

MYsign: Malaysian Sign Language Recognition System

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Abstract: Sign language is an important tool used by the impairment people as their communication tool. It utilizes hand articulation, face expression and body movement to convey message. However, there were scarce people in the society capable to communicate with these impairment people due to little knowledge about sign language. Hence, this creates barrier for them to do communication in their daily activities. In addition, although there exists a computerized sign language translator but it is very limited to American and British sign languages. This creates an opportunity to develop a Malaysian Sign Language recognition system. Henceforth, this project aims to develop a Malaysian Sign Language (MSL) recognition system namely "MYsign: Malaysian Sign Language Recognition System" that can recognize Malaysian Sign Language. This project was developed using the Deep Learning technology utilizing the Long-Short Term Memory (LSTM) algorithm to train the model for detection and recognition of the hand gesture. "Assalamualaikum", "Walaikumsalam", "Terima Kasih", "Sama-Sama", and "Maaf" were five classes of basic communication in Malaysian Sign Language that will be covered for this MYsign system. A total of 200 real-time videos from all classes were used to train the developed system. Additionally, system testing was done to evaluate the precision of the MSL basic communication sign language detection and recognition. Based on the testing result achieved, it is proved that the developed MYsign system is capable to perform good recognition.

Keywords: sign language; Malaysian Sign Language; face recognition; body movement, Deep Learning



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1. INTRODUCTION

Sign language is a non-verbal communication that uses hand articulation, facial expression and body movement to convey meaning instead of using spoken words (Josué Espejel-Cabrera, Jair Cervantes, Farid García- Lamont, José Sergio Ruiz Castilla, Laura D. Jalili, 2021). This language is mainly used by people with speech or hearing impairment. Deaf and mute communities communicate among themselves using sign language. Sign languages, like all languages, contain linguistic rules that underpin the structure of words and sentences. A lexicon, grammatical and derivational morphology, phonology, syntax, and semantics are all present in all sign languages (Squires, 2006). Although sign language is the main communication tools for these group people, but there were few people knows this language (Haris Al Qodri Maarif, 2012). This situation is worsening as the number of normal people who understand sign language is very low. These factors contribute to communication issues between normal individuals with deaf andmute people (Haris Al Qodri Maarif, 2012).

Nowadays, the execution of computer-based system has speed up many processes including in security, education and business sectors (Myeongsuk Pak, S. K., 2021). Machine Learning and Deep Learning technologies are among the promising techniques that being adopted into these areas with

the aim to provide robust and efficiency computation in solving many daily lives problem. Hence, there is a good opportunity to develop a computational based system for recognizing sign languages specifically Malaysian Sign Language (MSL). In addition, the developed system is believed to offers a platform that will ease a wide variety of people to communicate with deaf and mute people. The robustness and precision offer by Deep Learning technologies can be used to recognize sign language. Deep learning can automatically learn features from data, which is often beneficial when a large amount of training data is available for issues involving inputs such as photos (M. A. Hossen, 2018).

Henceforth, the goal of this project is to develop a computer-based system that can recognizes Malaysia Sign Language namely, "MYsign: Malaysian Sign Language Recognition System". The Deep Learning based technique, Long-Short Term Memory (LSTM) algorithm is proposed to be used in developing the system. This paper is outlined as follows. Section 2 will discuss on the Method and Material. Following, Section 3 and 4 will deliberates on Findings and Conclusion respectively.

2. METHOD & MATERIAL

This section discusses the method and material proposed for this study. It will be divided into two parts which are the Dataset and the MYsign System Development. Further elaboration is as following.

2.1 Dataset

This section presents the dataset for this project. This project requires data in the form of videos of MSL hand gestures while displaying various signs in front of a webcam. The dataset used is a secondary data, which means that it must be self-collected of different MSL. The process for collecting the MSL dataset is presented in Figure 1.

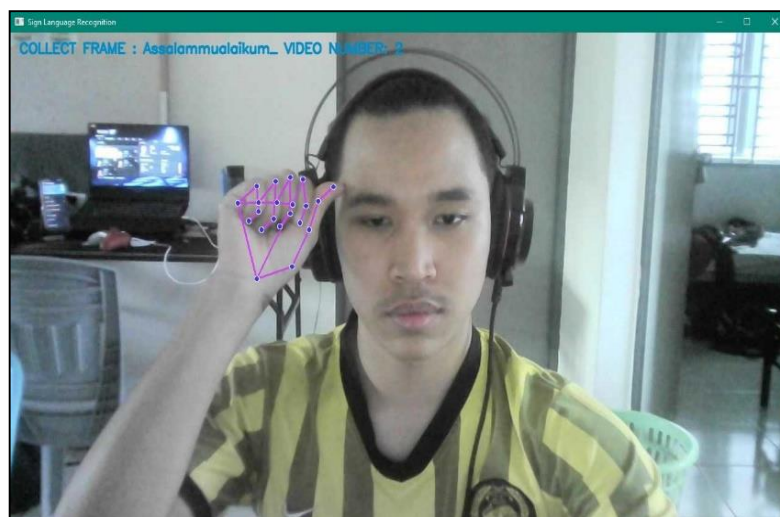


Figure 1: Process of Collecting MSL dataset.

"Assalaamualaikum", "Walaikumsalam", "TerimaKasih", "Sama-Sama", and "Maaf" were the five classes of MSL that have been chosed for basic communication. Each video is 30 frames long, which isequivalent to 3 seconds. For each class, 40 videos of MSL were collected with total of 200 videos for all classes and from 200 videos, 30% of it will separated for testing which make 140 videos from all classes for training and 60 videos from all classes for testing part to developed a new model that would be used for the detection and recognition process

2.2 MYsign System Development

This section will discuss in further the process involved throughout the development of MYsign System. To represent the functionality of the MYsign system, a Use Case diagram is constructed. Based on the Use Case diagram defines, the system should provide a system interface, capture sign language gestures from continuous real-time video by using a webcam, classify the sign language recognition that has been collected, and would calculate the accuracy of the system. Furthermore, the user would be able to use the sign language recognition system to translate the meaning of the sign language and also be able to view the translation of the sign language in form of text as the output of the translation. Figure 2 shows the proposed Use Case diagram for the system.

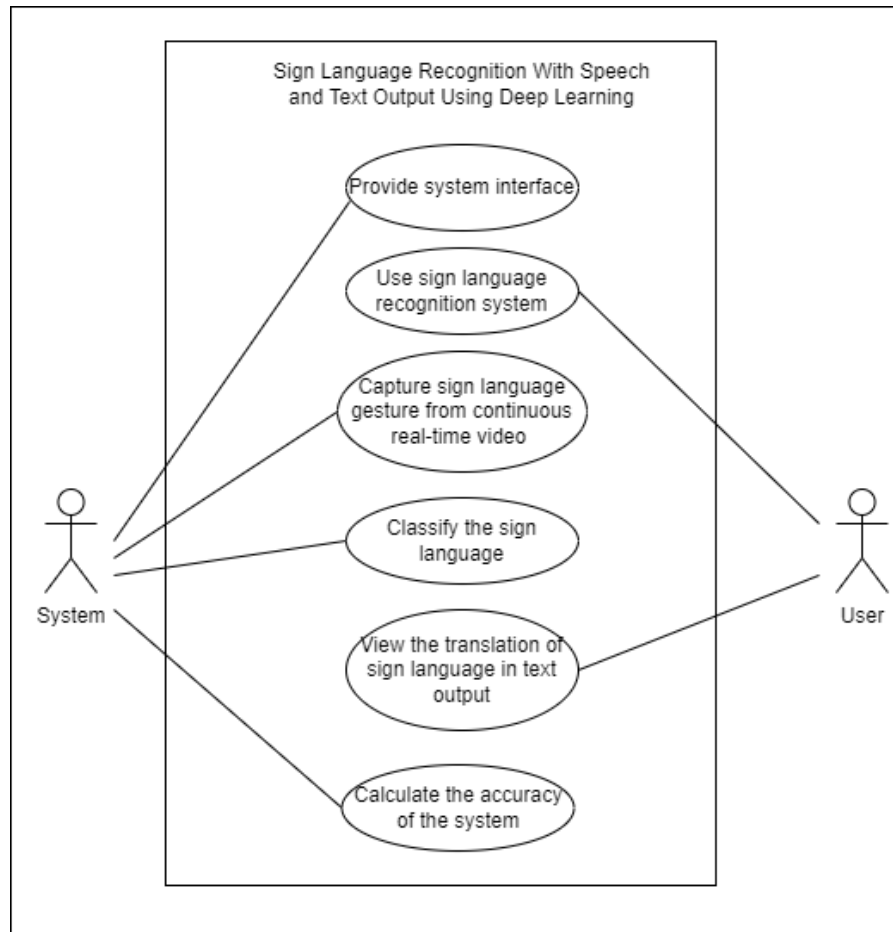


Figure 2: Use Case Diagram for MYsign System.

Next, the LSTM algorithm is implemented to developed the system. To begin the development, libraries and dependencies, as well as class label and the data store location, the Tensorboard log directory need to be execute and output file from the training session that contain the weight of trained LSTM model need to be load into the system. For the purpose of training the LSTM model, the Tensorboard log directory for this LSTM machine learning training need to be identify. This log directory was used to monitor the machine learning performance and accuracy as it is being trained. Figure 3 and 4 show the snippets of LSTM code.

```

1 model.fit(X_train, y_train, epochs=300, callbacks=[tb_callback])
5/5 [=====] - 0s 31ms/step - loss: 0.0512 - categorical_accuracy: 0.9868
Epoch 109/300
5/5 [=====] - 0s 31ms/step - loss: 0.0163 - categorical_accuracy: 0.9963
Epoch 110/300
5/5 [=====] - 0s 31ms/step - loss: 0.0056 - categorical_accuracy: 1.0000
Epoch 111/300
5/5 [=====] - 0s 31ms/step - loss: 0.0054 - categorical_accuracy: 1.0000
Epoch 112/300
5/5 [=====] - 0s 31ms/step - loss: 0.0123 - categorical_accuracy: 1.0000
Epoch 113/300
5/5 [=====] - 0s 31ms/step - loss: 0.0025 - categorical_accuracy: 1.0000
Epoch 114/300

```

Figure 3: Code Snippet for LSTM Model (1).

```

1
2 model = Sequential()
3 model.add(LSTM(64, return_sequences=True, activation='relu', input_shape=(30,63)))
4 model.add(LSTM(128, return_sequences=True, activation='relu'))
5 model.add(LSTM(64, return_sequences=False, activation='relu'))
6 model.add(Dense(64, activation='relu'))
7 model.add(Dense(32, activation='relu'))
8 model.add(Dense(basicCom.shape[0], activation='softmax'))

```

Figure 4: Code Snippet for LSTM Model (2).

The training session were set to 300 epochs. From the experiment conducted, 300 was the suitable epoch because if the training is set to 100-150, it was low for the system to be trained and the accuracy obtained would be low. The accuracy would be more than 90% but sometimes it could drop to an unacceptable accuracy rate.

Upon the completion of the training the LSTM model for the system, MYsign system is tested to test the functionality and accuracy of the system. In term of the accuracy of the system, the system output will be highlighted with an increasing bar and an output at the top left of the system interface. If the system recognizes MSL basic communication sign done by user, the class label for that specific sign will be highlighted with an increasing bar. The higher the probability the system detect the sign, the longer the highlighted bar will increase. The class for MSL basic communication that have the highest probability will be shown at the top left of the system, and it indicates the meaning of those specific sign in Malay text output. Figure 5 shows example output for *Assalamualaikum* and *Walaikumussalam* sign respectively.

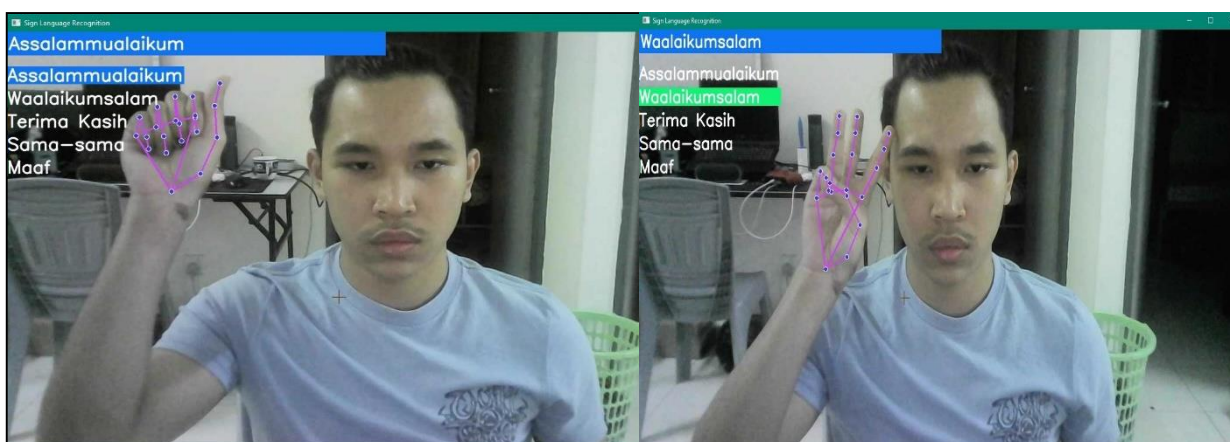


Figure 5: Example of Output for Sign *Assalamualaikum* and *Walaikumussalam*.

3. FINDINGS

Based on the testing conducted, all the use case developed for the MYsign system is working and functioning. Next, for the accuracy testing, the system is able to achieved 98.40% accuracy rate. Hence, this can be concluded that the implementation of LSTM is building a Malaysian Sign Language (MSL) is promising and successful.

4. CONCLUSION

As a conclusion, A Malaysian Sign Language Recognition System namely, MYsign System is successfully developed using LSTM algorithm. MYsign System is intended to recognize only MSL basic communication based on 5 classes of basic communication which are "*Assalammualaikum*", "*Walaikumsalam*", "*Terima Kasih*", "*Sama-sama*" and "*Maaf*". The self-collected dataset was used to train and test the system. In future, the dataset could be expanded to more MSL words.

Acknowledgments: All authors would like to thank to Universiti Teknologi MARA Cawangan Melaka for providing facilities and supports throughout the completion of this project.

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