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DETERMINING HALAL PRODUCT USING AUTOMATED RECOGNITION OF PRODUCT LOGO

KHAIRUL MUZZAMMIL SAIPULLAH, NURUL ATIQAH ISMAIL
Faculty of Electronic and Computer Engineering, Universiti Teknikal Malaysia Melaka, Malaysia
E-mail: muzzammil@utem.edu.my

ABSTRACT

A new method of determine Halal logo is proposed in this paper. It is based on the fractionalized principle magnitude (FPM) algorithm using the magnitude of the 1D Fourier transform. Compared with other logo detection methods that is HOG, Hu moment, Zernike and WCH, this method has the advantage which is achieve the highest average classification accuracy and also time classification. The proposed method have test on the traffic sign and texture database involving logo. Experiment show that the proposed method is achieve the excellence result and able to fight with the previous method.

Keywords: *Fractionalized Principle Magnitude (FPM), Logo recognition, Product Logo, Halal Logo*

1. INTRODUCTION

Islam is a way of life which is cover with rules and customs built. There are five pillars need to observe by each Muslim these include with shahadah, salat five times a day, zakat, fasting and hajj for those who are afford to go. Islam also required each Muslim to take care the cleanness especially during prayer. Furthermore it is important for find the clean and Halal food. Halal is an Arabic term meaning 'lawful' or 'permissible'. In the English word Halal frequently refers to food that is permissible regarding the Islamic law. In the Quran, the guide book especially for Muslims, there are state that Muslims are require seek provisions that are 'Halalan toyibban'. Halal is about everything covers from food, the business transaction include the activity we do in our daily lives.

The Halal food is cover quality of the product including service is safe for consumption, produced in a clean environment and health from any non-Halal ingredient. Malaysia is one of the moderate and dynamics Islamic country and become example to others Muslim country. This is shows Malaysia government had take seriously in promoting Islamic by the example in finance banking, Islamic insurance, Halal food industry and economic based on Islamic principle. In 1968, the Malaysia Council of Rules decided to established for a body that would mobilize the development and progress of Muslim in Malaysia, consist of country's status as an Islamic country which growing in strength as well as fast gaining worldwide recognition. The government's objective is to make Malaysia a Halal country and as result one department is responsible to handle the Halal issues also known as Jabatan Kemajuan Islam Malaysia (JAKIM).

A Halal product is the great concern of all Muslims in the world especially in Malaysia. It is written in the Quran that Muslims are needed to prepare and consume Halal products in their daily life. Halal logo also signals which food outlets are permissible to be patronage by the Muslim. As a result, the logo provides an avenue for the manufacturers to indicate to their target consumers that their products meet the Islamic standard. This definitely will create significant advantage to the particular manufacturers versus its competitors that do not have Halal certification.

The usage term Halal is according to food and beverage product, consumer product, food premises and slaughter house. The user or premis need to make the application from JAKIM to get the certificate of Halal, then the few process will be taken before the result of application is accepted or not. In order to help Muslims to identify which product is Halal, the department of Islamic Development (JAKIM) has define the Halal logo that needs to be displayed on the product or premises. The description of Halal logo is shown in Figure 1.

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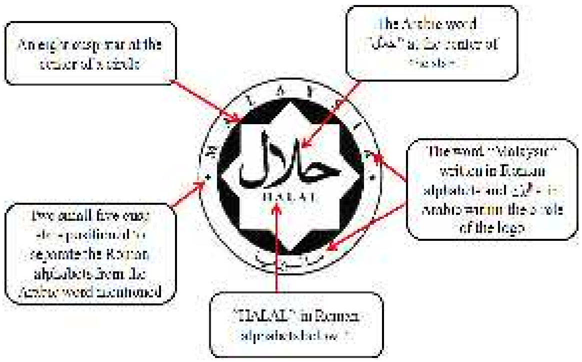

Figure 1: The Description Of Halal Logo

Figure 2: The Example Of Fake Halal Logo

Form the JAKIM website, the entire Halal product ingredient permitted under Syariah law and also fulfills the following requirement; the food or any parts of the product are free from the non-Halal animals regarding of Syariah law and also the animal which not slaughtered according the Syariah law. Then the product or foods are free from any Najs (unclean) according to the Syariah law and safe and harmful. The product is free from any part of human body. All the process or manufactured equipment is not contaminated with the Najs according to the Syariah law. During the preparation, process or packaging does not in contact or near with any food that does not meet the requirement or any substance will be consider impure by Islamic law (JAKIM, 2011).

Therefore Halal logo is created as facilitate the Muslim consumer especially to know either the food or product is Halal and be permitted by Syariah law. Unfortunately some of the irresponsible party makes the fake Halal logo and labeled at their product. It is because their take the easy way without get the permitted form JAKIM department. The application to get the permitted is only applied form JAKIM department and they need to follow the straight procedure had been set by JAKIM. Figure 2 shows the example of fake Halal logo have been display on the certain product by the irresponsible company. As the result, it is make confusing to those Muslims does not have knowledge about the logo.

To overcome this problem, a tool is needed to help the Muslims in Malaysia to classify the approved Halal logos. Since the logo can be distinguished using its visual information, the classification can be done using computer vision and image processing. To accurately classify the logo, a good feature extractor is necessary. Some of the feature extractors used in logo classification are histogram of oriented gradients (HOG) [2], Hu moment [6] [7], Zernike moment [9] and wavelet co-occurrence histogram (WCH) [4] [5]. However, even though these feature extractors hold high accuracy, their algorithms are too complex and time-consuming. Therefore, in this paper, a new, simple and high accuracy feature extractor has been proposed based on Fourier transform that is called Fractionalized Principle Magnitude (FPM) the combination of principle magnitudes of the Fourier transform extracted from the fractionalized images.

With the development of fast Fourier transform (FFT), Fourier transform becomes one of the fast methods to extract features and is widely used in feature extractor application. For example, K. Muzzammil and Deok-Hwan Kim proposed localized angular phase which utilizes the phase from the Fourier transform in localized polar space [12]. Besides that, Feng Zhou., Ju Fu Feng and Qing Yun Shi proposed texture descriptor by using the magnitude of the 1D Fourier transform [15]. Ville Ojansivu and Janne Heikkilä proposed blur insensitive texture descriptor using the phase of the local Fourier transform coefficients [13]. K. Muzzammil, Shao-huPeng, Hyun-Soo Kim and Deok-Hwan Kim proposed a 2D local Fourier transform based texture descriptor where spatial distribution of gray levels of neighborhood pixels can be extracted [14]. Furthermore K. Muzzammil and Deok-Hwan Kim have used Fourier transform

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in spectral feature extraction techniques in target detection of hyperspectral images[16].

This paper is organized as follows: in section 2, related works are discussed. In section 3, the detail explanations about FPM are presented. In section 4, the results and their analysis are presented. Finally, the conclusion is given in section 5.Applications of ANN to power systems are a growing area of interest. Considerable efforts have been placed on the applications of ANNs to power systems. Several interesting applications of ANNs to power system problems [1]-[5], indicate that ANNs have great potential in power system on-line and off-line applications. The feature of an ANN is its capability to solve a complicated problem very efficiently because the knowledge about the problem is distributed in the neurons and the connection weights of links between neurons, and information are processed in parallel.

Back-propagation is an iterative, gradient search, supervised algorithm which can be viewed as multiplayer non-linear method that can re-code its input space in the hidden layers and thereby solve hard learning problems. The network is trained using ANN technique until a good agreement between predicted gain settings and actual gains is reached.

During last three decades, the assessment of potential of the sustainable eco-friendly alternative sources and refinement in technology has taken place to a stage so that economical and reliable power can be produced. Different renewable sources are available at different geographical locations close to loads, therefore, the latest trend is to have distributed or dispersed power system. Examples of such systems are wind-diesel, wind-diesel-micro-hydro-system with or without multiplicity of generation to meet the load demand. These systems are known as hybrid power systems. To have automatic reactive load voltage control SVC device have been considered. The multi-layer feed-forward ANN toolbox of MATLAB 6.5 with the error back-propagation training method is employed.

2. RELATED WORKS

Histogram of Oriented Gradient

Histogram of Oriented Gradients (HOG), a technique for object detection, generally is applied to pedestrian detection based on the evaluation of comparison between the histograms regarding of gradient orientation among the localization of an images. The concept of the HOG is similar with that of edge orientation, scale-invariant feature transform (SIFT) descriptor and shape contexts, but it is regarding on a dense grid of uniformly spaced cells and used overlapping local contrast normalization for improved accuracy. Computation of each histogram is divided into small region called cells. The group of cell is combined to become a block. Then each cell is compiled using HOG and the combination of histogram represents descriptor. The illumination changes depend on strength of the normalization of the gradient. The performance of the HOG is related to the effective of local contrast normalization of each block [3].

Zernike Moments

Zernike moment, a set of orthogonal with simple rotation properties, as one of the tools of object recognition with a lower resistance to scaling, translation and rotation of the image will change with regard to the resolution or noise [10]. The Zernike polynomials are a set of complex, orthogonal polynomials defined over the interior of a unit circle x2+y2=1,

$$V_{nm}(x,y)=V_{nm}(\circ,{}^{-})=R_{nm}(\circ)e^{jm^{-}} \quad (1)$$

$$R_{nm}(\circ)=\sum_{s=0}^{\frac{n-|m|}{2}}(-1)^{s}\frac{(n-s)!}{s!\left(\frac{n+|m|}{2}-s\right)!\left(\frac{n-|m|}{2}-s\right)!}\circ^{n-2s} \quad (2)$$

where n is a non-negative integer, m is an integer such that n-|m| is even and

$$|m|\le n,\ \circ=\sqrt{x^{2}+y^{2}},\ \text{and}\ {}^{-}=\tan^{-1}\frac{x}{y} \quad (3)$$

Projecting the image function onto the basic set, the Zernike moment of order n repetition m is:

$$A_{nm}=\frac{n+1}{®}\sum_{x}\sum_{y}f(x,y)V_{nm}(x,y),\ x^{2}+y^{2}\le 1 \quad (4)$$

Equation (4) shows the Zernike moment in a rotated image different from the original image. The difference lie in that the equation is regarding on the phase shift but not in magnitudes. Therefore, A_{nm} can be used as a rotation invariant feature of the image function. Since $A_{n,-m}=A_{nm}$ and therefore $|A_{n,-m}|=|A_{nm}|$, so $|A_{nm}|$ is defined as feature size. Since A_{00} and A_{11} are the same for all of the normalized symbols, they will not be used in the feature set. Therefore the extracted features of the order n start from the second order moments up to the nth order moments.

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Moments Invariant

Moment invariants are related to the characteristic of pattern regarding position, size, and rotation of the image. The idea of the moment invariants was come from Ming-Kuei Hu in year 1962, who introduced six orthogonal invariants and one skew orthogonal invariants based on algebraic invariants [8]. Moment invariants have been applied to many applications especially pattern recognition, image registration and image reconstruction.

There are two dimensional of order (p + q) of a digital image f(x, y) that can be defined as follows:

$$m_{pq} = \sum_{x=0}^{M-1}\sum_{y=0}^{N-1} x^p y^q f(x,y), \quad p,q = 0,1,2,\ldots \tag{5}$$

The central moment of f(x, y) can be defined as:

$$\mu_{pq} = \sum_{x=0}^{M-1}\sum_{y=0}^{N-1} (x-\bar{x})^p (y-\bar{y})^q f(x,y),$$
$$p,q = 0,1,2,\ldots$$

Where $\bar{x} = \frac{m_{10}}{m_{00}}$ and $\bar{y} = \frac{m_{01}}{m_{00}}$ (6)

scaling normalization of central image moment can be defined as:

$$\eta_{pq} = \frac{\mu_{pq}}{\mu_{00}^{\gamma}}, \text{ where } \gamma = \frac{p+q}{2} + 1, \quad p+q = 0,1,2,\ldots \tag{7}$$

From the central moment, Hu has defined seven methods as follows:

$$\phi_1 = \eta_{20} + \eta_{02}$$
$$\phi_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2$$
$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2$$
$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$
$$\phi_5 = (\eta_{30} - 3\eta_{12})^2 (\eta_{30} + \eta_{12})\left[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2\right]$$
$$+ (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})\left[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right]$$
$$\phi_6 = (\eta_{20} - \eta_{02})\left[(\eta_{30} + \eta_{12})^2 (\eta_{21} + \eta_{03})^2\right] +$$
$$4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$
$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})\left[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2\right] +$$
$$(3\eta_{12} - \eta_{30})(\eta_{21} + \eta_{03})\left[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right] \tag{8}$$

Wavelet Co-occurrence Histogram

Wavelet co-occurrence histogram (WCH) is a method of object detection especially in logo detection. Ali Hesson and Dimitrious Androutsos used WCH for logo detection in their experiment, and the results showed that WCH is better in representation of the image feature compared to Edge Directional Histogram (EDH). Wavelet transform is used to produce a signal with a good resolution especially in spatial and frequency domain. One of the examples of wavelet transform is Haar transform, which is grouped into two types of filter that is low pass filter and high pass filter. There are four sub-bands used to apply the Haar transform namely Low-Low (LL), Low-High (LH), High-Low (HL) and High-High (HH) filters. The sub-band is represented with low pass filter and high pass filter in different order. Each wavelet transform can be divided into three dimensional vectors that are horizontal, diagonal and vertical, each of which represents pixel of the image. The first and second dimensions represent the pixel vectors and the third dimension represents the distance between the two vectors [5].

3. PROPOSED METHOD

Fractionalized 1D Principle Magnitude

This section presents the proposed fractionalized principle magnitude (FPM) algorithm using the magnitude of the 1D Fourier transform. Figure 1 shows the general flow of the system used to analyze the performance of the feature extractor methods.

The experiment begins with the reading of the Halal logo images from the database. All the images are resized into 210x210 pixels then converted from RGB to Grayscale image. Further, each image is divided into blocks with the size 5x5 fractions where each block is stored block location of the image as showed in the Figure 3.

a) Image size 210x210 b) Block of size 3x3 fractions c) Image size 42x42

Figure 3: The graphical illustration of dividing image into 5x5 fractions

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1D Fourier transform will be applied to the each fraction of the 2D Halal logo image. To achieve that, the 2D image needs to be converted to the 1D array. The entire first row is stored followed by the second array. The formula to arrange 2D image f(x, y) to 1D array is as follows:

$$f_{1D}(v) = f\left(\left\lfloor \frac{v}{W} \right\rfloor, v \bmod W\right), v = 0,1,...W \times H - 1 \quad (9)$$

where W is the width of the 2D image and H is the height of the 2D image. For better understanding, Figure 4 showing the graphical interpretation of the formula (9) gives an example of conversion from a 5x5 fraction 2D image to a 1D array. The reason for converting 2D data to 1D array is to reduce the dimensionality of the data.

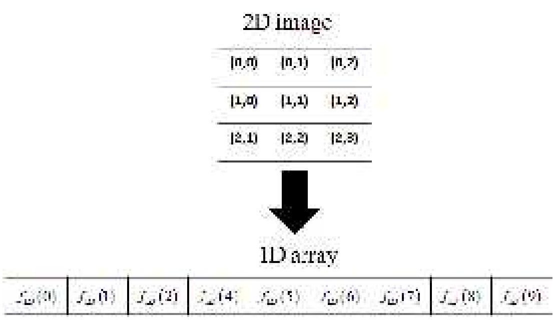

Figure 4: The Graphical Illustration Of Converting 2d Image To A Single Array

After the acquisition of the 1D array of the image, its Fourier transform can be calculated using 1D discrete Fourier transform formula as follows:

$$F_{1D}(n) = \sum_{v=0}^{H*W-1} f_{1D}(v) e^{-\frac{2\pi jnv}{H*W}}, n = 0,1,...., H*W-1 \quad (10)$$

The output of the Fourier transform is in complex number, by means of which, the magnitude and the phase of the 1D Fourier transform can be calculated using the following formula:

$$Mag\_F_{1D}(n) = \sqrt{\mathrm{Re}\left\{F_{1D}(n)\right\}^2 + \mathrm{Im}\left\{F_{1D}(n)\right\}^2}, \quad (11)$$

Because of the robustness and consistency value of the magnitude, the magnitude of the Fourier transform is only utilized as the feature. Among all of the magnitude, only 4 values; coefficients $Mag\_F_{1D}(1)$, $Mag\_F_{1D}(2)$, $Mag\_F_{1D}(3)$ and $Mag\_F_{1D}(4)$ are selected.

Fourier transform is similar to the summarization of the signals from the lowest frequency to the highest frequency. The low frequency contains the most significant information. So we select top four of the lowest frequency except for the lowest frequency coefficient which is removed due to its inclusion of an extremely large value compared to other low frequency coefficients that will disturb other values of the feature vectors.

As it is well known that the four values only gathered from the first fraction of the logo can be labelled as follows:

$$M\_F_{1D}^{1} = \begin{Bmatrix} Mag\_F_{1D}(1), Mag\_F_{1D}(2), \\ Mag\_F_{1D}(3), Mag\_F_{1D}(4) \end{Bmatrix} \quad (12)$$

The final feature vector is the combination of the 4 principle magnitude of all of the 25 fractions of the logo resulting in 100 elements, can be labelled as follows:

$$Final\_vec = \left\{M\_F_{1D}^{1}, M\_F_{1D}^{2}(z), ..., M\_F_{1D}^{25}\right\} \quad (13)$$

For the classification, KNN classification is applied to this system. It is known that KNN classifier is the simplest classification among other machine learning algorithms. The image is compared based on its similarity with the neighbor. In this experiment we used the value of k=1, where the object is simply assigned to the class of its nearest neighbour. Figure 4 shows the step process of feature vector beginning with 2D image until the final feature vector. The process is repeated from the first fraction to the last fraction.

Islam is a way of life which is cover with rules and customs built. There are five pillars need to observe by each Muslim

4. EXPERIMENTAL STUDIES AND EVALUATION

For the classification experiment, 50 class of approval Halal logo by JAKIM are used, each of which contains 5 different images and the total of Halal logo images are 250 images. As shown in Figure 5, the database images are gathered from various online resources such as JAKIM's website and Google's images.

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Figure 5: The 50's Type Of Halal Logo In The Database

The performance of FPM is compared with that of four other methods which are commonly used that is HOG, Hu moment, Zernike and WCH. This experiment is conducted on computer with an AMD E-350 processor 1.60GHz and 6GB of main memory. All the codes are written in MATLAB environment with Window 7 operating system.

For the classifier, k-nearest neighbour algorithm (k-NN) is implemented. k-NN is a method to classify data into two classes or more based on the closest training. Form research done by Yang and Liu, it was stated that k-NN outperformed other approaches especially in text categorization task. It is also one of the simple machine learning methods. k-NN is just developed to perform an analysis for estimate value or probability of the data when the unknown or difficult data should be classified[11]. In this experiment, it is assumed that value k=1 is a simple k-NN in classification between class and its nearest neighbour. Cosine similarity is implemented in this experiment to measure the different angle between two vectors.

Besides that, for the classification, cross-validation is utilized as the statistical method for evaluation and comparing learning algorithm by dividing data into two segments: one is used for test and the others used for train. In this experiment, k-fold cross-validation is in use where k is equal to 5. To measure the classification accuracy, each feature extractor is evaluated. There are 5 folds from each class used in this experiment and classification of each result of each fold is recorded. The classification accuracy for each fold is calculated using the following formula:

$$accuracy(\%) = \frac{no.of\ correctly\ classification}{no.of\ total\ images} \quad (14)$$

After calculating the accuracy of all of the 5 folds, the final average accuracy from each fold is calculated using the following formula:

$$average\ accuracy(\%) = \frac{total\ accuracy\ of\ each\ group}{no.of\ group} \quad (15)$$

Effect of Fraction size of FPM

There are five different size of fraction 2x2, 3x3, 4x4, 5x5, and 6x6 applied to this experiment respectively. The performance of each fraction and the performance of each size are calculated respectively. Then the optimum size of fraction is set regarding to optimum result of accuracy and time performance. Before the fraction process is applied, the image is resized into 210x210 pixels to standardise the size of image. The feature size refers to the size number of fraction. The performance of maximum accuracy over time (AOT) is calculated using the following formula:

$$Accuracy\ AOT(\%) = \frac{Accuracy}{Time} \quad (16)$$

Figure 6 showed the result of performance AOT for five different sizes of fraction. As can be seen from the graph which the red circle is the optimum size of fraction based on the performance of the proposed method when different size is applied. The highest value of performance accuracy over time will produce the optimum value of threshold.

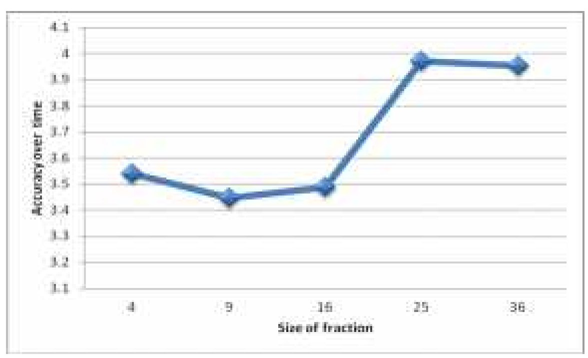

Figure 6: The Optimum Size Of Fraction

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Comparative Study of FPM with Others Method Based on Classification of Feature Extraction

The experiment is conducted to analysis the classification performance of feature extractor between FPM, HOG, Hu moment, Zernike and WCH on the Halal logo database. The average classification result is shown in the Figure 7. As we can see, FPM obtains the highest classification accuracy of 94% and Hu moment performs the lowest with 36%. It is because, FPM method has more significant information extracted with the information from the image. FPM is less sensitive to pose and scale changes since it resize back the image to a fixed size before processing it. Furthermore, FPM is based on 1D Fourier transform where a 2D image is transformed into a single dimensional with the localization of images. This mean FPM extracts the similar feature between the original image and different image. The other methods HOG, Zernike and WCH show the result below than 70%. All the method is run independently based on the physical characteristic of the algorithm.

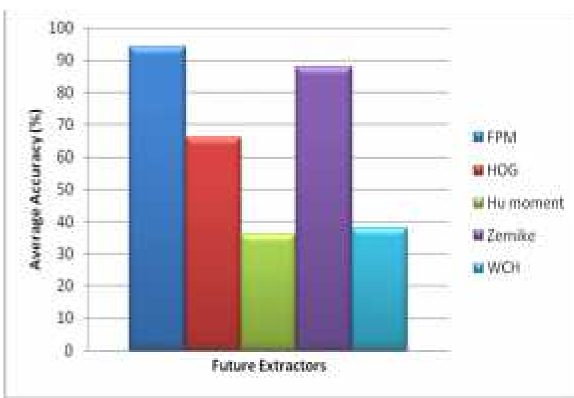

Figure 7: The Average Classification Accuracy On Halal Logo Database

Table I shows the time classification of each method to classify the approved Halal logo. Based on the result, FPM consumes the fastest processing speed among the others. It is because the FPM is simpler method among the others. Zernike method takes longer time to compute because the algorithm is complex and needs many calculations.

Table 1: Time Classification On Halal Logo

Method	Time classification
FPM	24.957557
HOG	100.354217
Hu moment	33.7412584
Zernike	5299.36361
WCH	1629.026105

The performance classification can also be measured by scrutinizing the number of false positive with different threshold value. The threshold values used are 40%, 60%, 80% and 100% of accuracies. The number of false positive classified logo for each feature extractor with different threshold are recorded and shown in Figure 8. It is clearly seen that FPM achieves the lowest true positive in every threshold. This means that FPM produces the lowest error rate compared to other feature extractor. For specific result of the true positive, Table 2 shows the specific value of true positive with the threshold 100%. The number is not achieving with threshold 100% is the number of wrongly classified logo. In a simpler word, it is the number of logo that does not achieve 100% classification accuracy.

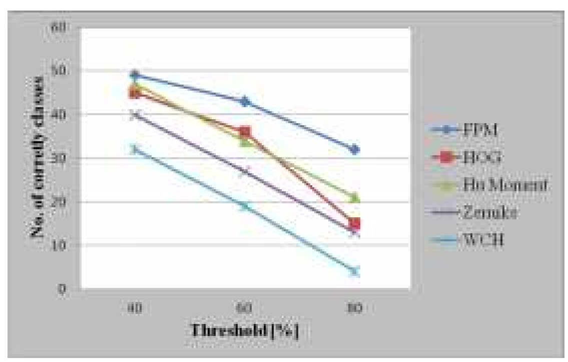

Figure 8: The Accuracy For Each Class

Table 2: The False Positive With Threshold 100%

Methods	FPM	HOG	Hu moment	Zernike	WCH
False Positive	18	37	49	46	38

Evaluation Classification of FSM versus Others Method based on Traffic Sign database

In this section the application of the FPM is applied with a new database. The evaluation of the performance of FPM and other four methods are

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presented. Figure 9 shows the example of traffic sign database gathered from German Traffic Sign Recognition Benchmark database (http://benchmark.ini.rub.de/). For the experiment 32 classes of traffic sign are used and each class contains 10 images and the total images are 320.

Figure 9: Traffic Sign Database

The same process is repeated and the accuracy performance and classification time are calculated and then the result is compared. Table 3 shows the accuracy and classification time result for the traffic sign database by which HOG achieves the highest speed compared to other methods and computation time of HOG method is shorter compared to other. Furthermore, the average classification accuracy shows HOG achieves highest accuracy performance. HOG algorithm is similar to edge orientation histogram which is detected from the edge of the image. For the information, FPM method is compatible to the image with same dimension. So the result for FPM method will also have effect.

Table 3: Accuracy And Classification Time On Traffic Sign Database

Method	Accuracy	Classification time
FPM	90	10.34
HOG	93.75	9.1608
Hu moment	25	17.8337
Zernike	62.5	1081.2
WCH	78.12	8716.1

Evaluation Classification of FPM versus Others Method based on Texture Database

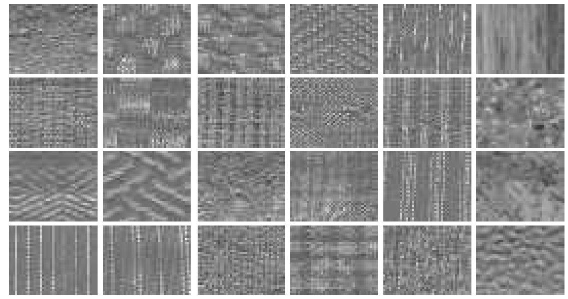

Figure 11: The Example Of Outex Database

The experiment is continued using the texture database gathered from KTH-TIPS database (Available at www.nada.kth.se/cvap/databases/kth-tips). There are 40 classes of Outex used in this experiment, each of which contains 12 images. Figure 11 shows the example of Outex image database. The performance of each method is recorded using a new database.

Table 4 shows the classification time of FPM and other feature extractors. Referring to the results, the highest accuracy for Outex database is HOG algorithm with 83.3% higher than other algorithm. Meanwhile FPM algorithm with the achievement of 50% accuracy and less computation time is appropriate for images logo with specific feature. Compared to other algorithms, it is applied to flexible image or object. Although the FPM algorithm result is less but it is able to compete with other algorithm.

Table 4: Accuracy And Classification Time On Texture Database

Method	Accuracy	Classification time
FPM	50	28.2225
HOG	83.3	40.0752
Hu moment	16.7	40.8569
Zernike	12.5	771.897
WCH	66.7	35929

5. CONCLUSION AND FUTURE WORKS

In this paper, a Fractionalize principle magnitude based on 1D Fourier transform is present. We evaluated the feature extractors with respect to average accuracy and time consumption of the classification of approved Halal logo. The classification is conducted using 5-fold cross validation scheme to obtain a reliable result. Regarding the result, FPM achieves the highest

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accuracy and the fastest computation speed compared to other feature extractors. Classification of FPM has been evaluated as well using the other database, and in this paper traffic sign and Outex database are in utilization. The performance of FPM and other methods are compared. For the future work, FPM will be embedded into Smartphone and the performance in classification of the Halal logo is tested using the image captured from the Smartphone camera directly. The performance using the Smartphone camera may different from the one conducted in this experiment and our job is to enhance FPM so that it can perform effectively on Smartphone.

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