IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Using Fuzzy C-Means and Thresholding to Detect Brain Tumors in MRI Images

S Anusha[1], N Naveen Kumar[2]

[1]M.Tech Scholar,Computer Networks and Information Security, School of Information Technology, JNTUH

[2]Associate Professor, Dept of CSE, School of Information Technology, JNTUH

ABSTRACT - An infectious region of a brain tumour must be identified, segmented, and detected, a time-consuming and arduous process. An MRI, an image processing concept, can show the various parts of the patient's psyche. Detecting abnormalities in the human brain with simple imaging methods is extremely difficult. Many imaging modalities are used in an MRI procedure to scan and preserve the inner brain structures, including a magnetic resonance imaging (MRI). Medical images can be improved for an accurate diagnosis employing a balance contrast enhancement technique that is the focus of this article (BCET). This is followed by picture segmentation. Fine edges are finally detected by employing the Canny edge detection method. The experimental results showed that the proposed technique was about 98 percent accurate in recognizing the tumour and natural regions of the brain in MRI images.

Keywords: Balance Contrast Enhancement Technique (BCET), Canny Operator, Edge Detection, Image Segmentation, Magnetic Resonance Imaging (MRI) Images, Tumor Pathology.

1. INTRODUCTION

A large part of diagnosing and treating individuals with disease involves the use of image analysis tools. Images are processed using computational procedures that change a reference picture into the other in which the relevant information is highlighted and the extraneous information is reduced or deleted. As a result of the numerous advantages that digital technology systems may provide, the vast majority of hospitals have implemented them to aid their operations. Doctors frequently use medical images to diagnose their patients; hence the outcome of the diagnosis is reliant on the image. A treatment plan will be devised for the patient based on the image's information, particularly object boundaries. The absence of data in a picture, as a result of inadequate image processing, causes many people to die each year. Feature extraction and feature extraction use edge detection to find discontinuities in digital images, which is a critical aspect of image processing since it aids in features extracted and object recognition (Cadena et al., 2017). A mass of aberrant brain cells is referred to as a tumour. One of the most common major causes of death is cancer, which is caused by a tumour. On a global scale, the incidence of cancer is rising at an alarming rate. As a result, early tumour diagnosis is critical. The first step in determining if a patient has brain cancer is to conduct thorough medical records, such as signs and risk factors. A complete physical and neurological examination is also part of the diagnosis process. Such functions as reflexes, feeling, movement stability, alert, cooperation, vision and hearing are evaluated by a neurological. Medical imaging requires a high level of expertise in radiology in order to accurately detect tumours. Based on characteristics such as tumour kind, location, size, and stage of growth, a person's risk level from a brain tumour varies. A medical imaging technology known as Magnetic Resonance (MRI) gives higher images of the human body's components. When treating brain tumours, ankle, and foot, MRI imaging is frequently used. High-definition images of the human body's internal organs can be obtained using MRI, an advanced imaging technique. Brain, ankle, and foot cancers are common targets for MRI imaging. The use of MRI in the clinical diagnosis of brain tumours is growing in popularity. Authors are familiar with works such as the detection of tumor stimulation utilizing unsupervised sector (CRF), early functional brain development using data collected from kids all through organic snooze (Redcay, Kennedy & Courchesne, 2007), and the calculation and visualisation of parametric grey infidelity primary residence in different from the data (DT) MRI (Kang, Herron, Turken & Woods, 2012). The separation of textural places of the brain's white matter (WM) and the detection of single cells (Leitea et al, 2016) (Schultz, Theisel & Seidel, 2007). A multi-stage process is involved in using MRI to find a brain tumour. In diagnostic imaging processing and prediction, segments are widely acknowledged to be a crucial but challenging phase. A two-part procedure is needed to remove a brain tumour from an MR image (Ain, Jaffar & Choi, 2014). In one section, the brain's tumour cells reside, while in the other, normal brain cells reside (Abdel-Maksoud, Elmogy, & Al-Awadi, 2015). Fuzzy C-Means (FCM) clustering approach suggested by Sharma, Diwakar, and Choudhary (2012), Selvakumar, Lakshmi, and Arivoli (2012) is frequently used for image segmentation. It was hypothesised by Zanaty (2012) that a hybrid technique to brain tumour segmentation might be used by merging FCM, seed region growth, and they consider having algorithm to assess segmented grey and white matter tissue from MR images. Methods like Sobel, Prewitt, Roberts, Canny and LoG (Canny, 1986; Stosic & Rutesic, 2018) and the shearlet transform (Hauser, 2011) can be used to tackle the problem of geometric image recognition, the allocation of linear and non-linear features (the edges, boundaries, and contours of objects). Existing tumour identification and evaluation techniques can be categorised as either region-based or contour-based. When using a region-based strategy (such as the ones developed by Dou, Ruan, Chen, Bloyet & Constans in 2007 or by Corso, Sharon & Yuille in 2006), a group of pixels with a high degree of similarity is sought out. Many low-level activities can be automated, such as techniques proposed, histogram analysis, and classification, reducing the need for human intervention. Aside from the structure and boundary information for each pixel, these approaches only use local data for each pixel. It is common for researchers to employ a wide range of approaches based on segmentation in order to locate and analyse a brain tumor's features. Verma (2017) used morphological operators and threshold selection to perform medical picture segmentation in the context of morphological operators. To detect the boundaries of a brain tumour, Rajesh and Bhalchandra (2012) used morphological procedures as well as thresholds and watershed segmentation, while Shah (2014) advocated using a hybrid approach that incorporates both watershed and Canny edge detection. In this work, the primary goal is to develop a reliable method for detecting cancers in multimodal MRI images using segmentation. With a small amount of customizable parameters dependent on the input image, this article aims to find a solution to a difficult problem: how to distinguish between tumour cells and normal brain cells in an MRI image with clarity. A series of computer processes is proposed by the researchers to prepare images for further study by medical personnel. An edge map is used for object segmentation in MRI images, as well as picture quality improvement and object segmentation using brain tumours and brain regions. In the end, the data is analyzed and parameters are calculated based on the diagnostic task.

2. METHODOLOGY

There are a variety of methods for detecting and segmenting brain tumours. This approach is recommended by the researchers since the findings of medical image segmentation may be distorted by the noisy environments in images, thus they recommend utilizing it.

1. Image acquisition

2. Preprocessing

3. Segmentation

4. Contour representation of tumor region and normal brain region in MRI image.

Image Acquisition: A patient's MRI scan results are originally assumed to be color, Grayscale, or intensity images and are shown at a standard size of 256x256. To converting a color image into gray, a large matrix with entry variables ranging from 0 to 255 is used, with 0 denoting black and 255 denoting white. The preprocessing, picture fragmentation, and contouring representations of a patient's brain tumour are the three primary steps in the classification phase.

Preprocessing: Preprocessing is primarily concerned with enhancing the MRI images so that they can be further processed by either a human or a machine vision system. Improved signal-to-noise ratio and visual look of MR images can also be achieved through preprocessing, which removes unwanted noise from MR images as well as cleaning the internal parts of a region and preserves it margins.

Segmentation: Imaging segmentation is critical to determining the best course of treatment for patients with a brain tumor based on magnetic resonance (MR) images or other medical imaging methods. Image segmentation yields either a collection of regions or a collection of contours that encompass the entire image. In terms of some characteristic or computed feature, such as color, intensity, or texture, each pixel in a region is comparable. The MR images are divided into binaries using the thresholding technique (Singh & Gupta, 2015). Segmentation is the process of dividing up an image into smaller, more manageable chunks. Preliminary segmentation of the medical image after enhancement identifies the most accurately the boundaries of the region of interest. The Fuzzy C-Means (FCM) clustering and thresholding methods were selected to perform the segmentation. Segmenting the normal brain is done using the Fuzzy C-Means segmentation, while the tumour is done using the thresholding segmentation, which converts the improved image to a binary image.

Contour Representation: Classification techniques, including Roberts, Prewitt, Sobel, and more complex ones, like LoG and Canny, can be used to create the contour map. Several image analysis edge detectors have been compared, and the Edge detection has been found to be the most effective. It is capable of detecting a wide variety of image edges. It has earned well-deserved identification for feature extraction because it needs to meet the basic guidelines correctly and because the successful implementation is really quite simple.

3. RESULTS AND DISCUSSION

Two datasets were used in this study, one of which was a dataset compiled by expert radiologists, which included images of 10 patients, each with six slices, and a total of 60 slices. The DICOM (Digital Imaging and Communication systems in Medicine) dataset is the first one to be examined (OsiriX, n.d.). In order to the researchers used the DICOM dataset to examine 15 images, all of which contained Are brain tissues infected with tumours. However, there were no images of ground truth in this dataset. The Full three-dimensional scans of human brains are included in the Brain Web image database (BrainWeb, n.d.). T1-weighted MRI, diffusion-weighted MRI, and diffusion-domain MRI were used to generate the simulated brain MR data. Both T2- and proton frequency MRI can be used for this procedure. A total of 15 images from a total of 48 were included in this dataset are brain issues infected with cancerous tumour cells. Different types of tumours can be found in the collected data. The size, shape, and density of the area, as well as the various types of pathologies that exist within it, close to where the tumor is located.

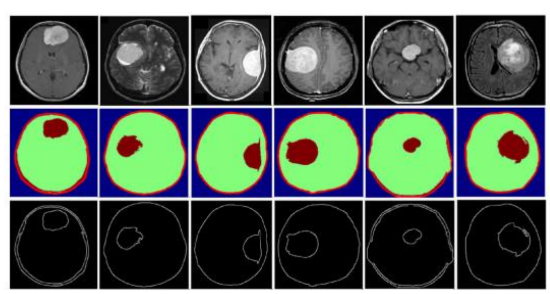

Figure: Some results of the proposed method

4. CONCLUSION

Using image processing, this work is able to locate the tumor's borders on MRI scans as well as the natural brain's. With segments, it is feasible to define exactly the affected areas (contours) of tumours and healthy brains. The benefits gained inside the present work were obvious and correct. In order to get the best possible outcome, each stage must be handled correctly. There seem to be a variety of options for every phase, and the ones that yield the greatest outcomes were selected. The final stage is to look for tumour margins and healthy brain tissue. A variety of segmentation techniques are available, however this algorithm uses Canny since it relies on neighboring pixels to find edges. For the research, a variety of brain tumour MRI pictures were consulted. The method was successfully applied to a wide number of photos, and the outcomes are excellent & effective. In addition, the proposed technique can be used to identify lung disease with a few tweaks. Algorithms like this one can be used to identify malignant cells in lung CT scans. The results have indicated that the suggested algorithm is capable of recognizing additional information, which can greatly aid in the identification of such variety of brain tumours.

5. REFERENCES

[1] Cadena, L., Espinosa, N., Cadena, F., Korneeva, A., Kruglyakov, A., Legalov, A., & Zotin, A. (2017, September). Brain's tumor image processing using shearlet transform. In Applications of Digital Image Processing XL (p. 103961B). International Society for Optics and Photonics; . doi:10.1117/12.2272792

[2] Wu, W., Chen, A. Y., Zhao, L., & Corso,J.J.(2014). Brain tumor detection and segmentation in aCRF (conditional random fields) framework with pixel-pairwise affinity and superpixel-level features. International Journal of Computer Assisted Radiology and Surgery, 9(2), 241–253. doi:10.1007/s11548-013-0922-7

[3] Redcay, E., Kennedy, D. P., & Courchesne, E. (2007). fMRI during natural sleep as a method to study brain function during early childhood. NeuroImage, 38(4), 696–707. doi:10.1016/j.neuroimage.2007.08.005

[4] Kang, X., Herron, T.J., Turken, U., & Woods, D. L. (2012). Diffusion properties of cortical and pericortical tissue: Regional variations, reliability and methodological issues. Magnetic Resonance Imaging, 30(8), 1111–1122. doi:10.1016/j.mri.2012.04.004

[5] Leite, M., Gobbi, D., Salluzi, M., Frayne, R., Lotufo, R., & Rittner, L. (2016, March). 3D texture-based classification applied on brain white matter lesions on MR images. In Medical Imaging 2016: Computer-Aided Diagnosis (p. 97852N). International Society for Optics and Photonics.

[6] Schultz, T., Theisel, H., & Seidel, H. P. (2007). Topological visualization of brain diffusion MRI data. IEEE Transactions on Visualization and Computer Graphics, 13(6), 1496–1503. doi:10.1109/TVCG.2007.70602.

[7] Ain, Q., Jaffar, M. A., & Choi, T. S. (2014). Fuzzy anisotropic diffusion based segmentation and texture based ensemble classification of brain tumor. applied soft computing, 21, 330-340.

[8] Abdel-Maksoud, E., Elmogy, M., & Al-Awadi, R. (2015). Brain tumor segmentation based on a hybrid clustering technique. Egyptian Informatics Journal, 16(1), 71–81. 10.1016/j.eij.2015.01.003.

[9] Sharma, P., Diwakar, M., & Choudhary, S. (2012). Application of edge detection for brain tumor detection. International Journal of Computers and Applications, 58(16).

[10] Selvakumar, J., Lakshmi, A., & Arivoli, T. (2012, March). Brain tumor segmentation and its area calculation in brain MR images using K-mean clustering and Fuzzy C-mean algorithm. In 2012 International Conference on Advances in Engineering, Science and Management (ICAESM) (pp. 186-190). IEEE.

[11] Zanaty, E. A. (2012). Determination of gray matter (GM) and white matter (WM) volume in brain magnetic resonance images (MRI). International Journal of Computers and Applications, 45(3), 16–22.

[12] Canny, J. (1986). A computational approach to edge detection. IEEE Transactions on Pattern Analysis and Machine Intelligence, PAMI-8(6), 679–698. doi:10.1109/TPAMI.1986.4767851.

[13] Häuser, S., & Steidl, G. (2012). Fast finite shearlet transform. arXiv:1202.1773.

[14] Stosic, Z., & Rutesic, P. (2018). An Improved Canny Edge Detection Algorithm for Detecting Brain Tumors in MRI Images. International Journal of Signal Processing, 3.

[15] Dou, W., Ruan, S., Chen, Y., Bloyet, D., & Constans, J. M. (2007). A framework of fuzzy information fusion for the segmentation of brain tumor tissues on MR images. Image and Vision Computing, 25(2), 164–171. doi:10.1016/j.imavis.2006.01.025.