ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

A Survey: Brain Tumor Detection Techniques from Various Clinical Images

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ABSTRACT: In today's world cancer is the most serious problem in medicine. Brain tumor or intracranial neoplasm occurs when there is a growth of cells in the brain that multiplies at an abnormal, uncontrollable rate. Tumors can either be malignant or benign that is cancerous or non-cancerous. Brain consumes and requires oxygen. Even short periods of de-oxygenation by invading tumor neurochemicals released by the tumor or bleeding resultant from the tumor can result in permanent damaged to the brain. The right treatment of early diagnosis of cancer patient gives the possibility of healing and returning to normal life. Tumor detection is done by a CT, MRI, PET scan, angiogram or neurologic examination to detect the tumor. In this work, a detailed survey has been made and categorized in identifying various techniques adopted in bringing a technological solution for the detection of brain tumor.

KEYWORDS: CT, MRI,

I. INTRODUCTION

Brain is the most complex organ found in humans. It is composed of soft nervous tissues contained in the skull (cranium), functioning as the coordinating center of sensation, intellect and nerve related activities [1]. It is made up of more than 100 billion nerves. These nerves communicate in trillions of connections called synapses.

The brain has many specialized areas that work together. The outermost layer is called cortex which in related to thinking and voluntary movements [2]. The brain stem consisting of the mid brain, pons and medulla is found adjoining and structurally continuous with the spinal cord. In the center of the brain is the basal ganglia that coordinates messages between multiple brain areas. It is located dorsal to the brainstem and is connected to the brainstem 3 pairs of cerebellar peduncles. The cerebellum receives information from the sensory systems, the spinal cord, and other parts of the brain and then regulates motor movements.

Cerebrospinal fluid (CSF) is a clear, colorless body fluid found in the brain and spine. It acts as a cushion or buffer for the brain's cortex, providing basic immunological and mechanical protection to the brain inside the skull. The several lobes of the brain are the frontal lobes, the parietal lobes and the occipital lobes. Meninges is a three layer of tissue consisting of arachnoid, duramater, and pia mater surrounding the brain. Corpus callosum connects both right and left hemispheres of the brain. The thalamus is center for impulses moving to and from the spinal cord, brain stem, cerebellum and cerebrum. The hypothalamus is that part of the brain responsible for the production of essential hormones and chemical substances that help control different organs. The pituitary gland attached to the base of the brain also called the master gland controls all other endocrine glands in the human body [3].

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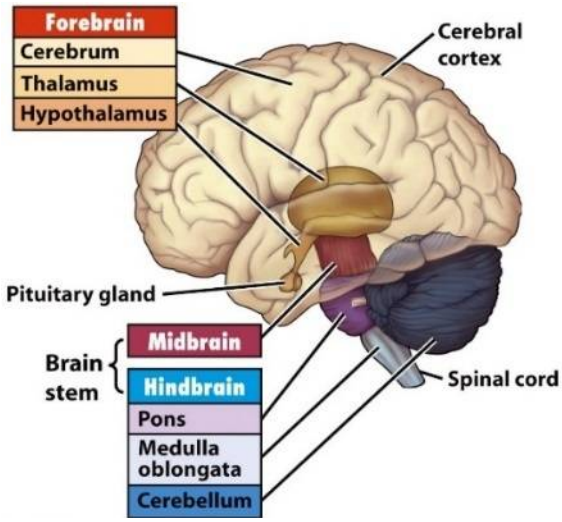

Fig.1: Structure of the human brain

A brain tumor or intracranial neoplasm is a growth of cells in the brain that multiplies in an abnormal, uncontrollable way. There are two main types of tumors- malignant tumors and benign tumors. Malignant tumors are primary or secondary tumors [4]. Malignant tumors grow and spread aggressively, spreading to distant parts of the body. Benign tumors do not invade nearby tissues or spread to distant areas. Secondary tumors metastasis to the brain from other parts of the body [5].

In adults, the most common types of brain tumors are those that start in the main part of the brain, the cerebrum. Around 24% start in the membranes that surround and protect the brain. 10% tumors start in the glands within the brain such as the pituitary gland or pineal gland. In children, 60% brain tumors start in the cerebellum or brain stem [6].

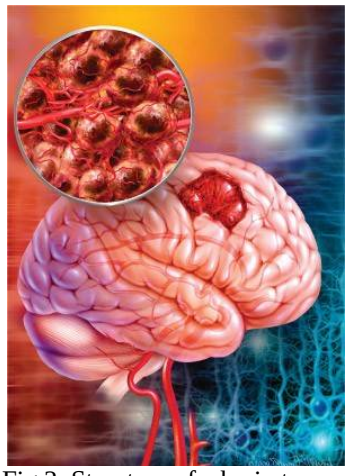

Fig.2: Structure of a brain tumor

The brain tumor detection is the key to diagnosis. One of the methods of diagnosis is biopsy. A biopsy may be done by either of the two methods surgery or sterotactic biopsy. Surgery, craniotomy, in which all or part of the brain tumor is removed. Sterotactic, needle biopsy may be used if surgery is suspected to be too risky or difficult. Another diagnosis approach would be lumbar puncture in which a small amount of cerebrospinal fluid is removed using a needle and tested for abnormalities. Neurologic examination is another medical method in which the vision, hearing, alertness, coordination, and reflexes are tested to detect the brain tumor [7].

Imaging is a technical methodology in brain tumor detection that gives the location, size and shape of the tumor. The most common imaging methods are Computer Tomography (CT), Magnetic Resonance Imaging (MRI) and Positron

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International Journal of Innovative Research in Computer and Communication Engineering

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Emission Tomography (PET). Angiogram is also preferred method of detection in which a dye is injected into the bloodstream and an x-ray shows the blood vessels that feed into the tumor. These technological advancements in the field of medical imaging have led to various advanced modes of brain tumor detection.

A. CT scan:

Computed tomography scan, a diagnostic medical test, produces multiple images and is one of the most precise scanners that give a clear image of the location of the tumor. The cross-sectional images of a CT scan can be reformatted in multiple planes, generate three-dimensional images. CT scans give greater details of tumors especially those near or involving a bone. They also show swelling, bleeding, and bone and tissue calcification and accurately detects metal foreign bodies[8].

Fig.3: CT scanner

B. MRI scan:

MRI has a much greater range of available soft tissue contrast, depicts anatomy in greater detail, and is more sensitive and specific for abnormalities within the brain itself. MRI is non-invasive and does not use radiation. It gives clear, detailed images and creates hundreds of images from any direction and in any orientation [9].

Fig.4: MRI Scanner

C. PET scan:

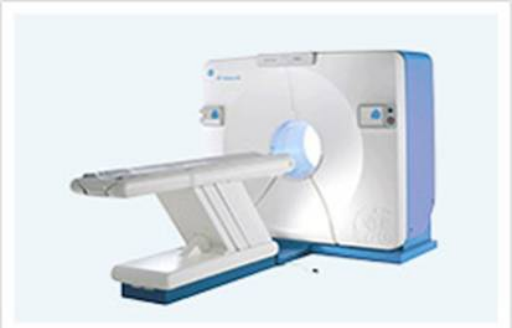

Fig.5: PET Scanner

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ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

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PET scans show the rate of activity of brain tissues. A small amount of radioactive glucose injected is taken up by the brain and the scan measures how quickly this happens in different areas. PET scans are normally used to detect if the changes seen after treatment are due to scaring or active tumor [10].

The resultant images from the above tumor scanning devices is used technologically for image processing to get a more technical solution to detect the brain tumor.

II. LITERATURE WORK

A detailed review has been made on various technical methodologies applied in the detection of brain tumor using medical images.

Sl. #	Title	Methodology	Publication	Year
01.	Automatic segmentation of non-enhancing brain tumors in magnetic resonance images	Fuzzy C clustering	Artificial intelligence in medicine	2001
02.	Automatic Brain and Tumor Segmentation	expectation maximization (EM) segmentation algorithm	Medical Image Computing and Computer-Assisted Intervention — MICCAI	2002
03.	Rapid and Automatic Detection of Brain Tumors in MR Images	k-means, fuzzy c-means and Self-Organizing Map networks	International Society for Optics and Photonics	2004
04.	Statistical analysis of fractal-based brain tumor detection algorithms	Non integer fractal dimension (FD)	Magnetic Resonance Imaging	2005
05.	An Improved Implementation of Brain Tumor Detection Using Segmentation Based on Neuro Fuzzy Technique 1	hierarchical self-organizing map, fuzzy c means and neuro-fuzzy technique	Journal of Computer Science	2007
06	A framework of fuzzy information fusion for the segmentation of brain tumor tissues on MR images,	creation of fuzzy models, fuzzy fusion, fuzzy connecting	Image and vision Computing	2007
07	Brain Tumor Detection Using Color-Based K-Means Clustering Segmentation	K-means clustering and histogram-clustering.	Intelligent Information Hiding and Multimedia Signal Processing, IEEE	2007
08	Detection of Brain tumor in medical images	mathematical morphology, wavelet transform, K- means	Signals, Circuits and Systems (SCS),	2009
09	Segmentation of tumor tissue in gray medical images using watershed transformation method	watershed transformation method	International Journal of Advancements in Computing Technology	2010

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10	Tumor detection by using Zernike moments on segmented magnetic resonance brain images	continuous wavelet transform , incremental supervised neural network (ISNN) and the wavelet-bands	Expert Systems with Applications	2010
11	Computer Aided Detection of Brain Tumor in Magnetic Resonance Images	de-noising in wavelet, non-linear enhancement function, iterative enhancement algorithm	IACSIT International Journal of Engineering and Technology	2011
12	Computer aided system for brain tumor detection and segmentation	global threshold segmentation	Computer Networks and Information Technology (ICCNIT)	2011
13	An Efficient Brain Tumor Detection Algorithm Using Watershed & Thresholding Based Segmentation	Threshold Segmentation and Watershed Segmentation	International Journal of Image, Graphics and Signal Processing	2012
14	Quick detection of brain tumors and edemas: A bounding box method using symmetry	change detection method, Bhattacharya coefficient	Computerized medical imaging and graphics,	2012
15	Brain Tumor Segmentation using Swarm Intelligence Approach	Ant Colony Optimization (ACO	International Journal of Scientific & Engineering Research	2013
16	Wavelet Based Image Fusion for Detection of Brain Tumor	Wavelet analysis, Image Fusion	International Journal of Image, Graphics and Signal Processing	2013
17	Brain tumor detection from clinical CT and MRI images using WT-FCM algorithm	Wavelet Transform-Fuzzy C-Means	Green Computing, Communication and Conservation of Energy (ICGCE),IEEE	2013
18	Detecting brain tumor in Magnetic Resonance Images using Hidden Markov Random Fields and Threshold techniques	Hidden Markov Random Fields (HMRF) and Threshold methods.	Research and Development (SCOReD), IEEE	2014

III. MOTIVATION

It is found that distinguishing the areas of the brain is the significant test in tumor discovery. Therefore a fusion based image combination is connected on the Magnetic Resonance (MR) images and Computed Tomography (CT) images which are utilized as essential sources to remove the excess and integral data so as to upgrade the tumor recognition in the resultant fused image.

The MRI and the CT image is pre-processed and stacked into Mat lab workspace. Both these images are decomposed independently using discrete wavelet transform. The image is further decomposed. Segmentation method is used to get the accurate fused image of the brain tumor.

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IV. CONCLUSION

After a detailed survey on the various techniques used in the detection of brain tumor images, an innovative method is proposed for Brain Tumor Detection from Clinical, CT and MRI Images using Image Fusion Techniques. A novel approach is implemented in which MRI and CT images are decomposed independently using discrete wavelet transform, it is further decomposed using Laplacian Pyramid Algorithm, an inverse discrete wavelet transform is applied to get a fused image, finally watershed segmentation is used to get a segmented image of the brain tumor. This gives an accurate location, size and shape of the tumor.

REFERENCES

[1] https://quizlet.com/44145437/the-nervous-system-divisions-flash-cards/
[2] www.webmd.com/brain/picture-of-the-brain
[3] www.medicalartlibrary.com/thalamus-hypothalamus
[4] ww.nhs.uk/conditions/brain-tumours/ Pages/ Introduction.
[5] www.nhs.uk/conditions/brain-tumours/Pages/Introduction.aspx
[6] http://www.cancerresearchuk.org/about-cancer/type/brain-tumour/about/primary-and-secondary-brain-tumours
[7] https://www.mdanderson.org/cancer.../brain-tumor/brain-tumor-diagnosis. http://www.medicinenet.com/brain_tumor /page6.htm
[8] hereiload.elycurtisspusher.com/cat-scan-design-the-future-download.html
[9] www.encyclopedia.com/topic/magnetic_resonance_imaging.aspx
[10] www.cancerresearchuk.org, Diagnosing brain tumours.
[11] Heath, L. M., et al. "Automatic segmentation of non-enhancing brain tumors in magnetic resonance images." Artificial Intelligence in Med 21 (2001): 43-63.
[12] Moon, Nathan, et al. "Automatic brain and tumor segmentation" Medical Image Computing and Computer-Assisted Intervention—MICCAI 2002. Springer Berlin Heidelberg, 2002. 372-379.
[13] Wang, Zhengjia, et al. "Rapid and automatic detection of brain tumors in MR images", Medical Imaging 2004. International Society for Optics and Photonics, 2004.
[14] Zook, Justin M. and Khan M. Iftekharuddin. "Statistical analysis of fractal-based brain tumor detection algorithms." Magnetic Resonance Imaging 23.5 (2005): 671-678.
[15] Murugavalli, S and V. Rajamani. "An Improved Implementation of Brain Tumor Detection Using Segmentation Based on Neuro Fuzzy Technique 1." (2007).
[16] Dou, Weibei, et al. "A framework of fuzzy information fusion for the segmentation of brain tumor tissues on MR images." Image and vision Computing 25.2 (2007): 164-171.
[17] Wu, Ming-Ni, Chia-Chen Lin, and Chin-Chen Chang. "Brain tumor detection using color-based k-means clustering segmentation", Intelligent Information Hiding and Multimedia Signal Processing, 2007. IIHMSP 2007 Third International Conference on. Vol 2. IEEE 2007.
[18] Kharrat, Ahmed, et al. "Detection of brain tumor in medical images." Signals, Circuits and Systems (SCS) 2009 3rd International Conference on. IEEE, 2009.
[19] Salman, Saif D and Ahmed A. Bahrani. "Segmentation of tumor tissue in gray medical images using watershed transformation method." International Journal of Advancements in Computing Technology 2.4 (2010).
[20] Iscan, Zafer, Zümray Dokur and Tamer Ölmez. "Tumor detection by using Zernike moments on segmented magnetic resonance brain images." Expert Systems with Applications 37.3 (2010): 2540-2549.
[21] Raj, Abhishek, Akansha Srivastava and Vikrant Bhateja. "Computer aided detection of brain tumor in magnetic resonance images." International Journal of Engineering and Technology 3.5 (2011): 523.
[22] Akram, M. Usman and Ahmad Usman. "Computer aided system for brain tumor detection and segmentation." Computer Networks and Information Technology (ICCNIT) 2011 International Conference on. IEEE, 2011.
[23] Mustaqeem Anam, Ali Javed, and Tehseen Fatima. "An efficient brain tumor detection algorithm using watershed & thresholding based segmentation." International Journal of Image, Graphics and Signal Processing 4.10 (2012): 34.
[24] Saha, Baidya Nath, et al. "Quick detection of brain tumors and edemas: A bounding box method using symmetry." Computerized medical imaging and graphics 36.2 (2012): 95-107.
[25] Kamble, Tinale and Prachi Rane. "Brain tumor segmentation using swarm intelligence approach." International Journal of Scientific&Engineering Research 4.5 (2013).
[26] Dwith, C. Y. N., Vivek Angoth, and Amarjot Singh. "Wavelet Based Image Fusion for Detection of Brain Tumor." International Journal of Image, Graphics and Signal Processing 5.1 (2013): 25.
[27] Tamilselvan K. S., G. Murugesan, and B. Gnanasekaran. "Brain tumor detection from clinical CT and MRI images using WT-FCM algorithm." Green Computing, Communication and Conservation of Energy (ICGCE), 2013 International Conference on. IEEE, 2013.
[28] Abdulbaqi, Hayder Saad, et al. "Detecting brain tumor in magnetic resonance images using hidden markov random fields and threshold techniques." Research and Development (SCOReD), 2014 IEEE Student Conference on. IEEE, 2014.