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Automatic Bleeding Frame and Region Detection for GLCM Using Artificial Neural Network

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ABSTRACT

Wireless capsule endoscopy is a device that inspects the direct visualization of patient's gastrointestinal tract without invasiveness. Analyzing the WCE video is a time- consuming task hence computer aided technique is used to reduce the burden of medical clinicians. This paper proposes a novel color feature extraction method to detect the bleeding frame. First, we perform word based histogram for rapid bleeding detection in WCE images. Classification of bleeding WCE frame is performed by applying for glcmusing Artificial Neural Network and K-nearest neighbour method. Second we propose a two-stage saliency map extraction method. In first stage saliency, we inspect the bleeding images under different color components to highlight the bleeding regions. From second stage saliency red color in the bleeding frame reveals that the region is affected. Then, by using algorithm we fuse the two-stage of saliency to detect the bleeding area. Experimental results show that the proposed method is very efficient in detecting the bleeding frames and the region.

Indexing terms/Keywords

Words based color histogram, Grey level co–occurrence matrix (glcm), artificial neural network (ANN).

Academic Discipline And Sub-Disciplines

Provide examples of relevant academic disciplines for this journal: E.g., History; Education; Sociology; Psychology; Cultural Studies;

SUBJECT CLASSIFICATION

E.g., Mathematics Subject Classification; Library of Congress Classification

TYPE (METHOD/APPROACH)

Capsule endoscopy has revolutionised the management of digestive tract diseases by providing a new non-invasive way to view the entire small bowel mucosa directly.In [1] author shows that Obscure gastrointestinal bleeding is the primary and best validated indication to capsule endoscopy, which when used as first-line exploration is the most efficient strategy as regards diagnosis.The author [2] describes that the in order to reduce this time, several works have proposed to automatically remove all the frames showing intestinal content. These methods label frames as fintestinal content - clearg without discriminating between types of content (with different physiological meaning) or the portion of image covered. In [3], a new automatic algorithm for bleeding detection in WCE images is proposed. This new approach mainly focuses on color feature which is also a very effective clue used by physicians for diagnosis.Ann automatic method for bleeding detection in WCE images in [4] a novel series of descriptors which combine color and spatial information is designed in a way that local and global features are also incorporated together.

INTRODUCTION

Causes of bleeding in the gastrointestinal tract are due to the ulcer, gastritis, fissures, colitis etc. The doctor may need to perform a procedure called endoscopy, colonoscopy, gastroscopy or an imaging test to detect the bleeding in the gastrointestinal tract. To diagnose the bleeding in the gastrointestinal tract clinicians performs a painful and invasive technique known as endoscopy, capsule endoscopy etc. The Wireless Capsule Technology (WCE) is a novel non-invasive technology which is first used in 2000 by the Given Imaging. Later US Food and Drug Administration approved it in August 2001 to record the videos of the digestive tract of a patient. The imaging capsule is 11mm x 26mm is pill shaped and contains miniaturized elements such as a battery, a lens, four light emitting diodes and an antenna/transmitter. For the images obtained and transmitted by the capsule endoscopy to be useful, they must be received and recorded for study. Patients undergoing the capsule endoscopy wear an antenna array consisting of 8 leads that are connected to the recording device to which the leads are attached. It is capable of recording the 55000 of images transmitted by the capsule and received by the antenna array. A typical capsule endoscopy examination takes approximately 7 hours. The recording device and its battery pack are worn on a special belt that allows the patient to move freely. In [2] the author described that time consumption is more for analysing the WCE video. Bleeding may be presented in two or three frames of the WCE video, and they may be not visible to naked eyes. To overcome this problem they used WCE images to reduce the work of clinicians. They proposed color based quantization method to discriminate the bleeding frame from normal frames.

WORKING METHODOLOGY

The author in [3] proposed three new methods image based, pixel based and patch-based method to detect the bleeding frame in WCE images. They used to edge and bleeding pixels method to point out the infected frames. In this

paper, we propose Words based color histogram to detect the bleeding frame on viewing the WCE images of GI tract. The recorded WCE videos are represented as WCE images in words based color histogram. SVM are used only to identify the bleeding frame whereas Artificial Neural Network (ANN) identifies and detects the severity of the bleeding frame with high accuracy. Here we used k-nearest neighbour and artificial neural network to detect the bleeding frame.

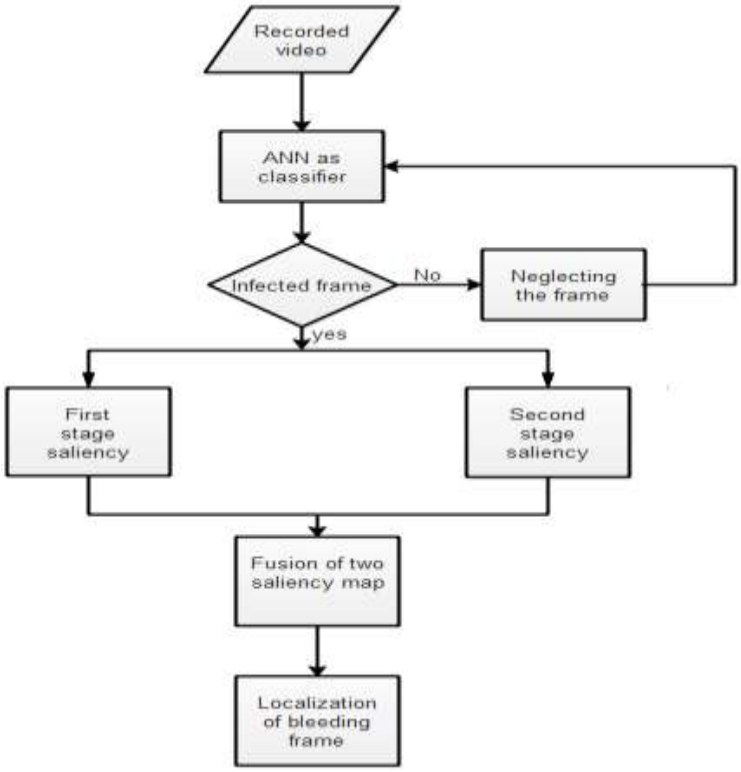

Figure 1:Workflow of the proposed method

After finding the bleeding frame, we have to expose the area localization of the infection. In first stage saliency, we use various color spaces like RGB, HSV, YCbCr and LAB to identify the infected frame from the normal frame. Saliency map for R is higher than G and B. In second stage saliency, based on the intensity of the color, the severe bleeding region is detected. By combining these two stages, we detect the bleeding frame region in WCE images.

COLOR SPACE FEATURE EXTRACTION

WCE images are analyzed in the color features such as Red, Blue, and Green. The infected frame is occupied by more red color rather than the blue and green. They proposed the new color extraction methods such as fixed cardinality and variable cardinality to extract the color distribution in the images. Many methods available are such as RGB, CIELAB, CIEXYZ, YUV, YIQ, CMYK, HSV and HIS for processing of color space images. They describes that HSI is used instead of RGB color space because color plays the major role in detecting the infected parts in the body. The gray scale algorithms are applied to the RGB color space; this is not significant because color detection plays a vital role in detecting bleeding frames. HSI which represents Hue, saturation, intensity is a color space which can also be used to detect the bleeding in WCE images. Here we propose the gray level co-occurrence matrix for feature extraction processing in the WCE images.

The two methods of ANN and KNN are used to find out the normal images and bleeding images. We can use ANN algorithm by calculating the distance from the test sample with the help of nearer neighbor search algorithm, here we used k-nearest neighbor for finding many data set .When the input data to an algorithm is too large to be processed, and it is considered to be unnecessary further input data is transferred into features.

Feature extraction is accomplished on data before applying KNN algorithm to change data into feature space. In a case of high dimensional data, before applying into KNN algorithm, dimensional reduction is carried out to repudiate the cause of dimensionality. Condensed nearest neighbor is the algorithm made intentionally to reduce the data set for KNN classification. For pattern recognition and data mining, KNN is used which is simple and instinctive.ANN made the conclusion by comparing the testing data with training data. Euclidean distance is calculated, and it is classified based on the K-nearest neighbor from training set sample.

Artificial neural network

ANN is a parallel distributed processor that has a natural tendency for storing experiential knowledge. They can provide suitable solutions for problems, which are generally characterized by non-linear ties, high dimensionality noisy, complex, Imprecise, and imperfect or error prone sensor data, and lack of a clearly stated mathematical solution or algorithm. A key benefit of neural networks is that a model of the system can be built from the available data. Image

classification using neural networks is done by texture feature extraction and then applying the back propagation algorithm.

Figure 1 represents architecture of a Simple Neural Network. It is made up from an input, output and one or more hidden layers. Each node from input layer is connected to a node from hidden layer and every node from hidden layer is connected to a node in output layer. There is usually some weight associated with every connection. Input layer represents raw information that is fed into the network. This part of network is never changing its values. Every single input to the network is duplicated and sends down to the nodes in hidden layer. Hidden Layer accepts data from the input layer. It uses input values and modes them using some

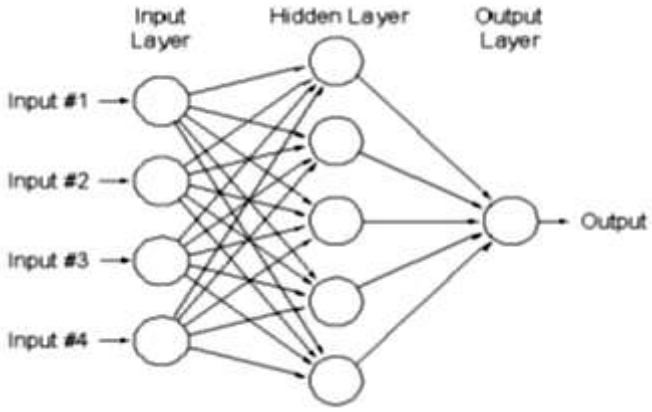

Figure 2: Simple neural networks

Weight value, this new value is than send to the output layer but it will also be modeled by some weight from connection between hidden and output layer. Output layer process information received from the hidden layer and produces an output. This output is than processed by activation function.Texture is characterized by the spatial distribution of gray levels in a neighborhood. In texture classification the aim is to assign an unknown sample image to one of set of known texture classes. Textural features are scalar numbers, discrete histograms or empirical distributions. In the design four textural features namely the angular second moment, contrast, correlation and variance are considered.The generalized steps involved in ANN algorithm is shown in the figure 2 which shows how the algorithm is used to converge to the final output.

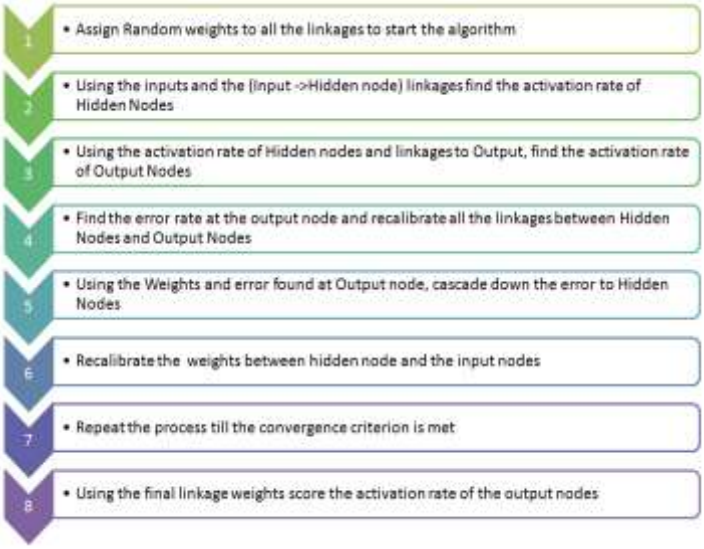

Figure 3: Steps involved in ANN classifier algorithm.

The computing world has a lot to gain from neural networks. Their ability to learn by example makes them very flexible and powerful. Neural networks also contribute to other areas of research such as neurology and psychology. They are regularly used to model parts of living organisms and to investigate the internal mechanisms of the brain.

RESULTS

Initially the Wireless Capsule Endoscopy video has been collected from the Government Mohan Kumaramangalam Medical College Hospital, Salem in Tamilnadu, India. The input video was processed with the different color space such as RGB, CIELAB, CIEXYZ, YCbCr, CMYK, HSV and HSI.The bleeding frame is processed with various color space is shown in the figure 4 and the fusion of saliency map 1 and saliency map 2.

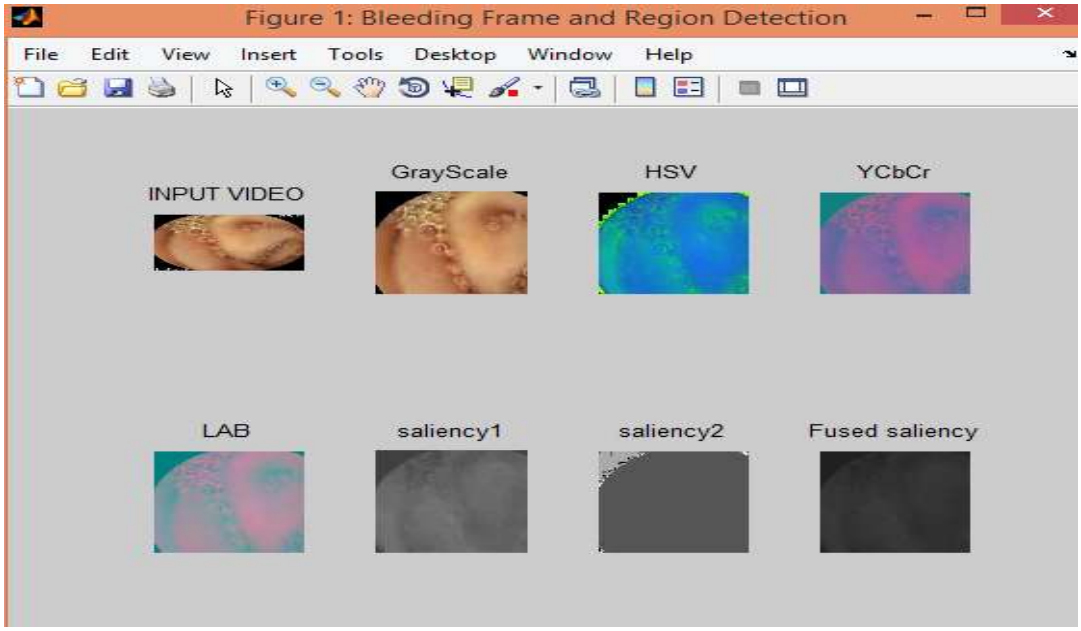

Figure 4: Results of processed images in various color spaces

Histogram for normal and bleeding images is analyzed. We conclude from the histogram that bleeding and the normal images have the different words based color histogram. The words based color histogram for bleeding frame is shown in the figure 5.The two methods of ANN and KNN are used to find out the normal images and bleeding images. We can use ANN algorithm by calculating the distance from the test sample with the help of nearest neighbor search algorithm, here we used k-nearest neighbour for finding many data set. When the input data to an algorithm is too large to be processed, and it is considered to be unnecessary further input data is transferred into features. Feature extraction is accomplished on data before applying KNN algorithm to change data into feature space. In a case of high dimensional data, before applying into KNN algorithm, dimensional reduction is carried out to repudiate the cause of dimensionality.ANN made the conclusion by comparing the testing data with training data. Euclidean distance is calculated, and it is classified based on the K-nearest neighbor from training set sample.After finding the bleeding frame, we have to expose the area localization of the infection. In first stage saliency, we use various color spaces like RGB, HSV, YCbCr and LAB to identify the infected frame from the normal frame. Saliency map for R is higher than G and B. In second stage saliency, based on the intensity of the color, the severe bleeding region is detected. By combining these two stages, we detect the bleeding frame region in WCE images.

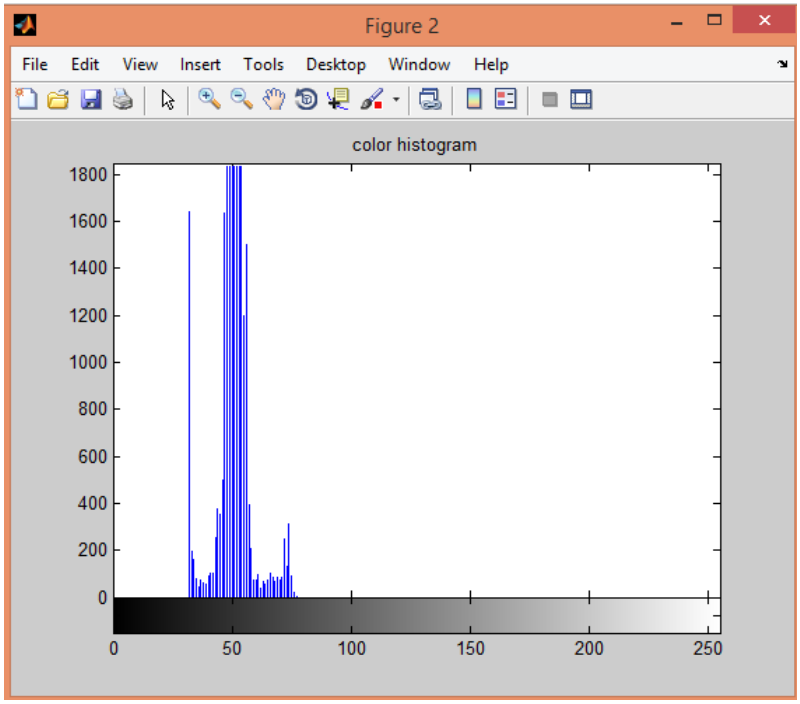

Figure 5: Words based color histogram

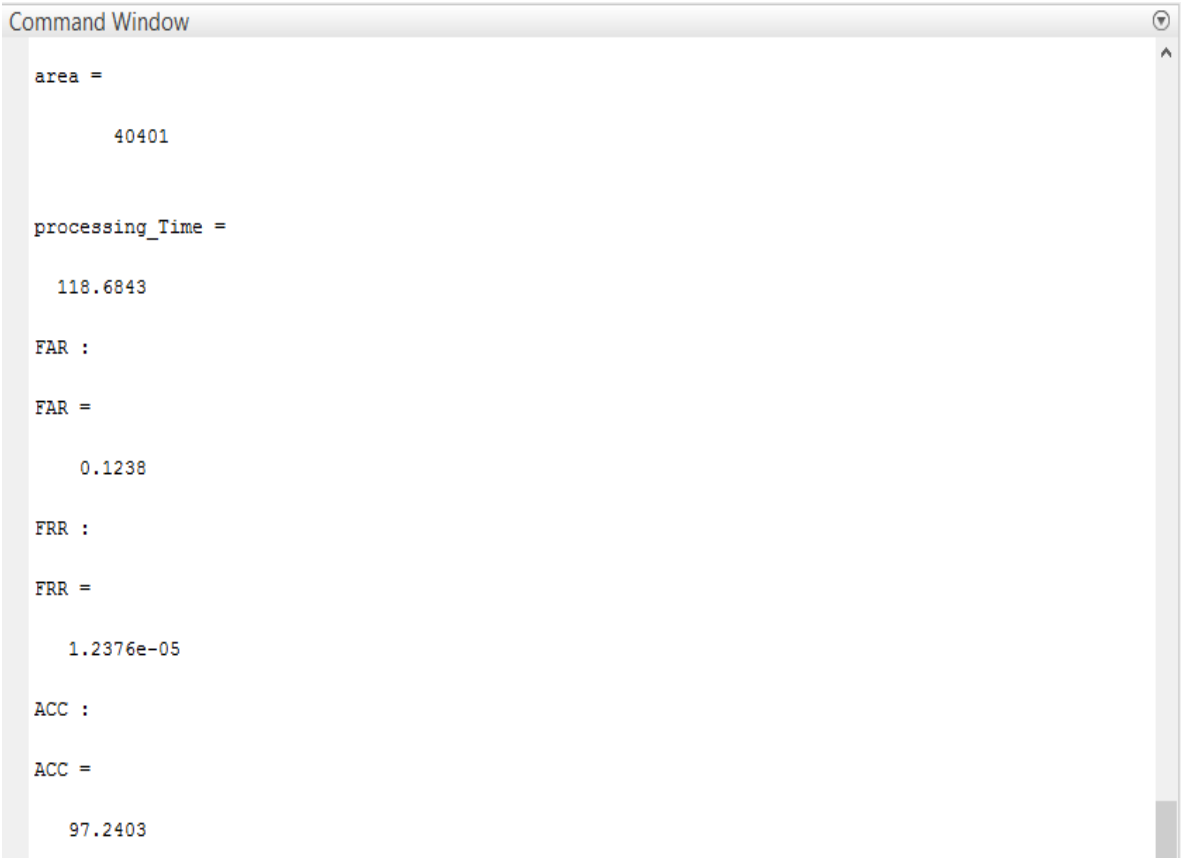

Figure 6: Output of the ANN classifier with performance specifications for bleeding frames

From the extracted features it is observed that the processing time is less for bleeding frames when compared with the normal frames. The system also shows the message box showing that the bleeding frame detection is severe or not.

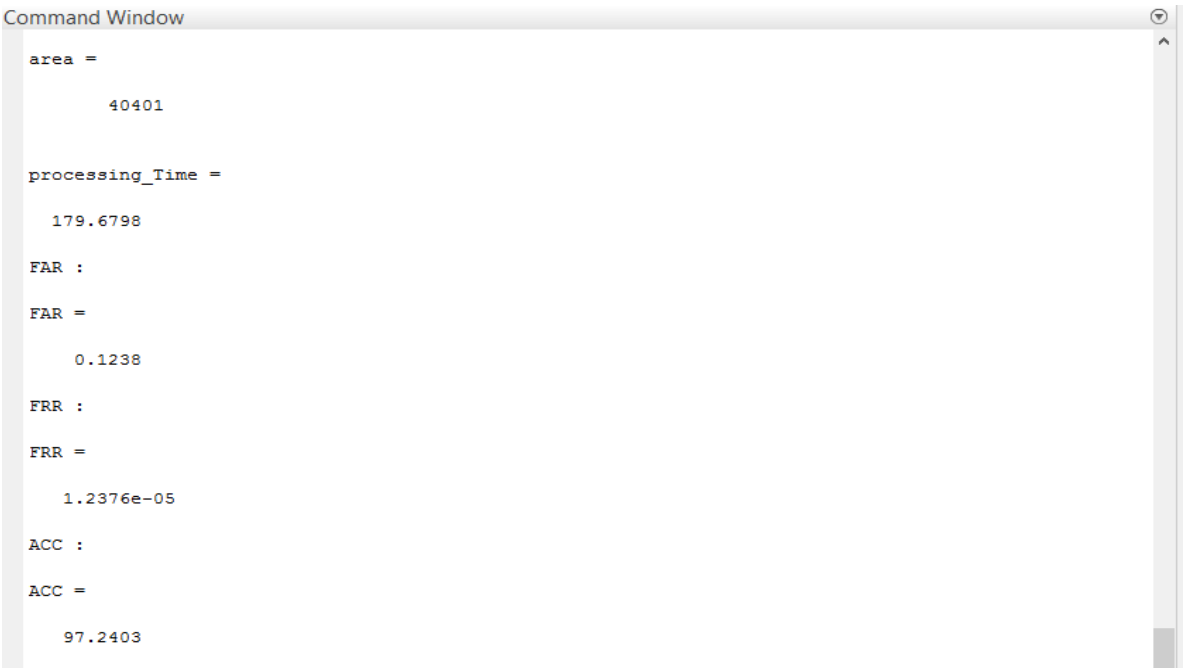

Figure 7:Output of the ANN classifier with performance specifications for normal frames

The detection of bleeding frame accuracy using artificial neural network is high compared with other support vector machine. The detection of normal frame is shown in the figure 7 .The dialog box shows that the input frames are normal.

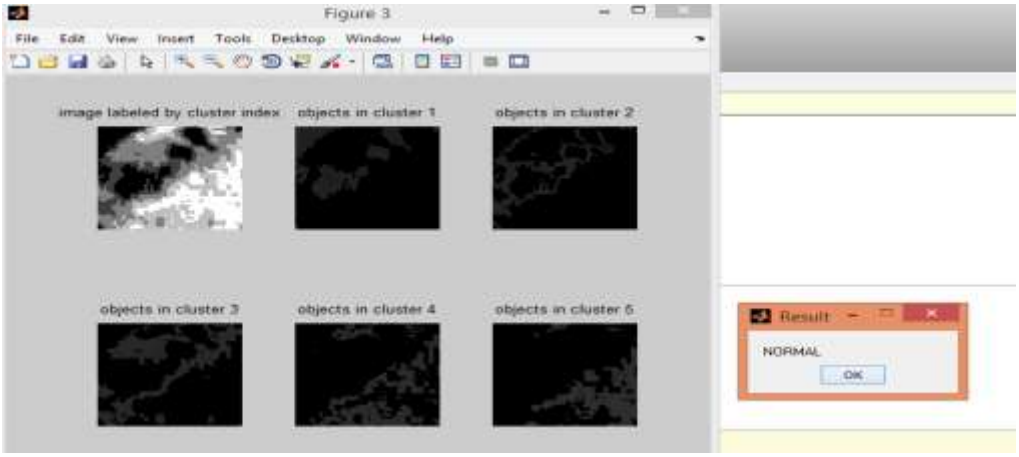

Figure 8:Clustering and Detection of Normal frames

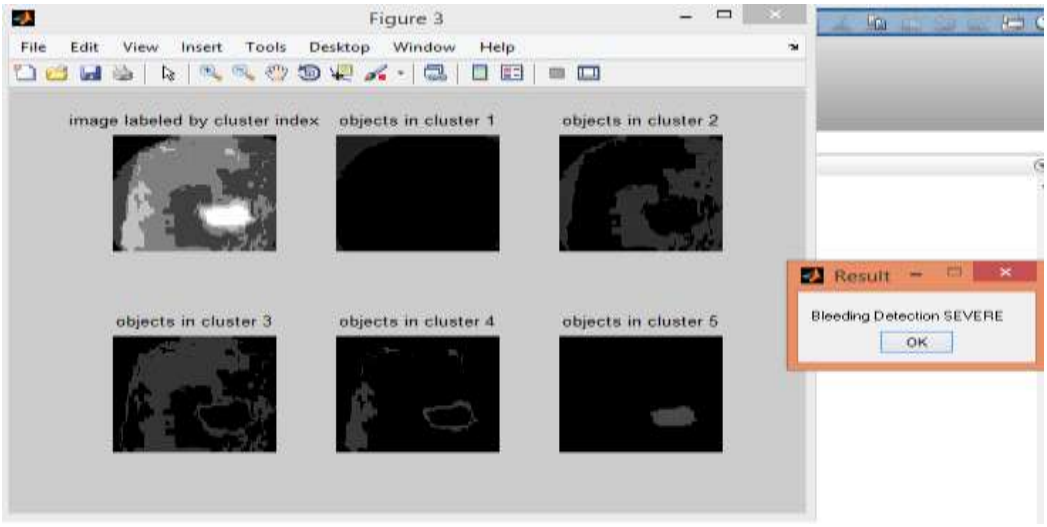

Figure 9: Clustering and Detection of bleeding frame severity

The system displays a message box indicating the severity of the bleeding frame shown in Figure 9. The K-nearest neighbours method is used to cluster the different regions and display it in the output.

Table1. Comparison of performance features for different methods

METHODS	ACCURACY	SENSITIVITY	SPECIFICITY	TIME(S)
HSV	92.37	84.75	93.90	422.27
HIS	83.00	78.00	84.00	530.93
SVM	95.25	92.00	96.50	293.50
ANN	97.25	93.25	97.25	27.383

Table1 shows the features of various histograms such as accuracy, sensitivity, specificity and time. This concluded that accuracy in detection of bleeding frame is higher for GLCM and ANN methods than other methods.

CONCLUSION

In this paper, the endoscopy video of the gastrointestinal tract is split into frames and analyzed to find out the bleeding frames. The resolution of original image is 256 x 256. The region of interest resolution is taken as 180 x 180 to explain the image features and to demonstrate about the bleeding frame. A novel method for bleeding frame detection and

region localization in WCE images is proposed in this project. In pre-processing stages, words based color histogram is used to represent the images and then to find the bleeding frame detection with gray level co-occurrence matrix is proposed. The first step of post processing is the fusion of two saliency map using the algorithm. The bleeding region is highlighted by clustering the images using the k-nearest neighbor technique. Finally, the ANN is used as the classifier to classify the bleeding image and normal image. In future the project can be modified by using latest genetic algorithms for improved accuracy and reduction of noise in processed output images.

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REFERENCES

1. Yixen Yuan, Baopu Li and Max QH Meng, fellow"Bleeding Frame and Region Detection in Wireless Capsule Endoscopy Video" VOL 20 no 2,March 2016
2. L. Cui, C. Hu, Y. Zou, and M.-H.Meng, "Bleeding detection in wireless capsule endoscopy images by support vector classifier," in Proc. IEEE Int. Conf. Inform.Autom., 2010, pp. 1746–1751
3. Y. Fu, W. Zhang, M. Mandal, and M.-H.Meng, "Computer-aided bleeding detection in WCE video," IEEE J. Biomed. Health Inform., vol.18,no.2,636–642,Mar.2014
4. F. Conversano, E. Casciaro, R. Franchini, S. Casciaro, and A. Lay-Ekuakillelly automatic 3D segmentation measurements of human liver vessels from contrast-enhanced CT," in Proc. IEEE Int. Symp. Med. Meas. Appl., 2014, pp. 1–5
5. F. Conversano, R. Franchini, C. Demitri, L. Massoptier, F. Montagna, A. Maffezzoli, A. Malvasi, and S. Casciaro, "Hepatic vessel segmentation for 3D planning of liver surgery: Experimental evaluation of a new fully automatic algorithm," Acad. Radiol., vol. 18, pp. 461–470, 2011.
6. J. Wang, J. Yang, K. Yu, F. Lv, T. Huang, and Y. Gong, "Locality-constrained linear coding for image classification," in Proc. IEEE Conf. Comput. Vision Pattern Recog., 2010, pp. 3360–3367.
7. G. Lv, G. Yan, and Z. Wang, "Bleeding detection in wireless capsule endoscopy images based on color invariants and spatial pyramids using support vector machines," in Proc. IEEE Annu. Int. Conf. Eng. Med. Biol. Soc., 2011, pp. 6643–6646.
8. R. Achanta, F. Estrada, P. Wils, and S. Susstrunk,¨ "Salient region detection and segmentation," in Computer Vision Systems. New York, NY, USA: Springer, 2008, pp. 66–75.
9. S. Goferman, L. Zelnik-Manor, and A. Tal, "Context-aware saliency de-tection," IEEE Trans. Pattern Anal. Mach. Intell., vol. 34, no. 10, pp. 1915–1926, Oct. 2012.
10. S. Segui, M. Drozdzal, F. Vilarino, C. Malagelada, F. Azpiroz, P. Radeva, and J. Vitria, "Categorization and Segmentation of intestinal content frames for wireless capsule endoscopy," IEEE Trans. Inf. Technol. Biomed., vol. 16, no. 6, pp. 1341–1352, Nov. 2012.
11. S. Hwang, J. Oh, J. Cox, S. J. Tang, and H. F. Tibbals, "Blood detection in wireless capsule endoscopy using expectation maximization clustering," Med. Imag., vol. 6144, pp. 61441P-1–61441P-11, 2006.
12. J. Yang, K. Yu, Y. Gong, and T. Huang, "Linear Spatial pyramid matching using sparse coding for image classification," in Proc. IEEE Conf. Comput. Vision Pattern Recog., 2009, pp. 1794–1801.
13. J. Wang, J. Yang, K. Yu, F. Lv, T. Huang, and Y. Gong, "Locality-constrained linear coding for image classification," in Proc. IEEE Conf. Comput. Vision Pattern Recog., 2010, pp. 3360–3367.
14. M. Mackiewicz, J. Berens, and M. Fisher, "Wireless Capsule Endoscopy Color Video Segmentation," IEEE Transaction on Medical Imaging, vol.27, no. 12, December 2008.
15. B. Li, "A Study on Computer-aided Diagnosis for Wireless Capsule Endoscopy Images," A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy In Electronic Engineering, The Chinese University of Hong Kong, September, 2008.
16. B. Li and Max Q.-H. Meng, "Computer- aided detection of bleeding regions for capsule endoscopy images," IEEE Transactions on Biomedical Engineering, Vol. 56, No. 4, pp.1032-1039, April 2009.
17. B. Li and Max Q.-H. Meng, "Computer-based detection of bleeding and ulcer in wireless capsule endoscopy images by chromaticity moments," Computers in Biology and Medicine, Vol. 39, No. 2, pp.141-147,February 2009.
18. B. Li and Max Q.-H. Meng, "Diseases detection in wireless capsule endoscopy images with color features," International Journal of Information Acquisition, vol. 4, no. 3, pp. 251-259, Sep. 2007.
19. D. G. Adeler and C. J. Gostout, "Wireless capsule endoscopy," in Proc. Hosp. physicians, pp. 14-22, March 2003. Maieron et al., "Multicenter retrospective evaluation of capsule endoscopy in clinical routine," Endoscopy, vol. 36, pp.

864–868, 2004.

20. R. D. Francis, “Sensitivity and specificity of the red blood identification (RBIS) in video capsule endoscopy,” presented at the 3rd Int. Conf. Capsule.
21. Y. S. Jung, Y. H. Kim, D. H. Lee, and J. H. Kim, “Active Blood Detection in a High-Resolution Capsule Endoscopy using Color Spectrum Transformation,” International Conference on BioMedial Engineering and Informatics, pp. 859-862, 2008.
22. M. Boulougoura, E. Wadge, V. S. Kodogiannis, and H. S. Chowdrey, “Intelligent systems for computer-assisted clinical endoscopic image analyses,” in Proc. 2nd Int. Conf. Biomed. Eng., Innsbruck, Austria, pp. 405–8, 2005.
23. B. Li and Max Q.-H. Meng, “Diseases detection in wireless capsule endoscopy images with color features,” International Journal of Information Acquisition, vol. 4, no. 3, pp. 251-259, Sep. 2007.

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