IJCAT - International Journal of Computing and Technology, Volume 2, Issue 8, August 2015
ISSN : 2348 - 6090
www.IJCAT.org

Detection System Tajwid Al Quran on Image Using Bray Curtis Distance

[1] Rizal, [2] Fadlisyah, [3] Muhathir, [4] Al Muammar Akfal

[1,2,3,4] Department of Informatics, Faculty of Engineering, University of Malikussaleh
Aceh, Indonesia, 24354

Abstract - Al Quran is the Muslim holy book written in Arabic. To read the Quran recitation necessary knowledge of the guidelines. In the context of everyday people find difficulty in recitation of the Quran. Therefore, the detection system tajwid needed to help users find the recitation of the Quran. In this study, the method of Bray Curtis Distance is used to detect the image of the Holy Qur'an recitation. The test results show that the accuracy of the system is 60% to 90%. The percentage of detection rate shows that the method can be used Bray curtis as one approach to detection at the image of the Holy Qur'an recitation. This system has several drawbacks that have a high false positive rate, or an error about a 40% chance. To improve the performance of this recitation detection system, can be done by providing further training with additional training data more and more varied. However, this recitation detection system does not deny the importance of teachers in learning how to read in accordance with the rules of recitation is right.

Keywords **– Bray Curtis Distance, Image Processing, Tajwid, Quran.**

1. Introduction

Al Quran is the Muslim holy book written in Arabic. To read the Qur'an there are two guidelines that must be learned is makhraj law and recitation. Makhraj literally means a discharge letter. As the term is a sound out letters hijaiyah from aleph to ya '. Recitation of understanding the language (ethimologi) is embellish things. Meanwhile, according to the term, Recitation Science is knowledge about the rules and how to read the Qur'an as well as possible. Most Muslims around the world know how to read the Koran, but not all Muslims can recite the Quran with Tajweed correctly by applicable law. An obligation for Muslims to read the Qur'an in accordance with the laws of recitation. This is because very little difference in the sound of the letters in Arabic can cause different meanings of the word. Based on the National Socioeconomic Survey in 2013, a total of 53.8% of Muslims in Indonesia can not read the Koran. This is unfortunate, considering Indonesia is dominated by 87.18% Muslim population according to 2010 census data from the Central Statistics Agency. Currently, technological developments, particularly in the field of software has spawned many intelligent applications, such as Al Quran Digital applications. Al Quran Digital has now become one of the software applications that can be installed on a personal computer or smartphone. Many of these applications help in reading the Quran, but unfortunately at the application placement recitation can not be displayed.

In this study, the authors developed a system that uses a combination of image of the Al Quran trained as input data for pattern matching recitation by comparing the input image of the Al Quran test. The image will be detected tested parts which tajwid contained therein so that the user can easily read the Tajwid. The purpose of this application is to build a system that can detect the presence of recitation of the Quran-based desktop. Ease in understanding the recitation of the Quran through this application. Understand and implement methods Bray Curtis Distance to the application.

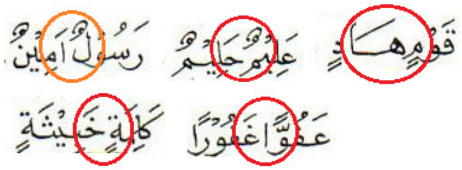
2. Literature Review

In the language of the Qur'an from Arabic, which qaraa-yaqrau-quraanan meaningful readings. Tajwīd **(تجويد)** literally means to do somethingwith the lovely and beautiful or niceandsmarten, tajwid comes from the word"Jawwada" **(تجويدا-يجوّد-جوّد)**in arabic. In the scienceqiraah, tajwid means getting letters from his place by givingitsproperties. Sotajwid isa science which studies howmelafazkanor pronounce the letters contained in the KoranandHadith and others.

a. Tanwin Izhar

When a word Izharthen meet with the letter or how to say it should bepronounced"clear". If death or Nunnation

metandlettersHalqi(throat) such as:alif/hamzah(ء), ha' (ح), kha' (خ), 'ain (ع), ghain (غ), dan ha' (ه). Izhar Halqi which meansa clearreadableexample:



b. Qalqalah

Qalqalahissoundingvoiceexcessofmakhrajletters.Qalqalahq alqalahoccurs when the letteris dead,or died ofwaqf(discontinued). Qalqalahletterwhichconsistsof5 letters د ج ب ط ق .Qalqalahdivided intotwoparts, namelyQalqalahSugra(Small Qalqalah) andQalqalahKubra(Qalqalah Large).
QalqalahSugraoccurs when the dead-letter qalqalah(breadfruit) on the word origin, generally located in the middle of the word. I read that the reflectionis not too strong. examples:

c. Image

In ageneral sense, the image is an image. In amore specificsense, the imageis avisual imageof an objectormultiple objects.The image is divided into two types, namely the image of analog and digital imagery. Analog image found on paper. Meanwhile, the digital image is an image which is expressed in a digital data set and can be processed by computers.

The image is two-dimensional image generated from analog images into a continuous two-dimensional image through a discrete sampling process. Analog image is divided into N rows and M columns so that a discrete image. Crosses between certain lines and columns are called pixels. Examples are image / discrete points on the line n and m column called pixels [n, m].

Image (image) is a two-dimensional image on the field. Image as the output of a data recording system can be:

1. Optics, in the form of photo
2. Analog signals such as video, such as images on a television monitor
3. Digital which can be directly stored on a magnetic tape.

In the field of image processing, the term image refers to a function of the intensity of the two-dimensional plane. Visible image of the light reflected from an object. The function f (x, y) can be seen as a function of the two elements. The first element is the power source of light that surrounds our view of objects (illumination). The second element is the amount of light that is reflected by the object into our view (reflectance components).

d. Digital Image

Digital image (digital image) is a continuous image f(x, y) is already did is kritkan both spatial coordinates and brightness levels. Continuous said here explains that the indices x and y only worth a round. We can think of a digital image (next to beabbreviatedimage) as a measure nxm matrix of rows and columns that shows the points are shown in the followinge quation:

$$f(x,y) = \begin{pmatrix} f(0,0) & f(0,1) & \dots & f(0,M-1) \\ f(1,0) & f(1,1) & \dots & f(1,M-1) \\ \dots & \dots & \dots & \dots \\ f(N-1,0) & f(N-1,1) & \dots & f(N-1,M-1) \end{pmatrix}$$

The image is not in color or black and white is known as the degrees of gray image (image graylevel / grayscale). Owned degrees of gray can range from 2 degrees of gray (ie 0 and 1), which is also known as a monochrome image, 16 degrees of gray and 256 degrees of gray.

In a monochrome image, a pixel is represented by 1 bit of data that contains data about the degree of the pixel gray-owned. Data will contain 0 when the pixels are black and one white pixel. Citra has 16 degrees of gray (ranging from 0 representing black and up to 15 representing white color) presented by 4 bits of data. While the image with 256 degrees of gray (value of 0 representing black and up to 255 representing white color) presented by 8 bits of data.

In a color image, the number of colors can range from 16, 256, 65536 or 16 million colors respectively presented by 4,8,16 or 24 bits of data for each pixel. Color is composed of three main components, namely red value (red), green value (green) and blue values (blue). Alloy forming the three main components of these colors are known as RGB (Red, Green, Blue) color that would form the color image.

e. Image Processing

Image processing is an image processing by using a special computer to produce an image of the other. While Computer Vision can be defined on par with the

understanding of image processing associated with image acquisition, processing, classification, recognition, and overall coverage, the return decision followed by the identification of the image.

f. Grayscale

The initial process is mostly done in the image processing is to convert color images into gray-scale image, it is used to simplify the model image. Color image consists of three layers, namely R-layer matrix, G-layer and B-layer. So as to make the production process remains to be seen three such layers. When every calculation process is done using three layers, meaning three calculations performed sama.sehingga this concept was changed by changing the layer above 3 to 1gray-scale matrix layer and the result is a grayscale image. In this image is no longer existing color image degree of gray.

To convert the image of the Red, Green, Blue(RGB) into agrey scale image, we use the following formula:

Bit_{RGB} (x, y) = 0,11 * bitR (x, y) + 0,59 * bitG (x, y) + 0,3 * bitB (x, y)

g. Convolution

Convolution is a way to combine the two signals. 2 pieces convolution function and is defined as:

$$h(x) = f(x) \otimes g(x) \cong \int_{-\infty}^{\infty} f(a)g(x-a)da$$

notation $\otimes$ is the convolution operator. For discrete convolution function is defined as,

$$h(x) = f(x) \otimes g(x) \cong \sum_{a=-\infty}^{\infty} f(a)g(x-a)$$

where $g(x)$ is the convolution kernel o rkernel filter.

For the function of two-dimensional convolution operation is defined as: (for continuous functions)

$$h(x,y) = f(x,y) \otimes g(x,y) \cong \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(a,b)g(x-a,y-b)dadb$$

And for a discrete function, defined as:

$$h(x,y) = f(x,y) \otimes g(x,y) \cong \sum_{-\infty}^{\infty}\sum_{-\infty}^{\infty} f(a,b)g(x-a,y-b)$$

Filter Function $g(x,y)$ also called convolution filter, mask convolution, convolution kernel, or template.

h. Bray Curtis Method

The distance (distance) is used to determine the level of similarity (similaryty degree) or in equality (disimilarity degree)twofeature vectors. The degree of similarity in the form of a value (score) and based on the scoresof the two feature vectors will be similar or not.

Bray Curtis Distance is the distance So rensen also called normalization method that is widely used in botany, ecology, and environmental science. The Bray-Curtis Distance has the property if the value is compared to positive and its values will be in between 0 and 1.
Bray Curtis Distance formulated by the sum ofthe absolutereduction invaluedivided by the number2in comparison. Zero Distance indicates Bray Curtis similarity. If the two objects of equal value to zero will cause a division by zero then for this case should be defined in advance.

Bray Curtis Distance :

$$d_{ij} = \frac{\sum_{k=1}^{n} |x_{ik} - x_{jk}|}{\sum_{k=1}^{n} (x_{ik} + x_{jk})}$$

Or same with :

$$d_{ij} = \frac{\sum_{k=1}^{n} |x_{ik} - x_{jk}|}{\sum_{k=1}^{n} x_{ik} + \sum_{k=1}^{n} x_{jk}}$$

3. Research Method

Scheme tajwid detection systems built in this study are illustrated in Figure1 and 2.

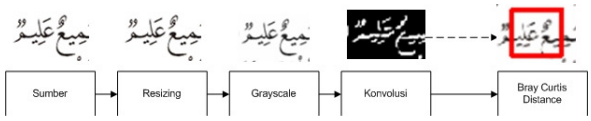


Figure 1. Scheme Izhar Legal System

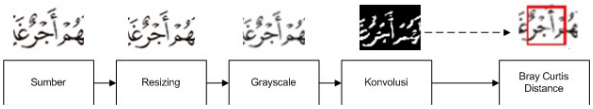


Figure 2.SchemeLegal SystemQalqalah

The stages were carried out after the system receives input image of the Koran are the stages of grayscale, convolution, and test pattern recognition using the Bray-Curt is tajwid Distance. In the pre-processing stage, the image of the Koran source input will be resized in advance to save time and number of it erations. After resizing, the image will be represented in the form of a canal, and ends with edge detection through convolution process. In the primary process, computation using Curtis Bray Distance, vector pattern recitation will be trained to obtain a weight in g matrix, which then is used as a weight in gmatrix matrix testing.

4. Result and Discussion

The natural process of computer-based system design, problem analysis plays an important rolein making the details of the application to be developed, the analysis of the problem is a step in understanding the issue before taking any action o rdecision final settlement. System analys is aims to identify the problems that exist in the system, in which applications built include the operating environment, the user (user) and associated elements. This analys is as a basis for the design stage of the system, which includes the selection of training samples recitation, Tajweed patterns defining the end of the reference vector, system testing, and measuring system performance. Here is an example of a formula translation Bray Curtis Distance method to determine the distance of two vectors in this application:

Example: For avectorAandBareasfollows.

A = [0,3,4,5]

B = [7,6,3,-1]

In this case, AandBaretwovectorsthatdistancewillbe calculated, BrayCurtisdistance oftwo vectorsin the form of:

$$d_{AB} = \frac{|0-7|+|3-6|+|4-3|+|5-(-1)|}{(0+7)+(3+6)+(4+3)+(5-1)} = \frac{7+3+1+6}{7+9+7+4} = \frac{17}{27} = 0.630$$

Tajwid training samples used in this study amounted to 29 images Tajweed recitation vectors representing different characteristics. Figure 3 shows some sample recitation used as training.

Figure 3. A few samplesTajwid Used

Each vector tajwid have a specific pattern or different from one another recitation recitation. In the method of Bray Curt is Distance, vector pattern tajwid reference has to be determined prior to the tests. Figure 4 shows the pattern vector generated reference recitation of observations on 29 tajwid image. Tajweed vector pattern associated with the emergence reference values of 0 or 1 on a number of training tajwid image. A value of 0 in the vector representing feature values that are not included in the recitation but tajwid region, otherwise the value of 1 represents the value that is included in the recitation features.

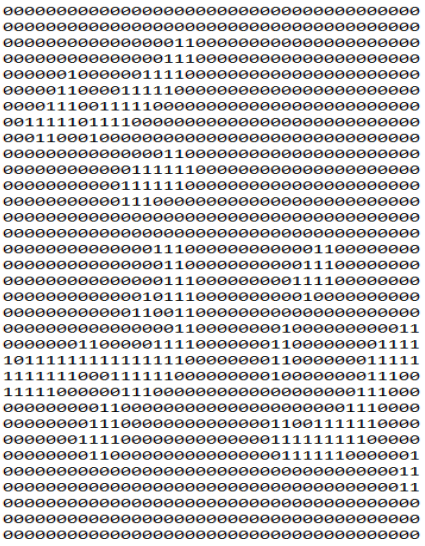


Figure:4Tajwid Vector Pattern Correction Results and Observations on Some imagesTajwid Used ForTraining.

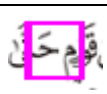
Figure5shows some test results tajwid detection system.

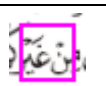
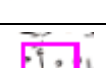
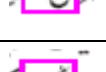
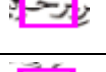
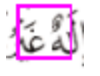
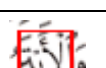
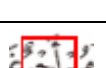
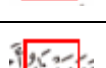
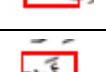
Figure5Some tajwid detection results.

Performance measurement system is done by training every recitation pattern. Table 1 illustrates some of the results pegukuran detection system performance tajwid $(T_1, T_2, T_3 \ldots T_{29})$. In the image of the Koran which contains the letters bertanwin Fathah met Ha (T1), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Fathah met Kha (T2), recitation detection system has a 70% accuracy rate. In the image of the Koran which contains the letters bertanwin Fathah met 'Ain (T3), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Fathah meet Gha (T4), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Fathah meet Haa (T5),

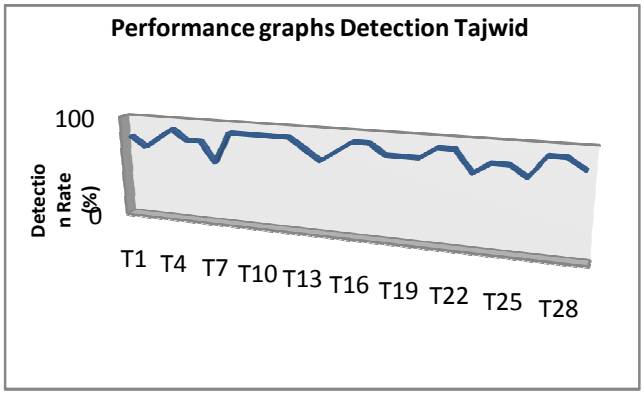
recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Fathah meet Alif (T6), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Kasrah met Ha (T7), recitation detection system has a level of accuracy of 60%. In the image of the Koran which contains the letters bertanwin Kasrah met Kha (T8), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Kasrah met 'Ain (T9), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Kasrah meet Gha (T10), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Kasrah meet Haa (T11), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Kasrah meet Alif (T12), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letter Nun died meets Ha (T13), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letter Nun dies met Kha (T14), recitation detection system has a 70% accuracy rate. In the image of the Koran which contains the letter Nun dies met 'Ain (T15), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letter Nun dies met Gha (T16), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letter Nun dies met Haa (T17), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letter Nun dies met Alif (T18), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Dlammah met Ha (T19), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Dlammah met Kha (T20), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letters bertanwin Dlammah met 'Ain (T21), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Dlammah meet Gha (T22), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letters bertanwin Dlammah meet Haa (T23), recitation detection system has a 70% accuracy rate. In the image of the Koran which contains the letters bertanwin Dlammah meet Alif (T24), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letter Qalqalah Ba (T25), recitation detection system has a 80% accuracy rate. In the image of the Koran which contains the letter Qalqalah Ja (T26), recitation detection system has a 70% accuracy rate. In the image of the Koran which contains the letter Qalqalah Dal (T27), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains the letter Qalqalah Tha (T28), recitation detection system has a level of accuracy of 90%. In the image of the Koran which contains Qalqalah letter Qa (T29), recitation detection system has a 80% accuracy rate. Results showed that the method of evaluation systems Bray Curtis has a high detection rate.

Table:1Results Performance Detection System Tajwid.

No	PatternimageTajwidTraining	TotalImageTesting	TotalImage DetectedTajwid	*False Positive Rate*	*Detection Rate*
1		10	8	0,2	0,8
2		10	7	0,3	0,7
3		10	8	0,2	0,8
4		10	9	0,1	0,9
5		10	8	0,2	0,8
6		10	8	0,2	0,8
7		10	6	0,4	0,6
8		10	9	0,1	0,9
9		10	9	0,1	0,9
10		10	9	0,1	0,9
11		10	9	0,1	0,9
12		10	9	0,1	0,9
13		10	8	0,2	0,8

14		10	7	0,3	0,7
15		10	8	0,2	0,8
16		10	9	0,1	0,9
17		10	9	0,1	0,9
18		10	8	0,2	0,8
19		10	8	0,2	0,8
20		10	8	0,2	0,8
21		10	9	0,1	0,9
22		10	9	0,1	0,9
23		10	7	0,3	0,7
24		10	8	0,2	0,8
25		10	8	0,2	0,8
26		10	7	0,3	0,7
27		10	9	0,1	0,9
28		10	9	0,1	0,9
29		10	8	0,2	0,8

The test results for $(T_1, T_2, T_3 \ldots T_{29})$, showed that the detection rate is greatly influenced by the source Tajwid pattern. Figure 6 shows a graph of the results of the performance of the detection system tajwid $(T_1, T_2, T_3 \ldots T_{29})$.



Specification:
T1 The image of the Koran which contains the letters meet bertanwin Fathah Ha.
T2 = The image of the Koran which contains the letters meet bertanwin Fathah CRC.
T3 = Citra Koran which contains the letters meet bertanwin Fathah 'Ain.
T4 = Citra Quran that contains the letter Gha bertanwin Fathah met.
T5 = Citra Quran that contains the letter Haa bertanwin Fathah met.
T6 = Citra Quran that contains the letter Alif bertanwin Fathah met.
T7 = Citra Koran which contains the letters Ha bertanwin Basrah met.
T8 = Citra Koran which contains the letters meet bertanwin Basra CRC.
T9 = Citra Koran which contains the letters meet bertanwin Basra 'Ain.
T10 = Citra Koran which contains the letters meet Gha bertanwin Basra.
T11 = Citra Koran which contains the letters meet Haa bertanwin Basra.
T12 = Citra Koran which contains the letter Alif bertanwin Basrah met.
T13 = Citra Koran which contains the letter Nun died meets Ha.
T14 = Citra Koran which contains the letter Nun died meets CRC.
T15 = Citra Koran which contains the letter Nun off to meet 'Ain.
T16 = Citra Koran which contains the letter Nun off Gha met.
T17 = Citra Koran which contains the letter Nun off Haa met.
T18 = Citra Koran which contains the letter Alif Noon off meeting.

T19 = Citra Koran which contains the letters meet bertanwin Dlammah Ha.
T20 = Citra Koran which contains the letters meet bertanwin Dlammah CRC.
T21 = Citra Koran which contains the letters meet bertanwin Dlammah 'Ain.
T22 = Citra Koran which contains the letters bertanwin Dlammah meet Gha.
T23 = Citra Koran which contains the letter Haa bertanwin Dlammah met.
T24 = Citra Koran which contains the letter Alif bertanwin Dlammah met.
T25 = Citra Koran which contains the letter Ba Qalqalah
T26 = Citra Koran which contains the letters Qalqalah Ja.
T27 = Citra Koran which contains the letters Qalqalah Dal.
T28 = Citra Koran which contains the letters Qalqalah Tha.
T29 = Citra Koran which contains the letter Qa Qalqalah.

Figure 6 Graph detection system performance tajwid $(T_1, T_2, T_3 \ldots T_{29})$.

In Figure 4.4, the graph illustrates the performance test and measurement performed after 29 vector pattern in the image tajwid trained for the overall characteristics of the image $(T_1, T_2, T_3 \ldots T_{29})$. The number of test images is as much as 10 images Koran, to all stages of training and obtained successively value detection rate for $T_1 = 80\ \%$, $T_2 = 70\ \%$, $T_3 = 80\ \%$, $T_4 = 90\ \%$, $T_5 = 80\ \%$, $T_6 = 80\ \%$, $T_7 = 60\ \%$, $T_8 = 90\ \%$, $T_9 = 90\ \%$, $T_{10} = 90\ \%$, $T_{11} = 90\ \%$, $T_{12} = 90\ \%$, $T_{13} = 80\ \%$, $T_{14} = 70\ \%$, $T_{15} = 80\ \%$, $T_{16} = 90\ \%$, $T_{17} = 90\ \%$, $T_{18} = 80\ \%$, $T_{19} = 80\ \%$, $T_{20} = 80\ \%$, $T_{21} = 90\ \%$, $T_{22} = 90\ \%$, $T_{23} = 70\ \%$, $T_{24} = 80\ \%$, $T_{25} = 80\ \%$, $T_{26} = 70\ \%$, $T_{27} = 90\ \%$, $T_{28} = 90\ \%$, $T_{29} = 80\ \%$.

Based on the research that has been done, the results of detection rate system performance is strongly influenced by the source tajwid patterns, observing the vector reference pattern for testing, the complexity of objects contained in the image, and the level of success of the system in mapping the pattern of recitation input vector to vector pattern tajwid edge. Location tajwid the image can be detected by the system if the vector pattern tajwid edge or edge image really contains a map feature recitation. Figure7 illustrates the state of tajwid edge image to the image that contains the location of recitation were detected.

Figure7 A few examples edge image that contains the location of recitation were detected.

In Figure7, we can see the whole image containing information tajwid features required by the system to decide on a location in the image containing the pattern of recitation. Role blockc onvolution process in mapping the various features contained in the recitation location is very important. Usually block convolution process often fails in mapping features when dealing with image tajweed containing vector values are far apart. In computing, a system built with two blocks of the main processes, namely: convolution and Curtis Bray method, and based on the detection rate is achieved, then the scheme proposed system has been able to make the detection tajweed using efficient computing.

Figure 8 Display Form Image Training PatternTajwid

Figure 9 Testing Process Tajwid type Izhar.

Figure10Testing Process Tajwid type Qalqalah.

5. Conclusion

The results showed that the detection system using the method of Bray-Curtis tajwid Distance has a detection rate ranged from 60% to 90%. The percentage detection rate shows that the method of Bray Curtis can be used as one approach to the detection of the image of the Koran recitation. Tajwid detection system using the Bray Curtis is able to work well on images that have a complex background or image that contains complex backgrounds with diverse images, tajwid detection system using the method of Bray-Curt is Distance has a high false positive rate, or an opportunity error ranges from 40%.

References

[1] Ahsiah Ismail , Mohd Yamani Idna Idris , Noorzaily Mohamed Noor , Zaidi Razak, ZulkifliMohd Yusoff. 2014. *Mfcc-Vq Approachfor Qalqalah Tajweed Rule Checkin.*(http://repository.um.edu.my/94649).

[2] Nurul Wahidah Arshad, Suriazalmi Mohd Sukri, Lailatul Niza Muhammad, Hasan Ahmad,Rosyati Hamid, Faradila Naim, Noor Zirwatul Ahlam Naharuddin._____. *Makhraj Recognition for Al-Quran Recitation using MFCC* (http://aicit.org/IJIIP/ppl/IJIIP129PPL.pdf)

[3] Humam, As'ad. 2005. *Cara Cepat Belajar Tajwid Praktis.* Yogyakarta : Tim Tadarus "AMM".

[4] Kadir, Abdul. 2013. *Dasar Pengolahan Citra dengan DELPHI.* Yogyakarta : Andi.

[5] Munir, Rinaldi, Pengolahan Citra Digital , Bandung, 2004 : Informatika.

[6] Putra, Darma. 2010. *Pengolahan Citra Digital.* Yogyakarta : Andi.

[7] Fadlisyah, S.Si. 2007. *Computer Vision dan Pengolahan Citra*. Yogyakarta : Andi.

[8] Fadlisyah. 2013. *Sistem Pendeteksian Wajah pada Video Menggunakan Jaringan Adaptive Linear Neuron (ADALINE).*

[9] Fadlisyah dan Rizal. 2011. *Pemograman Computer Vision Menggunakan Delphi + Vision Lab VCL 4.0.1.* Yogyakarta : Graha Ilmu.

[10] Seung-Seok Choi, Sung-Hyuk Cha, Charles C. 2010 *Tappert A Survey of Binary Similarity and Distance Measures.*(http://www.iiisci.org/Journal/CV$/sci/pdfs/GS315JG.pdf).

Rizal, Completed Postgraduate Program at the University Kebangsaan Malaysia (UKM) in 2005 on Information Technology Study Program and Lecturer at Departement of Informatics in University of Malikussaleh. Field of study interest and concentration of research is the Natural Language Processing and Data Mining. He currently serves Computer Center University of Malikussaleh.

Fadlisyah, Completed Bachelor's Degree in Computer Science at University of Padjadjaran Bandung and He Completed a Postgraduate in Computer Systems Engineering at University North Sumatera (USU). He has written many books that have been published throughout Indonesia. Who occupied positions ranging Informatics Laboratories, Head of Community Service, Head of Robot Intelligence Study Center, and also as a coach MTQ branch DAK Qur'an. Cultivated fields of research interest is the Image Processing and Speech Processing.