The Use of Imaging in the Early Detection of Liver Cancer

Ph.D. Thesis Summary

By

Meenu Sharma

Department of Computer Science
Faculty of Natural Sciences
Jamia Millia Islamia
New Delhi

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This research focuses on developing CAD methods for segmenting cancer nodules and detecting the various stages of liver cancer, assisting radiologists in analyzing the disease. It also worked on an image processing method extracting and discriminating areas of the liver, malignant and benign tumors from an MRI scan image, which can support information on the position and morphology of these tumors. The first step of the process is to isolate the liver portion from a magnetic resonance imaging scan using the edge and mask technique because the internal organ's intensity distributions are highly similar to one another. The k-means clustering algorithm, which divides the entire liver into clusters and is adaptable to all types of MRI scans, is used to segment areas of the liver by using the information on distributions of intensity within the liver. The area of the liver that represents the tumor is extracted by using clusters produced by the k-means clustering algorithm. A malignant tumor known as hepatocellular carcinoma can be seen in an MRI scan slice of the liver as being brighter than the surrounding tissue [1]. To evaluate the developed interface's performance, experimental data from MRI scan pictures downloaded from the TCGA database and from research papers are used. It is also checked that the outcome categories from developed interface match the categories in which the data was saved in the TCGA database. The evaluation findings demonstrated that liver and tumor areas were precisely retrieved and the suggested approach has high availability as an auxiliary diagnostic tool for differentiating between benign and malignant tumors like hepatocellular carcinoma (HCC). The basis for this classification is a statistical and physical examination of tumor.

The development of an innovative method for examining typical MRI scans is the beginning of this research. If 3-dimensional visualization for the segmented liver and detected tumors used, this technology could potentially be developed to encompass different types of tumors having with varying texture patterns and it might be highly helpful for surgery and radiation therapy planning. By employing an automated technique for the extraction of a Hepatocellular Carcinoma tumor that cannot be distinguished by the naked eye, we have improved the suggested method in subsequent works to examine in depth the intensity level of a Hepatocellular Carcinoma tumor. Additionally, we have implemented an automated auxiliary diagnosis system for the scan images captured by different imaging tests that has been used to distinguish between and analyze malignant and benign tumor.

This research developed image processing techniques for the accurate segmentation of liver cancer nodules and classified their stage. In conclusion, the proposed method can successfully detect hepatocellular carcinoma using computer-aided diagnosis on abdominal MRI scans.