System Development for Quality Evaluation of Fish Fillet Using Image Processing

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Abstract - This paper presents system development for quality evaluation of fish fillet using image processing. The proposed system consists of conveyer belt, Ultraviolet (UV) lamp, CCD Camera, electronic circuits, interface card and computer. K-means clustering and thresholding techniques are used for quality evaluation of fish fillet. The image segments are used to calculated area of fish fillet and fish bone. The quality of fish fillet is based on percentage of fish fillet and fish bone area. The experimental results show that the proposed system can evaluate quality of fish fillet.

Index Terms - Quality evaluation, Fish fillet, Fish bone, Image processing.

1. Introduction

Image processing and computer vision techniques are widely used in many industrial applications[1-3] such as food manufacturing, electronic manufacturing, industrial automation, product inspection, remote sensing etc. For food industry and food manufacturing, computer vision is use to quality evaluation of many food product such as grading of potatoes, classification and quality evaluation of table olives, quality evaluation of strawberries, citrus fruits, apples and seafood, quality inspection of poultry carcasses, quality measurement of cooked meats, quality evaluation of meat cuts etc.

Fish fillet is a fish which has been cut or sliced away from the bone by cutting lengthwise along one side of the fish parallel to the backbone. Frozen fish fillet is importance product of Thailand. Many countries import frozen fish fillet from Thailand. The quality of frozen fish fillet is based on size, weight and freshness. Major problem in many fish fillet product is remained have bone in side. Many researchers propose method for bone inspection in fish fillet[4-6]. Jensen et al. used UV lamp to exposed ultraviolet light about 340 nm and any fluorescent radiation emitted by fish bone which intensity is proportional to the amount of bones in the fish fillet[4]. Yanfang Han and Pengfei Shi presented fish bone detection based on image preprocessing[5]. Particle Swarm Clustering and D. Mery et al. presented automated fish bone detection using X-ray imaging[6]. However the above mentioned system is very expensive. In this paper presents low-cost system for quality evaluation of fish fillet using image processing.

2. The Proposed System

The schematic diagram of proposed low cost system for quality evaluation of fish fillet using image processing is shown in Fig.1.

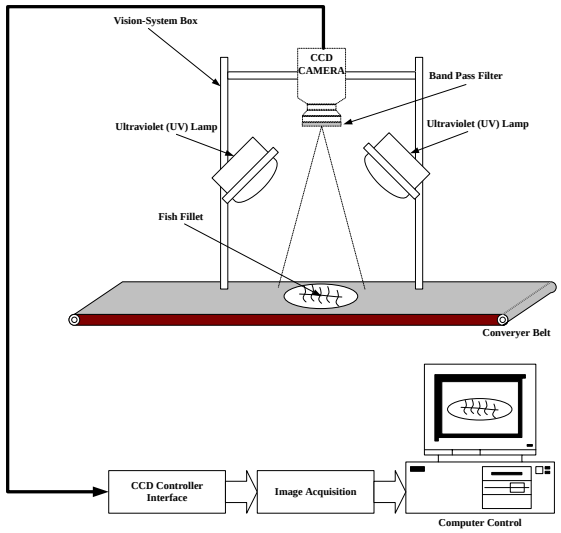


Fig.1. low-cost system for quality evaluation of fish fillet using image processing.

From Fig. 1, the proposed system consists of conveyer belt, UV lamp, CCD Camera, electronic circuits, interface card and computer. Conveyer belt uses for transport fish fillet to inspection box. UV lamp uses to exposed ultraviolet light about 340 nm to fish fillets sample. Webcam camera employs for image capture. Computer employs for control system and image analysis.

A. Image acquisition system

Image acquisition system is used for image capture. A digital image of fish fillet is captured and stored in the computer before analysis by proposed algorithm. The image acquisition system consist of:

1. A webcam camera with 5 megapixels of resolution, transmission rate 30 fps (WEBCAM OKER Model OE-183) with USB interface for image capture.

2. DELL INSPIRON N4010 notebook computer system is used for image stored and image analysis.

3. Two ultraviolet lamps (UV lamps) emit radiation over the whole UVA part of the spectrum 315-400 nm.

4. A plastic box where the illuminating tubes and the camera are placed. The interior walls of the box are painted black to minimize background light.

B. Image analysis

Fish fillet image from the image acquisition system is used for fish quality evaluation by image analysis. Image analysis is separate into two parts as shown in Fig. 2. and Fig. 3.

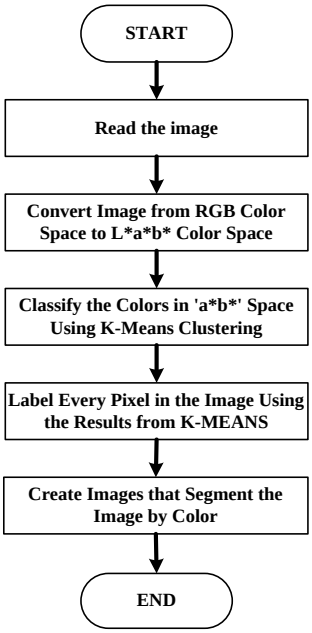


Fig. 2. Colour segmentation of fish fillet.

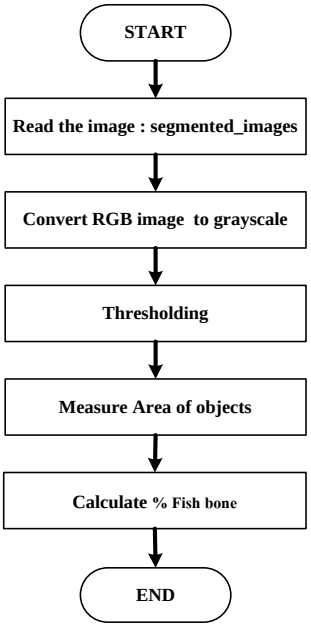


Fig. 3. Area calculation of fish bone.

Fig.2. shows image processing algorithm for color segmentation of fish fillet. The algorithm is based on K-means clustering and thresholding technique [1,7-8]. Three classify images were generated by this algorithm. Segmentation of fish images are fish fillet, fish flesh and fish bone. The segmentation images are used to calculate area of fish bone by algorithm as shown in Fig. 3. The area of fish bone is used to evaluate quality of fish fillet.

3. Experimental Results

To verify the performance of the proposed system, two fish fillet are used for experiment. Fig. 4 shows fish fillet with bone for testing the proposed system.

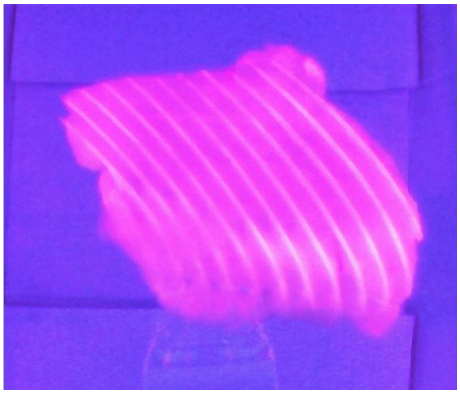
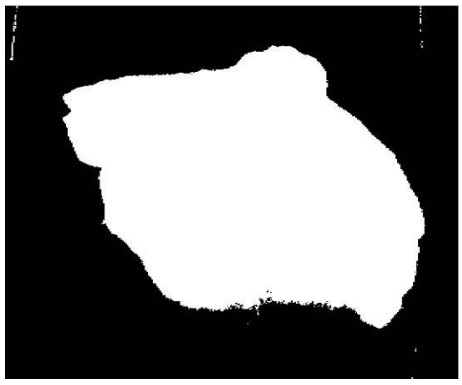


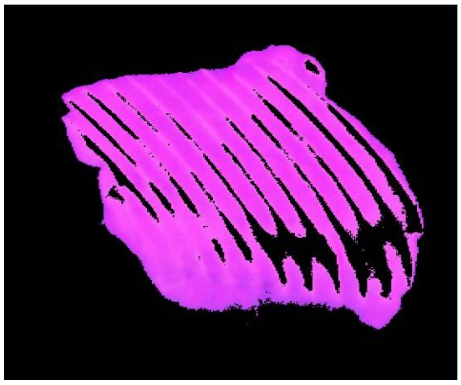
Fig. 4. Fish fillet sample for experiments. Sample I: Fish fillet with bone.

(a) fish fillet.

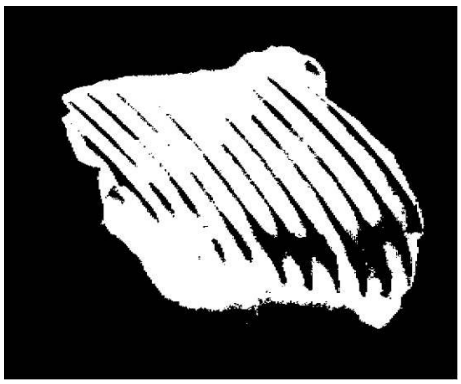


(b) fish fillet after thresholding.

Fig. 5. Segmentation images of sample I : fish fillet.

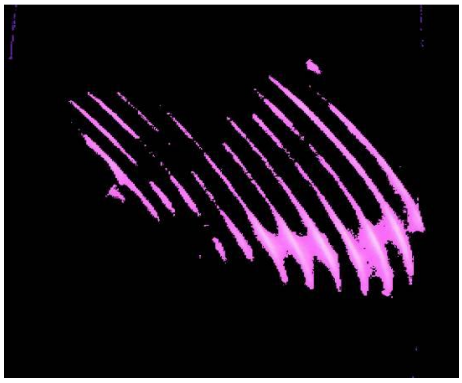


(a) fish flesh.

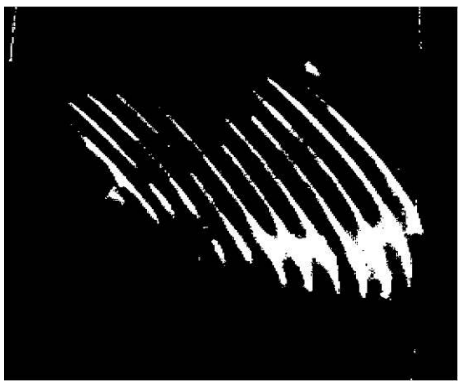


(b) fish flesh after thresholding.

Fig. 6. Segmentation images of sample I : fish flesh.



(a) fish bone.



(b) fish bone after thresholding.

Fig. 7. Segmentation images of sample I : fish bone.

The Fig. 5~7. show segmentation images of sample I (fish fillet with fish bone). Fig. 5(a), 6(a) and 7(a) show area of fish fillet in black color, fish flesh in purple color and fish bone in white color, respectively. Fig. 5(b), 6(b) and 7(b) show the images of Fig. 5(a), 6(a) and 7(a) after using thresholding technique, which can distinguish the image of fish fillet, fish flesh and fish bone, respectively. The percentage calculation of fish bone is about 20.23 percent.

Fig. 8. shows fish fillet without bone for testing the proposed system.

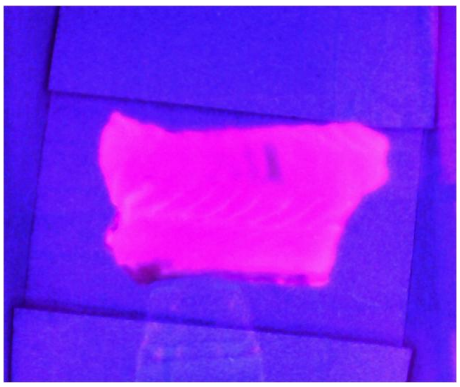
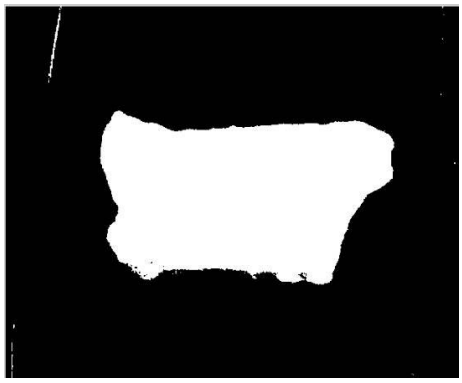


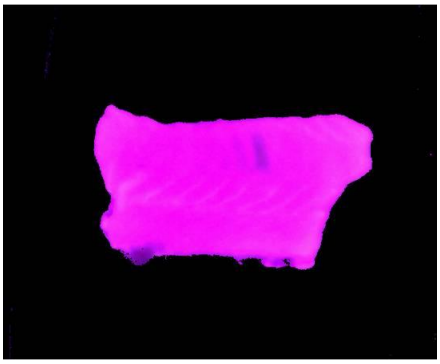
Fig. 8. Fish fillet sample for experiments. Sample II : Fish fillet without bone.

(a) fish fillet.

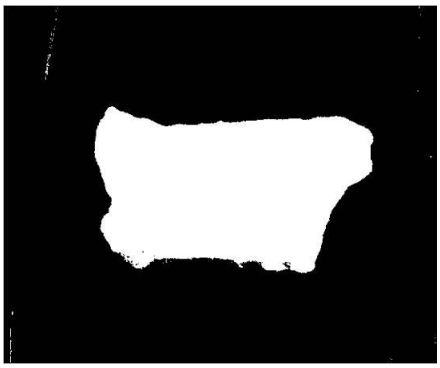


(b) fish fillet after thresholding.

Fig. 9 Segmentation images of sample II : fish fillet.



(a) fish flesh.



(b) fish flesh after thresholding.

Fig. 10 Segmentation images of sample II : fish flesh.

(a) fish bone.

(b) fish bone after thresholding.

Fig. 11 Segmentation images of sample II : fish bone.

The Fig. 9~11. show segmentation images of sample II (fish fillet without fish bone). Fig. 9(a), 10(a) and 11(a) show area of fish fillet in black color, fish flesh in purple color and fish bone in white color, respectively. Fig. 9(b), 10(b) and 11(b) show the images of Fig. 9(a), 10(a) and 11(a) after using thresholding technique, which can distinguish the image of fish fillet, fish flesh and fish bone, respectively. The percentage calculation of fish bone is about 3.64 percent.

The percentage of fish bone is used to evaluate quality of fish fillet sample.

4. Conclusion

System development for quality evaluation of fish fillet using image processing has been detailed in this paper. Results of some preliminary experiments with fish fillet has been shown satisfy evaluation of the proposed system. In experimental results shown the proposed system can evaluate quality of fish fillet sample by percentage of fish bone.

References

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