Detection of Mad Lazim Harfi Musyba Images Uses Convolutional Neural Network

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Detection of Mad Lazim Harfi Musyba Images Uses Convolutional Neural Network

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Abstract. Reading of Al Quran is an obligation for all Muslims. Lack of knowledge about the knowledge of recitation in reading the Al Quran is certainly a problem. The purpose of this study makes it easier for everyone to learn the law of recitation, especially Madd Lazim Harfi Musyba in the Al Quran verses. The method used is one of the deep neural network methods, namely Convolutional Neural Network (CNN), as real-time detection of the law of Madd Lazim Harfi Musyba, implementation of the method using the help of Tensorflow GPU (Graphic Processor Unit) library. The results of trials with the Deep Convolutional Neural Network model show the detection performance of 9 verses with an average accuracy of 93.25%. The conclusion is that the training data on the CNN model is very reliable in detecting the Mad lazim harfi musyba law. Therefore this system can be used to assist in applying the Mad Lazim Hafi Musyba legal recitation while reading the Al Quran.

1. Introduction
Developing computing technology is Artificial Intelligence[1][2]. Convolutional Neural Network model is a variation of the Multilayer Perceptron (MLP) model [3] which has good classification capabilities on image data and has a high degree of accuracy for detecting images [4] from the recitation of mad lazim harfi musyba from Al-Quran verses.

The results of this system research have an average detection rate of 84.85%. This research can be continued with input in the form of image reading patterns of reading-law on the Qur'an. This application makes it easy for people who want to learn the law reading mad lazim harfi musyba on the Al-Quran [5].

The purpose of this study is to detect the percentage of legal reading of Mad lazim harfi musyba on the Qur'an with the Convolutional Neural Network and to detect the reading of the recitation of the verses of the Qur'an with the Convolutional Neural Network.

2. Theoretical
2.1 Convolutional Neural Network (CNN)
Convolutional Neural Network is a development of the Multilayer Perceptron (MLP) which aims to process two-dimensional data. CNN is included in the Deep Neural Network [6]type and is widely applied to image data. MLP has a disadvantage in storing spatial information on image data so that it produces bad images. An MLP in Figure 1 has a layer (red and blue circle) with each circle layer containing ji neurons. MLP accepts one-dimensional input data and propagates the data on the network to produce the output[7]. Each relationship between neurons on two adjacent layers[8] has a one-dimensional weight parameter that determines the quality of the model. Each input data on the

layer is carried out linearly with the existing weight value, and then the computational results will be transformed using a non-linear operation called the activation function.

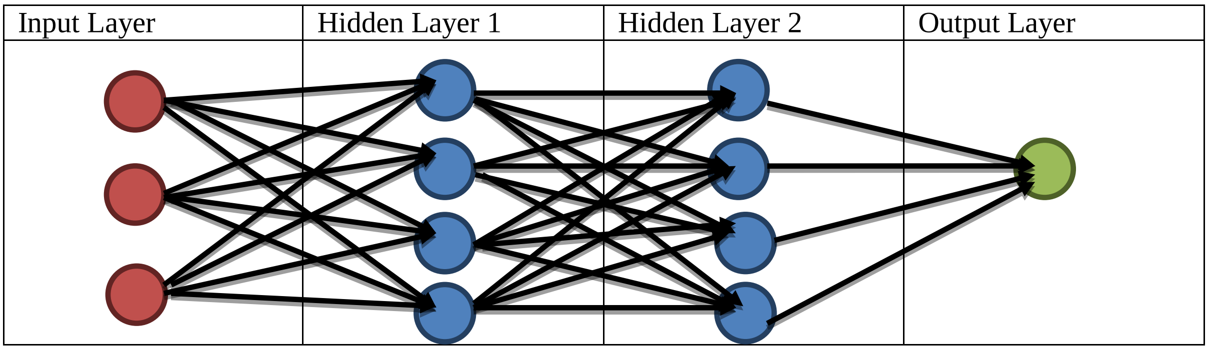

Figure 1. Simple Multilayer Perceptron (MLP) architecture

Data propagated on the network are two-dimensional data, so the linear operation and weight parameters on CNN are different. In CNN, linear operations use convolution operations, whereas weights are no longer just one dimension, but in the form of four dimensions which are a collection of convolution kernels like Figure 2, the weight dimensions on CNN are input neurons x output neurons x height x width. Because of the nature of the convolution process, CNN can only be used on data that has a two-dimensional structure such as image and sound.

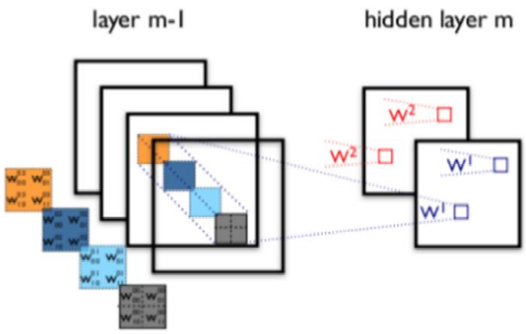

Figure 2. Convolution Process in Convolutional Neural Network

2.2 Convolution Layer
Convolution Layer performs convolution operations at the output of the previous layer. This layer is the main process that underlies a CNN. Convolution is a mathematical term that means to apply a function to the output of another function repeatedly. The purpose of convolution in image data is to extract features from the input image. Convolution will produce a linear transformation of the input data according to spatial information in the data[9].

2.3 Subsampling Layer
Subsampling aims to improve the position invariance of features. Convolution layer into several small grids and then take the maximum value from each grid to arrange the reduced image matrix.

2.4 Fully Connected Layer
The Fully Connected Layer aims to transform the dimensions of the data so that the data can be classified linearly. Each neuron in the convolution layer needs to be transformed into one-dimensional data before it can be put into a fully connected layer. Because it causes data to lose spatial information and is not reversible, the fully connected layer can only be implemented at the end of the network.

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2.5 Activation Function

The activation function is to transform input data into a higher dimension so that simple hyper lane cuts can be made which enable classification. There CNN activation function is used, namely the sigmoid function. The sigmoid function transforms the range of values from input x to between 0 and 1 with the shape of the distribution function, as shown in Figure 3.

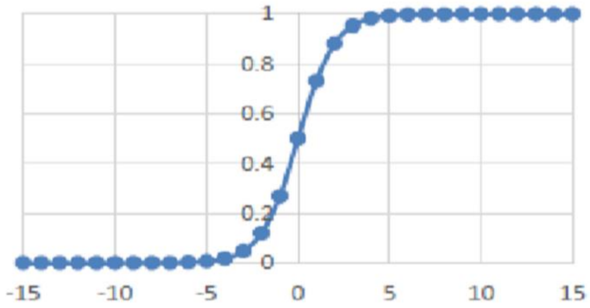

Figure 3. Distribution of Sigmoid Functions

2.6 Mad lazim harfi musyba

in the reading of the Al-Quran, there is tajweed science which is the knowledge to know how to pronounce the Alquran verses[10]. Mad lazim harfi musyba occurs only at the beginning of the surah in the Al-Quran. The following are hijaiyah letters on the AlQuran that have punctuation marks on mad lazim harfi musyba, ie. : كم ل، س، ع، ص، ق، ن، ،

Examples of surah contained in the recitation of Mad lazim harfi musyba on Al-Quran such as the name of Al-Quran Al-baqarah:1, name of AlQuran Yassin:1, name of Al-Quran Qof:1, Maryam:1, name of Al-Quran Al-qalam:1.

In reading the Mad lazim harfi musyba is 6 harakat (3 alifs). As an example in Al-Baqarah verses one الٓمٓ, Al-A'raf verses one الٓمٓصٓ, Al-Qasas verses 1 طسٓمٓ.

3. Method

In developing this system, there are system components, namely obtaining sample data, data labelling, training set, training data and data testing.

3.1 Samples Data

Data are taken from the Al-Quran; this data that will be used in this research is a verse from the Al-Quran, which includes punctuation marks from the mad lazim harfi musyba.

3.2 Data Labelling

There are two stages of the labelling process in this system, namely, making a rectangle box and labelling each training data will be a training data set. A rectangle box is to make boundaries on objects that will become training data. Making a rectangle box as shown in Figure 4.

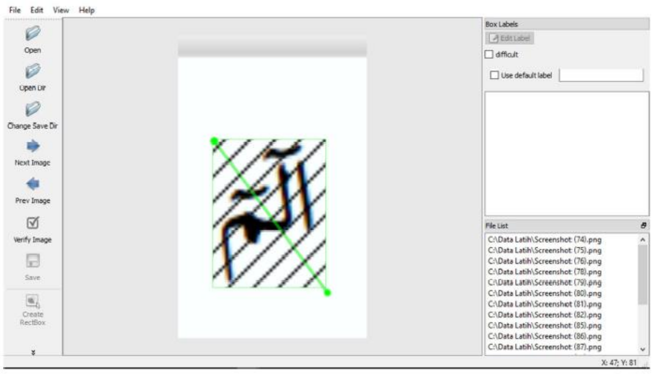

Figure 4. Making Rect Box

The rectangle box has a label for each of their training data to be trained. Labelling on each the rectangle box aims to have a label for training data as shown in Figure 5.

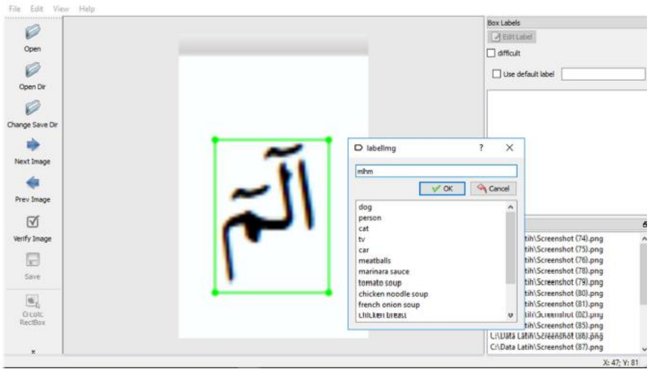

Figure 5. labelling for training data

3.3 Training Set

The training set is the data needed to do the training data process, then first to collect training data[11]. in the study find 27 surahs that there are 59 mad law lazim harfi musyba, in table 1 is the name of Al-Quran, there is a mad lazim harfi musyba punctuation mark :

Table 1. Punctuation Mark of Mad Lazim Harfi Musyba

No	Name of Surah	Verses	Mad lazim harfi musyba Images
1	Al-Baqarah	1	الٓمٓ
2	Ali-Imran	1	الٓمٓ
3	Al-A’raf	1	الٓمٓصٓ
4	Yunus	1	الٓر
5	Hud	1	الٓر
6	Ar-Rad	1	الٓمٓر
7	Ibrahim	1	الٓر
8	Al-Hijr	1	الٓر
9	Maryam	1	كٓهيعٓصٓ
10	Asy-Syu’ara	1	طسٓمٓ
11	An-Naml	1	طسٓ
12	Al-Qasas	1	طسٓمٓ
13	Al-Ankabut	1	الٓمٓ
14	Ar-Rum	1	الٓمٓ
15	Luqman	1	الٓمٓ
16	As-Sajdah	1	الٓمٓ
17	Yaasiin	1	يسٓ
18	Shad	1	صٓ
19	Ghafir	1	حمٓ
20	Fussilat	1	حمٓ

21	Asy-Syura	1 and 2	حمٓ عٓسٓقٓ
22	Az-Zukhruf	1	حمٓ
23	Ad-Dukhan	1	حمٓ
24	Al-Jasiyah	1	حمٓ
25	Al-Ahqaf	1	حمٓ
26	Qof	1	قٓ
27	Al-Qalam	1	نٓ

3.4 Training Data

This system uses the Tensorflow library as a deep learning library for conduct training data with the convolutional neural method network, this system conducts training data with as many epochs 56140, with the value of loss or error stable at 0.01 as shown Figure 6.

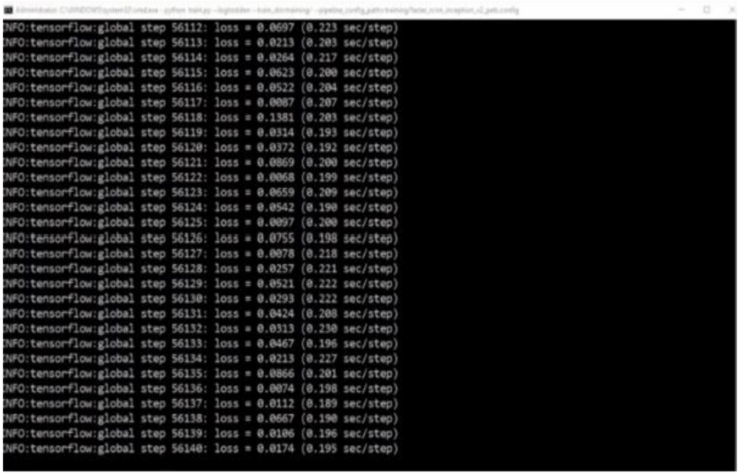

Figure 6. labelling for training data

Results of training data conducted on this system, by including the results of total loss that is visualised in the graphic, as shown in Figure 7.

Figure 7. The result from the total-loss of training data

3.5 Data Testing

Data processing is the stage where data is collected, labelled, and trained, to produce data that is ready to be tested data[12] then result from detection system images of mad lazim harfi musyba.

4. Result and Discussion

4.1. Training Set

This Training-Set will later be used to make machine learning models, and Training set to collect author summarises only a few surah which can represent the pattern in each of the common mad lazim harfi musyba letters. shown in Figure 8.

Letter of Mad lazim harfi musyba	ل	م	ص	ع	ق	س	ك	ن
Mad lazim harfi musyba on Al-Quran	آلٓ	مٓ مٓ	صٓ صٓ	عٓ عٓ	قٓ قٓ	سٓ سٓ	كٓ	نٓ
Training Set	الٓمٓ الٓمٓصٓ		صٓ	عٓصٓ	عٓسٓقٓ	سٓ	قٓ كٓ	نٓ

Figure 8. Training Set to collect letters of mad lazim harfi musyba images

4.2 Data Testing on the System

In the process of detect mad lazim harfi musyba then there is a colour mark on the reading that contains mad lazim harfi musyba. Shown in Figure 9.

No	Name of AlQuran	Training Set	Testing data	Response time	Accuracy
1	Al-Baqoroh:1	الٓمٓ		2 detik	97%
2	Al-‘Arof:1	الٓمٓصٓ		2 detik	97%
3	Shood:1	صٓ		2 detik	98%
4	Maryam:1	كٓ		4 detik	62%
5	Maryam:1	عٓصٓ		2 detik	97%

Figure 9. Detecting images on Al-Quran containing mad lazim harfi musyba

Testing data above using a sample of 9 verses from 8 surah in the Al-Quran, the total surah contained law tajweed madd lazim harfi musyba there are 27 surah out of 114 surah of the Al-Quran, but of the 27 surah many have the same pattern so that it can be collected and represented on 8 surah, on testing this system produces an average detection accuracy of 93.25%. However, there are still some law tajweed madd lazim harfi musyba detected less than 80%, and many other letters that are not letters from the recitation of law tajweed madd lazim harfi musyba are detected.

5. Conclusion

Detection System of law tajweed Mad lazim harfi musyba by using Deep Convolutional Neural Network has an average detection accuracy of 93.25% in the detection of the verses of the Al-Quran that contain the law madd lazim harfi musyba.

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