

Diagnosing the Location of Gastric Cancer by Thresholding Method Using the Image Processing Technique

Feryal Marandi^{1,*}, Ahmad Hatam²

¹M.S. Degree in Artificial Intelligence, Electrical and Computer Engineering College, Hormozgan University, Bandar Abbas, Iran

²Assistant Professor of Electrical and Computer Engineering College, Hormozgan University, Bandar Abbas, Iran

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ABSTRACT

Since the beginning of 1930s, gastric cancer has been reducing regularly in the world, especially in industrial countries. In some countries, however, especially the Asian ones, including Iran, the abundance of this disease is constantly on going. Gastric cancer is one the most prevalent and fatal types of cancer in Iran where around 10,000 people are suffering from the disease and it is mostly prevalent among the men. Further to International Health Organization's reports, Iran holds the maximum gastric cancer affected patients among the whole countries in the world. The main reason of such high fatality in gastric cancer is delay in its diagnosis. Therefore, in-time diagnosis and finding its exact location is of a great concern. Nevertheless, if this diagnosis could be performed intelligently it could be considered more important and valuable. In this paper the diagnosis shall be done via thresholding method and presenting a proposed algorithm. To provide a database a set of 100 real colored images achieved during the surgery operation have been used. The ulcers appeared in gastric ulcer are red, thus the color thresholding method has been used. Firstly, the images will be analyzed as required and then, after clearing the boundary of the required threshold, image processing will be performed on images, and finally, we will have been able to achieve a 95%-accurate diagnosis of the disease location.

KEYWORDS: Gastric Cancer; Thresholding; Boundary of Threshold; Image Processing

INTRODUCTION

Since the beginning of 1930s, gastric cancer has been reducing regularly in the world, especially in industrial countries. In some countries, however, especially the Asian ones, including Iran, the abundance of this disease is constantly on going. Gastric cancer is one the most prevalent and fatal types of cancer in Iran where around 10,000 people are suffering from the disease and it is mostly prevalent among the males. Further to International Health Organization's reports, Iran holds the maximum gastric cancer affected patients among the whole countries in the world. The main reason of such high fatality in gastric cancer is delay in its diagnosis. The most prevalent type of cancer is Adenocarcinoma or the "Gland Cancer" in the stomach. Gastric cancer can be known as *the non-controlled growth of the malignant cells inside the stomach*. Other forms of gastric cancer which are less prevalent, such as *Lymphoma* (A kind of cancer that involves lymphatic system) and *Sarcoma* (The Cancer involves conjunctive tissues such as muscles, adipose or blood vessels). Gastric cancer causes almost one million death-losses around the world [2]. The successful surgery operation on gastric cancer in 1881 was not only a success in gastric surgery but also in digestive system surgery operation. Beginning the 20th century, gastric surgery reached the current and present progress level. At that time, the success rate in removing the harmed part of stomach was 20 percent and the fatality rate reached 50 percent of the patients who were under the gastric cancer operation. For 30 years, after the 2nd World War, the process of removing the infected part of the stomach had been increasing. Since the time of *lymphadenectomy* introduction, in addition to the stomach, the numbers of simultaneous times at which other organs are removed have been increased. Since 1980, surgery operation among the patients suffering from gastric cancer has been improved and it is still in its primary stages. According to the data collected by Japanese Association of Gastric Cancer Research the present rate of stomach partial removal is about 91.3 percent, fatality 10 percent and 5-year surviving rate among the patients suffering from gastric cancer will be 71.6 percent [1]. Considering the previous arguments with the specialists in this field, including Dr. Dariush Niazi (Gastroenterologist in Bandar Abbas), some information was gained about the disease. The main property of the appeared ulcers in gastric cancer is their redness and bloodiness. An example of this kind of ulcer is shown in figure 1. This is the property that brings

the idea of color thresholding into the mind. Reviewing the redness and bolding the ulcer as well as operating the process to remove noise, we can easily distinct these kinds of ulcer.

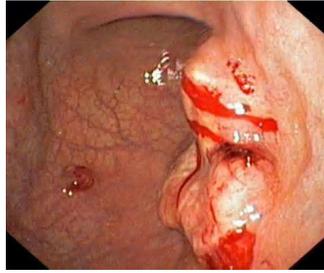
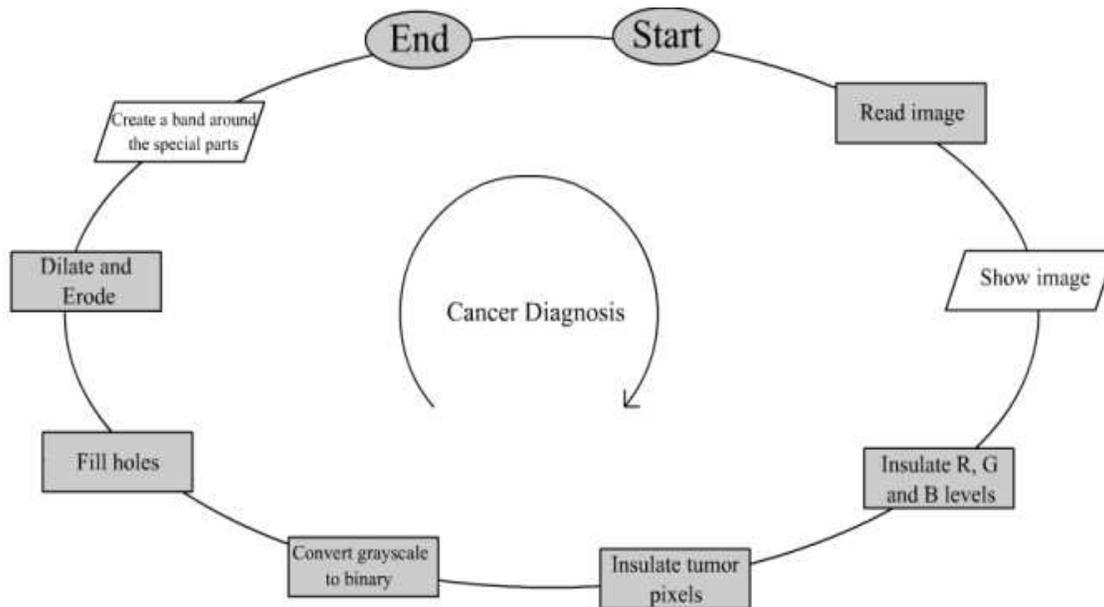


Fig. 1: An example of Gastric Cancer



Flowchart 1: Proposed algorithm stages for diagnosing the location of Gastric Cancer

In this research the proposed algorithm will be firstly presented in flowchart 1, then it will be evaluated and the result of the proposed method will be presented, and in the end, the discussion and conclusion are going to be submitted.

Property Selection Issue

Property selection issue is actually to pick out those properties with the maximum ability of predicting the output [3]; that is, the proposed subsets might depend on the issues we are facing [4]. In this study, the Optical Thresholding method has been used to test and classify the data. The reason to use such a method – as previously mentioned - is due to the redness of the ulcers caused in gastric cancer.

Gastric Cancer

The rate of dying by gastric cancer in developed countries has been clearly reducing during the recent 75 years due to unknown reasons; however, it is increasing in Iran, unfortunately [5]. There is a dramatically high risk of gastric cancer among the economically-poor families [6]. Around 85 percent of gastric cancer cases have been of the Adenocarcinomas type (a type of cancer cell) and the remained 15 percent include Lymphomas, Leomyosarcomas and Gastrointestinal cells [7].

The Adenocarcinomas is two types: Intestinal and Diffused [8]. The reason of cancer is long-term use of foods rich in nitrates, smoking and salt [9]. When the disease is still superficial and can be cured by a surgery operation, actually it does not show any symptoms [10]. As the tumor swells, it gets larger and progresses with symptoms like pain in the upper part of the stomach (Epigastrium), amnesia, fullness and heaviness feeling after eating food,

anorexia (inappetence), constant and severe pain and a smooth sense of nausea[11]. Gradual weight loss, nausea, and vomiting are mostly observed in cancers appear in the form of polyp or swelled masses. Disorders in swallowing (dysphagia) and early satiety might be of the significant symptoms of the diffused tumor at the gastric cardiac (at the stomach inlet). Anemia and lack of ferrous are very common symptoms found in gastric cancer [12]. Some researchers believe that the best and the most precise way to diagnose gastric ulcer is possible by means of endoscopy, since 8 percent of those seemed-to-be- benign ulcers can be malign ones [13]. Endoscopy makes it possible take samples and benign ulcers can be differentiated from the malign ones [14]. Gastric cancer’s healing might involve total tumor and lymph glands removal; of course, less than one-third of people who are suffering from cancer are in the phase in which the total tumor removal is possible [15]. Moreover, Gastric Adenocarcinomas are relatively responding to radiotherapy [16]. The combination of radiotherapy and chemotherapy in progressed non-operatable cancers will provide the patients with 30 to 50 percent healing response [17]. Radiography along with double-contrast technique can be the easiest way to diagnose the gastric cancer in patients suffering from stomachache [18].

Data Bank

The first step in performing the tasks of the diagnosis-related projects mainly involves calculating the required images in order to be processed. After studying the articles titled with topics related to various diseases diagnosis via image processing method, and consulting with experts of the field, it was decided to use CT-Scan images. Considering the problems occurred with using these images, the colored images were selected to be used. There were 100 images of various sizes which were used in algorithm test, i.e. the program.

Proposed Method

The purpose of this study is to present a method to find the location of gastric cancer. Thus, our proposed method contains several phases that are going to be discussed in continue. We shall firstly discuss about the pre-processing phase and then continue with achieving the threshold, image simplification with noise elimination, filling cavities, increasing the number of images, and viewing the location of the cancer ulcers shall be discussed. In the end, the results concluded through the algorithm will be reviewed.

Pre-processing

First, the color levels of the RGB image will be separated and divided into three levels, R, G and B. This can be clearly seen in figure 2.

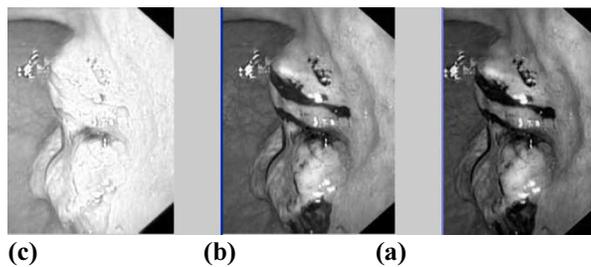


Fig. 2: (a) Level B; (b) Level G; (c) Level R

Achieving Threshold in the Image

After analyzing picture number 3 which is a sample of gastric cancer, the values of achieved pixels related to gastric cancer are indicated in table 1 and the level of the required threshold will be chosen.



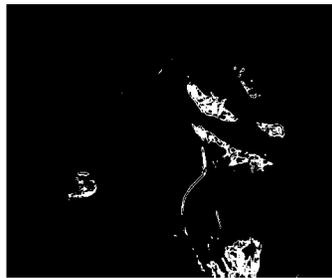
Fig. 3: Analyzing the pixels related to the ulcer area

Table 1: Values related to the pixels of the cancer area

Row	Level R	Level G	Level B
1	244	40	15
2	242	41	13
3	245	41	16
4	244	43	15
5	244	43	13
6	248	43	16
7	243	39	12
8	242	42	9
9	242	42	9
10	246	43	11
11	254	49	20
12	245	42	10
13	244	44	10
14	245	42	10
15	246	46	10

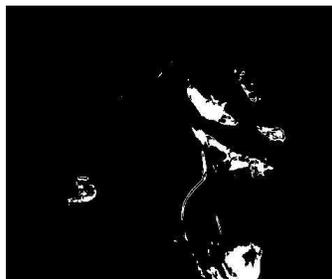
Based on the performed tests the values of threshold are selected so that the most pixels related to the cancer will be chosen.

In continue, the imaging has been performed, of which the simplest types of image in image processing are Binary Images. Figure 4 shows this state clearly.

**Fig. 4: Binary image**

Filling Cavities, Increasing Number of Images and Eliminating the Noise

In this part the cavities of the image will be filled. A cavity is a set of holes in a state at which if we start filling the pixels from the edge of the image, those pixels will not be available. This process can be seen in figure 5.

**Fig. 5: Cavities filling in the image**

Should some cavities likely be remained, they will be filled by increasing process and morphological operations. After performing the above mentioned tasks and processes, the image will become like what is shown in figure 6.



Fig. 6: The increased image

In continue the noises and actually, the invaluable pixels, shall be eliminated.

Viewing the Location of the Cancer Ulcers

As it was shown in part 5-3, the ulcers were separated thoroughly; now, these areas must be viewed on the main image (Figure 7).

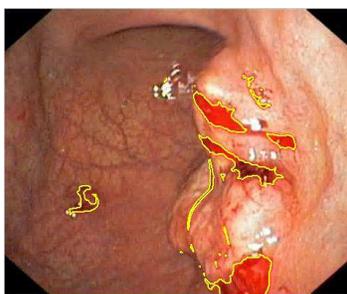


Fig. 7: Viewed Gastric Cancer

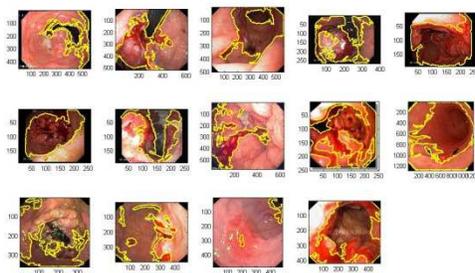


Fig. 8: Viewed disease in all images

As it was mentioned before, the noticed tasks were processed on lots of images and their results are shown via figure 8.

Conclusion

Gastric cancer is one the most common, prevalent and fatal types of cancer in Iran. More 10,000 people suffer from this illness yearly and it is the most prevalent one among the men. According to the International Health Organization's reports, Iran holds the greatest number of gastric cancer cases in the world. The most important reason of the high rate of fatality caused by gastric cancer is delay in its diagnosis. In this paper, thresholding method and proposed algorithm were used to find and specify the location of gastric cancer's ulcer and finally, we came up with a precise – around 95 percent accuracy - diagnosis of the disease location.

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