

Segmentation And Detection Of Polyp Using CT Colonography

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ABSTRACT

Todays Automated Detection System For Computed Tomography colonoscopy enables easy detection and segmentation of colorectal polyps .We present a new method that measure the protrudness of a body in adaptive fashion The performance of candidate detection is depends only on one parameter ,amount of protrusionsWe calculated the implementation of method on 90 patients with total 57 polyps larher than or equal to 6mm.we obtain a performances of 95% sensitivity .

Keyword :- Biomedical Image processing, Polyp detection, Colorectal cancer, Capsule Endoscopy

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1. INTRODUCTION

Colorectal cancer is one of the most commonly diagnosed types of cancer. Specifically, the American Cancer Society predicts 145,000 new cases and 56,000 deaths from colorectal cancer for 2005 [3]. Polyps are a well-known precursor to such carcinoma. Not surprisingly, it has been shown that early removal of polyps ensures a decrease in incidence [121]. In recent years, CT colonography has been proposed as a non invasive alternative to traditional polyp detection by colonoscopy . In CT colonography, the colon structure is often visualized from an endoluminal perspective by means of surface or volume rendering. Recently, methods have been proposed to support the inspection by a computer aided detection (CAD) system indicating suspect locations [106,141]. The size of a detected polyp is an important aspect for diagnosis and decision making. It is generally accepted that polyps with diameter < 5mm require no direct further action, whereas larger polyps should be removed via colonoscopy. Typically, the size of polyps is measured in colonoscopy by comparison with an open biopsy forceps. In CT colonography, it is usually measured in reformatted images, in which the largest polyp diameter is selected for size measurement. . polyp sizes thus measured by human experts can show significant inter- and intra-observer variability. Clearly, an automated method is needed to enable more accurate measurement of polyp size. As a side effect, such a procedure is also useful in CAD algorithms Automated Polyps detection is usually based on sophisticated pattern recognition techniques that take into account many features measured on tentatively selected candidates (e.g. size, area, average shape index etcetera). Proper segmentation is crucial to perform reliable feature measurement.The existing methods for colonic polyp segmentation (such as Summers et al. and Yoshida et al. are especially designed to work directly on the 3D CT data. Such an approach is hindered by not operating on a specifically defined region of interest c.q. the colon surface. Hence, segmentation of polyps which are by definition protrusions of the colon surface is not a trivial task.

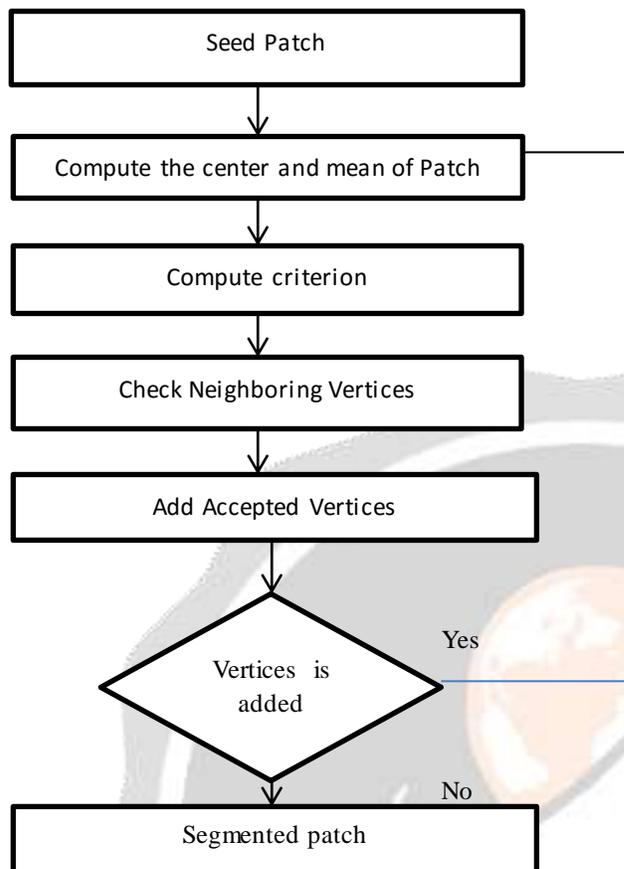


Fig:1 Schematic overview of segmentation procedure

In this paper we present a new method for semi-automatic segmentation of polyp-like structures. Additionally, a technique is described to automatically measure polyp sizes. Additionally, a technique is described to automatically measure polyp sizes using this algorithm. Our method assumes that the colon surface has been identified as a region of interest. Moreover, it is asserted that a candidate location has been identified; in our system by a vertex detection step based on the measured shape index [128]. We will compare the size measurement by our algorithm with that of physicians in a set of phantom objects (in which the size is known a priori).

2. POLYP SEGMENTATION

Ideally, a polyp could be described as a rather spherical, symmetric mound on a background shape (see e.g. Figure 2a). One could intuitively delineate a polyp by the inflection points on both sides. However, these points may not be easily identifiable due to the curvature of the background shape (e.g. a fold). Hence, we model a polyp to have a symmetry axis that goes through the center point (P_c) in which the apical surface normals converge, and the mean position (P_m) calculated from the polyps surface points. The edge of the polyp is defined by the points at which the surface normals tend to deflect from the center point (we will formalize this below). Initially, a single position or a small patch indicates a point on the polyp candidate. Since the center and mean points may not be robustly determined from such a seed patch, the polyp segmentation procedure is set up as an iterative process. During each cycle of this process neighbouring vertices are added if certain criteria are met. The process terminates when no more points are added. An overview of the procedure is shown in figure 1.

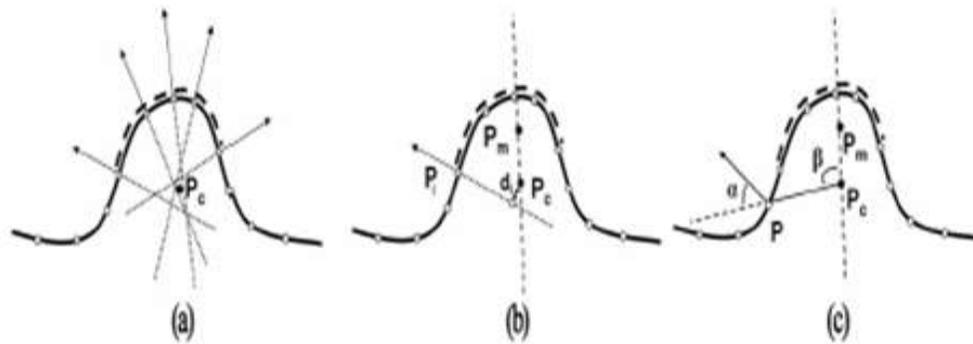


Fig 2: Schematic representation of a patch (dashed curve) on the colon wall. Figure (a) shows how convergent normals define a center point; figure (b) shows how the minimized distance d_i is defined for surface point P_i ; figure (c) shows how the angles α and β are defined

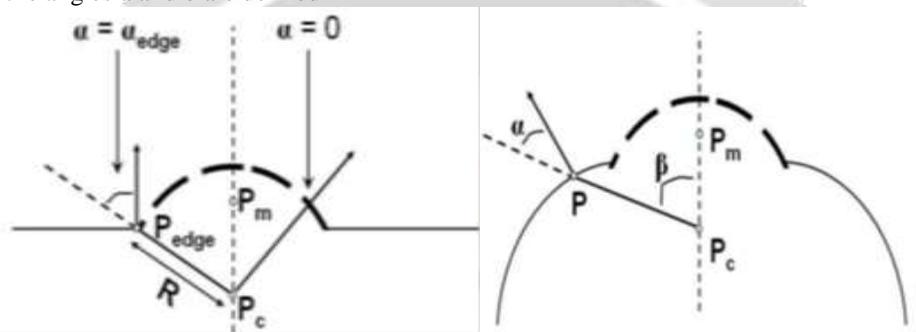


Fig 3: Schematic representation of a polyp (dashed curve) on a flat background

2.1 computing The Center and mean point

As depicted in Figure 2a, the surface normals on the polyp apex tend to converge in a center point. This point (P_c) is found by minimizing the sum of the distances (d_i) to all normals ($\sim n_i$). The surface normals are calculated by Gaussian derivatives the underlying 3D CT data at a scale of 2mm. This scale was determined experimentally such that no polyps are missed. The distances can be computed according to

$$d_i = \frac{\|\vec{n}_i \times (P_i - P_c)\|}{\|\vec{n}_i\|}$$

where P_i is a point on the patch and \times denotes the vector outer product. Additionally, a mean point (P_m) is associated with a patch. The position of the mean is simply computed by averaging the positions of all vertices: $P_m = 1/N \sum P_i$. The mean and the center point define a centerline (dashed in Figure.2b). Henceforth it is called the polyp axis. An important aspect that is used in deciding on a patient’s treatment is the polyp size. It is measured from the largest object diameter in cross sectional views or in volume renderings . A role of CT colonography in screening is to pre-select patients with polyps such that only patients with polyps are sent to colonoscopy. Another advantage of CT colonography that it aids colonoscopy by localizing the lesion and hence increasing the overall sensitivity.

2.2 Adding Point To Seed Patch

Points are to be added to a seed patch until the local surface normal tends to deviate from P_c . To formalize the stopping criterion, consider first a sphere on a flat background. Let us define α as the angle between the line from the center point (P_c) to the vertex (P_i) and the normal at the position of the vertex (see Figure.2c). Clearly, on top of the polyp α is small (exactly zero on a spherical cap, see Figure 3). The angle α increases while moving to periphery of the polyp. Right outside the polyp the angle is given by (compare with Figure 3): Introduction related your research

4.RESULT

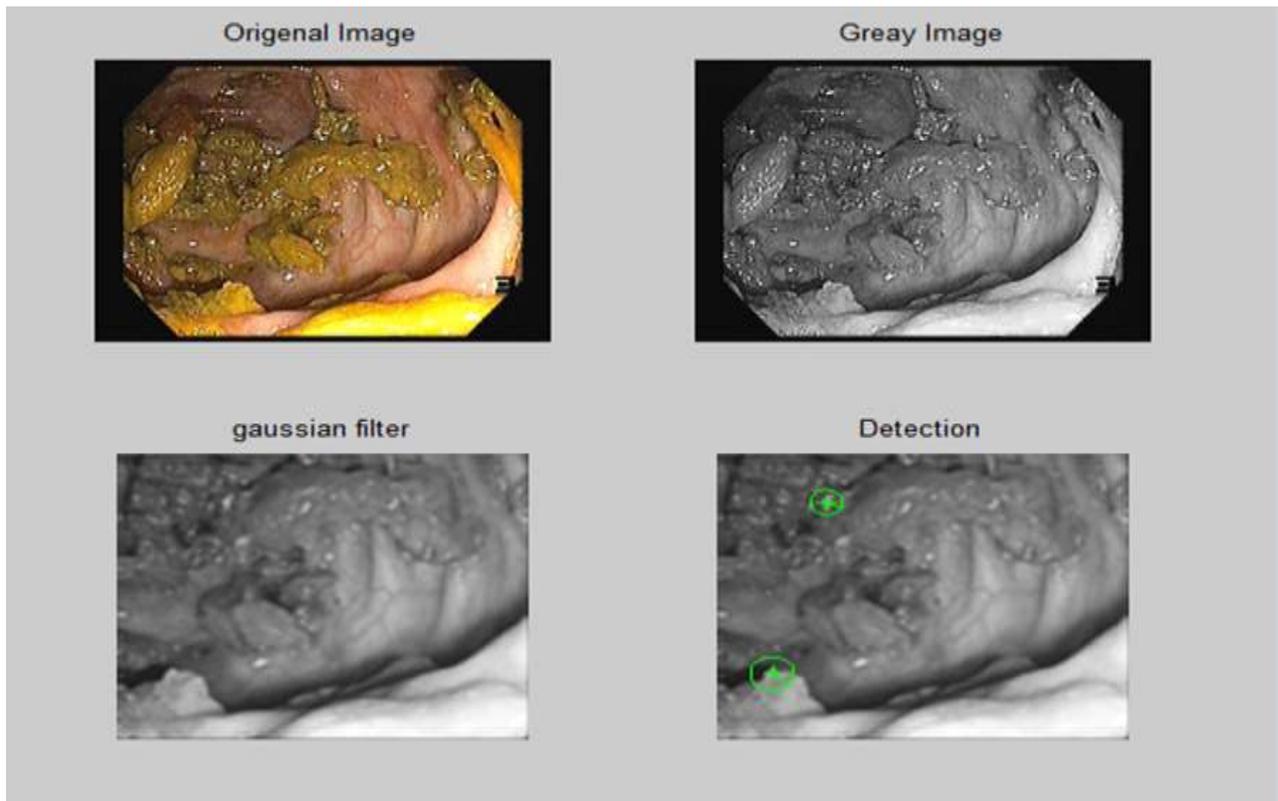


Fig 4 Polyp Detection Steps

4. CONCLUSIONS

The size of a colonographically detected polyp is important for diagnosis and decision making. The size measurement by human observers is generally considered to be imprecise and inaccurate. In this paper we presented a method for the automatic segmentation of polyp-like structures. The polyp size was automatically derived from the segmentation result. It was shown that our algorithm yields a smaller bias than the measurements from radiologists: on average 1mm or less for the automatic method and between 1 and 7mm for the radiologists, depending on the irregularity of the object. Even more important, the algorithm is consistent irrespective of the polyp shape. As opposed to that, the radiologists show a four times larger variation for the irregularly shaped objects. It is this irregularity which occurs in practice. A good polyp segmentation algorithm is also useful for automatic polyp detection algorithms. It allows for extraction of features such as volume, surface area, average grey-value etcetera. Such features may improve the specificity of CAD algorithms

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6. REFERENCES

- [1] D. G. Adler and C. J. Gostout, "Wireless capsule endoscopy," *Hospital Physician*, vol. 39, pp. 14–22, 2003.
- [2] L. Breiman, "Random forests," *Mach. Learn.*, vol. 45, pp. 5–32, 2001.
- [3] A. Buades, T. Le, J.-M. Morel, and L. Vese, Cartoon+texture image decomposition, image processing on line 2011 [Online]. Available: http://dx.doi.org/10.5201/ipol.2011.b1mv_ct
- [4] Y. Cao, D. Li, W. Tavanapong, J. Oh, J. Wong, and P. C. De Groen, "Parsing and browsing tools for colonoscopy videos," in *Proc. 12th Annu. ACM Int. Conf. Multimedia*, 2004, pp. 844–851, ACM.
- [5] Y. Cao, D. Liu, W. Tavanapong, J. Wong, J. H. Oh, and P. C. DeGroen, "Computer-aided detection of diagnostic and therapeutic operations in colonoscopy videos," *IEEE Trans. Biomed. Eng.*, vol. 54, no. 7, pp. 1268–1279, Jul. 2007.
- [6] F. Condessa and J. Bioucas-Dias, "Segmentation and detection of colorectal polyps using local polynomial approximation," in *Image Analysis and Recognition*. New York: Springer, 2012, pp. 188–197.
- [7] C. Cortes and V. Vapnik, "Support-vector networks," *Mach. Learn.*, vol. 20, pp. 273–297, 1995.
- [8] M. Delvaux and G. Gay, "Capsule endoscopy: Technique and indications," *Best Practice Res. Clin. Gastroenterol.*, vol. 22, pp. 813–837, 2008.
- [9] R. Eliakim, "Video capsule colonoscopy: Where will we be in 2015?," *Gastroenterology* vol. 139, 2010, p. 1468.
- [10] R. Eliakim, K. Yassin, Y. Niv, Y. Metzger, J. Lachter, E. Gal, B. Sapoznikov, F. Konikoff, G. Leichtmann, Z. Fireman, Y. Kopelman, and S. Adler, "Prospective multicenter performance evaluation of the second-generation colon capsule compared with colonoscopy," *Endoscopy*, vol. 41, pp. 1026–1031, 2009.
- [11] P. Figueiredo, I. Figueiredo, S. Prasath, and R. Tsai, "Automatic polyp detection in pillcam colon 2 capsule images and videos: Preliminary feasibility report," *Diagnostic Therapeutic Endoscopy*, p. 182435, 2011.
- [12] J. Gerber, A. Bergwerk, and D. Fleischer, "A capsule endoscopy guide for the practicing clinician: Technology and troubleshooting," *Gastrointestinal Endoscopy*, vol. 66, pp. 1188–1195, 2007.
- [13] B. Gustafsson, H.-O. Kreiss, and J. Olinger, *Time Dependent Problems and Difference Methods, Pure and Applied Mathematics*. New York: Wiley, 1995.
- [14] R. M. Haralick and L. G. Shapiro, *Computer and Robot Vision*. New York: Addison Wesley, 1992, vol. I, pp. 28–48.
- [15] T. K. Ho, "The random subspace method for constructing decision forests," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 20, no. 8, pp. 832–844, Aug. 1998.
- [16] R. S. Hunter, "Photoelectric color difference meter," *J. Opt. Soc. Am.*, vol. 48, pp. 985–993, 1958.
- [17] G. Iddan, G. Meron, A. Glukhovsky, and P. Swain, "Wireless capsule endoscopy," *Nature*, vol. 405, p. 417, 2000.
- [18] A. Jemal, F. Bray, M. M. Center, J. Ferlay, E. Ward, and D. Forman, "Global cancer statistics," *CA, Cancer J. Clin.*, vol. 61, pp. 69–90, 2011.
- [19] G. Kiss, J. Van Cleynenbreugel, S. Drisis, D. Bielen, G. Marchal, and P. Suetens, "Computer aided detection for low-dose CT colonography," in *MICCAI*. New York: Springer, 2005, pp. 859–867.

- [20] M. Liedlgruber and A. Uhl, "Computer-aided decision support systems for endoscopy in the gastrointestinal tract: A review," *IEEE Rev. Biomed. Eng.*, vol. 4, pp. 73–88, 2011.
- [21] T. Lindeberg, *Scale-Space Theory in Computer Vision*. NewYork: Springer, 1993.
- [22] J. Liu, K. R. Subramanian, and T. S. Yoo, "An optical flow approach to tracking colonoscopy video," *Comput. Medical Imag. Graphics*, vol. 37, pp. 207–223, 2013.
- [23] J. Liu, K. R. Subramanian, and T. S. Yoo, "A robust method to track colonoscopy videos with noninformative images," *Int. J. Comput. Assist. Radiol. Surg.*, pp. 1–18, 2013.
- [24] A. Moglia, A. Menciassi, and P. Dario, "Recent patents on wireless capsule endoscopy," *Recent Patents Biomed. Eng.*, vol. 1, pp. 24–33, 2008.
- [25] A. Moglia, A. Menciassi, P. Dario, and A. Cuschieri, "Capsule endoscopy: Progress update and challenges ahead," *Nature Rev. Gastroenterol. Hepatol.*, vol. 6, pp. 353–361, 2009.
- [26] T. Nakamura and A. Terano, "Capsule endoscopy: Past, present, and future," *J. Gastroenterol.*, vol. 43, pp. 93–99, 2008.
- [27] J. Oh, S. Hwang, J. Lee, W. Tavanapong, J. Wong, and P. C. De Groen, "Informative frame classification for endoscopy video," *Med. Image Anal.*, vol. 11, pp. 110–127, 2007.
- [28] M. Pauly, "Point primitives for interactive modeling and processing of 3D geometry," *Hartung-Gorre*, 200

