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MALAYSIAN SIGN LANGUAGE DETECTION USING SSD REAL-TIME OBJECT DETECTION

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ABSTRACT

Sign language is a natural, visually focused, nonverbal communication channel that enables communication between individuals using facial or physical emotions, postures, and a set of gestures. It is mostly used to communicate with individuals who are deaf or have a hearing impairment. There are several sign languages around the world, just as there are various spoken languages. Malaysian Sign Language is one of them. However, sign language is not compulsory for us to learn, yet some people do not even recognize sign language. This makes it difficult for individuals with disabilities to communicate with others. Thus, this application is developed to overcome the latter issue. By using this application, users will be assisted to identify the sign language; the application acts as the bridge in closing the gap between the disabled and normal individuals in communicating with each other. Single-shot detector (SSD) Algorithm is implemented to perform the detection. The project used the TensorFlow Lite Model Maker library to simplify the process of training a TensorFlow Lite model using a custom dataset. This project utilizes the Agile framework in project development. The result shows that this project achieved a detection accuracy of 75.2%.

Keywords: Hearing Impairment, Object detection, Sign Language, Single-shot detector (SSD)

1. INTRODUCTION

Communication is necessary in our daily life. It is the interaction between two parties known as the sender and the receiver. Communication between both parties is needed to guarantee that the message conveyed is correctly perceived by the receiver. Most people can interact effectively without any problems compared to those who have disabilities. Disabled individuals neither hear nor talk, making the world a difficult environment for them to survive. For the disabled, even fundamental things become challenging. Human disability is a sensitive issue. It restricts the person to a particular degree of performance. Being profoundly introverted, lacking in education, and struggling to deal with deafness has caused the issue to be pushed to oblivion. This society requires empowerment in an unequal world.

Sign language is a common communication tool that is used by people who have a hearing impairment to perform daily interactions. Sign language is not compulsory for us to learn, yet some people did not even recognize the sign. This makes it difficult for individuals with disabilities to communicate with others (Sanmitra et al., 2021). Since numerous countries have distinct sign languages, it means that there are many sign languages in the world. Sign language was created by people who have hearing impairment based on their native culture and it was

strongly inspired and translated from the spoken language (Asri et al., 2019). Generally, sign language is divided into two parts; hand posture, which is expressed by the position and arrangement of the fingers and hand gesture, which then is conveyed by the movement trajectory of the hand (Yi et al., 2018). In addition, sign language has five basic parameters: hand form, hand orientation, movement, placement, and emotion, as well as non-verbal communications. All five of these parameters must be practiced correctly in order to have an accurate sign word (Rastgoo et al., 2021).

Statistics show over nine billion individuals worldwide have hearing impairment. There are around 2.8 million people with this disability in Malaysia (Shukor et al., 2015). If the public purposely takes this communication medium for granted or unwilling to acknowledge it, there will be miscommunication between the two parties which may lead to more difficult situations considering it will always be the barrier for those who possess no knowledge about the language. Therefore, the inability of special needs persons to communicate with persons of the hearing society might lead to a loss of sociability (Rastgoo et al., 2020). Thus, this application is proposed to overcome this issue. This application will help users to identify the sign language so it will be the bridge to close the gap between the disabled and normal individuals in communicating with each other.

2. FINDINGS

The era of Industrial Revolution (IR) 4.0 has changed the world in unimaginable ways. Communication technology has a huge impact on humans. No one should be constrained by his or her limitations in the technological age. Despite human nature, the application of technology should result in a platform or a society where everyone is treated equally. Technology represents the most inventive thing there is since every time the clock strikes, researchers, software engineers, programmers, and information technology professionals come up with new, brilliant ideas to make life easier for everyone. This application demonstrates the way Artificial Intelligence (AI) is used to assist individuals who are not able to carry out daily tasks like most people. In order to meet its purpose for effective communication, this program makes it possible for those who are unable to talk or hear to be completely understood, allowing them to acquire their language more quickly and easily for themselves and those who would communicate or interact with them. With the help of this method, everyone can recognize the intricate sign languages that are presented. The application is designed to show the potential it can accomplish and help those who struggle to achieve effective communication because of the impairment.

3. METHODOLOGY

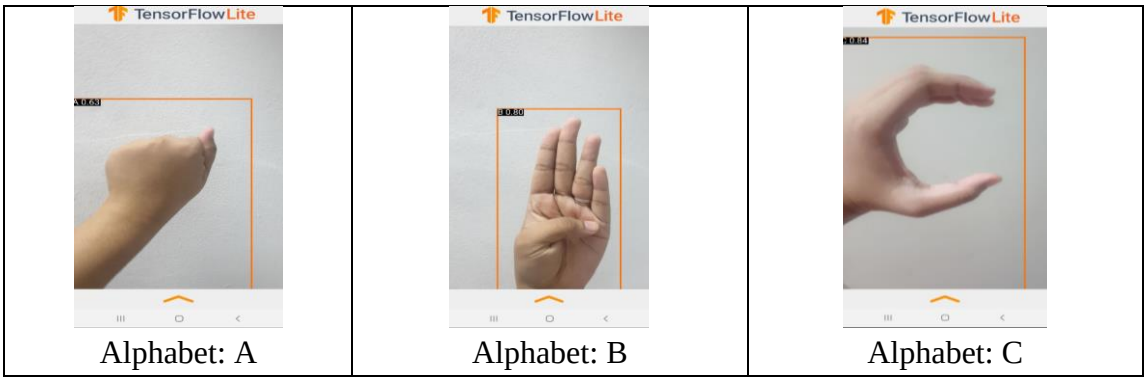
In this project, a real-time sign detection model was built with the help of LabelImg software and TensorFlow. The system architecture is divided into two models which are training and detection models. The Training model comprises labelled and trained dataset. The Detection model will then be used in testing the data. The data obtained from Kaggle and an XML file is

produced for each image once it has been labelled and saved as training and testing data. During the development phase for training and testing data, this XML file includes information on where the model should look in the image. The system will begin to operate by accepting real-time input of a sign language image. Then, the training period starts, with the system extracting features from the required image using the SSD algorithm. Finally, after the model has been trained, the Sign Language Detection stage may follow.

The performance of the model is determined by testing it against the project or problem requirements. In this application, the deep learning SSD machine learning algorithm is used to train the machine learning model and the TensorFlow Lite Model Maker is applied to test it. The TensorFlow Lite Model Maker library simplifies the process of training a TensorFlow Lite model using a custom dataset. It uses transfer learning to reduce the amount of training data required and shorten the training time.

4. RESULTS

Accuracy tests were performed to evaluate the performance of the Sign language detection application in detecting and recognizing sign language. The study tested the accuracy of the developed algorithm using five sign language classes ranging from A to E. The result of the detection is evaluated using Average Precision (AP) in COCO evaluation metric. AP is average of precision. The AP is averaged across all categories. Traditionally, this is referred to as mean average precision (mAP). Thus, the mAP obtained for this project is 0.752. This shows that the average precision of the system detection and recognition is mostly accurate. Figure 1 shows the Application Interface Design for Malaysian Sign Language Detection using SSD Real-Time Object Detection.



Alphabet: A | Alphabet: B | Alphabet: C

Figure 1 Application Interface Design

5. CONCLUSION

The application is developed to translate sign languages into a form that users can easily understand. Consequently, it will benefit people who have hearing impairment and also individuals who do not have a background in sign language to easily communicate with each

other. In terms of the detection accuracy, the application achieved a maximal performance in detecting sign language at a percentage of 75.2%. Besides, due to the capability of identifying gestures, there is a lot of potential for this application where we can label the gestures in whatever languages needed, thus enabling the users to communicate with others regardless of the language barriers.

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