Helmet Detection and Number Plate Recognition using Machine Learning

Gauri Marathe[1], Pradnya Gurav[2], Rushikesh Narwade[3], Vallabh Ghodke[4], Prof. S. M. Patil[5]
[1,2,3,4] *Department of Computer Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India*
[5]*Sinhgad College of Engineering, Pune*

***Abstract*— Motorcycles have always been the primary mode of transportation in developing countries. Motorcycle accidents have increased in recent years. One of the main reasons for fatalities in accidents is that a motorcyclist does not wear a protective helmet. The most common way to ensure that motorcyclists wear a helmet is by traffic police to manually monitor motorcyclists at road junctions or through CCTV footage and to penalize those without a helmet. But it requires human intervention and effort. This system proposes an automated system for detecting motorcyclists who do not wear a helmet and a system for retrieving motorcycle number plates from CCTV video footage. First, the system classifies moving objects as motorcycling or non-motorcycling. In the case of a classified motorcyclist, the head portion is located and classified as a helmet or non-helmet. Finally, the motorcyclist without a helmet is identified. Further we have developed a system which identifies the number plates and extracts the characters of the number plate using OCR algorithm.**

I.INTRODUCTION

Motorcycle Accidents have been rapidly growing throughout the years in many countries. The helmet is the main safety equipment of motorcyclists. However, many drivers do not use it. The main goal of helmet is to protect the drivers head in case of an accident. In such a case, if the motorcyclist does not use a helmet, it can be fatal. It is not possible for traffic police force to watch every motorcycle and detect the person who is not wearing a helmet. There was need to propose an automated system that monitors motorcycles and detects the persons wearing helmet or not and a system to detect number plates.

In India, road accidents are increasing very rapidly and lots of deaths occur due to head injuries as number of people do not wear helmets. To avoid these actions, there is need for a system that automatically detects the people who are not wearing a helmet and a system that detects number plates of the motorcycles and extracts the vehicle number which would help find the motorcyclist to be penalize. By doing this we propose that rate of accidents will reduce and many lives will be saved.

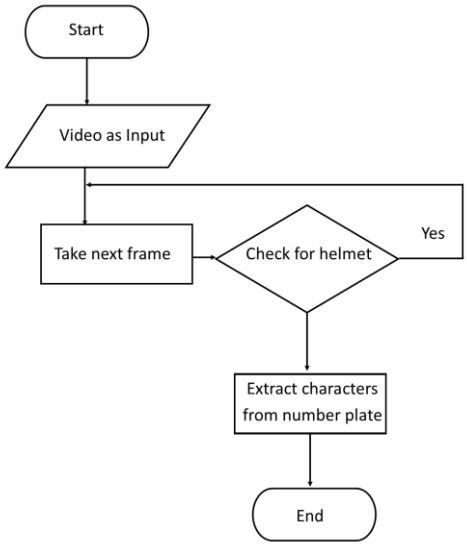
II.RELATED WORK

Sr.No.	Page Title	Authors	Methodology
1	Automated Helmet Detection for Multiple Motorcycle Riders using CNN	Madhuchhanda Dasgupta, Oishila Bandyopadhyay, Sanjay Chatterji, Computer Science Engineering IIIT Kalyani West Bengal, India	First detects riders using Y.OLOv3 and then detects if the rider is wearing helmet or not
2	Helmet and Number Plate detection of Motorcyclists using Deep Learning and Advanced Machine Vision Techniques	Fahad A Khan, Nitin Nagori, Dr. Ameya Naik, Department of Electronics and Telecommunication K. J. Somaiya college of Engineering Mumbai, India	The system uses YOLO to detect if the rider is wearing helmet or not.
3	Helmet Detection Using ML IoT	Dikshant Manocha, Ankita Purkayastha, Yatin Chachra, Namit Rastogi, Varun Goel Department of Electronics and Communication Engineering Jaypee Institute of Information Technology Noida, India	This system first identifies motorcyclists and then checks whether rider and pillion rider are wearing helmet or not using OpenCV and extracts number plate using OCR.
4	Convolutional Neural Network-based	Y Mohana Roopa, Sri Harshini Popuri, Gottam Gowtam sai Sankar, Tejesh	In this system rider with no helmet is detected then respective frame is

	Automatic Extraction and Fine Generation	Chandra Kuppili, Computer Science and Engineering Institute of Aeronautical Engineering, Hyderabad, India	taken and number from number plate is extracted. Then the challan is sent to vehicle owner's number.
5	Improved OCR based Automatic Vehicle Number Plate Recognition using Features Trained Neural Network	Bhavin V Kakani, Divyang Gandhi, Sagar Jani, EC Engineering Department Institute of Technology Nirma University	Thissystemisdedicated on animprovedtechnique ofOCRbasedlicenseplaterecognitionusingneuralnetwork

III.METHODOLOGY

A.Figures



B. Phases of Development

1 Designing a module for functions to detect the helmet in the frame.
2 Designing a module to detect the number plate and extract the vehicle number from frame.
3 Connecting all the modules together and testing the integrity and accuracy of the system.

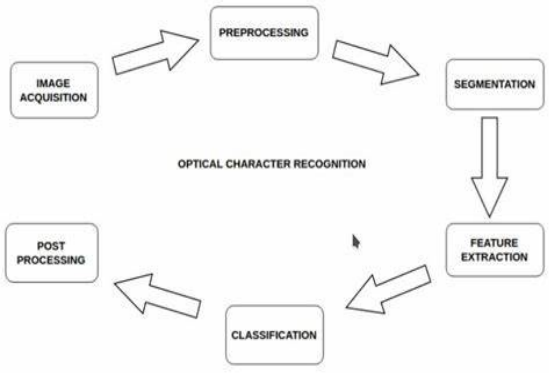
C. Implementation

1 Taking video or camera as input.
2 Taking single frame from that input.
3 Checking if that frame contains a helmet.
4 If the helmet is present then going back to 2nd stage
5 If helmet is not present then giving this frame to the function which detects number plate and extracts characters from it.
6 Repeating this procedure till the input is not empty/null.

D. Impletation Using YOLOv3

The YOLOv3 algorithm first separates a fame into a grid. Each grid cell predicts some number of boundary boxes (sometimes referred to as anchor boxes) around objects that score highly with the aforementioned predefined classes.Each boundary box has a respective confidence score of how accurate it assumes that prediction should be and detects only one object per bounding box. The boundary boxes are generated by clustering the dimensions of the ground truth boxes from the original dataset to find the most common shapes and sizes. The object detection problem is treated as a regression problem in the YOLO algorithm and the image is divided into an S × S grid. If the centre of a target falls into a grid, the grid is responsible for detecting the target.Each grid will output a bounding box, confidence, and class probability map. Among them. The bounding box contains four values: x, y, w, h, (x, y) represents the centre of the box. (W, h) defines the width and height of the box. Confidence indicates the probability of containing objects in this prediction box, which is the IoU value between the prediction box and the actual box. The class probability indicates the class probability of the object, and the YOLOv3 uses a two-class method.

E. OCR



Optical character recognition or optical character reader is that the electronic or mechanical conversion of pictures of written, handwritten, or printed text into machine-encoded text, whether or not from a

scanned document, a photograph of a document, a scene photograph, or subtitle text superimposed on a picture.

1: Acquisition

Obtaining non-editable text content from scanned documents of all types, from flatbed scans of corporate archival material through to live surveillance footage and mobile imaging data.

2: Pre-processing

Cleaning up the source imagery at an aggregate level so that the text is easier to discern, and noise is reduced or eliminated. OCR software often "pre-process" images to boost the chances of recognition.

3: Segmentation and feature extraction

Scanning of the image content for groups of pixels that are likely to constitute single characters, and assignment of each of them to their own class. The machine learning framework will then attempt to derive features for the recurring pixel groups that it finds, based on generalized OCR templates or prior models. However, human verification will be needed later.

There are two main methods for extracting features in OCR:

In the first method, the algorithm for feature detection defines a character by evaluating its lines and strokes.

In the second method, pattern recognition works by identifying the entire character.

We can recognize a line of text by searching for white pixel rows that have black pixels in between. Similarly, we can recognize where a character starts and finishes.

4: Training

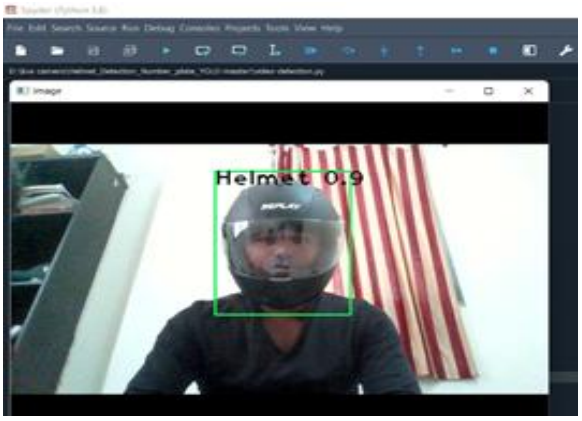
Once all features are defined, the data can be processed in a neural network training session, where a model will attempt to develop a generalized image>text mapping for the data.

5: Verification and re-training

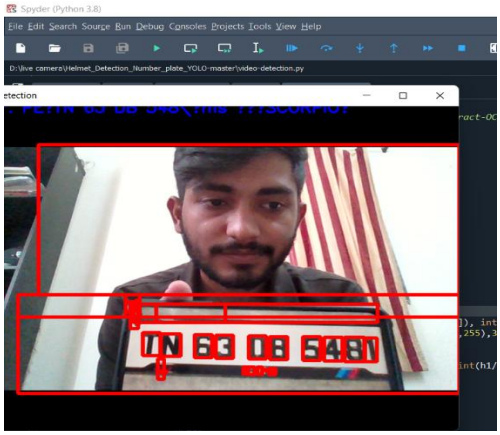
After processing, humans evaluate the results, with corrections fed back into subsequent training sessions. At this point, data quality may need to be reviewed. Data cleaning is time-consuming and expensive, and while initial training runs will perform de-skewing, high contrast processing, and other helpful methods to obtain a good algorithm with minimal pre-processing, further arduous refinement of the data may be necessary. OCR accuracy can be improved if the output is limited by a lexicon (a list of words permitted in a document). For instance, this could be all the words in English, or a more technical lexicon for a particular field. This method can be less efficient if the document contains words that are not in the lexicon, like proper nouns. Fortunately, to improve accuracy, there are OCR libraries available online for free. The Tesseract library is using its dictionary to control the segmentation of characters.

IV.RESULT

When we give the input video wearing helmet, it successfully detects the helmet and shows the confidence score and also it prints "Helmet Detected!" on the console



When the person is not wearing helmet the system searches for the number plate in the frame. Once detected it extracts characters and prints on the console.



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