BRAMSIT: A Database for Brain Tumor Diagnosis and Detection

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Abstract
MRI is the most frequently used imaging technique to detect brain tumor. The brain is composed of nerve cells and supportive tissues such as glial cells and meninges. A brain tumor is a collection, or mass, of the brain in abnormal cells. Primary brain tumors can be either malignant or benign . A primary brain tumor is a tumor located in the brain tissue. New technologies in supplement to existing imaging modalities improve brain tumor screening. Most brain tumor databases are not publicly available. BRAMSIT is a resource for possible use by the MRI image analysis research community. The projected MRI database is a termed BRAMSIT, characterized by an attempt to offer a group of normal and malignant brain tumor images. The details such as age, and the MRI axial position (i.e., trans-axial, coronal and sagittal) of the patient are interpreted in the database.

Keywords: Brain tumor, Database, Malignant, Benign

I. INTRODUCTION AND RELATED WORKS

Brain tumor is a life- threatening disease. Brain tumors can be malignant or benign. When tumor cells grow it cause pressure inside the skull, this leads to brain damage. Two types of Brain tumor namely Primary and secondary. Primary brain tumors are benign and that are originates in brain. Secondary brain tumors occur when cancer cells spread over the brain from other organ such as lung or breast. It is also called as metastatic brain tumor. Brain tumor can be occurred in any ages. If brain tumor detected early stage it is treatable. Brain tumor cause more death in children and adults under the age of 40 than any other cancer. In India the tumors ranges from 5 to 10 per 100,000 populations with an increasing trend.

Diagnosing brain tumor is a tedious process. Computer Tomography scan (CT scan), Magnetic Resonance Imaging(MRI), tests like an Angiogram, Spinal tab and Biopsy are used to diagnosis brain tumors. CT scan uses x-ray to produce images. CT scan expose patients to ionizing radiation .High radiation are involved in CT scan . A new study in the Journal of the National Cancer Institute suggests that CT scans, commonly used in medical imaging, may increase the risk of brain tumors.

Magnetic Resonance Imaging (MRI) plays an important role in the medical era. It is noninvasive method to detect Brain tumor. MRI uses Magnetic field and Radio waves to produce Brain images. MRIs create more detailed pictures than CT scans. MRI is the preferred screening examination for brain tumor. The goal is to detect brain tumor before clinical signs are noticeable. The size of the tumor can be measured by MRI. A special dye called contrast medium is injected into the patient's vein or given as a pill or fluid to swallow before an MRI scan.

Any area with abnormal tissue can cause for cancer. The abnormalities will be examined by radiologist. A focused white area on MRI can be a lump or tumor. Tumors can be cancerous or benign. If a tumor is benign, it is not a risky and is unlikely to grow or change shape. The radiologist will check its shape and pattern, as they can sometimes be a sign of cancer.

Medical image processing system used to process MRI images. Image processing converting physical image into equivalent digital image and extract the details from the digital image. Image processing is any form of signal processing in which input as an image like photograph or video and the output may be either an image or a set of characteristics or parameters related to the image. As a result, very suitable differences between abnormal and normal but dense tissue can be made more obvious. BRAMSIT images need to be combined with a regular database of young bud researchers to accurately examine the clinical results of the images.

In order to detect tumors and validate the results, a few databases available publically and help the research community to come up with better algorithms. Among those BRATS dataset, Fig share and kaggle plays a major role with huge image dataset. Fig share[5] consisting of 3064 T1-weighted contrast-enhanced images with three kinds of brain tumor such as normal, benign and malignant. The images can be down loaded along with their ground truth images in BLACK &WHITE (BW) format. The dataset consists of tumor mask, tumor border, and original image in .MAT file. The space occupied by the database is more. Some of the sample dataset images are shown in Figure 1

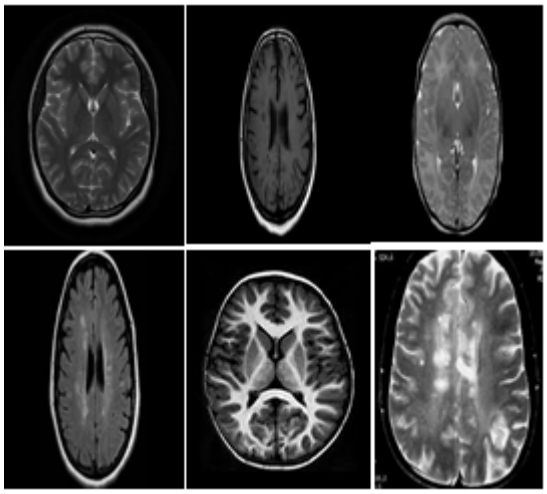

Fig.1. Sample Figshare Dataset Images along with its ground truth Images[5]

Brats dataset[6] is a dataset used for many researchers for their work. The numbers of images along with their ground truth are . The images consist of normal benign and malignant images. Lot of versions exist in Brats dataset. All the proposed algorithms for tumor detection in various survey papers are normally validated in BRATS dataset only. Figure 2 shows the

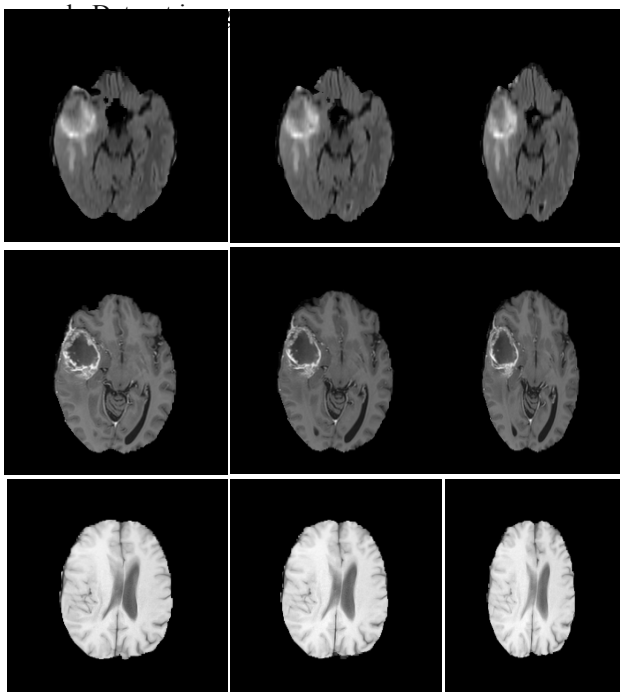

Fig.2. Sample Brats Dataset Images and its ground truth Images[6] Kaggle dataset [7]involves the images for brain tumor detection. It is developed by Navoneel Chakrabarty in the year 2019. These datasets involves original images only. Few images are available for analysis. samples are An example of images from Kaggle dataset are shown in Figure 3.

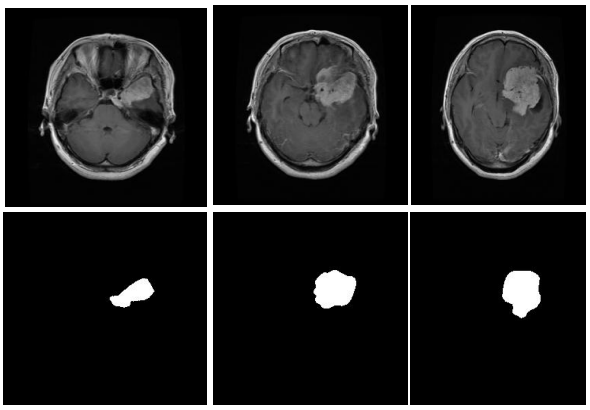

Fig.3. Sample Kaggle Dataset Images[7]

In [1], the authors discussed about the method to produce local volumes of the tumor databases. The authors analyzed numerical and quality parameter of the images using changes in morphological variations. In [2], the authors discussed a new method with a large number of CNNs with the information in overlapping regions. The authors used the OASIS dataset for validation of the results. V.P.Gladis Pushpa Rathi et al[3] proposed a tumor classification method based on feature extraction, features selection, PCA analysis and LDA analysis. The classification accuracy for the proposed method is 98.87%. The authors Amit Kumar Rohit et al.,[4], discussed a single query system based on Content Based Image Retrieval System(CBIR).The proposed system involves preprocessing, feature extraction and detection of tumors. The accuracy of the proposed method is 98.33%. Based on above said survey, many of the works still didn't follow a simple user friendly and accessible database. In this work, we proposed to create a database of MRI scan images, which we named as 'BRAMSIT Database' for the benefit of the biomedical engineering research community. An important risk in the research and development of this community is the lack of medical explanation and the plane for the tumor identification. Although some relevant papers have discussed localization issues, they do not provide such databases friendly to researchers.

Thus motivated by these factors, our main contributions in this work are:

- Create a new BRAMSIT database which involves 319 MRI scan images along with its ground truth images.
- Present the annotation of all the 319 subject's biological data along with their axial position

II. BRAMSIT DATABASE

The BRAMSIT database is deliberated through subsequent stages:

1) Structure Details along with their axial position
2) Labelling the Images
3) Manual Annotation

These are explained step by step

A. *Structure Details*

This dataset involves of 319 MRI scan images collected from various subjects. BRAMSIT consist of 319 images of different subjects. Each subjects includes reference number, age and their axial. The samples of BRAMSIT normal scan images of some subjects are shown in Figure 4. Similarly, the samples MRI abnormal and ground truth images of 5 subjects are shown in Figure 5.

The salient features of the database are:

- Creation of database along with its clinic statistics for better use of images for research.
- Abnormal Images with the Ground truth for easy classification.

The sample images along with the ground truth images are used for better segmentation and classification. All the ground truth images are developed from the experts opinion.

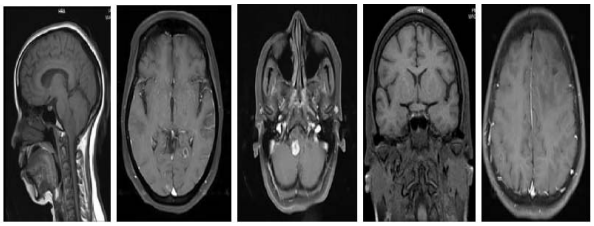

FIGURE 4 SAMPLE OF MRI NORMAL SCAN IMAGES

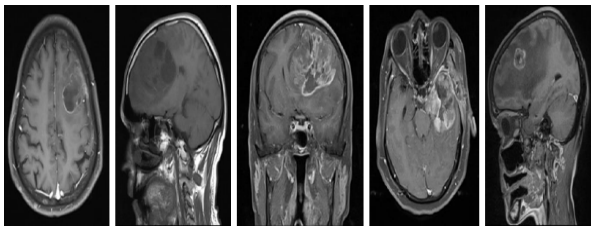

FIGURE 5 SAMPLE OF MRI ABNORMAL SCAN IMAGES

B. *Labelling the Images*

In the proposed database all the images are labeled perfectly for the purpose of understanding and interpreting. From the label itself one can easily identify the Subject ID, age and axial position. For example for a image with any abnormality suspect, the images are taken in three planes such as Sagittal ,Transaxial, and coronal View or Transaxial, Coronal and Sagittal View or Coronal ,Sagittal View and Transaxial view. Based on that, some abnormal suspected images are three in number based on their plane. Some normal images are single image with single view. Considering these factors, if Sub1 has three view images then it is labelled as Sub_1_STC, Sub_1_TCS, Sub_1_CST. This indicates subject1's STC means Sagittal, Transaxial, and coronal View, Sub_1_TCS means subject1's Transaxial, Coronal and Sagittal View and Sub_1_CST means subject1's Coronal ,Sagittal View and Transaxial view. In normal cases, the images are labelled as Sub_2_N_TCS, Sub_2_N_STC and Sub_2_N_CST view.

TABLE 1. DETAILS OF THE SUBJECT IN THE DATABASE.

Ref.No	Age	Gender	Axial
Sub_1_TCS	40	Male	Transaxial
Sub_2_STC	51	Male	Sagittal
Sub_2_CTS	51	Male	Coronal
Sub_3_TCS	55	Female	Trans axial
Sub_4_STC	58	Female	Sagittal

C. *Manual Annotation*

BRAMSIT provides a detailed analysis of each and every MRI scan image. Each MRI scan images for the following attributes we manually annotated.

- Unique ID of the subject- Based on the axial Position
- Age
- Axial position –Transaxial, Sagittal and Coronal
- Gender- Male or Female

From the database, the table 1 shows the details of the images. The manual annotation is represented below: The age of the subject, gender, subject Id and the axial position is annotated. A sample subject shown in the annotation box below.Sample MRI images and the ground truth images are shown in Figure.6.

Age:40
Gender: Male
Id: Sub_1_TCS
Tra>Cor>Sag_2

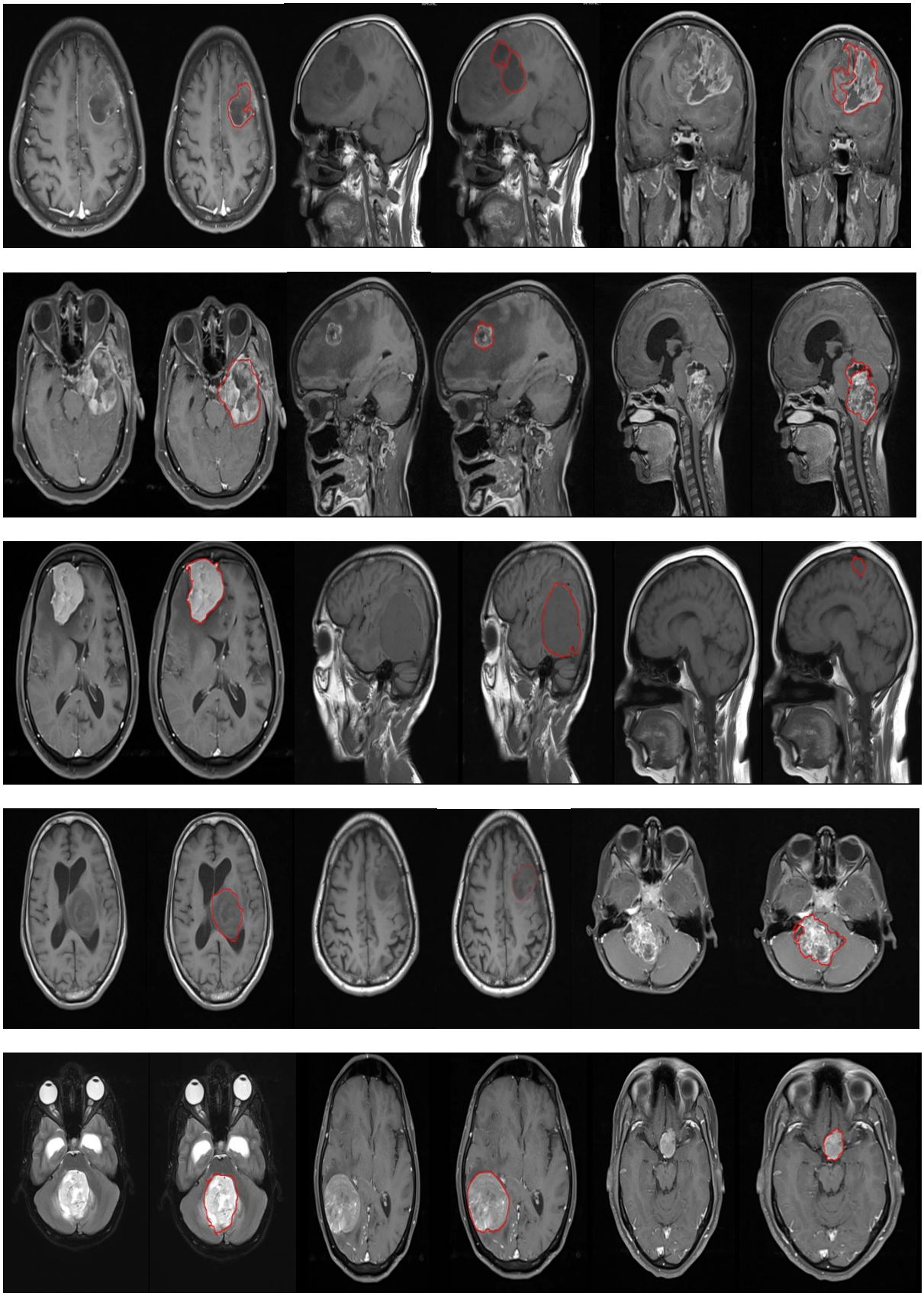

FIGURE 6. SAMPLE OF MRI ABNORMAL SCAN IMAGES AND THEIR GROUND TRUTH IMAGES

III. COMPLEXITY OF THE DATABASE

As said earlier, many databases are there for analysis of brain tumor in MRI imaging modality. As this dataset is also created for the same research outcome when compared with the other databases, one main feature of the proposed dataset is the ease of access and the speed in processing or analysis of the images. When compared with the BRATS dataset, Figshare and Kaggle, the proposed BRAMSIT processing time and accessing time is very less during some bench mark image processing algorithms.

TABLE.2. ACCESS TIME AND PROCESSING TIME FOR VARIOUS DATASET AND PROPOSED BRAMSIT DATABASE

S.No	Dataset	Access Time	Processing Time
1	BRATS	2.35ms	4.2ms
2	Figshare	2.01ms	3.52ms
3	Kaggle	2.45ms	3.87ms
4	BRAMSIT	0.2ns	1.5ns

As shown in table 2, the access time and processing time for the proposed dataset is very less when compared with other datasets**.**

IV. CONCLUSION

The paper describes Screening Brain Tumor for the most recent database. Investigating brain tumor image analysis by using it as a resource. The "abnormal" and "ground truth" images. The main characteristics of this BRAMSIT database are a) 319 MRI images b) Marking the entire subjects biological data. The biomedical research community provides the brain tumor of many uncertain research problems.

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