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Research Article

Image Processing Techniques to Cope Color Vision Deficiency in Detecting Pork Adulteration in Meatballs Visually

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Abstract: The aim of this study is to utilize image processing techniques for solving color vision deficiency problem in visual detection of colors. Besides, about 0.5% female and 8% male were affected by color vision deficiency. Nevertheless, pork cheating in beef and chicken meatballs was investigated by the changing in color of pork's DNA containing samples into a remarkable color. The visual results were supported by absorption spectroscopy device to avoid color vision deficiency problems. Surly, any pork component is prohibited in Halal and Kosher food and many non-Muslim countries are interested in Halal food as it reduces the risk of zoonotic diseases as well as having unique quality attributes economically. Utilizing spectroscopy device is inappropriate way to support the visual decision compared to image processing techniques. The key feature in this study is the pixel color intensity. The colors were enhanced by adjusting their brightness and saturation levels. Matlab was used to measure and classify the pixels of images. The image size was 320×240 pixels; which provides 76,800 pixels to be averaged, measured and classified. Moreover, a graphical user interface was designed to make the algorithm to be simply used by even unprofessional users. The results of this study indicated that the applied method is less complicated, more than $8,000 cost saving and it detected the Halal and non-Halal samples as the previous study did. Thus, it can be a good alternative to the utilizing of spectroscopy device.

Keywords: Color vision deficiency, Halal food, image processing, pork detection

INTRODUCTION

One of the comprehensive religions is Islam, which is followed by the entire Muslims around the world. Its economic, social and ethical aspects are governed by rules and guidelines of Islamic religion under what is called Shariah law. The Holy Quran and Hadith (what Prophet Muhammad PBUH has been practicing) are the only sources for Muslims to rely upon in deriving their rules. Since the last verse of Quran was sent to prophet Mohammed, the rules have remained fixed and clearly unchangeable. One of these principles discusses about the Halal and non-Halal food, which signifies the status of food, whether or not it can be eaten (Nakyinsige *et al*., 2012a).

Halal and Haram are two terms that were found in the Holy Quran and they are written in Arabic language. Halal means approved, legal, authorized, allowed, permitted, lawful, licit or legitimate, whereas Haram points out the opposite meaning to Halal (Nakyinsige *et al*., 2012b). It is well-known that when a food is considered Halal, it means that Muslims have the permission to consume it and vice versa. Meanwhile, Kosher is a Hebrew term referring to "suitable or fit" for Jews, which describes about three main issues: the prohibition of blood, the allowed animals and the prohibition of mixing meat with milk (Regenstein *et al*., 2003). Jews and Muslims are in the same agreement about the types of allowed animals as well as the prohibition of the consumption of blood. The Codex Alimentarius Commission, a joint FAO/WHO subsidiary body responsible for developing international food standards has adopted general guidelines for the use of the term Halal at its 22nd session in Rome In 1997, (as cited in Nakyinsige *et al*. (2012a).

Halal food trading has exceeded USD 661 billion in collection (Ali *et al*., 2012a) as many of the non-Muslim consumers are interested in this area because of its quality attributes and contributions in reducing the risk of zoonotic diseases (Gregory, 2008; Mohamad *et al*., 2013). Likewise, many European food industries

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have realized the significance of Halal food as they invested in the market in a regular and frequent way (Van der Spiegel *et al*., 2012). On the other hand, a number of countries such as Malaysia, Indonesia, Thailand, China, India, Australia, New Zealand, Brazil, Turkey and Singaporeendeavor to invest in Halal food as well as being a part of the huge global Halal food market (Wang *et al*., 2004).

Pork or any component extracted from animals with canine teeth such as rats, monkeys, cats and dogs is not allowed to be consumed by Muslims according to the Islamic law. Furthermore, breaking these rules is a significant issue that may bother many people who follow the principles of Halal and Kosher (Ali *et al*., 2011, 2012b). However, Halal foods are healthier than the normal food because they are based on religious and health norms (Ali *et al*., 2015). Additionally, the possibilities of cheating this type of food are much higher than those of the normal food products due to the special requirements of production (Ali *et al*., 2015).

Nanotechnology is considered one of the most important technologies, which has been applied in many studies. Recently, the advance technology of nanomaterials was used to discover the toxin, food borne and cheated food in meat products (Inbaraj and Chen, 2016). The nanomaterials exclusive properties could improve the sensitivity of sensing systems, enable the capacity of multiplexing operations and minimize the time required for detection purpose (Jain, 2005; Nath *et al*., 2008; Rosi and Mirkin, 2005). Moreover, nanomaterials features can be modified in many ways, such as changing the shape, size, composition and adjusting its surface with suitable materials (Inbaraj and Chen, 2016). There are different types of nanomaterials used for the purpose of food and meat detection, the most popular types are the Silver Nanoparticles (SNPs), silica nanoparticles, Quantum Dots (QDs), Magnetic Nanoparticles (MNPs), gold nanorods and Gold Nanoparticles (GNPs) (Inbaraj and Chen, 2016).

One of nanomaterial applications is to detect pork meat cheating in chicken and beef meatballs. An example of this application can be seen in the study done by Ali *et al*. (2012c). This study has developed a method to detect pork meat adulteration using citrate-coated GNPs with a size of 20 nm. The key principle of the method was the changing in the color of the nanomaterial from its original color into gray-purple color. In other words, when the GNPs were added into the pork DNA containing vials, the solution color turned from pinkish-red into gray-purple. In addition, the 20nm size of GNPs gave a noticeable change in color with higher absorption amount compared to 40 nm size (Ali *et al*., 2011, 2012a, 2012b). Moreover, the cited technique is sensitive, less complicated and less expensive with the use of UV-VIS spectrophotometer. Unlike other studies that used the traditional PCR device, the GNPs method was faster than PCR by more than 10 minutales with higher sensitivity.

Recognizing the colors of vials visually is a simple way to give the final decision. However, the study on GNPs illustrated that the decision could not be very strong because of color vision deficiency errors (Ali *et al*., 2012c). Color vision deficiency is a serious problem in such field as it negatively affects approximately 8% males and 0.5% females around the world. People with color vision problems suffer from this disadvantage when they perform visual related jobs. Thus, they are most likely to be rejected from exercising specific occupations (Simunovic, 2010).

The color vision deficiency problem in GNPs study has been already solved by using absorption spectroscopy machine to support the naked visual results. Ultraviolet spectrophotometry or ultraviolet-visible spectroscopy refers to reflectance spectroscopy or absorption spectroscopy in the ultraviolet-visible spectral range. The concept of this machine can be understood as it calculates the amount of light absorbed by the chemical solution. In other words, it gives the absorption ratio by calculating the output light subtract from the input light (Skoog *et al*., 2007). The previous technique was undoubtedly inexpensive, available and reliable as what was explained by the GNPs study (Ali *et al*., 2012c), but in comparison with the use of image processing techniques, the latter one produces the same results with reasonable cost and less complication.

Image processing technique is widely used as a tool in food and meat industries to monitor the quality and detect the reliability of products. Image processing is a creative way to support human vision as it is based on the same concept of the three filters in human eyes, which are red, green and blue channels (Lorente *et al*., 2012). Color is the one of vital components when it comes to meat products; color of meat is not unique, because it represents the chemical and physical characteristics of the material itself (Girolami *et al*., 2013). There are several color spaces in digital color images; one of the most common color spaces is the RGB. RGB color space comprises three main channels, namely red, green and blue channels, which are available in each pixel with the intensity ranging from 0 to255 (Valous *et al*., 2009). The color intensity varies from one image to another. Color intensity is widely used in face recognition, hand tracking, skin color detection, object recognition and human-computer interface (Park and Lu, 2015). Accordingly, the color intensity is the key feature in the present study. Thus, this study attempts to give a clear result that could distinguish between the two color samples based on their color intensity.

Before the beginning of this study, the R, G and B intensity values that were in the vial images of Ali *et al*.

(2012c) have been verified by using the powerful image processing tool Adobe Photoshop. Adobe Photoshop is widely used in image processing field (Jin *et al*., 2013). In addition, random pixels areas were also selected. The results showed that the images have similar intensity values that were not reliable in producing a strong decision. Therefore, image enhancements was done to acquire the images new features that could extend the space between the two color intensities. After the intensity values have been extended, the accuracy of the result increased. Another point has to be discussed on the data that was measured; some parts of the images were ignored because they were unclear due to the illumination condition that affected the color intensity. Moreover, Region of Interest (ROI) was selected and good images were finally produced for test and calibration purposes.

The objectives of this study were to solve color vision deficiency problem by: a) utilizing image processing techniques, b) verifying the results using Matlab, and c) evaluating the results with the recent work that utilized the absorption spectroscopy device. These objectives were done by virtue of the following process: first, applying some image processing techniques using Adobe Photoshop to enhance the original images and to acquire them new features that could make the classification more accurate, second, verifying the result or the new color intensity by using Matlab software, thirdly, evaluate the results of the proposed study with the study of using absorption spectroscopy device.

MATERIALS AND METHODS

The research was carried out on vials image samples found in GNPs study (Ali *et al*., 2012c). These images clearly demonstrate the color of GNPs in genomic DNA that was extracted from meatballs mixed with pure pork, pork and beef, pork and chicken, chicken and beef, pure beef and pure chicken from left to right, respectively as shown in Fig. 1.

The R, G and B intensity values were verified using Matlab software and the results suggested that the images in the present condition are not reliable to give the final decision due to the unclearness of some parts of the images. Thus, the images were segmented and Region of Interest (ROI) was selected to give better images for test and calibration purposes.

As it can be seen in Fig. 1, the images contained some parts that seemed unclear. The middle part of the images is an appropriate area for test. The area size is approximately 320×240 pixels, which is equal to the QVGA image size. Moreover, QVGA size provides 76,800 possible color values that can be used for verification and averaging aim. Thus, the 76,800 values will increase the accuracy of the results.

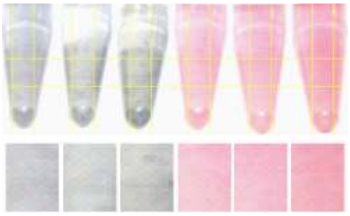

Fig. 1: The yellow guidelines demonstrate the region of interest (ROI) selected from the original vials (Ali *et al*., 2012c)

The digital images have many formats and they are divided based on the data compression type into lossless and lossy. In addition, the compression type could affect the quality of the image. Furthermore, the well-known lossless compression files are Portable Network Graphics format (PNG), Tagged Image File Format (TIFF) and Graphic Interchange Format (GIF). While one of the lossy compression file is the Joint Photographic Experts Group Format (JPEG). However, PNG, which is a file type that does not lose data when it is compressed. PNG has various properties: variable range of transparency, controllable image brightness (gamma correction) and the 2D interlacing for faster image viewing. In this case, PNG file is preferable because the TIFF has a large file size. Additionally, most of PNG features are not supported by GIF file format and it is about 5-25% less compression efficient than PNG file (Graham *et al*., 2005). Thus, PNG file format has been chosen in this study based on the above features.

In this study, all image color intensities were checked. There was a specific range of intensities for every channel of the three channels, which are R, G and B. Images were created using Photoshop based on the following properties: RGB color mode; as it is the original color space of the original images, 300 dpi resolution; which is the same as the original resolution, the size of the file was 320×240 pixels and the rest of the setting was set as default. The total number of images was60, 30 of them represented the Halal color intensity and the other 30 represented the Haram color intensity. Additionally, that number was chosen as it represents the number of frames per seconds in video camera. All images were colored based on the intensity values of the original images. Finally, all images were saved with PNG file type.

This study followed the five general image processing steps (Du and Sun, 2004) as shown in Fig. 2. The first step is the use of image acquisition and pre-processing method to extract the images from the PDF file and remove the unimportant parts of the image. The second one is the image segmentation, which takes the ROI for each image and saves the images using a proper file format. The third step is the image enhancement that applies some improvements to acquire some new properties for images to make them different from each other. The fourth is the object

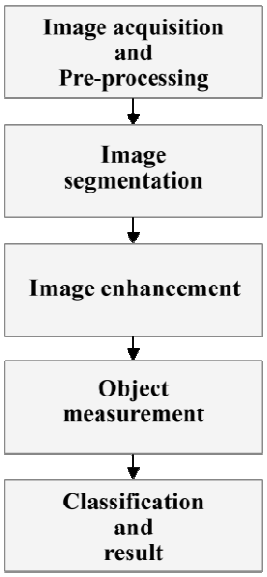

Fig. 2: General image processing steps

measurement, which measures the features of objects such as shape, texture, color and size. The final step is the classification and result step, which in this part refers to the objects that will be classified into groups based on their properties.

Image acquisition and pre-processing: The images were imported from GNPs article (Ali *et al*., 2012c), which is in a PDF file format. The extraction of images from the PDF file was done using Adobe Photoshop software. Next, the vial images were cut using the Crop tool in Photoshop. Then, a new file was created with the properties of the RGB color mode, 300 dpi resolution and the file size set as similar asthe cut area. Finally, the images was saved using the PNG file format.

Image segmentation: Image segmentation is a challenging task because of the richness of visual information of the images. It classified the image into its constituent objects. Region-based segmentation technique is the one that was chosen to implement this task and the images were manually segmented using Adobe Photoshop tools. The tools have been used arethe Crop tool, the Rectangular Marquee tool and the Polygonal Lasso tool. In other words, a shape with 320×240 pixel size was created using rectangle tool. Next, guidelines were set for each image based on the created shape's size as shown in Fig. 1. Then, the ROI was selected by the Rectangular Marquee tool. The selected ROI was then copied and pasted into a new file with the same setting as the one created in the pre-processing stage. The images then were separately saved as PNG images.

Image enhancement: Once the image segmentation step and ROI selection have successfully done, the images were then processed. At this stage, some image enhancement tools were applied to increase the image's texture as well as making some new details for measurement purpose. This operation was carried out through two steps: (1) adjusting the image saturation and (2) adjusting the image brightness. Having done these processes, the images acquired new details that made the measurement and classification more accurate.

Adjusting the image saturation: In order to adjust the saturation level of any RGB image, the color space of the image should be converted from RGB to HSI (hue, saturation and intensity), HSL (Hue Saturation Lightness), or HSV (Hue Saturation Value). Next is increasing the saturation value in the new color space and finally converting the color space back to RGB. The transformation formulas that convert the RGB to HSV or vice versa as well as the alternative color spaces has been carried out by Travis, Gonzalez and Woods (Ford and Roberts, 1998). The transformation procedure is quite complex. Thus, it can be done by the use of many image processing tools, (*i.e.* Adobe Photoshop, Matlab Image Processing Toolbox and Python Imaging Library PIL).

In this study, Matlab software was used for reading the original image's pixel values and calculating the average value of pixels. First, the images were loaded intoMatlab workspace. Next, the red, green and blue channels were split into three separated channels. After that, the mean value of all pixels was taken. Finally, the final value of each channel was stored in a new variable.

The saturation value of all images was increased using Photoshop, which was done by applying the Hue/Saturation effect from the image-adjustments-Hue/Saturation menu. The saturation value was set to +45. After applying the saturation effect on the images (the real and virtual ones), Matlab was used to check the new pixel values. The new red, green and blue pixel values of the non-pork containing samples (pink color) demonstrated anoticeable change in color intensity with the stability of pork containing color intensity values (gray color).

Adjusting the image brightness: Brightness is a measure of light intensity. This term is sometimes referred to the intensity (Tkalcic and Tasic, 2003). In a color space such as RGB, the brightness of the red, green and blue colors varies from each other and the brightness can be calculated by (R+G+B/3) formula in some systems (Poynton, 1999). In this part of the study, the image brightness was set to be decreased to increase the red color intensity in the pink color images and decrease it in the gray images. The other color channels was affected as well, but the focus of this stage wason the red color intensity.

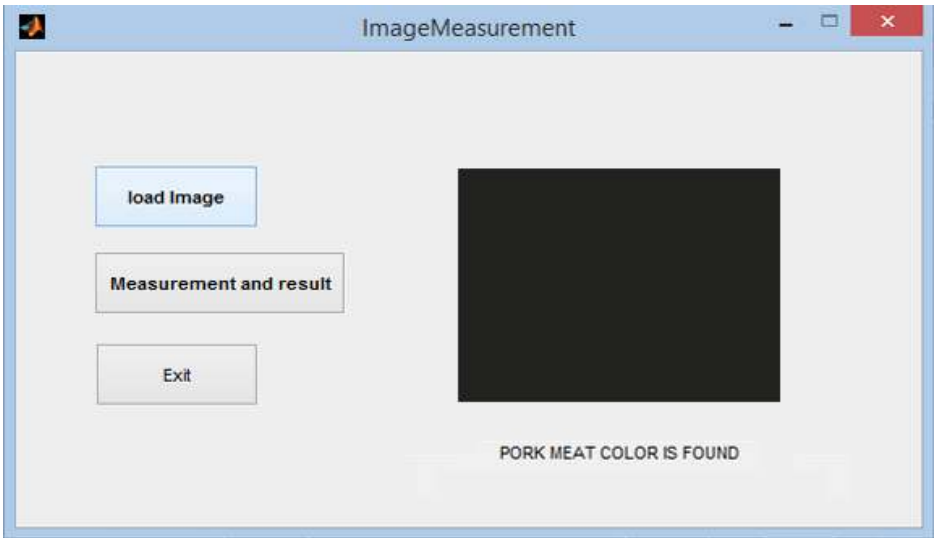

Fig. 3: Graphical User Interface (GUI) screen shows an RGB image of pork containing color (Haram color)

By the help of Adobe Photoshop, the brightness was decreased, which was done by choosing (Image-Adjustments-and Brightness/Contrast) menu with the favorite brightness value of -150. This operation was repeated twice with a steady contrast. This effect was applied to all images either virtual or the real ones. Finally, the resulting images were black for the pork containing samples and red for the other samples.

All in all, to make the image enhancement to be done faster, an action was created by Photoshop to get the images ready with one click and within one second. An action is a sequence of tasks that you play back on a single file or a batch of files. For example, an action can be created to change the size of an image or apply an effect to the image and then saves the file in the desired format (Photoshop Help, 2015).

Object measurement: The aim of object measurement is to determine the color pixel intensity whether it is pork containing color (Haram) or not pork containing color (Halal). Good object measurement of any color is the one that provides overall coverage of different color intensities. This measurement depends on pixel color intensities as the main object to be measured. In image measurements, color is an effective attribute and robust describer that could make the object extraction and identification much simpler. Color features can be measured by checking every pixel within any image boundaries (Du and Sun, 2004). Color is considered a powerful tool for measuring several types of food products such as grain, fruit, vegetable and meat (Du and Sun, 2004). The color of tomato was used to evaluate the maturity stage using image analysis as carried out by Jahns *et al*. (2001). Ruan *et al*. (2001) have reported a scabby wheat grain percentage, presentedby the normal wheat grain using automatic system based on color feature extraction. Since color type or intensity is a successful tool in providing object measurement, the object measurement algorithm in this study was based on checking the pixel color intensities. Moreover, the algorithm measures the intensity of each band known as red, green and blue channels of the RGB image.

After adjusting the image brightness, RGB images were saved as PNG files. These images were used in this stage to be measured and examined based on their pixel color intensities. The measurements of the RGB image intensities were done using Matlab software.

Graphical User Interface (GUI) was designed to simply perform this measurement with less complexity to the user. In Fig. 3, the GUI screen has a load button, measurement and result button, exit button and a message showing the result after executing the algorithm.

The RGB image measurement algorithm comprises several steps. The first step is the loading of image. The second oneis the splitting of the image channels into red, green and blue channels, with the red channel being the color that was compared and measured. The third step is the determination of average pixels value. The last one is the storage of final value in a separate variable. Moreover, the measurement button measures and give results for the selected image. The proposed algorithm measured 76,800 pixel values that belong to the red channel of each sample. This amount of pixels will highly increase the accuracy of results.

Classification and results: This is the final stage of the presented image processing steps in which it will give the result as text and image to aid people with color vision deficiency problems make a strong decision regarding the Halal and Haram colors.

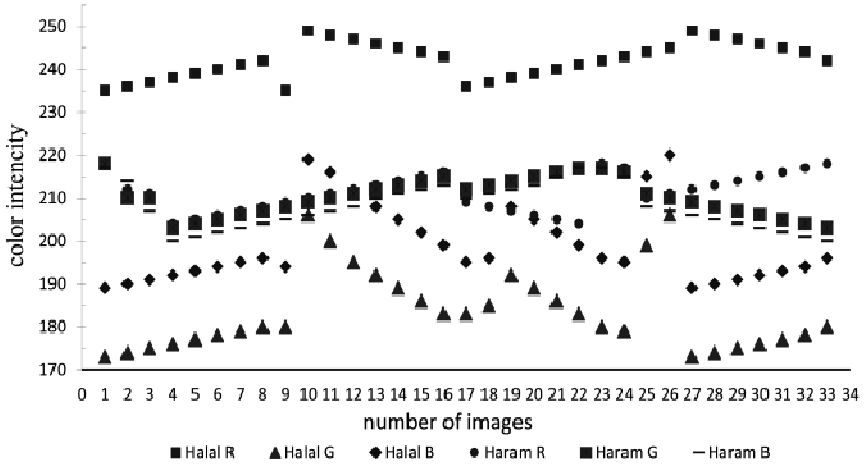

Fig. 4: RGB color intensity for images before the proposed method

As the images were successfully pre-processed, segmented, enhanced and measured, the RGB images at this stage had a specific range of pixel intensities for the pork and non-pork colors. Moreover, a comparison was made to the red color in both images. The intensity difference in red color for both is about 213 values, suggesting a higher accuracy of the result. The Halal images gained more red color intensity after enhancement process, which showed a full intensity of 255 for all images, while the Haram images became black after enhancement, showing the intensity ranging from 33-42 for there d channel. Thus, the result and calibration algorithm compared both colors based on their intensities.

After the loading of the images and when the average value of the pixels was calculated, there is a number to be compared for each image. The calibration for the Halal and Haram colors is based on the comparison bet weenred channel intensity, which is 255 and other intensity that ranges from 33 to 42. The error range was set tobe±8 based on the differences between the intensities of the red channel in the original images before any image processing step was performed.

The results were based on four conditions. The first condition, if the red color intensity is 255, thus, this color is Halal. The second one, if the color intensity is from 33-42, thus, this color is Haram. The third condition, if the intensity is ±8 from the previous ranges, the color is doubtful or suspected and in this case, the program will display a message which is "The color is doubtful pleasere do the test". The fourth condition is as if the intensity is out of the previous ranges, the result is unknown and the program will display a message which is "The color is unknown or out of range, it is better to check your samples and redo the test".

RESULTS AND DISCUSSION

The color intensity of R, G and B channels that belong to Halal and Haram images before the proposed study is shown in Fig. 4. The proximity between the intensities of those images made the results to become unreliable and inaccurate to give a strong decision.

The images after Photoshop processing contained two different colors; one was red, while the other was black. The total number of images was33 for Halal images with three of them represented real images, while the other 30 were virtual images. Similarly, Haram images also displayed 33 numbers of images; three, were real and 30 were virtual images. The intensities from the total of 66 images after Photoshop processing were tested in Matlab and the results of red channel are as shown in Fig. 5.

The Halal color intensities were all equal to 255 and the Haram color intensities were in the range of 33 to 42. Thus, the huge difference between both colors was very sufficient to decide whether or not this sample is Halalas shown in Fig. 5.

The green channel intensities of Halal and Haram RGB images were conflicted in the same areas. The range of the Haram intensities was from 32-40 and the Halal one was from 23-33 as shown in Fig. 6. Moreover, the similarity and proximity in intensity values made the classification more difficult.

The blue channel of the images showed that the Haram intensity values were from 31-40 and 28-38 for the Halal images. Additionally, this wa salso considered as unreliable, similar to the previous channel due to the conflicts and proximity in the intensities. The result illustrated in Fig. 7 shows how the two image intensities are similar, inaccurate and a bad choice for testing and calibration.

All 66 images were tested in the proposed Matlab algorithm. The first 33 images that belong to Halal have displayed red color, suggesting that it is not pork meat containing color. In addition, the rest of the images that belonged to the Haram color intensities showed black color; hence proposing that it is pork meat containing

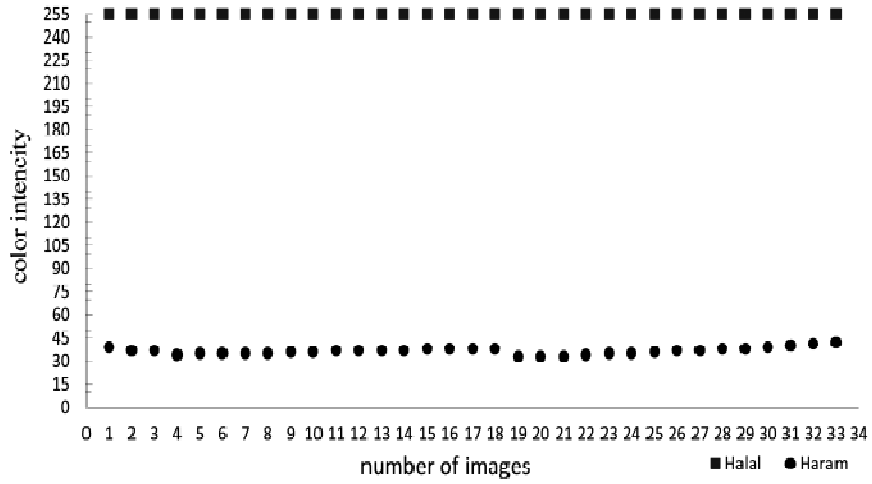

Fig. 5: Halal and Haram red channel intensity after applying the proposed method

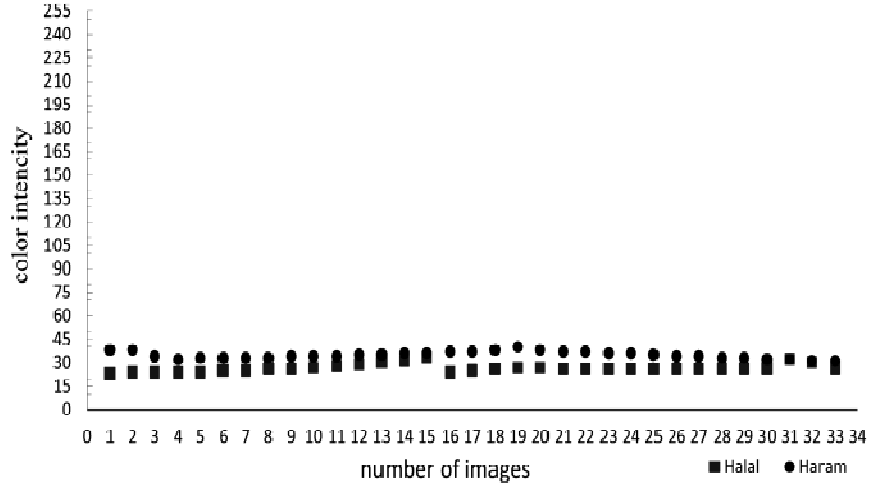

Fig. 6: Green channel intensity of the proposed method

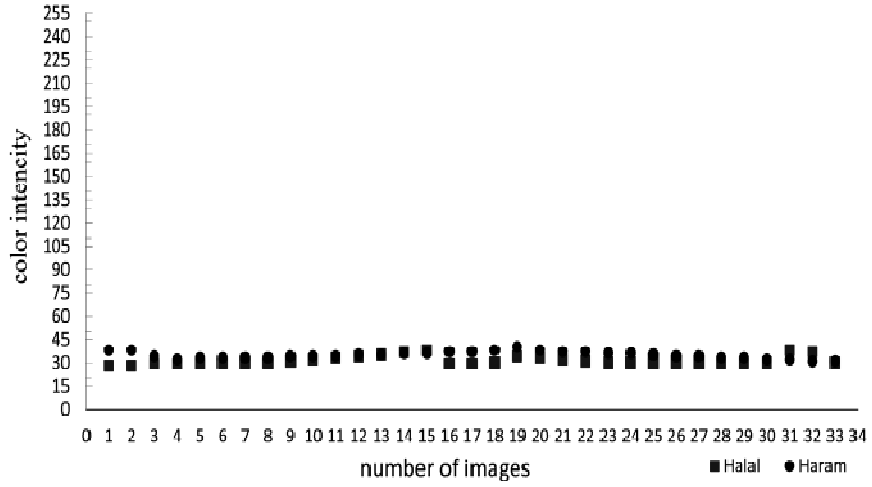

Fig. 7: Blue channel intensity of the proposed method

color. For the other two conditions in the proposed algorithm, images with ±8 color intensities from the defined maximum and minimum two ranges for thered channel and the intensities that were out of defined

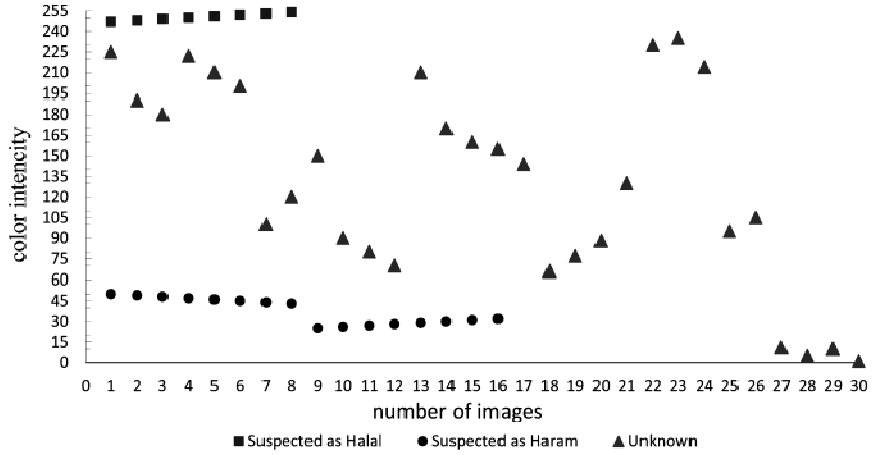

Fig. 8: The suspected and the unknown color intensities features of this work

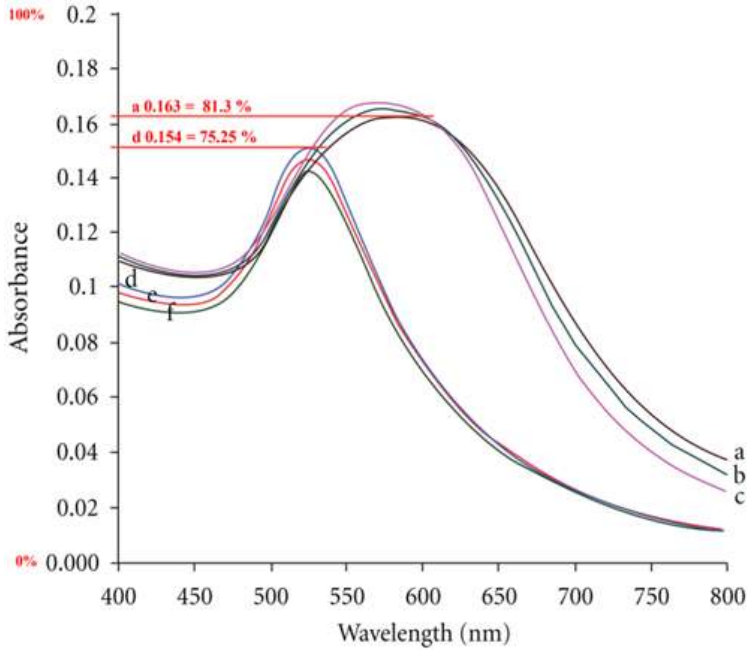

Fig. 9: The result of absorption spectroscopy device for pork adulteration in meatball (Ali *et al*., 2012b)

range were created by Photoshop to test algorithm's accuracy. Twenty four images with ±8 were created as they represented the doubtful images and 30 images that were out of range for the unknown intensities. All images were successfully tested by Matlab and they gave the expected result as presented in Fig. 8.

The use of absorption spectroscopy machine in solving color vision problems has shown that the difference between the Halal and Haram curves was approximately 6% with the 100% represents 0.2 and 0% represents 0. As shown is Fig. 9, the y axis represents the absorbance value with respect to the wavelength value in x axis.

The maximum absorption of sample "d" that does not contain pork DNA is approximately 0.154 and the minimum absorption of pork containing sample "a" is approximately 0.163, thus showing only 0.009 difference which is equal to 6% of the total range which is between 0-0.2. However, the proposed study showed that the difference between Halal and Haram based on color intensity is approximately 81%, with 100% represents 255 and 0% represents 0. In Fig. 5, the y axis represents the color intensity with respect to the image numbers in x axis. Thus, that huge difference between Halal and Haram aid to give a very sufficient decision as the using of absorption spectroscopy for this purpose.

From several brands of absorption spectroscopy the study has chosen Hitachi brand for cost comparison purpose. Moreover, Hitachi absorption spectroscopy is the one that has been used in the laboratories of Halal policy and management at University Putra Malaysia

Table 1: The comparison between the proposed method and the using of absorption spectroscopy machine

Features	Absorption spectroscopy	Image processing
Detecting Halal sample	Yes	Yes
Detecting Haram sample	Yes	Yes
Suspected samples	Undefined	Defined
Unknown samples	Undefined	Defined
Cost	>$8,000	<$500
Complexity	Professional User	Any User

(UPM). However, the available device from Hitachi is UH5300 and its cost is more than $8.000 (VWR International, 2015). Furthermore, these types of devices require professional users to operate and take some minutes to get the test and result done. On the other hand, the proposed method is cost effective with reasonable price, which is less than $500 including the laptop, Matlab software and Adobe Photoshop software (Adobe, 2015; ASUS X551, 2014; Matlab, 2015). Besides, it is also less complicated as it is all about one click on Photoshop plus one click on Matlab to get the results ready. The proposed study has detected all the Halal and Haram colors and supported the visually detection actively with two extra features, which are the suspected and the unknown ranges.

Table 1 illustrates the comparison between the using of absorption spectroscopy and image processing to solve the color vision deficiency problem.

Table 1 shows that the absorption spectroscopy device and the proposed method (image processing) have detected the Halal and Haram samples. The suspected and the unknown samples were undefined in the absorption spectroscopy while it is defined in the proposed method. As it can be seen from the cost of the current method (<$500) is obviously less than the absorption spectroscopy method (>$8,000). Moreover, any user is able to operate the image enhancement in Photoshop by click on the run button in the actionmenu. After this process, the result could be obtained when the image is loaded by click on measurement and result button using GUI program. On the contrary, extracting the results from the absorption spectroscopy device is complicated since its setting should be set by professional user.

The results showed that this study is a good alternative to solve color-blindness problems mentioned in the visual detection of pork adulteration in the meatballs study (Ali *et al*., 2012c).

CONCLUSION

The results of this study found out that the proposed method (image processing technique based Photoshop and Matlab) is an alternative method to the utilizing of absorption spectroscopy device in solving color vision deficiency problem in the visual detection of pork adulteration in meatballs. The proposedmethod is simple; as it is all about two clicks one on Photoshop and the other on the GUI program,produced the same results of absorption spectroscopy using the same samples and cost efficient with more than $8,000 saving compared to the use of absorption spectroscopy machine for color vision problem purpose.

The proposed method can be developed and enhanced by increasing the sample numbers, using high quality images and creating a dataset for the pork and non-pork colors as what is well-known in skin color and face detection dataset.

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