowded. Thus, road accidents are bound to happen. They cause loss of lives as well as material.

Importance of Road Safety Awareness:

Over 1.35 million people die from road accidents every year, with a fact of around 20 to 50 million of people suffer from moderate and non-fatal injuries due to road accidents which leads to various disabilities because of the injuries. A survey was conducted by the World Health Organization [7] (WHO) on the road accidents and deaths that are based upon the financial status of the country,it was witnessed that poor and middle-class people of the developing countries holds the highest number of road accident related deaths.

Road Accidents in India:

In India, it is found from the reports that 13 people die every hour as a victim to road accidents across the country. However, if we lookout to the real case scenario, it could go much worse, as many of the accident cases are mostly just left unreported. India is on the way to the number one country in the present days in deaths from road accidents because of the low average record of 13 deaths every going hour, which results about 140,000 per year.

Proposed Car Crash Detection System:

Due to the increase in motor vehicle accidents, there is a growing need for high-performance car crash detection systems. The authors of this research propose a car crash detection system that uses both video data and audio data from dashboard cameras in order to improve car crash detection performance. In this research, deep learning techniques, gated recurrent unit (GRU) and convolutional neural network (CNN), are used to develop a carcrash detection system. A weighted average ensemble is used as an ensemble technique.

Urgency for Effective Road Safety Measures:

The proposed car crash detection system, which is based on multiple classifiers that use both video and audio data from dashboard cameras, is validated using a comparison with single classifiers that use video data or audio data only. Car accident YouTube clips are used to validate this research.

CHAPTER 2

LITERATURE SURVEY

Wan-Jung Chang, Liang-Bi Chen et al "Deep-crash: A Deep Learning- Based Internet of Vehicles System for Head-On and Single-Vehicle Accident Detection With Emergency Notification"

IEEE-2019

Most individuals involved in traffic accidents receive assistance from drivers, passengers, or other people. However, when a traffic accident occurs in a sparsely populated area or the driver is the only person in the vehicle and the crash results in loss of consciousness, no one will be available to send a distress message to the proper authorities within the golden window for medical treatment. Considering these issues, a method for detecting high-speed head-on and single-vehicle collisions, analyzing the situation, and raising an alarm is needed. To address such issues, this paper proposes a deep learning-basedInternet of Vehicles (IoV) system called Deep-crash, which includes an in- vehicle infotainment (IVI) telematics platform with a vehicle self-collision detection sensor and a front camera, a cloud-based deep learning server, and a cloud-based management platform. When a head-on or single-vehicle collision is detected, accident detection information is uploaded to the cloud-based database server for self-collision vehicle accident recognition, and a related emergency notification is provided. The experimental results show that the accuracy of traffic collision detection can reach 96% and that the average response time for emergency-related announcements is approximately 7 s.

Unaiza Alvi, Muazzam A. Khan Khattak et al "A Comprehensive Study on IoT Based Accident Detection Systems for Smart Vehicles"IEEE-2020

With population growth, the demand for vehicles has increased tremendously, which has created an alarming situation in terms of traffic hazards and road accidents. The road accidents percentage is growing exponentially and so are the fatalities caused due to accidents. However, the primary cause of the increased rate of fatalities is due to the delay in emergency services. Many lives could be saved with efficient rescue services. The delay happens due to traffic congestion or unstable communication to the medical units. The implementation of automatic road accident detection systems toprovide timely aid is crucial. Many solutions have been proposed in the literature for automatic accident detection. The techniques include crash prediction using smartphones, vehicular Ad-hoc networks, GPS/GSM based systems, and various machine learning.

Yoshiaki Endo, Chinthaka Premachandra et all "Development of a BathingAccident Monitoring System Using a Depth Sensor"IEEE-2021

Among the domestic accidents that occur globally, a few percent are due to accidental drowning, mostly related to bathing. This letter examines countermeasures against bathing accidents and proposes a bathing accident monitoring system to prevent accidental drowning due to loss of consciousness during bathing. This system considers the user's privacy and uses only the depthinformation acquired by a depth sensor installed in the bathroom. This system grasps the movement of the bather with a depth sensor and informs others, such as the bather's family, when drowning might be occurring. In this letter, we mainly analyzed depth data from depth sensors and developed automatic detection of drowning conditions.

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Daxin Tian, Chuang Zhang et all "An Automatic Car Accident Detection Method Based on Cooperative Vehicle Infrastructure Systems" IEEE-2019

Car accidents cause a large number of deaths and disabilities every day, a certain proportion of which result from untimely treatment and secondary accidents. To some extent, automatic car accident detection can shorten response time of rescue agencies and vehicles around accidents to improve rescue efficiency and traffic safety level. In this paper, we proposed an automatic car accident detection method based on Cooperative Vehicle Infrastructure Systems (CVIS) and machine vision. First of all, a novel image dataset CAD-CVIS is established to improve accuracy of accident detection based on intelligent roadside devices in CVIS. Daxin Tian, Chuang Zhang et all "An Automatic Car Accident Detection Method Based on Cooperative Vehicle Infrastructure Systems" IEEE-2019

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Hiroaki Hayashi, Mitsuhiro Kamezaki et all "Toward Health–Related Accident Prevention: Symptom Detection and Intervention Based on Driver Monitoring and Verbal Interaction"IEEE-2021

Professional drivers are required to safely transport passengers and/or properties of customers to their destinations, so they must keep being mentally and physically healthy. Health problems will largely affect driving performance and sometimes cause loss of consciousness, which results in injury, death, and heavy compensation. Conventional systems can detect the loss of consciousnessor urgently stop the vehicle to prevent accidents, but detection of symptoms of diseases and providing support before the driver loses consciousness is more reasonable. It is challenging to earlier detect symptoms with high confidence. Toward solving these problems, we propose a new method with a multi-sensor based driver monitoring system to detect cues of symptoms quickly and a verbal interaction system to confirm the internal state of the driver based on themonitoring results to reduce false positives. There is almost no data that records abnormal conditions while driving and tests with unhealthy participants are dangerous and ethically unacceptable, so we developed a system with pseudo- symptom data and did outlier detection only with normal driving data. From data collection experiments, we defined the confidence level derived from cue signs. The results of evaluation experiments showed that the proposed system worked well in pseudo headache and drowsiness detection scenarios. We found that signs of drowsiness varied with individual drivers, so the multi-sensor based driver monitoring system was proved to be effective. Moreover, we found that there were individual differences in how the cue signs appeared, so we can propose an online re-training method to make the system adapt to individual drivers.

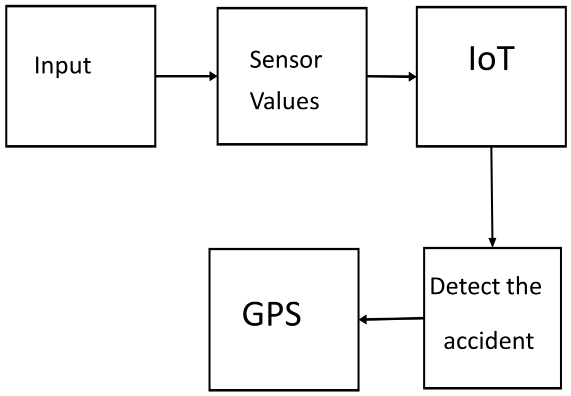
Bilal Khalid Dar, Munam Ali Shah et all "Delay-Aware Accident Detection and Response System Using Fog Computing" IEEE-2019

Emergencies, by definition, are unpredictable and rapid response is a key requirement in emergency management. Globally, a significant number of deaths occur each year, caused by excessive delays in rescue activities. Vehicles embedded with sophisticated technologies, along with roads equipped with advanced infrastructure, can play a vital role in the timely identification and notification of roadside incidents. However, such infrastructure andtechnologically-rich vehicles.

EXISTING BLOCK DIAGRAM:

FIG 3.1.1 BLOCK DIAGRAM FOR EXIST

low-cost solutions are required to address the



issue. Systems based on the Internet of Things (IoT) have begun to be used to detect and report roadside incidents. The majority of the systems designed for this purpose involve the use of the cloud to compute, manage, and store information.However,the centralization and remoteness of cloud resources can result in an increased delay that raises serious concerns about its feasibility in emergency situations; in life-threatening situations, all delays should be minimized where feasible. To address the problem of latency, fog computing has emerged as a middleware paradigm that brings the cloud-like resources closer to end devices. In light of this, the research proposed here leverages the advantages of sophisticated features of smartphones and fog computing to propose and develop a low-cost and delay-aware accident detection and response system, which we term Emergency Response and Disaster Management System (ERDMS).

DISADVANTAGES OF EXISTING SYSTEM

1.Security risks: With the increased connectivity and sharing of data, thereis a higher risk of security breaches, hacking, and privacy violations. Since IoT devices are often interconnected, a vulnerability in one device can compromise the entire network

2.Compatibility issues: As there is no universal standard for IoT devices, compatibility issues may arise between different devices, making them difficult to integrate and use together.

3.Reliance on technology: IoT devices are heavily reliant on technology, and any disruption in the network or power supply can cause significant problems.

4.Data overload: IoT devices generate a massive amount of data, and itcan be challenging to manage and analyze all the data that is collected.

5.Cost: The cost of implementing and maintaining IoT technology can be high, particularly for businesses and organizations that require a large number of devices.

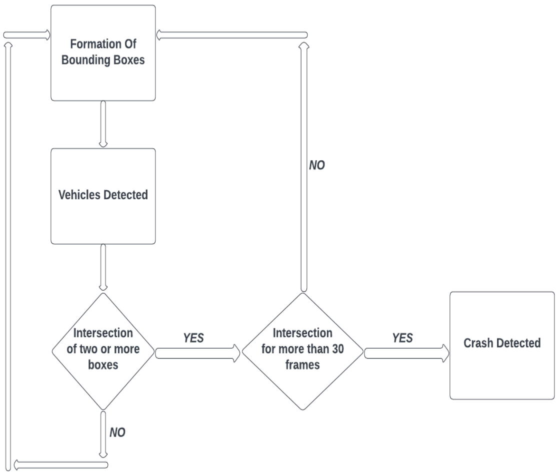
6.Lack of regulation: As IoT technology is relatively new, there are limited regulations in place to ensure the security and privacy of users, leaving users vulnerable to exploitation.

7.Unemployment: The increased automation and efficiency that IoT technology brings can also lead to job losses in certain industries, particularly those that rely on manual labor.

Volume: 07 Issue: 05 | May - 2023 SJIF 2023: 8.176 ISSN: 2582-3930

PROPOSED SYSTEM

The proposed system goes with the use a ODTS (Object Detection and Transfer System).



It interacts with the live CCTV feeds inside to any tunnel and tracks the live feeds of the accident using the object detection technique.

The proposed method assumes that traffic accident events are describedby visual features occurring through a temporal way.

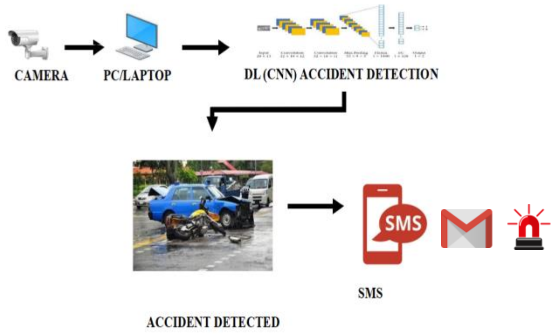
Therefore, a visual features extraction phase, followed by a temporary pattern identification, compose the model architecture.

The visual and temporal features are learned in the training phase through convolution and recurrent layers using built-from-scratch and public datasets.

An accuracy of 98% is achieved in the detection of accidents in public traffic accident datasets, showing a high capacity in detection independent of the road structure.

- Finally, using the output from our deep l

PROPOSED BLOCK DIAGRAM



FLOW CHART

USECASE DIAGRAM

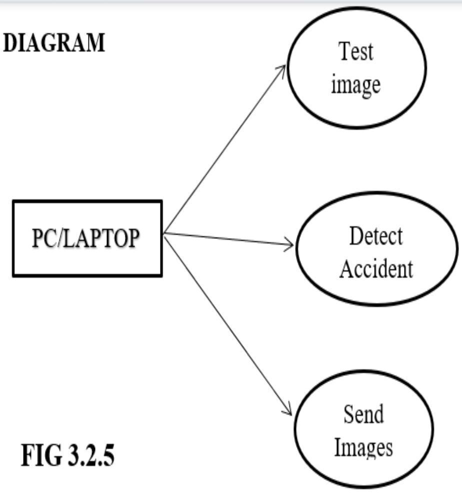
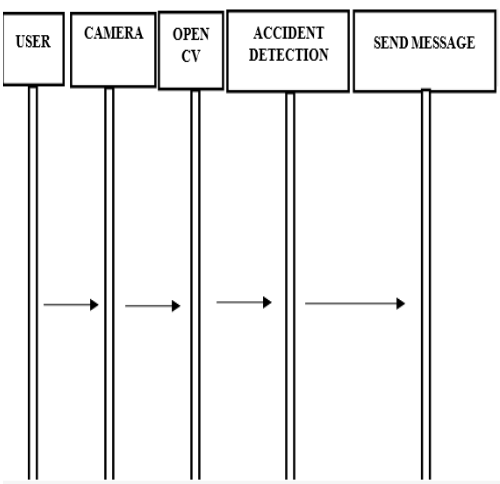


FIG 3.2.5

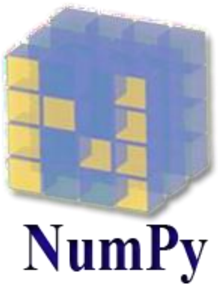
SEQUENCE DIAGRAM



CHAPTER 4

ACCIDENT CRASH DETECTING USING DEEP NEURAL NETWORK

1. IMAGE COLLECTION
2. IMAGE PREPROCESSING
3. IMPORTING MODULES
4. TRAINING DATASET
5. TESTING DATASET
6. CAMERA INTERFACING
7. NUMBER PLATE RECOGNITION



CHAPTER 5

MODULES

- PYTHON
- NUMPY
- PILLOW
- SCIPY
- OPENCV
- YOLO-V8
- CONVOLUTIONAL NEURAL NETWORK (CNN)

PYTHON

Python is a popular programming language. It was created by Guido vanRossum, and released in 1991.

It is used for:

- Web development (server-side),
- Software development,
- Mathematics,
- System scripting.

PYTHON NUMPY

Our Python NumPy Tutorial provides the basic and advanced concepts of the NumPy. Our NumPy tutorial is designed for beginners and professionals.

NumPy stands for numeric python which is a python package for the computation and processing of the multidimensional and single dimensional array elements.

FIG 5.1.1

OPEN CV

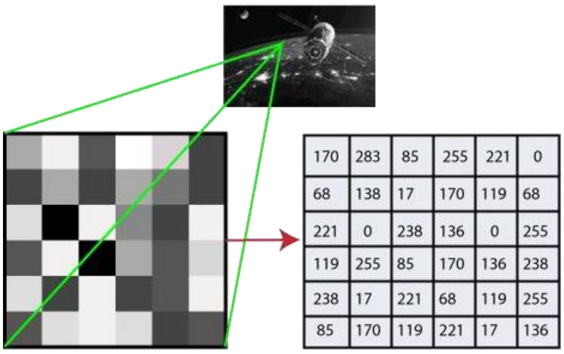
Open CV tutorial provides basic and advanced concepts of OpenCV. Our Open CV tutorial is designed for beginners and professionals. OpenCV is an open- source library for the computer vision. It provides the facility to the machine to recognize the faces or objects.

FIG 5.2.1

Object Identification - In the object identification, our model will identify a particular instance of an object - for example, parsing two facesin an image and tagging one as Virat Kohli and other one

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 05 | May - 2023 SJIF 2023: 8.176 ISSN: 2582-3930

as RohitSharma.



OpenCV using pip command:

1. pip install opencv-python

```
C:\Users\DEVANSH SHARMA\PycharmProjects\myproject\venv\Scripts>pip install opencv-contrib-python --upgrade
Collecting opencv-contrib-python
  Downloading https://files.pythonhosted.org/packages/00/a3/dfdbd5db6ba7f5b5a34d969c7508866c48826c61eb5e2c913d27f8784ff4/opencv_contrib_python-4.1.1.26-cp37-cp37m-win_amd64.whl (45.4MB)
    100% |████████████████████████████████| 45.4MB 79kB/s
Collecting numpy>=1.14.5 (from opencv-contrib-python)
  Downloading https://files.pythonhosted.org/packages/e9/dd/a177f27765b1e5f94fa879cbeef61f8807086371d0b6aa232b836d38b78b/numpy-1.17.3-cp37-cp37m-win_amd64.whl (12.7MB)
    100% |████████████████████████████████| 12.7MB 66kB/s
Installing collected packages: numpy, opencv-contrib-python
Successfully installed numpy-1.17.3 opencv-contrib-python-4.1.1.26
```

You are suggested to install 3.7 working with Python 3.

Open the command prompt and type the following code to check if the OpenCVis installed or not.

```
C:\Users\DEVANSH SHARMA\PycharmProjects\myproject\venv\Scripts>python
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul  8 2019, 20:34:20) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> print(cv2.__version__)
4.1.1
>>> _
```

CAMERA :

A webcam is a hardware camera and input device that connects to a computer and the Internet and captures either still pictures or motion video of a driver drowsiness.

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach toa user's monitor, or are built into the hardware

FIG 5.3.2

YOLO-V8 -- INTRODUCTION:

Joseph Redmon, Santosh Divvala, Ross Girshick, and Ali Farhadi introduced YOLO (You Only Look Once) a family of computer vision models that are seeking the attention and fanfare of many AI enthusiasts. On January 10th, 2023, the latest version of YOLO which is YOLO8 launched claiming advancements in structure and architectural changes with better results.We experimented with the brand-new, cutting-edge, state-of-the-art YOLO v8 from Ultralytics. YOLO versions 6 and 7 were released to the public over a period of 1–2 months. Both are PyTorch-based models. Even its predecessor YOLO v5 also has one PyTorch-based model.

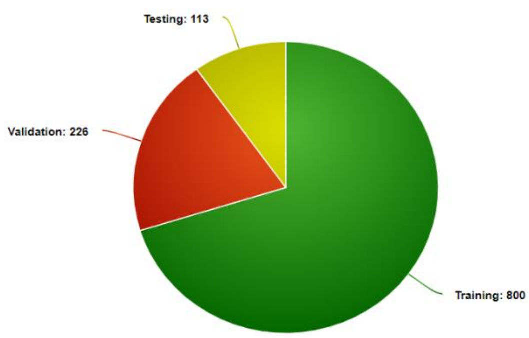


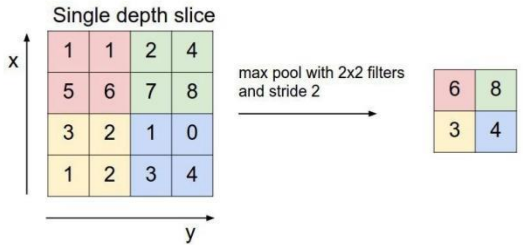
Figure 5.5.7: YOLO-V8

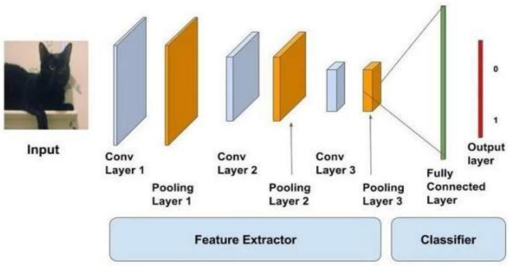
Volume: 07 Issue: 05 | May - 2023 SJIF 2023: 8.176 ISSN: 2582-3930

YOLO-V8

Following are the two YOLO-V8 Convolutional Neural Networks

After understanding machine-learning concepts, we can now shift our focus to deep learning concepts. Deep learning is a division of machine learning and



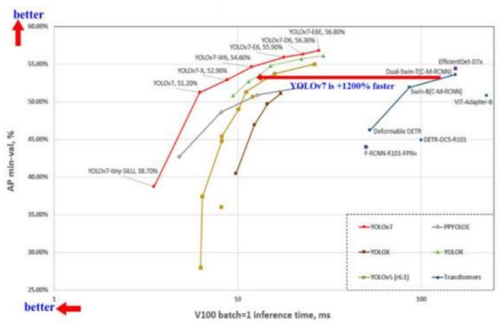


is considered as a crucial step taken by researchers in recent decades. The examples of deep learning implementation include applications like image recognition and speech recognition.

Important types of deep neural networks:

Convolutional Neural Networks

Recurrent Neural Networks



Layers in CNN

There are five different layers in CNN

- Input layer
- Convo layer (Convo + ReLU)
- Pooling layer
- Fully connected(FC) layer
- Softmax/logistic layer
- Output layer

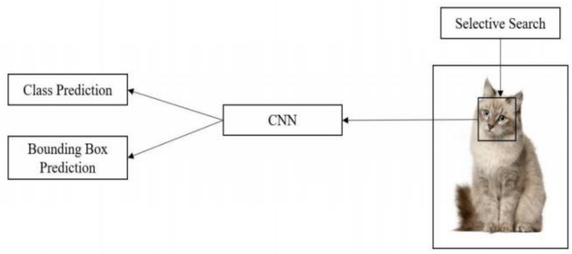
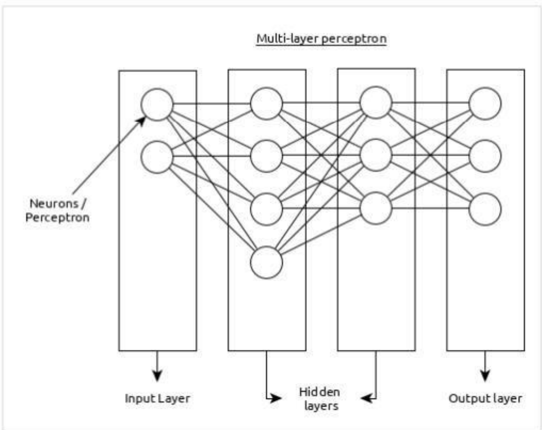


Fig. 3: Working principle of R-CNN [6]

METHODOLOGY:

Convolutional neural network basics The main building blocks of a deep convolutional neural network (CNN) are the convolutional layer, commonly called CONV2D, the pooling layer, the rectified linear unit (ReLU) layer, and a series of fully connected layers. In other words, as shown in Fig.1, a deep CNN basically consists of two subnetwork, a series of 2D convolutional layers and a classical but deep neural network.



ADVANTAGES

Accident detection using convolutional neural networks (CNN) offers several advantages, including:

Accurate and fast detection

Automated detection

Low cost

Scalability

Real-time response

Improved safety

APPLICATIONS

Automotive industry

Public safety

Transportation industry

Insurance industry

Smart cities

Law enforcement

CONCLUSION:

In conclusion, the combination of accident detection using convolutional neural networks (CNNs) is provided for number of benefits for improving safety on the roads and enhancing emergency response times. Accident detection using CNNs can accurately and quickly detect potential accidents in real-time, which can help to reduce response times for emergency services. The use of these technologies is particularly relevant for hit-and-run accidents, where drivers flee the scene before emergency services arrive. law enforcement agencies can track down the driver and hold them accountable for their actions. However, the effectiveness of these systems depends on the quality of the data, the accuracyof the algorithms, and the reliability of the hardware used.

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