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Progress in Computing and Mathematics Journal
College of Computing, Informatics, and Mathematics
Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin
77300, Merlimau, Melaka Bandaraya Bersejarah

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EDITORS

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PREFACE

Welcome to the inaugural volume of the **Progress in Computing and Mathematics Journal (PCMJ)**, a publication proudly presented by the College of Computing, Informatics, and Mathematics at UiTM Cawangan Melaka.

This journal represents a significant step in our commitment to fostering a vibrant research culture, initially providing a crucial platform for our undergraduate students to showcase their intellectual curiosity, dedication to scholarly pursuit, and potential to contribute to the broader academic discourse in the fields of computing and mathematics. However, we envision PCMJ evolving into a beacon for researchers both nationally and internationally. We aspire to cultivate a space where groundbreaking research and innovative ideas converge, fostering collaboration and intellectual exchange among established scholars and emerging talents alike.

The manuscripts featured in this first volume, predominantly authored by our undergraduate students, are a testament to the hard work and dedication of these budding researchers, as well as the guidance and support provided by their faculty mentors. They cover a diverse range of topics, reflecting the breadth and depth of research interests within our college, and set the stage for the high-quality scholarship we aim to attract in future volumes.

As editors, we are honored to have played a role in bringing this journal to fruition. We extend our sincere gratitude to all the authors, reviewers, and members of the editorial board for their invaluable contributions. We also acknowledge the unwavering support of the college administration in making this initiative possible.

We hope that PCMJ will inspire future generations of students and researchers to embrace research and innovation, to push the boundaries of knowledge, and to make their mark on the world of computing and mathematics.

Editors
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AUTOMATED HELMET AND PLATES NUMBER DETECTION USING DEEP LEARNING

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Abstract

The increasing use of motorcycles and the corresponding rise in related accidents, particularly among riders not wearing helmets, necessitates an efficient and cost effective solution for helmet detection. Despite the existence of laws mandating helmet use, enforcement remains a challenge due to the need for manual human assistance in monitoring compliance. This study aims to address this issue by 1) designing a system capable of detecting motorcyclists not wearing helmets and identifying their license plate numbers, 2) developing an automatic detection system using ResNet50 and EasyOCR, and 3) testing the functionality and accuracy of the developed system. The system was trained using a dataset of 500 images sourced from Kaggle, featuring riders both with and without helmets. The application of ResNet50 and EasyOCR demonstrated significant performance in recognizing helmets and license plates across various scenarios. The results indicate that the helmet detection model using ResNet50 has achieved a significant performance with a 90% accuracy rate in recognizing helmets and license plates. Despite certain limitations, this project opens avenues for future research to refine further and advance detection systems, ultimately benefiting users in monitoring and enhancing their safety on the road.

Keywords: Motorcycle safety, helmet detection, ResNet50, EasyOCR, automatic detection system, license plate recognition, road safety, enforcement, accident prevention.

INTRODUCTION

Licence plate recognition is a crucial and commonly utilised component of contemporary intelligent transportation systems. The analysis of the vehicle picture or video sequence taken

by the camera is based on digital image processing, pattern recognition, computer vision, and other technologies. The identification procedure is finished by obtaining each vehicle's individual number plate number (Han & Bo, 2021). Motorcycles being one of the most convenient modes of transport has led to increasing use and thus accounts for the highest share of total road accidents. As per one survey carried out in the year of 2014, 30% of all road accidents related to deaths were of riders on two-wheelers. Also, as per the record of Chennai, India, between the period of January 1, 2013, to June 28, 2015, total 1,453 two-wheeler riders who died in road accidents were not wearing helmet (Mistry et al., 2018).

Nowdays, Most countries have laws requiring motorcyclists to wear helmets to solve this problem. Although this rule has been gazetted, they continue to find ways to avoid traffic and try not to be stopped by enforcement. Because of this, there is a need for efficient law enforcement, which requires more workers and costs time and money. Some governments have installed special sensors to determine whether motorcyclists are wearing helmets. However, buying a sensor for every motorcyclist is too expensive. Although widely used for surveillance 1 purposes, CCTV still requires automated manual human assistance.(Aashik Mathew et al., 2023)

Problem Statement

Due to rising population and human requirements, motorbike use has significantly expanded in Malaysia nowadays. Malaysians have bought a wide variety of motorcycles as a result. In recent years, there have been many alternative styles for each motorcycle plate. Besides that, the negligence of not wearing a helmet by motorcyclist is a most important factor and most of the head injuries such as trauma to the brain and skull are due to the motorcycle riders not wear a helmet. In the past few decades, most of the accident deadth reason is injuries in the head. Helmet wearing is also compulsory as per traffic rules for motorcycle riders, violation of this rule effect a massive fine. But unfortunately, there is a large number of motorcyclist that not obey this rule (Afzal et al., 2021).

Many motorcyclists still refuse to wear a helmet, even though it is made mandatory by the law. The number of motorcyclists on the road is also very high, preventing law enforcement personnel from enforcing the rules effectively. Manually monitoring every single motorcyclist on the road is time-consuming and costly. This problems opens up an opportunity for research in the area of helmet detection (Sugiarto et al., 2021).

This, an automated system that can automatically detect and recognize number plates and helmets of motorcyclists is in need. Therefore the study proposed to develop a smart system that can be detect and recognize number plates and helmets of motorcyclist using ResNet50.

Objective

The objectives for this project are:

1. To a system which can detect the motorcyclist that did not wearing helmet and the plate numbers of the said motorcycle
2. To develop a system that can automatic detect of number plates and helmet motorcyclist using Resnet-50
3. To test the functionality and testing of the developed helmet and number plates detection system.

Project Scope

The project entails creating a system based on the ResNet50 algorithm, integrating it with current traffic surveillance cameras, and testing and assessing the system's precision, dependability, and effectiveness in locating and tracking motorcycle riders without helmets. The project's scope is restricted to creating a software system it excludes creating the system's necessary hardware. The project's focus is on enhancing road safety by automatically detecting traffic violations relating to helmet use and number plate identification..

Project Significance

Deep learning-based automated helmet and licence plate identification offers the benefit of teaching the general population to be more obedient in wearing helmets, ensuring their safety, and adhering to legal requirements. By using this technology, people are more likely to understand the value of wearing helmets after seeing how the automated detection process works. This acts as a reminder and promotes adherence to safety precautions. By encouraging a safety culture and respect for established standards, the system's capacity to precisely determine whether a biker is wearing a helmet fosters a sense of accountability among riders. The automatic detection system ultimately serves as an instructional tool, increasing public awareness and promoting responsible behaviour, which helps to create a society that is safer and more orderly.

The capacity of deep learning to lower the incidence of fatal accidents or accidents that seriously harm motorcyclists is in addition to its automatic helmet and number plate detection. This technology can shift the culture among motorcycle riders to prioritise safety by raising awareness and enforcing compliance with helmet use. The technology can properly determine whether the rider is wearing a helmet, thanks to automated detection. This increases riders' understanding of donning a helmet as a fundamental safety measure. Because the right helmet can shield the rider from the risk of suffering significant injuries in the case of an accident, it is possible to reduce the number of fatal accidents and serious injuries. This technology's capacity to lower injuries by promoting consistent helmet use will improve road safety statistics and make motorcycle riders safer.

LITERATURE REVIEW

The literature review and relevant studies from the same field of study will be covered in this chapter. Additionally, studies and information on licence plate recognition are provided. Additionally, this review aims to have a deeper comprehension of the subject. These literature reviews include several sections that will be discussed, including those on licence plates, helmets, camera, image processing, licence plate recognition (LPR), and method comparisons.

License Plate

A little metal or plastic plaque with the vehicle's number plate number is used for official identification. Usually supplied in pairs, licence plates are attached to the front and rear of the vehicle as shown in Figure 2.1. Additionally, the number plate has an alphanumeric number on it that is assigned specifically to the vehicle. Private motor vehicle licence plates in Malaysia must all have a white background with black characters (digits and letters) that adhere to the standards set by the Malaysian Road Transport Department as can be seen in Figure 2.2tourism services. Tourism-related activities, locations, entities (people, places, devices, and items), time, and the environment are an instance of contextual information. Every car registered in one of Malaysia's states will have a licence plate that starts with the state's identifying character, such as Kuala Lumpur plate character (Figure 2.3) that has start with letter “W”. Moreover, for the state of Kelantan it will start with the characters “D” (Figure 2.4)

Deep Learning

Artificial neural network (ANN)-based deep learning techniques are a subfield of machine learning inspired by the brain's structure and operation. Deep learning is known to experts in this field, and this perspective provides extensive explanations of deep learning (Brownlee, 2019). A system employing ANN and deep learning is similar to the human brain. Image recognition is a use case for ANNs. According to Geoffrey Hinton, "he may have started using the word "deep" to describe the growth of massive artificial neural networks. Then great neural learning was developed in order to describe ANN. One of the reasons deep learning is employed is due to the superior results obtained.

Under the umbrella of artificial intelligence is deep learning. In the 1970s and 1980s, the system began the application of artificial intelligence in the compilation process. In order to gain particular spectral features and improved grouping possibilities, specialised camera technology is utilised. This ultimately results in improved AI accuracy. Because of this, it will be feasible to categorise each pixel's composition according to its spectrum (Flemming and Balthasar, 2019).

Sh

The distance between shopping places in Malaysia is crucial in facilitating tourists' choices based on their preferences. By providing information about the proximity of shopping destinations, tourists can plan their itinerary more efficiently, considering factors such as travel time. This approach aligns to enhance the overall tourist experience and optimize the time spent exploring different areas. (Patwary, 2020) argued that understanding the spatial distribution and distances between shopping places is vital for tourists to make informed choices and navigate efficiently. This information contributes to a more seamless and enjoyable travel experience.

Residual Network (ResNet)

In Convolutional Neural Networks (CNNs) have significantly surprised the computer vision community and have improved state-of-the-art outcomes in many computer vision applications. Deeper and deeper CNNs have been proposed since AlexNet's groundbreaking triumph at the ImageNet Large Scale Visual Recognition Challenge 2012, and they have improved performance on ImageNet or other benchmark data sets. The outcomes of these

models demonstrated the significance of network depth, since deeper networks produce better outcomes (Zhang et al., 2018).

Residual networks (ResNets) won the state-of-the-art performance prize for classification, localization, detection, COCO detection, and segmentation tasks at the ILSVRC 2015 with a sharp rise in depth.

However, overfitting issues and vanishing gradients will affect very deep models. As a result, thousand-layer ResNets perform less well than hundred layer ResNets. Then, by using BN-ReLU-conv order, Identity Mapping ResNets (Pre-ResNets) made it easier to train residual networks. PreResNets can solve the vanishing gradients issue, which will enhance the performance of thousand-layer PreResNets even further. The vanishing gradients problem was addressed by wide residual networks (WRN), which increased width while reducing depth.

However, the overfitting issue is made worse by the exponentially growing number of parameters that larger networks bring. Because of this, dropout and drop-path methods are frequently employed to alleviate overfitting, and stochastic depth (SD) residual 14 networks, which can increase test accuracy and shorten training times, are the leading way on ResNets. All residual networks share a common foundation: they execute residual mapping fitted by stacked nonlinear layers employing shortcut connections, which makes it simpler to optimise than the original mapping. The residual mapping of the residual mapping, according to our hypothesis, is simpler to optimise than the original residual mapping. In order to improve performance, we can build a better residual network design on top of this theory (Zhang et al., 2018)., 2020).

METHODOLOGY

The waterfall development model was used to create this application. The waterfall model divides project activity into several phases, which are consecutive and linear. This model is characterized most frequently by the fact that each phase depends on and relates to the previous phases. Due to its straightforward and sequential paradigm, which allows for step-by-step development toward the project's objective, this is extensively employed. The drawback of this paradigm is that any changes made to one phase will impact the phases that follow it. Due to this drawback, this model is not the best choice for projects requiring several adjustments and revisions because it will take much time. Structured or waterfall analysis and

design The development process is broken down into sequential steps in the model, and the program that manipulates the data will be kept separate from the data used in the system. Additionally, it has strict development stages that include requirements for the system and software, analysis, program design, coding, testing, and operating (Imanuel et al., 2022).

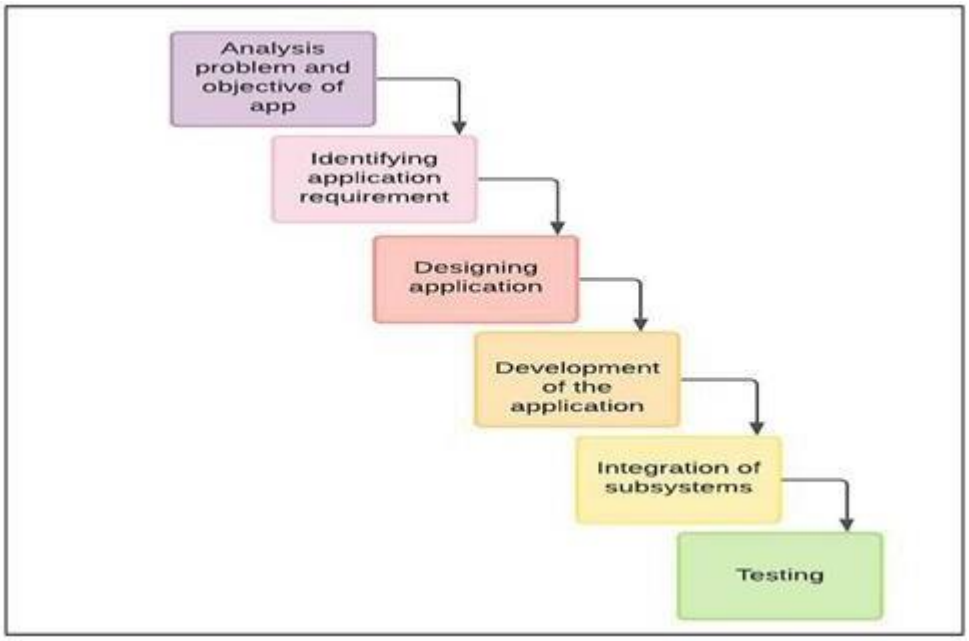

Figure 1: Modified Waterfall Model

RESULT AND DISCUSSION

The Automated Helmet and License Plate Number Detection system has effectively accomplished its objective by designing, developing, and evaluating a deep learning-based detection system. Utilizing the ResNet-50 model, the system exhibits remarkable performance in identifying helmets and license plates across diverse scenarios. Despite inherent limitations, this project paves the way for future research aimed at refining and advancing detection systems, ultimately contributing to improved road safety (Aashik Mathew et al., 2023). The chapter elucidates the comprehensive design and development process of the system, encompassing hardware and software requisites, system flowchart, algorithmic design, interface development, and implementation (Afzal et al., 2021). By harnessing the capabilities of ResNet-50 for image recognition and EasyOCR for optical character recognition, the system offers a holistic solution for real-time detection of helmets and license plates. The user-friendly

web interface facilitates seamless interaction, ensuring effective monitoring and compliance with safety regulations.

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