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Course code : CSE418

Course Title : Scientific Research & Methodologies.

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Topic : Summary of research paper's studied.

Date of Submission : 24 September, 2024.

Paper 01 :

Title : Design and Implementation of an Automated Car Plate Number Recognition System (ACPNRS).

Purpose:

The purpose of this paper is to develop a system that automates the recognition of car license plates in real-time to improve traffic management, enhance security, and support law enforcement activities. The system is designed to be scalable, capable of recognizing different license plate formats across various countries, and adaptable to changing environmental conditions such as low light and harsh weather.

Languages and Methods:

- **Languages:** it relies on advanced image processing techniques.
- **Methods:** The methods include **image preprocessing**, **spectral analysis**, **character segmentation**, and **Optical Character Recognition (OCR)** to capture and analyze license plates. Machine learning, particularly **deep learning**, is employed for recognition, leveraging Region-based CNNs (R-CNNs) and image processing algorithms such as "**Canny edge detection** and **morphological operations"**.

Limitations:

The system faces limitations in processing time, particularly when handling large datasets or dealing with non-standard license plates. Environmental challenges such as **glare**, **shadows**, and **poor lighting** can affect the accuracy of the recognition. Scalability is another limitation, especially in handling varying license plate formats and increasing traffic volumes.

Future Trends:

The future direction involves improving the system's ability to handle **non-standard license plates**, increasing scalability, and integrating more advanced deep learning models. The researchers also suggest exploring **hardware acceleration** (like GPUs/TPUs) to improve real-time recognition performance and adopting cloud-based solutions for better data management.

Work Done:

The system was tested under real-world conditions with a focus on handling **various lighting conditions**, **camera angles**, and **environmental factors**. It demonstrated promising results, particularly in terms of character segmentation and recognition accuracy.

Paper 02 :

Title : Traffic Violation Detection System.

Purpose:

The aim of this research is to develop a Traffic Violation Detection System (TVDS) that automatically detects various traffic violations, such as illegal parking, lane cutting, U-turn violations, and speeding, in real-time. The system aims to curb traffic violations, reduce accidents, and assist in corruption-free fine management.

Languages and Methods:

- **Languages:** The system was developed using Python for edge server operations.
- **Methods:** The paper uses YOLOv5 for real-time vehicle detection and DeepSORT for tracking vehicles across video frames. It integrates computer vision techniques for license plate recognition, backed by deep learning models for object detection and tracking. The system also incorporates a centralized server for violation reporting and an SMS-based fine management system.

Limitations:

The paper acknowledges limitations such as the inability to detect violations in low-light conditions without special preprocessing. The system struggles with poor image quality due to camera angle changes or motion blur. Another limitation is in scalability, where the system's processing power might not be sufficient for large-scale deployment in heavy traffic areas.

Future Trends:

Future improvements include enhancing the system's accuracy in detecting violations at night and integrating hardware-based solutions such as edge devices for localized detection. The researchers also suggest the integration of 3D bounding boxes for more accurate vehicle tracking and violation detection, particularly in congested environments.

Work Done:

The system was implemented and tested using a custom vehicle dataset in Sri Lanka. It effectively detected multiple types of traffic violations in real-time and sent violation notifications via SMS. The system showed significant potential for reducing traffic accidents and improving law enforcement efficiency.

Paper 02 :

Title : Automatic Vehicle Number Plate Recognition System Using Machine Learning.

Purpose:

The goal of this paper is to propose a smart vehicle detection system using **machine learning** that can automatically recognize vehicle number plates from digital images. The system is designed to improve vehicle management, reduce human error, and enhance efficiency in various applications such as parking lots, toll collection, and traffic management.

Languages and Methods:

- **Languages:** The system uses **Python** for model training and testing.
- **Methods:** The key methods include **image acquisition**, **grayscale transformation**, **bilateral filtering**, and **morphological operations** (such as erosion and dilation) to process the image and detect the number plate. The paper employs **Optical Character Recognition (OCR)** for character recognition from the segmented images. The algorithm utilizes **image desaturation** and **thresholding** to facilitate plate detection.

Limitations:

The existing system faces several limitations, including:

- **High manpower requirements** for manual vehicle recognition.
- **Costly and error-prone** due to reliance on human effort.
- **Lower performance** when compared to automated systems.
- **Time-consuming** processes and dependency on human intervention. These drawbacks highlight the inefficiency of traditional vehicle identification methods.

Future Trends:

Future improvements focus on integrating **face recognition** and linking the system with criminal databases to detect wanted criminals via their vehicle. Another direction is to enhance real-time performance, scalability, and reduce dependency on high-powered hardware by optimizing algorithms and incorporating **edge computing**.

Work Done:

The system was implemented using a combination of image processing techniques and trained machine learning models. The paper documents the use of **grayscale conversion**, **image segmentation**, and **character recognition** to accurately detect number plates from images. Results are presented via a **Graphical User Interface (GUI)**, demonstrating the effectiveness of the trained model in identifying and logging vehicle details.