An Automated Way to Detect Tumor in Liver

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Abstract
In recent years, the image processing mechanisms are used widely in several medical areas for improving earlier detection and treatment stages, in which the time factor is very important to discover the disease in the patient as possible as fast, especially in various cancer tumors such as the liver cancer. Liver cancer has been attracting the attention of medical and sciatic communities in the latest years because of its high prevalence allied with the difficult treatment. Statistics indicate that liver cancer, throughout world, is the one that attacks the greatest number of people. Over the time, study of MR images related to cancer detection in the liver or abdominal area has been difficult. Early detection of liver cancer is very important for successful treatment. There are few methods available to detect cancerous cells. In this paper, an automatic approach that integrates the intensity-based segmentation and k-means clustering approach for detection of cancer region in MRI scan images of liver.
Keywords:
liver tumor, magnetic resonance imaging, segmentation, feature extraction, image processing

1. Introduction

THE Liver cancer is considered to be the main cause of cancer death worldwide, and in its early stages it is difficult to detect because only in the advanced stage symptoms appear causing the mortality rate to be the highest among all other types of cancer (Kavitha and Nadu 2016). If liver nodules can be identified accurately at an early stage, the patient's survival rate can be increased by a significant percentage. HCC typically develops in the setting of chronic liver inflammation, such as infection with hepatitis B or C viruses (Hetta, Shebrya, and Amin 2011). Other risk factors for HCC are alcohol abuse, hereditary hemochromatosis, non-alcoholic fatty liver disease, stage 4 primary biliary cirrhosis, alpha 1 antitrypsin deficiency, and aflatoxin exposure (Gervais and Arellano 2011). Diabetes, which is associated with nonalcoholic fatty liver, is currently recognized as a risk factor for HCC as well (Yu N.C., Lu D.S. et al. 2006). Hepatocellular carcinoma (HCC) is the most recurrent hepatic malignancy and the third in the cancer-related casualties in the west. The frequently-documented causes of HCC are chronic liver infections by hepatitis B virus or hepatitis C virus, nonalcoholic fatty liver disease, cirrhosis, exposure to aflatoxins and tobacco smocking, etc. (Bose and Chatterjee 2019). Hepatocellular carcinoma (HCC) is one of the most prevalent cancers globally. In contrast to the declining death rates observed for all other common cancers such as breast, lung, and prostate cancers, the death rates for HCC continue to increase by 2-3% per year because HCC is frequently diagnosed late and there is no curative for an advanced HCC (Wang and Wei 2020). In the modern age of computerized fully automated trend of living, the field of automated diagnostic systems plays an important and vital role (Kaur 2013). Automated diagnostic system designs in Medical Image Processing are one such field where numerous systems are proposed and still many more under conceptual design due explosive growth of the technology today (Guruprasad and Vidyadevi 2012).

The process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics is known as Image segmentation (Sharma and Jindal 2011), (A. Roozgard, S. Cheng and H. Liu 2012), (Prem Chander 2017). Literature has a wide range of segmentation techniques used in liver cancer diagnosis. Image processing has wide scope in medical image processing for diagnosing the Liver cancer (Chaudhary and Sukhraj Singh 2012), (Hashemi et. al. 2013), (Song et. al. 2013). The purpose of this paper is to review related work on automatic diagnosis of liver cancer and summarization various segmentation and classification techniques for detection of liver nodules.

The paper is organized in four sections. Section II covers materials and methodology used for liver cancer detection. Section III provides results and discussion. Section IV covers the conclusion.

2. Materials and Methodology

Database is comprising of 29 hepatocellular carcinoma MRI scan images downloaded from TCGA database. Fig. 1 shows an example of a slice extracted from the patient having cancerous tissue. The automated detection method is consisting of liver segmentation, feature tumor extraction and then its analysis. All these steps done in MATLAB, coding is also given. The tumor or cancerous region was segmented using k-means clustering algorithm subsequently statistical analysis were done.

To obtain accurate lesion structure, the segmentation was performed on high contrast MRI scan images. In the MRI image, the contrast of the cancerous region is high compared to other healthy tissues. The abdominal MRI images generally consist of liver and some region of kidney, spleen, etc., they do not have significant difference in intensity. So, it is necessary to separate the liver from the MRI images for which k-means clustering was applied. Mask is prepared and saved for 25 MRI scan images. In k-means clustering, whole

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liver is clustered among k groups, out of which one group belongs to tumor or cancerous region, then it will be statistically analyzed. The flow chart of complete methodology is shown in Fig. 2.

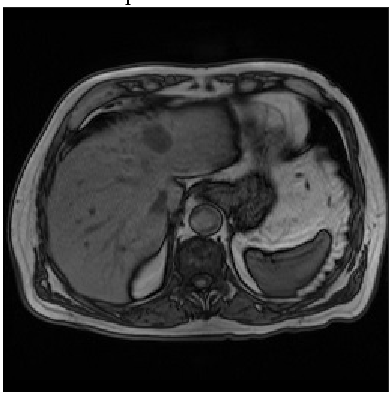


Figure 1: Represented one slice of Patient MRI scan image with Cancerous region.

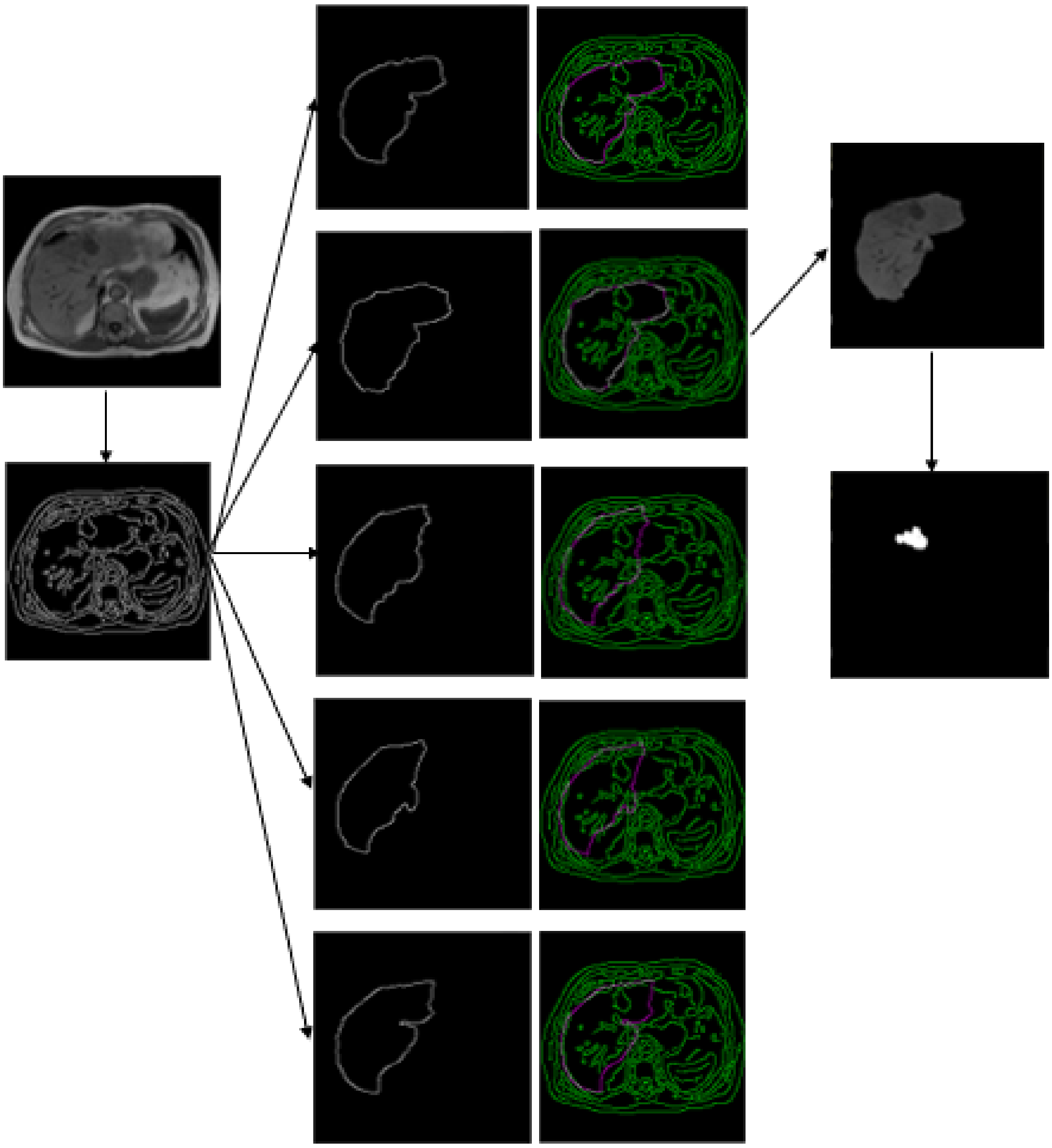
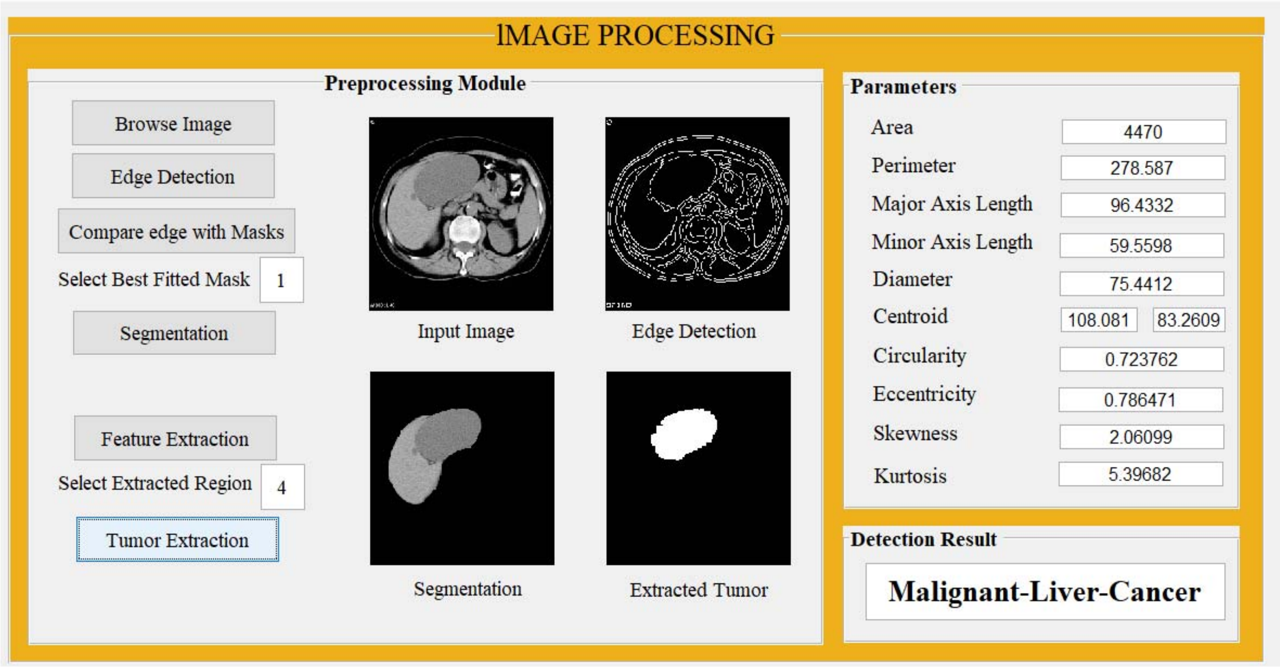
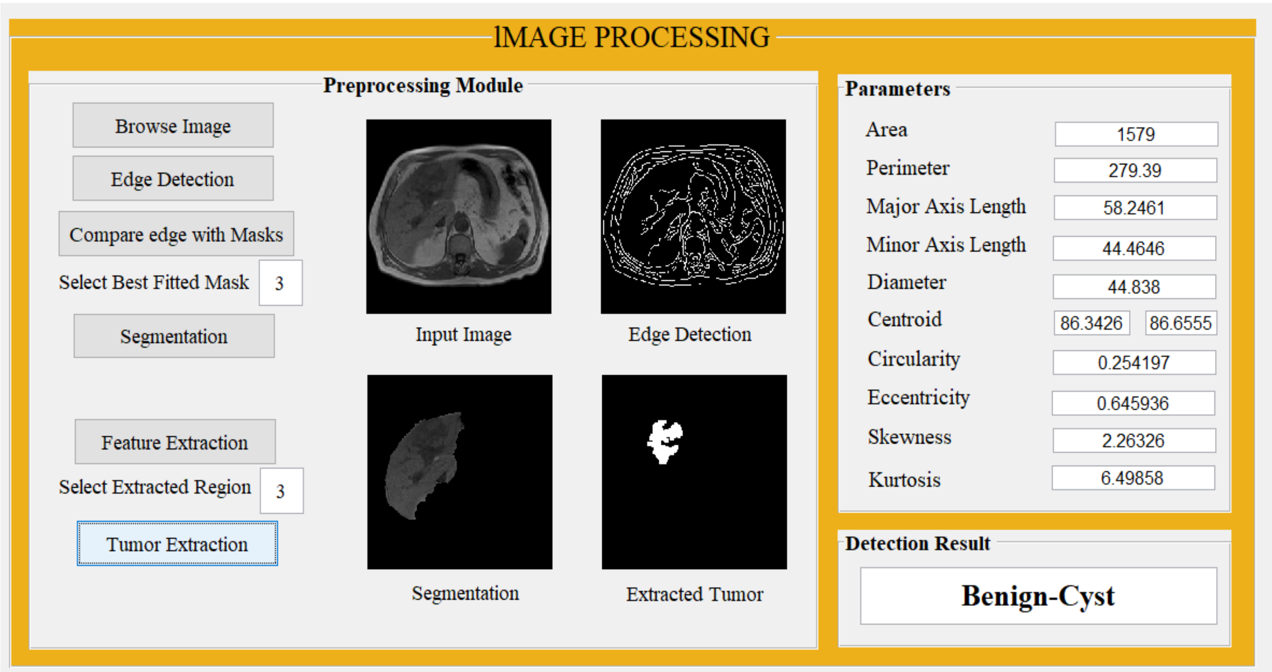


Figure 2: Flow chart shows the working of proposed algorithm taking five mask into consideration



(a)



(b)

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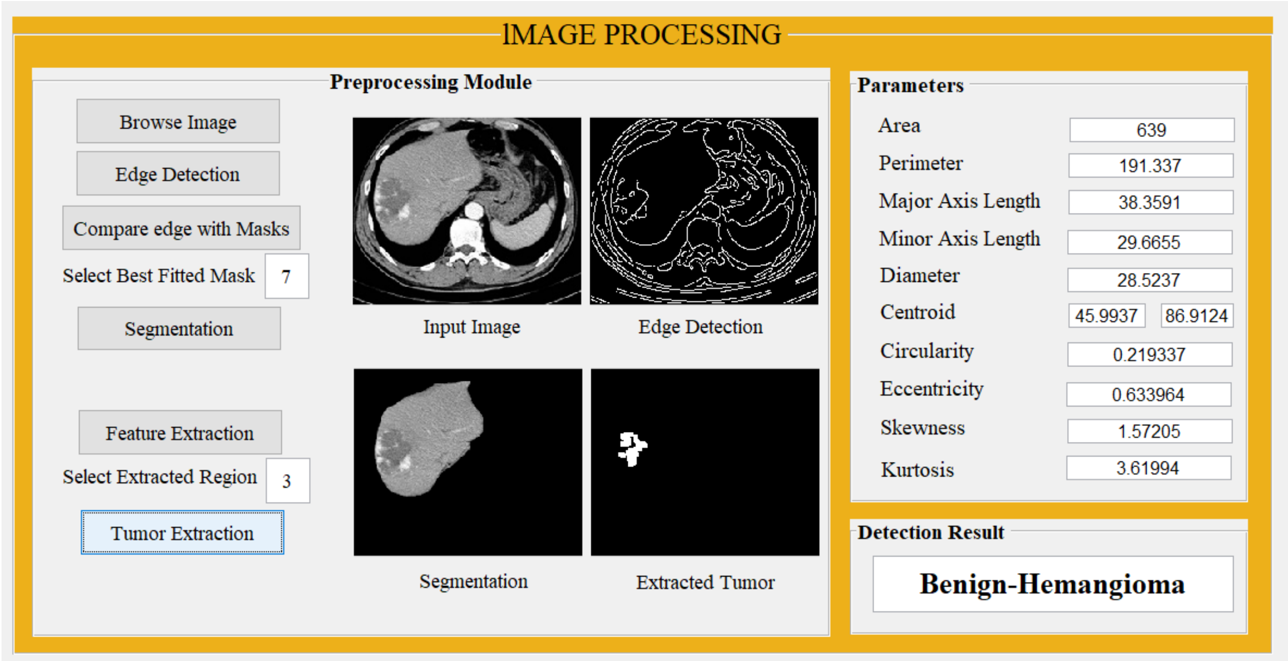
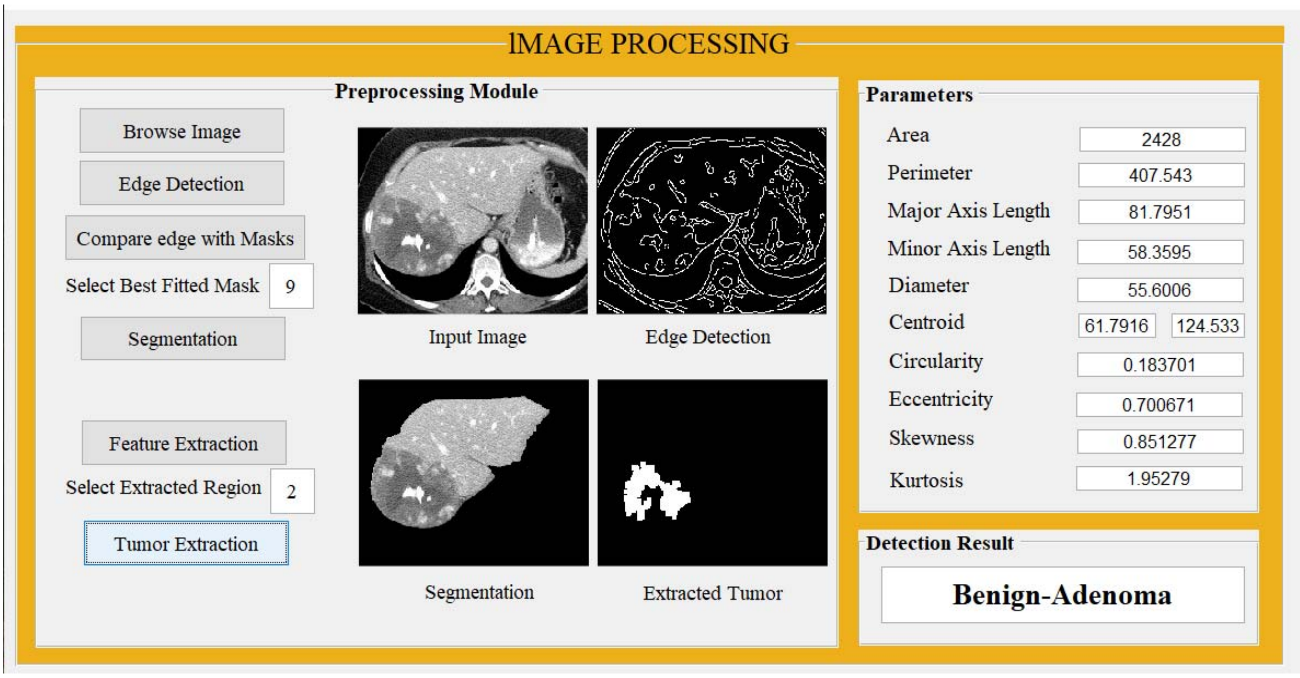


(c)



(d)

Figure 3: Represented the result of interface a). Malignant Liver Cancer, b) Benign Cyst, c) Benign Hemangioma and d) Benign Adenoma.

3. Results and Discussion

Mask has been prepared for 25 hepatocellular carcinoma MRI scan images. These masks have been stored to train the model. For testing purpose, we have taken four MRI scan images of hepatocellular carcinoma computed mask of MRI scan is computed with the saved 25 masks. Best fitted mask is selected and then further k-means clustering algorithm is applied over it, to differentiate cancerous or tumor region from healthy regions. Its statistical characteristics are computed. An interface has been made to automatically predict cancer among four categories i.e. Malignant Liver cancer, Benign Cyst, Benign Hemangioma and Benign Adenoma and result represented in Figure 3.

4. Conclusion

Image segmentation of liver MRI scan image is a crucial task as the image comprise some portion of kidney, spleen etc. The contour and clustering based methods were widely used for medical image segmentation. In this paper, we have presented a way to automate the liver segmentation, feature extraction in the form of tumor, further its analysis based on statistical characteristics.

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