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Helmet Detection with Number Plate Recognition System

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ABSTRACT: Helmet violation detection is a crucial aspect ofroad safety, as it can significantly reduce the number of fatalities and injuries caused by motorcycle accidents. In recent years, computer vision techniques have been widely used to develop automated systems for helmet violation detection. This project proposes a helmet violation detection system using image processing and machine learning techniques. The proposed system employs computer vision algorithms to detect whether a motorcyclist is wearing a helmet or not. The system is based on a deep learning model, specifically Convolutional Neural Networks (CNN), to classify the input images into two classes, i.e., helmet and non-helmet. The system is trained on a large dataset of images with differentlighting conditions, backgrounds, and helmet types to enhance its accuracy and generalization ability. The proposed system can be implemented on existing surveillance cameras installed at strategic locations on the road. This system has the potential to increase road safety and reduce the number of motorcycle accidents caused bythe violation of helmet-wearing rules. The system involves person detection, helmet, vs. no-helmet, classification using YOLO algorithm. Convolutional neural network with sequential model is implementing for number plate detection process CNN classification model proposes for classify the number plate in image and extract the user details. Then calculate the fine amount. Finally making SMS services to send alert the users too preventing motorcycle accident.

KEYWORDS: Helmet Detection, Number Plate Detection, ArtificialIntelligence, CNN, Deep Learning, YOLO V5 Algorithm

I.INTRODUCTION

Machine learning is a field of study in computer science that focuses on developing algorithms that allow computers to learn from data without being explicitlyprogrammed. It is a subset of artificial intelligence that involves the use of statistical techniques to enable machines to learn and improve over time. At its core machine learning involves training algorithms on large datasets, allowing them to identify patterns and make predictions based on that data. These predictions can be used to make decisions, optimize processes, or automate tasks, making machine learning an incredibly powerful tool in a wide range of industries. One of the key advantages of machine learning is its ability to handle large and complex datasets. With the increasing volume of data being generated in virtually every industry, machine learning algorithms can quickly identify patterns and insights that might be missed by human analysts. This makes it a valuable tool for businesses looking to improve their operations, identify opportunities for growth, and optimize their decision- making processes. Another key advantage of machine learning is its ability to adapt and learn over time. By continuously analyzing new data, machine learning algorithms can refine their predictions and improve their accuracy. This allows businesses to stay ahead of changing market conditions, adapt to new trends, and make better-informed decisions. There are several different types of machines learning algorithms, including supervised learning, unsupervised learning, and reinforcement learning. Supervised learning involves training algorithms on labeled datasets, allowing them to make predictions based on the input data. Unsupervised learning, on the other hand, involves training algorithms on unlabeled data, allowing them to identify patterns and group data points based on similarities. . Reinforcement learning involves training algorithms to make decisions based on feedback from their environment, allowing them to learn through trial and error.

II. EXISTING SYSTEM

One of the main causes of fatalities in society today is traffic accidents. Severe injuries can result from motorbike accidents.For every motorcycle rider, the helmet is essential. However, many people disregard the requirement to wear helmets. Helmets are necessary equipment to safeguard employees from harm during operation and inspection. Given

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that certain employees might not always abide by the law, supervisors and video surveillance systems spanning the entireplant are essential to keep an eye on whether employees are donning helmets or not.A vast number of monitoring screens, however, make it impossible to spot any helmet violation behaviour at any moment, which might result in serious accidents. Computer vision-based inspections have become oneof the most significant industrial applications of image recognition technology due to their rapid growth.

III. PROPOSED SYSTEM

Due to the lack of an automatic system that can identifymotorcycle riders who are not wearing helmets and or masks, traffic police officers must manually keep track of these trafficrule infractions by either recalling the licence plate or taking aphoto of it. This manual administration might occasionally result in mistakes. We have created an automated helmet and face mask detection system that can find all motorcyclists whoare not wearing helmets and masks just by saving the number plate of those bike riders in order to get around these limitations. We have suggested an automated approach that is more precise and takes little human work to solve the drawbacks of the current system.

IV. MACHINE LEARNING APPLICATIONS

Machine learning (ML) is a powerful tool that is used to find insights and patterns from data. There are many applications ofmachine learning in various fields, some of which include, Image recognition: Machine learning can be used to build image recognition systems that can identify objects in images orvideos. This has many applications, from self-driving cars to medical imaging. Machine learning can be used to build image recognition systems that can identify objects in images or videos. This has many applications, from self-driving cars to medical imaging. Natural language processing (NLP): ML can be used to build NLP models that can understand and generate human language.This can be used for chatbots, translation, and speech recognition. Predictive analytics: Machine learning can be used to build predictive models that can forecast future events based on past data. This has many applications, from finance to weather forecasting. Fraud detection: Machine learning can be used to detect fraudulent transactions by identifying patterns in data thatsuggest fraud. Personalization: Machine learning can be used to personalize recommendations for users based on their behavior, preferences, and past interactions. This is commonly used in e- commerce, streaming services, and social media. Healthcare: Machine learning can be used in healthcare to predict and diagnose diseases, analyze medical images, and improve patient outcomes. Robotics: Machine learning can be used to teach robots to perform complex tasks, such as navigating through a room or manipulating objects. Autonomous vehicles: Machine learning can be used to train self-driving cars to recognize objects and make decisions based on their surroundings.

V. TYPES OF MACHINE LEARNING

Machine learning (ML) is a branch of artificial intelligence (AI) that focuses on building systems that can learn and improve from experience without being explicitly programmed. In this essay, we will explore each of these types of machines learning in more detail.

A. SUPERVISED LEARNING

Supervised learning is the most common type of machine learning. It involves training a model on a labeleddataset, where the output is known for each input. The model is then able to make predictions on new, unseen databased on what it learned during training. In supervised learning, the goal is to minimize the difference between the predicted output and the actual output, also known as the loss function. Some common algorithms used in supervised learning include linear regression, logistic regression, decision trees and neural networks. Supervised learning has many applications, suchas image classification, speech recognition, and natural language processing.

B.UNSUPERVISED LEARNING

Unsupervised learning involves training a model on an unlabeled dataset, where the output is not known. The goal of unsupervised learning is to discover patterns and relationships in the data without being explicitly told what to look for. In unsupervised learning, the model is not given any feedback on its predictions, and it is up to the model to figure

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out what is important and what is not. Some commonalgorithms used in unsupervised learning include clustering, principal component analysis (PCA), and auto encoders. Unsupervised learning has many applications, such as anomaly detection, recommendation systems, and market segmentation. It is particularly useful in cases where the data is complex and difficult to label.

C.REINFORCEMENT LEARNING

Reinforcement learning involves training a model to make decisions based on feedback from the environment. The model is given a set of actions to choose from, and it learns which actions are most effective based on the rewards or penalties it receives for each action. It is particularly useful in cases where the outcome is not clear or well-defined. Machine learning is a powerful tool that can be used to build models that learn and improve from experience.

D. ADVANTAGES OF MACHINE LEARNING

Machine learning (ML) is a powerful tool that has many advantages in various fields. In this paragraph, we will explore some of the main advantages of machine learning. One of the primary advantages of machine learning is its ability to analyze vast amounts of data quickly and accurately. Machine learning (ML) algorithms can sift through large datasets and identify patterns that would be impossible for humans to detect on their own. This ability is particularly useful in fields such as finance, healthcare, and marketing, where large amounts of data are generated daily. Another advantage of machinelearning is its ability to make predictions and identify trends.ML algorithms can be trained on historical data to forecast future events with a high degree of accuracy. This is useful in fields such as finance, where ML can be used to predict stock prices and market trends. Machine learning can also be used to automate repetitive tasks, freeing up human resources for more important work.

E.CHALLENGES IN MACHINE LEARNING

Despite its many advantages, machine learning (ML)also faces several challenges. In this paragraph, we will explore some of the main challenges in machine learning. One of the primary challenges in machine learning is the quality of data. ML algorithms rely on large amounts of high-quality data to make accurate predictions. However, inmany cases, the data available is incomplete, biased, or of low quality, which can lead to inaccurate predictions and unreliable models. Cleaning and pre-processing the data can be a time-consuming and expensive process. Another challenge in machine learning is the interpretability of the models. Many ML algorithms are black boxes, meaning thatit is difficult to understand how the algorithm arrived at a particular prediction. This lack of transparency can make it challenging to trust the models and explain their predictions to stakeholders. Another challenge is the need for continuous learningand Adaptation. Machine learning models must be continuously updated and refined to reflect changes in the data and the environment. This requires a significant investment in time and resources and can be a challenge for organizations with limited budgets and resources. Finally, there is the challenge of bias and ethics. Machinelearning algorithms can unintentionally perpetuate biases in the data and result in unfair or discriminatory outcomes. For example, an algorithm used in hiring may inadvertently discriminate against certain groups of people. It is essential to address these biases and ensure that ML models are ethical and fair.

VI. HELMET DETECTION

One of the leading causes of fatalities, injuries, as well as property destruction is car crashes. Going above the speed limit, driving while intoxicated and not utilizinghelmet as well as seatbelts is the causes of these collisions. Over 1 lakh people have reportedly died inalmost 5 lakh transport incidents in India. Roughly half ofthese are collisions involving motorcycles. A motorbike rider is more likely to get in an incident than someone driving a vehicle or another type of vehicle. Motorcyclistsfrequently lead in injuries, the majority of whom areheadaches and head trauma. Riders that are not wearing seatbelts are at greater risk. The biker can partly avoid deadly brain trauma and avoid death by wearing a helmet. A mechanism should be in place to identify helmets on motorcycle riders and to penalize those who are not carrying them in needed to guarantee that they are using them. The methods now in use either rely on manual detection systems or employ sluggish or inaccurate heuristics. The suggested approach employs the clear andprecise

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YOLO paradigm for detection. A data analysis technique called machine learning automates the creation of analytical models. Computer training is a particularbranch of artificial intelligence that teaches a machine how to learn, whereas artificial intelligence (AI) is indeedthe general science that aims to emulate human skills. Todiscover more about the connection among Ai technologies, watch the video below. With the help of practical examples and a few humorous asides, you'll learn how well these two technologies operate. The same variables that have increased the popularity of data mining as well as Bayesian analysis also have a re-emerging enthusiasm in machine learning. Things include expanding data quantities and kinds, more powerful and economical computing, including reasonably priced storage systems. Because of all of these factors, models that can evaluate more, more complicated data andprovide faster, more accurate answers even on a quite large scale. Computer training is a particular branch of artificial intelligence that teaches a machine how to learn, whereas artificial intelligence (AI) is indeed the general science that aims to emulate human skills. To discover more about the connection among Ai technologies, watch the video below. With the help of practical examples and a few humorous asides, you'll learn how well these two technologies operate. The same variables that have increased the popularity of data mining as well as Bayesian analysis also have a re-emerging enthusiasm in machine learning.

VII. SYSTEM REQUIREMENTS

HARDWARE REQUIREMENTS

- Processor : Dual core processor 2.6.0 GHZ
- RAM : 1GB
- Hard disk : 160 GB
- Compact Disk : 650 Mb
- Keyboard : Standard keyboard
- Monitor : 15inchcolormonitor

SOFTWARE REQUIREMENTS

- Operating system : Windows OS
- Front End: PYTHON
- Back End : MYSQL
- IDE : PYCHARM

VIII. SYSTEM IMPLEMENTATION

Helmet violation detection is a computer vision application that uses deep learning algorithms to detect whether or not a person is wearing a helmet in a video frame. This technology has important applications in road safety, as helmet use is a critical factor in reducing the riskof serious injury or death in motorcycle accidents. The helmet violation detection

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system typically involves the collection of a large dataset about helmets that are collected from Kaggle source. This dataset is used to train YOLO algorithm that can then accurately classify whether a personin a given video frame is wearing a helmet or not. The algorithm works by identifying key features of the helmet, such as its shape, color, and position on the person's head, and comparing these features to those of non-helmeted individuals. Once the algorithm has been trained, it can be deployed in a variety of settings, such as at traffic intersections or on the side of roads, to detect helmet violations in real-time.

IX. PROPOSED SYSTEM IMPLEMENTATIONA.FRAMEWORK CONSTRUCTION

Intelligent traffic systems optimize the movement of automobiles over transport networks. This optimization includes Automatic Car License Plate Detection and Recognition. Research on Automatic car license plate detection LPR has gained momentum in recent yearsdue to neural networks and deep learning. It can be appliedto many areas like traffic law enforcement and road traffic monitoring. To identify License plate technologies such as computer vision and artificial intelligence algorithms can employed. The steps involved in ALPR are image acquisition, pre-processing of the image, finding the region of interest (ROI), segmentation and optical character recognition. In this module, admin can create the GUI for store the user details. User details contains the information such as Vehicle number, mobile number and so on. These details are trained as RTO database.

B.CAMERA CAPTURING

Due to the low cost and widespread use of motorbikes, there has been a sharp rise in motorcycle accidents. Most riders do not wear helmets, making motorcycle accidents a daily risk. Enable the camera to analyze traffic offences in this section. To distinguish between the foreground and background scenes, use binarization techniques. One of the key problems in the field of computer vision and image processing is foreground detection, which aims to identify changes in image sequences. Any technique that enables the foregroundof an image to be extracted for additional processing (object detection, etc.) is known as background removal. Many applications may not require a completeunderstanding of how movement changes over time ina video sequence.

C.HELMET CLASSIFICATION

In this module implement object detection system using YOLO algorithm. Then detect the objects and draw bounding box on that object. Verify the features which are contains the helmet objects. If helmet object not occurred means, forward to next module. For training our custom object detection model, we will need a lot of images of objects which we're going to train nearly a few thousand. We first perform feature extraction to determine the distribution and mathematical characteristics of the dataset; then we build YOLOv3 on our pre-processed data for training to build our model to detect helmets on the camera. Based on the features of the dataset, we can obtain relevant information that willprovide better support in building neural network training. For feature extraction, Calculation of the proportion of each target in the original.

D.NUMBER PLATE RECOGNITION

In this module, implement number detection approachbased on text strokes values which is defined in the formof minimum and maximum values in order to obtain thelicense plate only and remove other very small or very large identified objects which were outside the threshold range. The objects passed successfully through predefined threshold criterion were forwarded to the training process. In this module, text strokes in number plate detected using Conditional Random field. Detected texts are drawn asbounding box. Text can be recognized using Convolutional neural network algorithm. In this module implement CNNalgorithm to recognize the detected text. CNN is a piece of software that converts printed text and images intodigitized form such that it can be manipulated by machine.

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CNN is a complex problem because of the variety of languages, fonts and styles in which text can be written, andthe complex rules of languages etc. Character segmentationis done on the binary image of the extracted license plate. Inthis module, number plate can be detected and recognizedusing Convolutional neural network algorithm. First detect the text strokes in number plate and recognized the number. Then return as Label box in real time camera capture. Finally matched with database and extract the owner details.Artificial Neural Networks (ANN) are capable of learningand may thus be trained to recognize patterns, develop solutions, predict future occurrences, and classify data.

E.ALERT SYSTEM

In this module, recognized user details are extractedfrom database which are extracted from trained database. CNNs will compare input images pixel by pixel or group ofboxes. The regions that appearances for are called landscapes. By definition rough feature contests in roughly the similar places in two images, convolutional neural network gets a lot of improved at sighted likeness than entire–image matching patterns and send the amount details to appropriate the user in the form of SMS alert.

X. RESULTS AND DISCUSSION

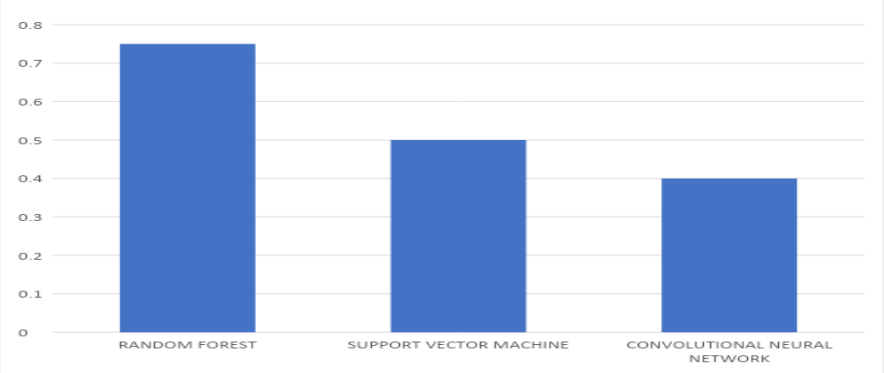
Helmet images are collected from KAGGLE datasets. Different performance measures such as accuracy, sensitivity, specificity, error rate and precision can be derived for analyzing the performance of the system.
True positive (TP): number of true positives -perfect positive prediction False positive (FP): number of false positives - imperfect positive prediction True negative (TN): number of true negatives - perfect negative prediction False negative (FN): number of true negatives - imperfect negative prediction

A. Error rate

Error rate (ERR) is computed as the fraction of total number of imperfect predictions to the total number of test data. The finest possible error rate is 0.0, whereas the very worst is 1.0. Minimization of this error rate will be the prime objective for any classifier.

$$ERR=FP+FN/TP+TN+FN+FP$$

ALGORITHM	ERROR RATE
RANDOM FOREST	0.75
SUPPORT VECTOR MACHINE	0.5
CONVOLUTIONAL NEURALNETWORK	0.4



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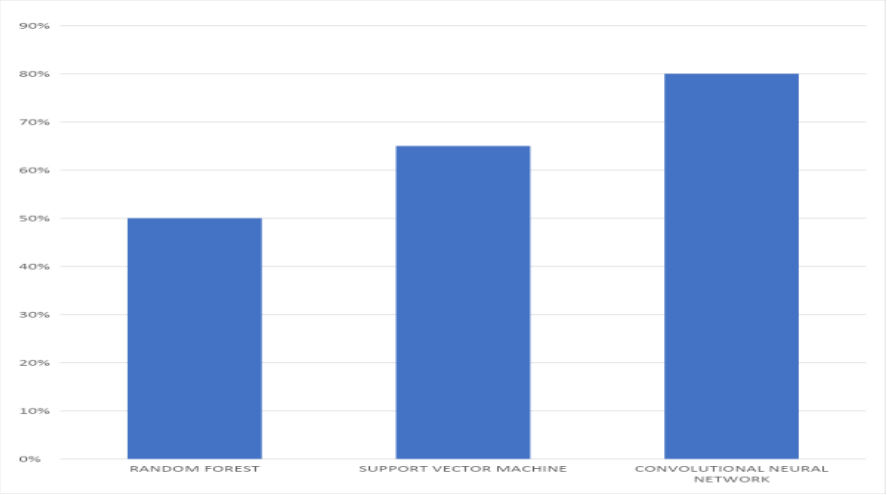
B. Accuracy: Accuracy (ACC) is found as the fraction of total number of perfect predictions to the total number oftest data. It can also be represented as 1 – ERR. The finest possible accuracy is 1.0, whereas the very worst is 0.0.

ACC=TN+TP/TP+TN+FP+FN

ALGORITHM	ACCURACY
RANDOM FOREST	50%
SUPPORT VECTORMACHINE	65%
CONVOLUTIONAL NEURAL NETWORK	80%



XI. CONCLUSION

As a result, this technique is quite successful for user safety. Since a helmet is required to ride a bike, the rider will abide by all traffic laws. This technology is controlled by your pocket, so you can ride a two-wheeler while keeping your expenses and personal safety in mind. This system has simple controls. It gives the cyclist better security.

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