Detection of Bike Riders without Helmet and Triple Riding using YOLO v3 model

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Abstract- As the number of bikes have been increasing throughout the years in several countries. he danger of demise has also increased 2.5 times among the riders without using a helmet contrasted with person wearing a helmet. To address this issue, most countries have laws which mandate the use of helmets for two-wheeler riders. This paper plans to unwind this issue by automating thetechnique for distinguishing the riders with and without helmets. The system takes a video of traffic on an open street as an information and recognizes the moving items inside the scene. This work proposes a system based on the location of individual or different riders taking a trip on bikes with no helmets. Inside the proposed approach, from the beginning stage, bike riders are recognized with the use of YOLOv3 model which is a consistent type of YOLO model, the forefront methodology for object distinguishing helps as such in distinguishing the riders with and without helmet. The vertical projection of binary image is used for counting the number of riders if it exceeds two.

*Key Words***:** Motorcycle Accident, Helmet Detection, YOLOv3, Object detection, Road Safety, Rule Violation.

1. INTRODUCTION

A helmet aims to reduce the risk of serious head and brain injuries by plummeting the impact of a force or collision to the head, motorcyclists must take extra precautions to protect their body. Riders and passengers wearing helmets increase their possibility of survival appreciably over non-helmet wearers. According to the law, every motorcyclist must wear a helmet while riding the motorcycle. But many bikers ignored and use their vehicle without defense apparatus. The policeman tried to control this problem manually but it is inadequate for the real state ofaffairs. Recently helmets have been made mandatory, but still, people drive vehicles without helmets. The number of deaths has been expanding every year, especially indeveloping countries as helmets are the main safety equipment for motorcycle drivers as well as passengers, but many drivers do not use them. Wearing a helmet is the most effective way to reduce head injuries and fatalities arising from motorcycle and bicycle accidents. Motorcycle drivers who do not wear helmets are at a greatly risk of sustaining head injuries and dying from these injuries. In addition, riders who do not wear helmets impose additional costs on hospitals, while the cost of disability resulting from these head injuries is at an individual, family, or career and social level. Generally, helmets are mandatory for riders only as perthe Indian Road and Safety Department.

Fig. 1. Helmet Norms Violation

Fig. 1 shows the norms of helmet use in every city for the safety of motorcyclist. It should be mandatory for passenger also which is missing in the figure that could be append in road and safety rules.

Fig. 2 Helmet wearing

Fig. 2 shows the actual norms that should be followed by everyone for better safety. There are various premised where proposed system can be implemented that can mandate the use of helmet if arrival is not entertained without helmet. It can be implemented if a barrier is associated with the system that can only open once no violation has been detected. It may force the riders to wear helmet with their passengers at any costs. The proposed system is able to detect head with helmet and without helmet for better prediction and decision making. Even after increasing the penalties over rule violations may not discover the solutions regarding use of helmets in people. There should be alternative way that can force public to use helmet with their families and cure about the lives anyhow.

2. LITERATURE SURYEY

G. Sasikala et al. [1] proposed a system which is based RF transmitter and receiver that enhance the feature of helmet and provide extra protection while accidents. It may increase the cost of helmet and does not provide a solution that could mandate the use of helmet for every rider or non-riders.

Narong Boonsirisumpun et al. [2] proposed a system which is based on convolutional neural network. System is able to classify the helmet and motorcycle using CNN, but CNN is limited with training samples that restricted if a person is using different kind of helmet or if girls cover her face may detected as helmet that may increases the false recognition rate.

Liang-Bi Chen et al. [3] proposed a system which is based on IR sensors that proposes an intelligent helmet with heavy vehicle detection to aware the riders to not to be a part of any casualties. Here system uses camera on helmet's back side for recognizing heavy vehicles that approaches.

Mario Andres Varon Forero et al. [4] proposeda system which is based on convolutional neural network and background subtraction approach that may highlight the riders with helmets. Helmet has been classified using support vector machine and samples of training data. The accuracy of the system is bit good but system may not work for various situations specially that encounters in India such as use of clothes over face, passengers with no helmet etc.

Rohith C A et al. [5] proposed a system which is based on CNN that is able to detect two wheelers with helmet and no helmet. So as per the earlier discussion CNN is limited with the samples and most of the distinct situation cannot be handled using this technique. Detecting multiple helmet and persons head along with motorcycle is a challenging task.

3. PROPOSED SYSTEM

This segment presents the proposed approach for continuous recognition of number of bike-riders and bike riders without helmets utilizing YOLO.

3.1 You Look Only Once

YOLO is a smart convolutional neural network (CNN) for performing object detection in actual-time. The technique uses one neural network on the entire image, later splits the photograph into different areas and predicts bounding containers along with possibilities for each region. The biggest advantage of using YOLO is its pace which could be very speedy and may process 45 frames according to second. Beside simple image characterization, there are numerous captivating troubles in PC vision, with item identity being one some of the first fascinating. It's often recognized with self-riding vehicles where systems blend PC imaginative and prescient, LIDAR and one-of-a-kind advances to get a multidimensional portrayal of the street with each one of its members. Item discovery is commonly used in video commentary, for instance, swarm controlling, visitors light, in shopping facilities and so on.

YOLO trains on various full pictures and legitimately expands discovery execution. This particular model has loads of greater advantages over standard strategies for object popularity. In the first vicinity, YOLO is extremely brief. Since area is outlined as a relapse issue, the system need not hassle with a luxurious pipeline. The neural system is run on a substitution photograph at test time to foresee discoveries.
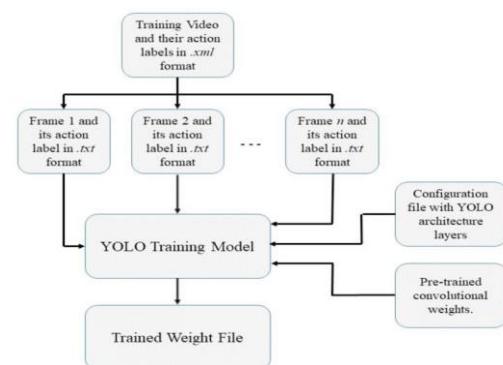

Fig-3: Work flow of Yolo

Contrasted with other nearby proposition association structures (brief RCNN) which carry out place on extraordinary district hints and along those strains land up performing forecast on several occasions for one-of-a-kind regions in an image, Yolo layout is an increasing number just like FCNN (fully convolutional neural gadget) and passes the picture (nxn) as soon as thru the FCNN and yield is (mxm) expectation. This design is parting the records image in mxm lattice and for every matrix age 2 bouncing boxes and sophistication probabilities for the ones leaping bins.

Calculations that depend on relapse, as opposed to choosing fascinating pieces of an image, they anticipate classes and leaping confines for the whole image one run of the calculation. The two most popular models from this gathering are the YOLO family calculations and SSD (Single Shot Multibox Detector). They are normally utilized for ongoing item identification as for the most part, they exchange a hint of exactness for monster enhancements in pace. The work flow of YOLO scheme can be seen in Fig 1 above.

3.2 Machine Learning

The simple system of device studying is to give schooling facts to a learning algorithm. The learning algorithm then generates a brand-new set of rules, primarily based on inferences from the facts. This is in essence producing a new algorithm, officially referred to as the machine mastering model. Instead of programming the computer each step of the manner, this approach offers the device commands that allow it to study from facts without new step-with the aid- of-step commands via the programmer. Several troubles need to be considered while addressing AI, including, socio- economic effects; troubles of transparency, bias, and accountability; new makes use of for information, considerations of protection and safety, ethical issues; and, how AI enables the advent of latest ecosystems.

At the same time, in this complicated field, there are specific demanding situations facing AI, which encompass: a loss of transparency and interpretability in selection - making; problems of information satisfactory and capability bias; protection and safety implications; concerns regarding responsibility; and, its doubtlessly disruptive effects on social and monetary structures. Here Machine learning is used with YOLO for the detection specifically of heads, vehicles - two wheelers.

3.3 Methodology

In this paper, YOLOv3 calculates an attempt to do an image grouping to investigate the information dataset about motorcyclists with a helmet or without a helmet. A profound learning technique for picture identification to attempt to discover a biker by not having helmet discovery from the video picture. This exploration has upheld the five-advanced procedure: video and image gathering, image classification, vehicle detection and grouping, image detection examination, and interpretation of result. The entire workflow of the methodology.

3.3.1 Video and Image Gathering

The information datasets were gathered from the asset's dataset of IIT Hyderabad. There are 3 unique recordings utilized. Video Dataset for Helmet Detection in Sparse Traffic from IITH Campus, in Crowded Traffic from Hyderabad City CCTV Network and Hyderabad City Video Dataset for Accident Detection from Hyderabad City CCTV Network. Images were also collected from different sources in different angles.

3.3.2 Classification of Image

The pictures were split into two classes in the wake of gathering 1000 pictures for the examination dataset, one for preparing information and another for test information to be utilized in grouping tests. The system has utilized a 10-crease cross approval analysis for the assessment, where a set up for various test information for 10 percent of the general picture. Preparing systems are prepared with the guide of the Python TensorFlow library; at that point exactness is measured and picks two appropriate models for use in picture recognition. Further it is processed with Google colab to train the data. The Fig 2 below shows the formation of bounding box for classification of object, in this case here, triple rider.
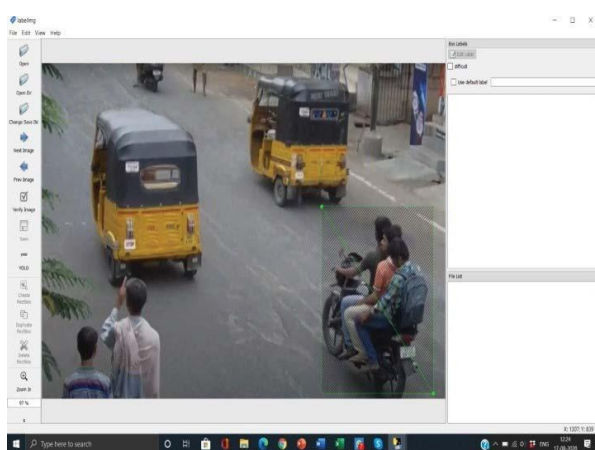

Fig-4: Formation of bounding box

3.3.3 Detecting Vehicle and grouping

a. Vehicle detection

From the beginning YOLOv3 designing was used for two wheelers and individual revelation. YOLOv3 model is a continuous upgrading type of YOLO obtained by J. Redmon

et al. The model is in a circumstance to recognize a colossal game plan of classes, among them only two classes' riders and person's head are taken for disclosure. The bouncing boxes are pulled in to confine the things. The framework predicts 4 headings; bx, by are the inside bearings and bw, bh are width, height independently of the ricocheting box of estimate. The covering zone among vehicles and individuals is taken from the bounding boxes to spot whether the individual is a bike rider or not.

b. Grouping

At that point the Euclidean Distance between the center directions of two jumping boxes of an individual are determined and in this manner the cruiser. On the off chance that the space is inside the jumping box of the bike, at that point it may be inferred that the individual is the rider of that vehicle. Utilizing this procedure, all the number of riders on a motorbike is checked. Number of people is distinguished utilizing the directions from the jumping box. First the bike is identified and inside certain arrangements focuses if the quantity of people is surpassing three then violation comes into picture. For recognizing people and vehicles, the system is using a pre-prepared model.

3.4 Image detection experiment

In this progression, 3 recordings were gathered and were used to attempt to do a picture recognition test utilizing the YOLOv3 calculation that browsed the past advance. All recordings tried and determined the exactness of the biker with or without the helmet and number of people recognized on the bike inside the video. Tallying the quantity of undetected motorcyclists to remember the error percentage.

3.5 Interpretation of the result

In the last advance, the performance is compared with two preceding stages and made the conclusion. The exactness of the investigations will show the exhibition of the procedure as far as in terms of image classification and image detection.
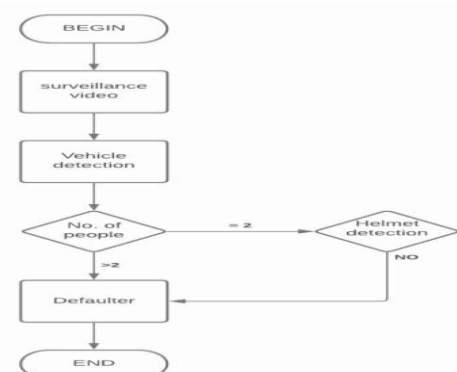

Fig-4: Work flow of methodology

The OpenCV Libraries are used alongside the detection system which contains the predefined functions and data members used for processing images like background subtraction, morphological operations, feature extraction and classification.

4 RESULT ANALYSIS

From prior stages, nearby outcomes for example regardless of whether a two-wheeler rider is using a helmet or notes taken at some stage in that aspect. Be that as it may, till now the association between consistent casings is dismissed. Along these lines, as to downsize bogus alerts, then merge nearby outcomes. This included first, the detection of a bike and afterwards, the individual. After the identification of the bike just the location of the helmet was done on the rider utilizing YOLO. The heads with and without helmets were separated and exhibited in various shaded bounding boxes.

In corresponding with the helmet location program, moreover the rider counter program is executed which utilizes the projection activities and lessen tasks to check the quantity of riders on the vehicle. After calibration of the code, the outcomes acquired are shown in Fig.4, Fig.5 and Fig.6.
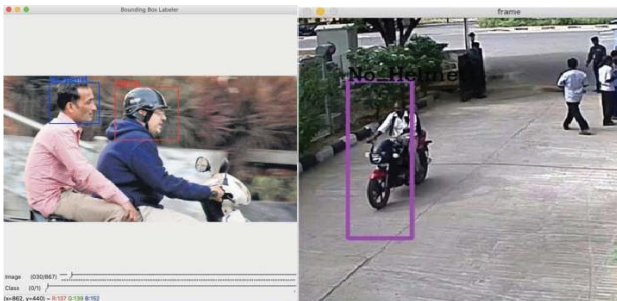

Fig-5: Detection of helmet

Fig-6: Detection of helmet

Fig-7: Detection of triple riders

Objects are detected by a mixture of object locator and an object recognizer. YOLOv3 approaches the thing identification issue in a totally unique manner. It advances the whole picture only one event through the system.

In the first place, it isolates the photo into a 13×13 lattice of cells. The elements of those 169 cells shift depending on the components of the information. For each bouncing compartment, the system likewise predicts the pride that the jumping holder genuinely encases an object, and therefore the possibility of the encased thing being a specific class.

A large portion of those jumping boxes are disposed of due to their certainty which is low or in light of the fact that they're encasing a proportional item as another bouncing box with a very high certainty score. This system is named non-maximum suppression.

5. CONCLUSION

In this paper, a system is proposed for ceaseless identification of traffic rule violators who ride motorbikes without using helmets and also defaulters, who triple ride on the vehicle. A PC vision framework that is isolated into modules like moving items division, moving articles arrangement and helmet use identification will help the traffic specialists to require activity contrary to managing violators. Proposed framework additionally will help the traffic police for such violators in odd ecological conditions like scorching sun, and so on. This framework is regularly stretched out to recognize and report number plates of violators by consolidating this method with programmed vehicle place acknowledgment frameworks by synchronizing various view cameras.

Likewise propelled following calculations are regularly required to deal with impediment. Night-sight cameras are frequently used to utilize the location framework inside the nonattendance of light. In future, bigger quantities of positive and negative examples can be remembered for requests to expand the speculation capacity of the framework. Likewise work with front-end video catch modules.

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