Survey of Ulcer Detection for Wireless Capsule Endoscopy Diagnosis Model

[1]S.Dharani, M.Sc(CS)., [2]M. Buvaneswari, M.Sc.,M.Phil.,SET.,NET.,

Abstract— **Image segmentation is the process of obtaining particular regions from the images. Edge detection identifies the edge points around the needed objects. Contour extraction refers to outlining the segmented portion from the image. In order to make the method practically useful in hospital clinical trials, further tests using a much larger number of datasets are critical to validate the effectiveness and the robustness of the WCE images. In this paper is analysis a saliency estimation method that takes advantage of the superpixel segmentation method and the image contrast information. In this paper survey the statistical data such as number of objects found during segmentation and similar objects within the WCE image are also calculated. The gray scale conversion of the particular segments is also carried out so that the output WCE image partitions the image into different objects.**

Index Terms— ***Digital Image Processing, Superpixel Segmentation, Clustering, K-Fuzzy Logic***

I. Introduction

Digital Image Processing is a component of digital signal processing .The area of digital image processing refers to dealing with digital images by means of a digital computer. Digital image processing has several advantages above analog image processing and it allows a considerably wider collection of algorithms to be apply to input data and can keep away from problems for instance the build-up of noise and signal deformation during processing. Digital Image Processing involves the modification of digital data for improving the image qualities with the aid of computer. The processing helps in maximize the clarity, roughness of image and details of features of interest towards extraction of information and further analysis.

A. Graph-Based Segmentation

Let G = (V, E) be an undirected graph with vertices vi ∈ V, the set of elements to be segmented, and edges (vi, vj) ∈ E consequent to pairs of neighboring vertices. Each edge (vi, vj) ∈ E has a corresponding weight w((vi, vj)), which is a non-negative measure of the dissimilarity between neighboring elements vi and vj. In the case of image segmentation, the elements in V are pixels and the weight of an edge is some quantify of the dissimilarity between the two pixels connected by that edge (e.g., the difference in intensity, color, motion, location or some other local attribute). In consider particular edge sets and weight functions for image segmentation. However, the formulation here is independent of these definitions. In the graph-based approach, a segmentation S is a partition of V into components such that each component (or region) C ∈ S corresponds to a connected component in a graph G0 = (V, E0), where E0 ⊆ E. In other words, any segmentation is induced by a subset of the edges in E. There are different ways to measure the quality of segmentation but in general we want the elements in a component to be similar, and elements in different components to be dissimilar. This means that edges between two vertices in the same component should have relatively low weights, and edges between vertices in different components should have higher weights.

Manuscript received September, 2017.
S.Dharani, M.Sc (cs)., Research Scholar, Department of Computer Science, Vivekanandha College for Women, Tiruchengode, Mobile.No:9047365719.

M.Buvaneswari, M.Sc. ,M.Phil., SET. ,NET., Assistant Professor, Department of Computer Science, Vivekanandha College for Women, Tiruchengode. Mobile.No:9443409134.

II. Literature survey

A. Bag-of-visual-words approach

Sae Hwang [1], describe a Wireless Capsule Endoscopy (WCE) is a relatively new technology (FDA approved in 2002) allowing doctors to view most of the small intestine. One of the most important goals of WCE is the early detection of colorectal polyps. We introduce “Bag-of-Visual-Words” method which has been successfully used in particular for image classification in non-medical domains. Initially the training image patches are sampled and represented by speeded up robust features (SURF) descriptor, and then the bag of words model is constructed by K-means clustering algorithm. Subsequently the document is represented as the histogram of the visual words which is the feature vector of the image. Finally, a SVM classifier is trained using these feature vectors to distinguish images with polyp regions from ones without them.

B. Salient object detection based on context and location prior

Duzhen Zhang and Chuancai Liu, A novel automatic salient object detection algorithm, which integrates context-based saliency with location computation, based on the boundary priors. Input image is expressed as a close-loop graph with superpixels as nodes and salient object of image has a well-defined graph-based manifold ranking location. The saliency of the image elements is defined based on their relevances to the given seeds or queries. Saliency object location is carried out in a two-stage scheme to extract background regions and foreground salient objects efficiently. We introduce a location weight to measure the relationship of superpixels and the centroid of the detected salient regions to eliminate the background. Saliency map is computed through context analysis and location computing based on multi-scale superpixels. Visual saliency plays important roles in natural vision in that saliency can direct eye movements, deploy attention, and facilitate tasks like object detection and scene understanding. Many models have been built to compute saliency map. There are two major categories of factors that drive attention: bottom-up factors and top-down factors. Bottom-up factors are derived solely from the visual scene. Regions of interest that attract our attention are in a bottom-up way and the responsible feature for this reaction must be sufficiently discriminative with respect to surrounding features.

C. Detection of small bowel polyps and ulcers videos

Alexandros Karargyris and Nikolaos Bourbakis [3], describe a wireless capsule endoscopy (WCE) technology has become a very useful tool for diagnosing diseases within the human digestive tract. Physicians using WCE can examine the digestive tract in a minimally invasive way searching for pathological abnormalities such as bleeding, polyps, ulcers, and Crohn's disease. To improve effectiveness of WCE, researchers have developed software methods to automatically detect these diseases at a high rate of success. This novel synergistic methodology is automatically discovering polyps (protrusions) and perforated ulcers in WCE video frames. Finally, results of the methodology are given and statistical comparisons are also presented relevant to other works.

D. Multi-scale region-based saliency detection

Lei Zhu, Dominmik A. Klein [4], describe a segment-based method for saliency detection based on multi-size superpixels that combines local and global saliency cues. We extract superpixels at several scales and represent each superpixel with a normal distribution in CIE-Lab space estimated from its associated pixels. Global saliency is computed by grouping similar superpixels to estimate the spatial distribution of colors, while local saliency detection is achieved by determining the center-surround contrast of neighboring superpixels.

E. Enhanced ulcer recognition from capsule endoscopic images

Vasileios Charisis, Leontios Hadjileontiadis, George Sergiadis [5], describe the advent of Wireless Capsule Endoscopy (WCE) and the gastroenterologists' requirement for faster and more secure diagnoses necessitated the development of effective intestinal disorder recognition systems and automated WCE image analysis/inspection techniques. The aim of WCE image processing techniques is to help the physician draw more reliable conclusions by generating enhanced and more informative images. During an examination with a stethoscope the physician instructs the patient how to breathe in order to get the best possible auscultation. In a similar way, a gastroenterologist who reviews an endoscopic video would desire the images to be as much informative as possible, but, without the opportunity to either give instructions to the patient or guide the capsule. The automated intestinal-disorder recognition systems target to detect potential regions of abnormal tissue in order to help the physician reach a diagnosis

Re. no	Researcher	Advantages	Disadvantages
1	Sae Hwang	To Obtain the local descriptors; Quantize the descriptors into a codebook;	To extend our method to detect more abnormalities such as bleed, ulcer and tumor.
2	Duzhen Zhang and Chuancai Liu	Top-down methods are task-driven that entails supervised learning with class labels. Attention models were reviewed recently. Saliency models have been developed for eye fixation prediction and salient object detection.	Location weight to measure the relationship of superpixels and the centroid of the detected salient regions is introduced to eliminate the background.
3	Alexandros Karargyris and Nikolaos Bourbakis	To obtain larger spectral information while maintaining maximum spatial localization log .	Limitation of the current scheme is that it does not take into consideration the presence of food substances or excessive mucus.
4	Lei Zhu, Dominmik	Spatial Distribution of Colors s more sophisticated in the way that we add a higher level clustering step based on superpixels and rate the spatial intra-cluster distances.	In the future, we plan to use a sparse affinity matrix based on clipped distances to achieve real-time performance
5	Vasileios Charisis, Leontios Hadjileontiadis, George Sergiadis	It was even possible that transmission stopped before the end of ileum, in case of extended residence in stomach	The classification performance of individual IMFs does not exceed 84% classification accuracy),

III. FUZZY SUPERPIXEL SEGMENTATION

A. Proposed Methods and Original Contributions

In this propose paper a two-staged fully automated computer-aided detection system to detect ulcers from WCE images. In the first stage, owing to the drawbacks of traditional segmentation methods focus on the automatic estimation of salient regions across the WCE images. The classical saliency extraction approaches often calculate a pixel-based saliency, ignoring the neighbor information and boundary information of the object. In addition, the human is attracted more by object instead of sole pixels. As an alternative approach, we propose to adopt superpixel representation for ulcer saliency detection in the WCE images.

A superpixel is a group of pixels under some restriction of local image features such as color, intensity, or texture. It preserves most of the image structure and greatly reduces the complexity of the image processing. Furthermore, the single scale superpixel may not be able to represent the accurate contour of objects. Thus we propose the saliency calculation method based on the multi-graph region clustering algorithm for superpixel representation for the images.

Since the ulcer shows significant color and texture information on the WCE mucosa surface analyze these characteristics to evaluate the corresponding saliency value for each superpixel and obtain the saliency map for each level. The final saliency map is calculated by a fusion strategy that integrates the obtained saliency maps from all levels.

In the second stage, we employ the obtained saliency maps for the ulcer classification task. Inspired by the promising results of bag-of-words (BoW) or BoF model and its variants propose to classify the ulcer images by coding WCE images with a modified Locality-constrained Linear Coding (LLC) method. The proposed modified LLC method integrates the original LLC method with a saliency based max-pooling to emphasize the salient region for ulcer classification. The main contributions of this paper are summarized as follows:

- Instead of extracting features from the whole WCE images propose a saliency map estimation method to outline the ulcer first and then extract the corresponding feature to better encode WCE images. The proposed saliency method is based on multi graph region clustering algorithm superpixel color and texture representation.
- Different from utilizing the existed image coding methods a saliency based max pooling method integrated with the original LLC method is proposed to carry out ulcer frame classification tasks.

B. Fuzzy Segmentation

A Fuzzy superpixel is defined as the meaningful entity by grouping spatially neighboring pixels with the similar property. Simple Linear Iterative Clustering (SLIC) is the state-of-the-art superpixel algorithm that outputs a desired number of regular, compact superpixels with a low computational overhead. The propose system apply a SLIC superpixels as a pre-processing method for WCE image saliency detection. Because it not only provides good segmentation results, but also generates suitable size of superpixels for WCE image analysis. In the SLIC method, the local K-means clustering is first performed on the pixels based on the color space and spatial distances. Then the isolated small clusters are merged with the largest neighbor clusters to obtain the specific number of the superpixels.

Each segmented fuzzy superpixel is used as a processing unit in the proposed saliency model. Choosing a suitable number of fuzzy superpixels for the WCE image is empiric and case-specific. This is because that too many numbers of fuzzy superpixel lead to over-segmentation, while too few superpixels result in loss of the boundary information of the objects. In addition, using a single superpixel size to do segmentation may not be able to describe the boundary well for some cases.

Therefore, a multi-level fuzzy superpixel method that first segments the image by using multiple different numbers of fuzzy superpixels (a.k.a., multiple levels of superpixels), then fuses all fuzzy superpixel segmentation in all levels later. The number of superpixels K we tested in this paper is set to be 50, 100, 150, 200, and 250 in each level, which results in level number $L = 5$.

IV. CONCLUSION

The proposed system is very fast in applying segmentation algorithm. This software is very particular in reducing the difficulty in segmentation algorithms. Through this paper, the problem of manual pattern is eliminated. Since very less input is given, any persons can use the researches. Once the pixel value is found to be incorrect in given rectangular area, the entire area is ignored for further fuzzy pixel comparison. This experimental result in fast work and their overall recognition time is reduced. The end users are required to have minimum working experience in systems to run this software. The proposed clustering reduces recognition time and helps in improving error free and efficient patterns identification. The survey of proposed system is tested well so that the end users use this software for their whole pattern recognition related operations.

ACKNOWLEDGEMENT

My heartfelt gratitude goes to my beloved guide Mrs.Buvaneswari, Assistant Professor, Department of Computer Science, Vivekanandha College for Women, Tiruchengode, India for dedication and patience in assigning me her valuable advice and efforts during the course of my studies.

REFERENCES

[1] V. Charisis, L. Hadjileontiadis, and G. Sergiadis, “Enhanced ulcer recognition from capsule endoscopic images using texture analysis,” *New Advances in the Basic and Clinical Gastroenterology*, pp. 185– 210, 2012.

[2] V. S. Charisis, L. J. Hadjileontiadis, J. Barroso, and G. D. Sergiadis, "Intrinsic higher-order correlation and lacunarity analysis for wce-based ulcer classification," in *Computer-Based Medical Systems (CBMS), 2012 25th International Symposium on*. IEEE, 2012, pp. 1–6.

[3] M. Appleyard, Z. Fireman, A. Glukhovsky, H. Jacob, R. Shreiver, S. Kadirkamanathan, A. Lavy, S. Lewkowicz, E. Scapa, R. Shofti, P. Swain, and A. Zaretsky, "A randomized trial comparing wireless capsule endoscopy with push enteroscopy for the detection of smallbowel lesions," *Gastroenterology*, vol. 119, no. 6, pp. 1431 – 1438, 2000.

[4] B. Upchurch and J. Vargo, "Small bowel enteroscopy," *Reviews in gastroenterological disorders*, vol. 8, no. 3, p. 169177, 2008.

[5] M. Manno, R. Manta, and R. Conigliaro, "Single-balloon enteroscopy," in *Ileoscopy*, A. Trecca, Ed. Springer Milan, 2012, pp. 79–85.

[6] G. Iddan, G. Meron, A. Glukhovsky, and P. Swain, "Wireless capsuleendoscopy," *Nature*, vol. 405, p. 417, 2000.

[7] N. M. Lee and G. M. Eisen, "10 years of capsule endoscopy: an update,"*Expert review of gastroenterology & hepatology*, vol. 4, no. 4, pp. 503–512, August 2010.

[8] B. Li and M. Q.-H. Meng, "Texture analysis for ulcer detection incapsule endoscopy images," *Image and Vision computing*, vol. 27, no. 9,pp. 1336–1342, 2009.

[9] V. S. Charisis, C. Katsimerou, L. J. Hadjileontiadis, C. N. Liatsos, andG. D. Sergiadis, "Computer-aided capsule endoscopy images evaluationbased on color rotation and texture features: An educational tool tophysicians," in *Computer-Based Medical Systems (CBMS), 2013 IEEE26th International Symposium on*. IEEE, 2013, pp. 203–208

[10] A. Eid, V. S. Charisis, L. J. Hadjileontiadis, and G. D. Sergiadis, "Acurvelet- based lacunarity approach for ulcer detection from wireless capsule endoscopy images," in *Computer-Based Medical Systems (CBMS),2013 IEEE 26th International Symposium on*. IEEE, 2013, pp. 273–278.

First Author:
Ms.Dharani working as M.Phil Scholar in the Department of Computer Science at Vivekanadha College for Women, Tiruchengode, India. She has completed her Under Graduate Degree in Computer Science from Vivekanandha College for Women, Tiruchengode, India. She completed her Master degree at Navarasam Arts and Science College for Women.

Second Author:
Mrs.Buvaneswari is currently working as Assistant Professor in the Department of Computer Science at Vivekanandha College for Women, Tiruchengode, India. She did her Under graduate degree at Bharathiyar Arts and ScienceCcollege for Women,Attur. She has obtained her Master degree in Mahendra Arts and Science College, Kaalipatti. She did her M.Phil degree at Kongu Arts and Science College, Erode. And then, she also completed the State level eligibility test in the year of OCT 2012 and National level eligibility test in the year of DEC 2015. She worked as an assistant professor in Sri Balamurugan arts and science college, Sathappadi, mecheri from 2005 July to 2007 April.