International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-4, February 2019

Generalized Detection of Colloid Cyst in Brain using MRI Scan/CT scan

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Abstract: ***Brain is one of the most important organs in the human body. The working of this organ decides the human being work and his life to success. In order to lead the good life, one should have the brain and its related parts under good condition, i.e., not affected with any diseases or any serious problems. The presence of cyst in the brain is one of the important issues to be considered and identification of such cyst in good time is very important for the health of a human being. If the cyst is not identified in appropriate times, the brain will be suffered with serious issues and it may lead to the loss of the human being. Hence, in this article a new approach is taken to consideration for identification of the cyst in the brain through MRI/CT scan images. In the current work, a new approach of matrix method with the combination of monochrome images was considered for identification of the cyst presence with MRI/CT scan images. A new algorithm was also proposed to find the presence of cyst in the brain with more accurate performance. The performance of the current model was verified with two sets of scan images and the results are displayed in the result section.***

Index Terms: ***Neuroepithelial Cyst, Magnetic Resonance Images (MRI), Computed Tomography (CT), Fixed Threshold Method.***

I.INTRODUCTION

Brain is the foremost organ of the central nervous system that coordinates and controls the activities of other organs in our body. Cysts in the brain are the group of cells, clustered collectively to form a sac that contains fluid or semi-solid material, such as cerebrospinal fluid, blood, tissue or tumor cells [1]. Cysts are generally benign, but are destructive when it is found in parts of the brain where it restricts the crucial performance of the brain. Various types of Cysts found in the brain are, the Arachnoid Cyst, the Colloid Cyst, the Dermoid Cyst, the Epidermoid Cyst, the Pineal Cyst and the Tumor-associated Cyst [2]. Symptoms of cyst diverge depending upon its location, size and type. In this paper we focus on the automatic detection of Colloid Cyst in Brain from MRI or CT scanned images. Colloid cysts are known to be formed during the embryonic formation of the Central Nervous System. It contains a thick, gelatinous substance called colloid which came from the Greek word *Kollodes* (Kolla meaning glue and eidos meaning appearance).

Manuscript published on 28 February 2019.
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Apart from the colloid filling, the cyst may contain blood, minerals or cholesterol crystals [3]. Colloid Cysts are found in the center of the brain that holds spinal fluid, or, in the lining of the third ventricle. Cysts in this location block the foramina of Monro causing obstructive hydrocephalus that increases pressure in the brain. Familiar symptoms are severe headache, nausea, vomiting, seizures, vertigo, memory loss, insomnia, gait disorder, drop attack, and many more. The mortality rate due to Colloid cyst has been between 58% and 77% [4,5]. Its size may vary from 3 to 40 mm. Since, even small Colloid cyst can cause sudden death, it is vital to identify or detect the cyst at an early stage.

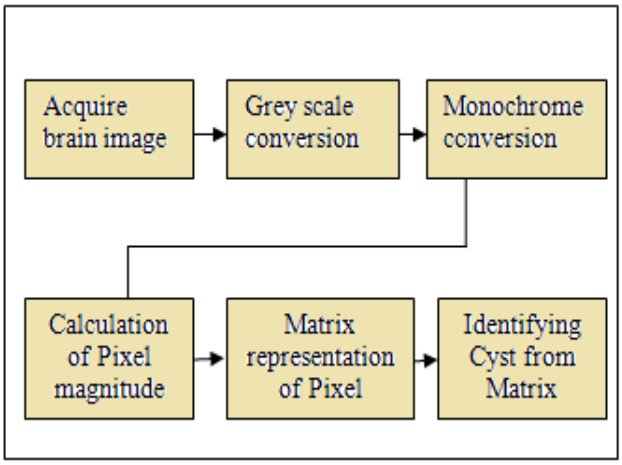

Fig. 1 Basic Steps Involved in Image Processing

Medical Image Processing has become an essential feature in the fields of Bio-Medical research. Imaging Technology like Magnetic Resonance Imaging, CT scanner, digital mammography provides a detailed or third dimension view of the body. The digital images acquired from these imaging technologies can be improved and analyzed through java programming and Image Processing Technique for easier diagnosis. Image Processing Techniques reduces the complicated manual tasks of the radiologists to identify any abnormalities in the brain, it saves time and is cost valuable. It involves preprocessing of the digital images by passing them through different types of filters to reduce noise and improve the quality of the image. It also includes emphasizing on the region of interest and automating the process of segmentation of Cysts to extract complex information. Morphological operations can be used to remove imperfections from these images depending on the relative ordering of the pixels. We have proposed here an algorithm that uses many advanced image processing techniques to automatically detect the Colloid cyst of all sizes from the digital images.

II.LITERATUREREVIEW

In the past, various algorithms has been developed to automate the system of detecting Cysts and Tumors in the Brain by using Image Processing techniques like Threshold Segmentation, Edge Detection, Clustering based segmentation, Watershed Segmentation and many more.

Karishma Sheikh, Vidya Sutar and Silkesha Thigale in their paper proposed a system that used a pixel to pixel comparison, the gray scale and K-means segmentation algorithm to detect tumor from MRI images [4]. They used clustering to differentiate between affected and unaffected cells. Ed-Edily Mohd. Azhari, Muhd. Mudzakkir Mohd. Hatta, Zaw Htike and Shoon Lei Win detected and localized Brain Tumor in Magnetic Resonance Imaging by applying edge detection method, modified histogram clustering and morphological operations [5]. They used a method where histogram values were plotted and threshold value was kept fixed based on the pixels and grey level value in the images. Tumor part was extracted by using morphological operations and by specifying the Region of Interest. Vrushali D. Dharmale and P.A. Tijare used Canny Edge detection and segmentation method for Cyst detection from MRI brain images and mentioned the accuracy rate to be 100% [6]. Mr. Lalit P. Bhaiya, Ms. Suchita Goswami and Mr. Vivek Pali classified abnormalities in Magnetic Resonance Brain images by developing a hybrid model that combined advantages of both Artificial Neural networks and Fuzzy Logic [7]. In this system textural features were extracted using principal component analysis (PCA) technique. The extracted features were then used to train the neuro fuzzy classifier. The Adaptive Network based Fuzzy interference system (ANFIS) was tested for classification of different Brain MRI samples. The results illustrated that the model was effective enough in terms of classification accuracy and convergence rate. Mashal Tariq, AttaullahKhawajah and Munawer-Hussain presented a system that focused on the early detection of the tumor [8]. In this paper Noise Reduction was done by the use of Median Filter, information about the object boundaries in an image was obtained through Sobel Edge Detector.Thealgorithmproposedthatseveralmorphologicalop erationsalongwith morphological reconstruction could accurately segment out Solid cum Cystic Tumor from T1 and T2 images. On a different note Alexander C. Mamourian, Laurence D. Cromwell and Robert E. Harbaugh presented different cases and tried to prove that Colloid Cyst are sometimes more perceptible or noticeable on Computed Tomography Images than Magnetic Resonance Images. They stated cases where Colloid Cyst were found without any association with hydrocephalus and 55 cases where the cause of sudden death was due to Colloid Cyst in Brain ranging from 1 to 8cm. They concluded that “Ventricular size is not a reliable predictor of the outcome” [9]. Emanuela Turillazzi, Stefania Bello, Margherita Neri, Irene Riezzo and Vittorio Fineschi in their article mentioned reasons that proved that “As the hypothalamic structures which are involved in neuroendocrine and autonomic regulation playing a key role in cardiovascular control are located close to the walls of the third ventricle which is the most frequent anatomical site of colloid cyst, this may suggest that reflex cardiac effects due to the compression of the hypothalamic cardiovascular regulatory centers by the cyst explain the sudden death in patients harboring a colloid cysts when signs of hydrocephalus or brain herniation are lacking” [10]. ShreetamBehera, Miihir Narayan Mohanty and Srikanta Patnaik have done a “Comparative Analysis on Edge Detection of Colloid Cyst” [11,12,13]. Based on simple mathematical morphology they provided edge detection method to detect Colloid Cyst in Brain. Sameer S Shaktawat, Walid D Salman, ZuhairTiwaj and Abdul Al-Dawoud wrote an article on “Unexpected death after headache due to colloid cyst of the third ventricle”. They presented a case of a 17 year old female who had mild headaches for a period of two years died suddenly and the findings in the post mortem report concluded that the death was due to the Colloid cyst of 1cm. Their report highlighted, “the difficulty in diagnosis and the importance of recognizing Colloid cyst in Brain” [14,15,16]. Debapriya Hazra et al. [17] had considered the MRI/Ct scan images and by using the MATLAB programming and image processing models, they tried to identify the presence of colloid cyst in brain images.

A. OBSERVATIONS FROM THE PREVIOUS WORKS

From the several works mentioned above, it is observed that no authors had implemented the matrix method with the combination of monochrome images for identifying the cyst presence in the human brain with MRI and CT scan images. Hence, we tried to consider this observation and a new matrix method with monochrome image was used with a new algorithm to identify the presence of cyst in the human brain MRI or CT scan images.

III.PROPOSED WORK

In the current work, in order to identify the cyst in the brain with the help of MRI/CT scan images, a new algorithm that detects the colloid cyst of all age groups in brain was considered and the algorithm can be observed as follows,

A. Algorithm

Step 1: Start.

Step 2: Read input MRI/CT scan image.

Step 3: Resizing the input image to matrix orientation.

Step 4: Conversion of input image to Grayscale.

Step 5: Conversion of Grayscale image to Monochrome image.

Step 6: Convert the monochrome image to matrix mode

Step 7: The size of the matrix is fixed based on the number of pixels on the image

Step 8: To identify the colloid cyst presence from matrix model with 1’s and 0’s representation.

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IV.METHODOLOGY AND ALGORITHM ANALYSIS

i. Generally the image is stored in column x row format. After undergoing into several steps the result produced will also be in matrix format.
ii. To obtain this format initially input image is to be resized according to matrix orientation so as to evidently identify the cyst according to the area of location occurred in original image.
iii. Next input image is converted into grayscale by using average method.
AVG=(R+G+B) /3
iv. From the above formula R, G, B represents red, Green, Blue pixels of an image.
v. The conversion of Grayscale image to monochrome image is to effortlessly identify the colloid cyst. This is done by using "Fixed Threshold Method".
vi. The monochrome image contains two values i.e., black and white and they were represented in the form of 1 and 0.
vii. The cyst is identified from obtained matrix values that enclose 1's and 0's.
viii. Therefore, the presence of the cyst is represented as 1 otherwise considered as 0.

V.ARCHITECTURE OF THE MODEL CONSIDERED

The architecture model of the current entire process of identification of the cyst in brain images was represented as follows,

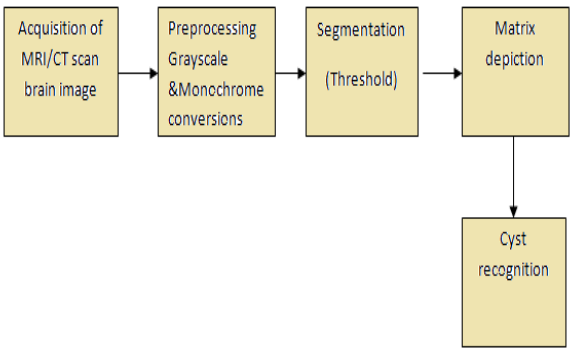

Fig. 2 Architecture for detection of the colloid cyst

The components present in the architecture model of the entire process are, Acquisition of input images, preprocessing of the images, segmentation of the converted images, matrix representation of monochrome images, identification of the final cyst in the input images. At first, the input images were acquired. The preprocessing of the image received was done and the input image was converted to the grayscale image. After that the same image was converted to the monochrome image. The segmentation was then applied to the monochrome image by using the fixed threshold method. After that, the magnitude of each pixel was calculated and stored the values in the array model. Then the entire pixel values were analyzed and the results were displayed in the form of a matrix model by using arrays. From the matrix model, the cyst can be displayed on the matrix model in the form of number of 1's as the cyst observed in the original image. Similarly, the absence of cyst can be represented by 0's in the matrix model as in the original image.

VI.RESULTS AND DISCUSSIONS

In the current section of results, two cases were considered for analyzing the performance of the model developed. The two cases considered are one model is for the identification of the cyst in the original image and second model was the identification of the absence of the cyst in the original image.

Case1: Testing the MRI brain image for the presence of the colloid cyst

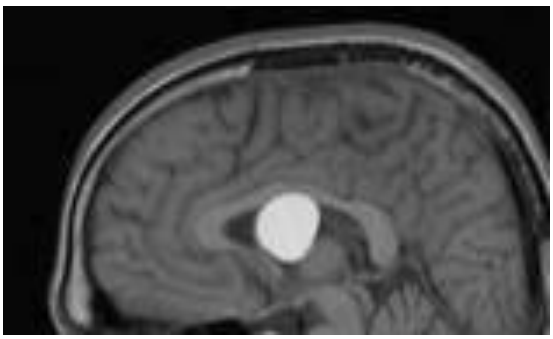

Fig.3 Input MRI brain image

The input image is considered for checking the current model was represented in fig.3.

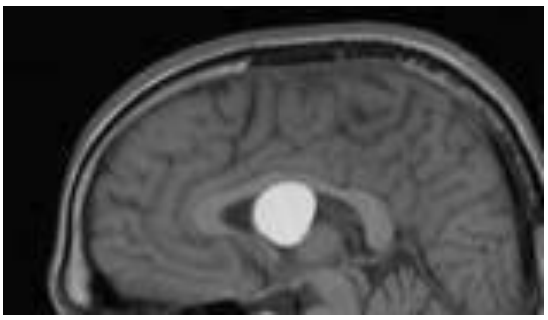

Fig. 4 Grayscale Image

The converted grayscale image from the actual input image was observed in fig.4.

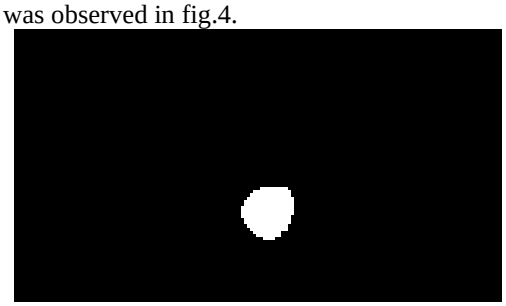

Fig.5 Monochrome Image

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The above grayscale image was given as input to the model for converting the grayscale image to monochrome image. The converted monochrome image was observed in fig. 5.

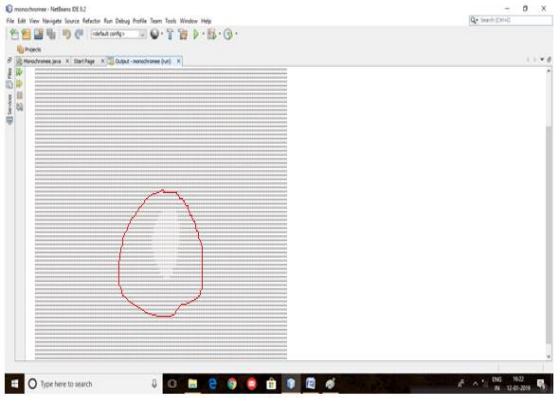

Fig.6 Matrix Depiction

From the above output image, the result we thereby declared the presence of cyst shown in matrix format. The cyst can be observed clearly in fig 6 with new binary 1s in the total matrix output.

Case 2: Absence of colloid cyst.

In the current case, another set of image was considered in which the cyst was not present and we had tried to identify the performance of the current proposed method to identify that the cyst was not present in the input image. The performance of the method considered can be observed as follows,

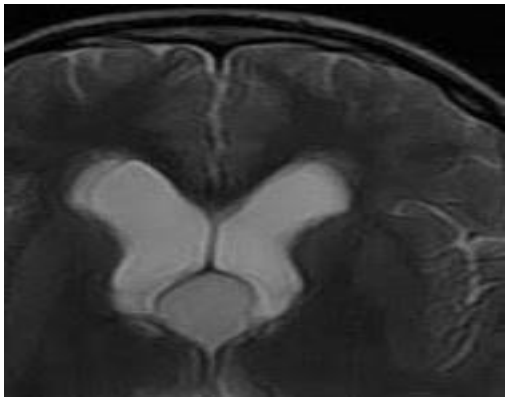

Fig.7 Input MRI image

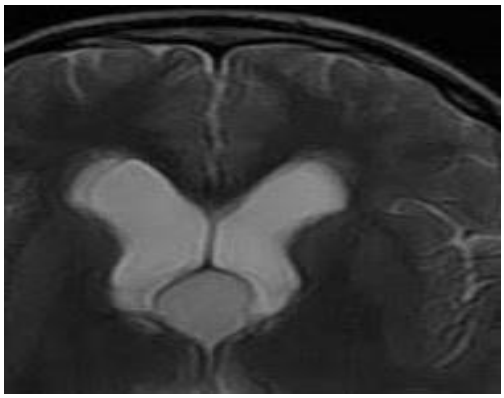

Fig. 8 Grayscale Image

The converted grayscale image from the input image can be observed in fig 8.

Fig. 9 Monochrome Image

The grayscale image was converted further to the monochrome image and the converted image was displayed in fig. 9.

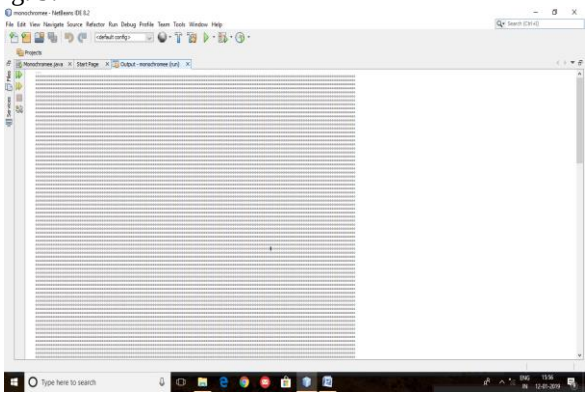

Fig. 10 Matrix Depiction

After completing the conversion of the grayscale image to the monochrome image, the threshold process, segmentation and other methods were implemented on the converted image and the final matrix representation of the data in the form of the matrix model with the help of the array model was displayed in fig. 10. In the above image, all zeroes are represented in the image which gives us the confirmation that no cyst was present in the input images which was given as input to the current model.

VII.CONCLUSION

The proposed methodology detects presence or absence of colloid cyst easily by using image processing techniques through java programming. The methods used here are grayscale conversion, then conversion from grayscale to monochrome and then representing the converted images in to the matrix model by using the array concept well excellent. The results observed from the current considered model are excellent. The colloid cyst in the brain is detected by matrix depiction and the results are discussed in the results section. Therefore, it is clear that this methodology shows result precisely. The matrix representation containing 0 says that there is no colloid cyst in the brain otherwise declared as presence of the cyst considering by value 1.

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