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Detection System for Motorcyclist Without Helmet Using YOLO Technology

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Detection System for motorcyclist without helmet using YOLO Technology: A Review

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Abstract

In this review paper, we are going through an already existing Automatic Detection System for Motorcyclists without Helmet and also the detection of the license plate. As we know, Two-wheelers are the most useful and popular means of transport. Some reports say that one of the five bike accidents resulted in the death of the motorcyclist due to not wearing a helmet and not following the traffic rules. In this research, we propose an approach of utilizing machine learning algorithms and techniques for the detection of the helmets worn by the motorcyclist and recognition of the license plate of the motorbikes. Our methodology consists of Python-based libraries and frameworks like Tensorflow and OpenCV. For the vehicle classification, we used the Support Vector Machine (SVM) and CNN algorithms for helmet detection. For license plate recognition, Optical Character Recognition (OCR) and You Look Only Once (YOLO) algorithms are used.

Keywords: YOLO, Helmet detection, License Plate detection.

Introduction

In the realm of road safety, the vulnerability of two-wheeler users cannot be overstated. One of the leading causes of fatalities and severe head injuries among these riders is the unfortunate choice to forego wearing a helmet. While two-wheelers remain a highly popular and convenient mode of transportation, they come with a significantly higher risk of head injuries or even fatal outcomes compared to those traveling in enclosed vehicles like cars.

The significance of helmets in averting head injuries cannot be emphasized enough. These safety accessories serve as the first line of defence in a road accident, significantly reducing the likelihood and severity of head injuries. Thus, the introduction of a helmet detection and license plate recognition system represents a crucial step toward promoting safer road practices and protecting the lives of two-wheeler users who might otherwise be at greater risk due to non-compliance with safety measures.

Methodology

This technology uses a variety of approaches to detect helmets and identify license plates. The license plate detection system and the helmet detection system largely employ machine learning and deep learning methods like Support Vector Machine (SVM) and Convolutional Neural Networks (CNN). Tensorflow and OpenCV are only a couple of the Python-based frameworks and tools that are included. For the purpose of recognizing the vehicle's license plate, techniques such as optical character recognition (OCR) and the You Look Only Once (YOLO) algorithm are employed.

1. Literature Research

1.1 Database Selection

Our research process involved a systematic and comprehensive search for academic papers focusing on helmet detection and license plate detection. To access a broad spectrum of relevant studies, we utilized well-established academic databases, namely IEEE Xplore, PubMed, ACM Digital Library, and Google Scholar. These databases are renowned for their extensive collections of scholarly articles, making them reliable sources for academic research.

Our purpose in conducting this search was to assemble a diverse and representative selection of research articles, encompassing various approaches, methodologies, and findings related to helmet and license plate detection. By exploring these reputable sources, we aimed to gain insights from the collective knowledge and expertise of researchers in the field.

1.2 Related Work

Automatic Helmet Detection:

Researchers have used special computer programs called convolutional neural networks (CNNs) to find helmets in pictures and videos. One of these approaches, known as Faster R-CNN, was introduced by researchers like Ren et al. in 2017. It's good at finding helmets accurately and quickly, especially in traffic cameras. This is super important because it helps make sure people on motorcycles are wearing their helmets as required by safety laws.

These methods work by looking at pictures and videos and figuring out where the helmets are. Imagine them as smart detectives who can spot helmets in a crowd. This technology is used in traffic surveillance systems to keep an eye on the road and make sure everyone is staying safe. When it sees someone without a helmet, it can alert authorities to prevent accidents and make sure people follow safety rules. So, these computer programs play a vital role in road safety by detecting helmets effectively.

2. Module Description

2.1 Vehicle Classification

In an Automatic Helmet Detection System, the vehicles under consideration encompass a broad spectrum of motorized and non-motorized modes of transportation. These vehicles serve as the subjects of interest in the context of ensuring compliance with helmet-wearing regulations and enhancing road safety.

1. Motorcycles and Scooters: Motorcycles and scooters are primary targets for helmet detection. These two-wheeled vehicles pose a higher risk to riders in the absence of protective headgear. The system focuses on identifying riders and passengers on these vehicles to ensure they are wearing helmets.

2. Electric Bikes (e-Bikes): With the rise of e-bikes, particularly in urban commuting, the system can extend its functionality to include the detection of helmet usage among e-bike riders, promoting safety in this emerging transportation mode.

3. E-Scooters: In shared micro-mobility ecosystems, electric scooters have become increasingly prevalent. The system can be tailored to identify riders on e-scooters and determine whether they are complying with helmet regulations.

2.2 Helmet Vs Non-Helmet Classifier

1. Input and Processing: The classifier takes in images or video frames captured by surveillance cameras, typically placed at intersections, highways, or urban streets. It uses special computer techniques called computer vision to analyze these images. Its primary goal is to pinpoint where people's heads are in these pictures.

2. Helmet Detection: Using advanced machine learning and deep learning algorithms, the classifier closely examines these identified regions above the shoulders. Its mission is to decide whether there's a helmet on a person's head or not. To do this, it uses state-of-the-art object detection methods such as YOLO or Faster R-CNN, which are good at figuring out what's in pictures quickly and accurately.

3. Real-time Decision-Making: The beauty of this classifier is that it works superfast. It can make instant decisions about whether someone is wearing a helmet or not. This speed is crucial because it allows for immediate action. For example, if it detects someone without a helmet, it can trigger alarms or alerts in traffic systems or even notify the police.

4. Integration: The Helmet vs. Non-Helmet Classifier seamlessly fits into the License Plate Detection System. This means that when it spots someone not wearing a helmet (non-compliant), this information can be linked with license plate data for further action.

2.3 License Plate Recognition

License Plate Recognition, or LPR for short, is a smart technology that helps machines read the numbers and letters on vehicle license plates. It's like having a computer that can understand what's written on a license plate. People use LPR in many ways, like in traffic cameras, parking lots, and security systems.

License Plate Recognition is like having a super-smart camera that can understand license plates on its own. It helps with things like parking, security, and making sure the roads are safe.

2.4 Alert Generation

The Automatic Detection System first detects the motorcycle vehicle and then checks whether the

motorcyclist is wearing a helmet or not. If the motorcyclist is found without wearing a helmet, then the system detects the license plate of the vehicle. The R.TO. Officer then sends a bill that the motorcyclist has to pay as a fine to the address of the registered license plate holder and an alert message is also sent on the user's cell phone number which is registered on the license plate.

3. Conclusion

In conclusion, automatic helmet detection and license plate detection systems play a crucial role in making our roads safer and more efficient. They help ensure that people wear helmets, promoting responsible riding and reducing accidents. Additionally, these systems assist law enforcement by identifying vehicles and ensuring compliance with regulations.

With advancements in AI, we can expect these systems to become even more accurate and reliable, further enhancing their effectiveness. In summary, automatic helmet detection and license plate detection are vital tools for enhancing road safety and law enforcement, and their prospects are promising.

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