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A REVIEW ON INTELLIGENT COMPUTING TECHNIQUES ON MEDICAL IMAGE SEGMENTATION AND ANALYSIS

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Abstract-

A review of the idea of correcting for intensity inhomogeneity in magnetic resonance imaging is presented in this work. The information term in our variety system truly ensures the gradually shifting property of the inclination field obtained from the proposed vitality, without imposing an express smoothing term on the predisposition field. It evaluates the performance of a few selected MR images and provides the useful results with division and vitality advancement. This makes use of the level set technique, specifically for MR images, for synchronous division and inclination correction. Entropy is a crucial parameter that can be altered by adjusting the knots. MATLAB will be used for all of the simulations.

***Keywords-* MR images, energy minimization, Image Processing, Spline Method, optimization etc.**

I. INTRODUCTION

A medical imaging method called magnetic resonance imaging (MRI) is used in radiology to create images of the body's morphology and physiological functions. Strong magnetic fields, magnetic field gradients, and radio waves are used in MRI scanners to create images of the body's organs. MRI differs from CT and PET scans in that it doesn't use ionizing radiation or X-rays. Nuclear magnetic resonance (NMR) is a technique used in medicine called magnetic resonance imaging (MRI). NMR spectroscopy is another NMR application that uses MRI for imaging.MRI is frequently utilized in clinics and hospitals for illness monitoring, staging, and medical diagnosis. When comparing contrast in images of soft tissues, such as those in the brain or abdomen, MRI performs better than CT. Though "Open" MRI designs generally alleviate this, patients may still feel less comfortable because the measurements are typically noisier and longer while the subject is in a lengthy, constricted tube. Furthermore, certain patients may not be able to safely undergo an MRI due to the presence of implants or other non-removable metal in their bodies.

The term "nuclear" was removed from the original name of magnetic resonance imaging (MRI) to avoid connotations with nuclear matter. When exposed to an external magnetic field, some atomic nuclei have the ability to absorb radio frequency energy. This evolving spin polarization can then cause an RF signal in a radio frequency coil, which can be detected. Hydrogen atoms are most frequently utilized in clinical and research magnetic resonance imaging (MRI) to produce a macroscopic polarization that is detected by antennas near the patient being studied. Humans and other biological organisms inherently contain large amounts of hydrogen atoms, especially in fat and water. Because of this, the majority of MRI scans effectively map the body's fat and water locations.

The versatility of magnetic resonance imaging (MRI) has been demonstrated since its inception in the 1970s and 1980s. Although MRI is most commonly employed in biomedical research and diagnostic medicine, it can also be utilized to create images of inanimate objects, like mummies. The capabilities of MRI are expanded by diffusion MRI and functional MRI, which allow for the acquisition of detailed spatial images as well as neural tracts and blood flow, respectively, in the nervous system.

An MRI scan, also known as magnetic resonance imaging, is a painless procedure that creates incredibly clear images of the inside organs and structures in your body. MRI creates these finely detailed images by using radio waves, a computer, and a big magnet. It doesn't employ radiation or X-rays. The preferred imaging test for those who require routine imaging for diagnosis or treatment monitoring, particularly for the brain, is magnetic resonance imaging (MRI) as it doesn't require X-rays or other radiation.

The following things need to be considered before getting an MRI scan: Individuals who have implants—especially ones that contain iron—should avoid going into an MRI machine. These include persons with pacemakers, vagus nerve stimulators, implanted cardioverter-defibrillators, loop recorders, insulin pumps, cochlear implants, deep brain stimulators, and capsules from capsule endoscopy.

II. TYPES OF MRI MACHINES

There are two types of MRI Machines: Closed Bore &Open MRI

1. Open MRI

An MRI that uses an open bore (or open) method is the kind of machine used to capture the images. Two flat magnets are usually placed above and below you in an open magnetic resonance imaging (MRI) equipment, with plenty of room for you to lie between them. This reduces the claustrophobia that many individuals feel when using closed-bore MRI equipment and provides open space on two sides.

However, compared to closed-bore MRI scanners, open MRIs don't capture as sharp an image. A ring of magnets in the center of a closed-bore MRI machine creates an open hole or tube where you would lie to obtain images. Narrow and with limited head-to-ceiling space are closed-bore MRIs. Although contemporary MRI machines capture the highest quality images, some people may experience anxiety and discomfort as a result. Consult your healthcare professional if you experience anxiety before MRI scans or if you are afraid of enclosed areas. Your doctor will go over your options for sedatives (drugs that help you relax) or even anesthetic if needed.

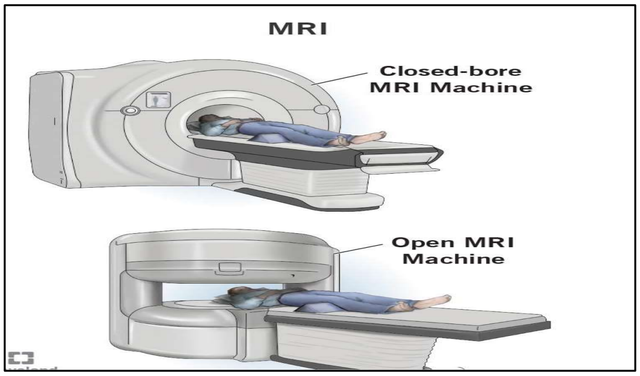

Figure 1: Types of MRI Machines

2. Contrast MRI

Contrast agent injections are used in certain MRI examinations. A rare earth metal called gadolinium is present in the contrast agent. When this material is in your body, it changes the surrounding water molecules' magnetic characteristics, improving the quality of the pictures. The diagnostic pictures' sensitivity and specificity are enhanced as a result. Contrast material makes the following more visible:

1. Tumors
2. Inflammation.
3. Infection.
4. Blood supply to certain organs.
5. Blood vessels.

III. DIFFERENCE BETWEEN MRI SCAN & CT SCAN

While computed tomography (CT) uses X-rays and computers to create images of the inside of your body, magnetic resonance imaging (MRI) employs magnets, radio waves, and a computer. MRI scans are frequently preferred by medical professionals over CT scans for examining the soft tissues or non-bony areas of the body. Because MRI scans don't use the same harmful ionizing radiation that X-rays do, they are also safer. Additionally, compared to standard X-rays and CT scans, MRI scans produce far sharper images of your brain, spinal cord, nerves, muscles, ligaments, and tendons. But not everyone is able to have an MRI. The MRI's magnetic field has the potential to dislodge metal implants and interfere with the operation of insulin pumps and pacemakers, among other devices. The next best thing in this scenario is a CT scan. MRI scans are typically more costly than CT or X-ray scans.

IV. TYPES OF MRI EXAMINATION

Problems with the brain, neck, and spinal cord can be assessed with an MRI. Additionally, it can assist caregivers in examining issues related to your abdomen, joints, blood vessels, chest, or heart. These are typical tests for magnetic resonance imaging:

1. Functional MRI (fMRI)
2. Breast scans
3. Magnetic resonance angiography (MRA)
4. Magnetic resonance venography (MRV)
5. Cardiac MRI

Functional Magnetic Resonance Imaging or Functional MRIIt detects variations in blood flow that are linked to brain function. This method depends on the correlation between cerebral blood flow and neuronal activity. Blood flow increases to a part of the brain that is being used. Blood-oxygen-level dependent (BOLD) contrast was identified by Seiji Ogawa in 1990 and is used in the primary type of fMRI. This kind of specialized brain and body scan measures neuronal activity in the human or other animal brain or spinal cord by measuring the change in blood flow (hemodynamic response) associated with brain cell energy utilization. fMRI has dominated brain mapping research since the early 1990s since it does not need injections, surgery, drug ingestion, or exposure to ionizing radiation. The method can localize activity to within millimeters, although it can only do so within a few-second window when utilizing conventional techniques. Diffusion MRI and arterial spin labeling are different ways to obtain contrast. Similar to BOLD fMRI, diffusion MRI uses the amount of water molecule diffusion in the brain to provide contrast.FMRI is utilized in clinical treatment and research to a lesser degree. It can be used in conjunction with other brain physiology measurements including near-infrared spectroscopy (NIRS) and electroencephalography (EEG). More recent techniques that enhance spatial and temporal resolution are being studied; these primarily employ biomarkers other than the BOLD signal. Although some businesses have created commercial products based on fMRI techniques, such as lie detectors, it is thought that the research is not yet advanced enough for general commercial application.

Breast Scans

This test looks for anomalies in the breast as well as breast cancer. Multiple images of your breast are taken during a breast MRI. A computer is used to integrate breast MRI scans to produce detailed images.An MRI of the breast may be utilized in many circumstances. To test for breast cancer: A screening breast MRI is advised in addition to an annual mammography for some women who are at high risk for breast cancer. Due to its tendency to miss certain malignancies that a mammogram would detect, MRI is not advised as a screening test in and of itself. While MRI can detect some cancers that are not visible on a mammography, it also has a higher rate of false positives, or findings that turn out not to be cancer. Some women may end up having unnecessary tests and/or biopsies as a result of this. For this reason, women with an average risk of breast cancer are not advised to undergo an MRI as a screening test.To assist in determining the extent of breast cancer: If breast cancer has already been detected, a breast MRI may be performed to help pinpoint the precise position and size of the cancer as well as to search for additional breast tumors and tumors in the other breast. Not every woman who has been diagnosed with breast cancer needs to undergo a breast MRI because it isn't always beneficial in this situation. To look for leakage in silicone breast implants: Breast MRI can be performed to look for implant leaks in women who have silicone breast implants. Women with saline breast implants do not use this.

Magnetic Resonance Angiography (MRA)It is a collection of methods for imaging blood arteries that are based on magnetic resonance imaging (MRI). In order to assess arteries (and less frequently veins) for anomalies such as stenosis (abnormal narrowing), occlusions, aneurysms (dilatations in the arterial wall that are susceptible to rupture), or other conditions, magnetic resonance angiography is used to create pictures of the arteries. MRA is frequently used to assess the arteries in the legs (the latter test is often called a "run-off"), the thoracic and abdominal aorta, the neck and brain arteries, and the renal arteries.

Magnetic Resonance Venography (MRV)

To focus on the body's veins and assess vein health, the MRV is a very precise and noninvasive imaging method. Blood is returned to the heart via veins from the body's organs, where it receives oxygen and essential nutrients. The MRV evaluates blood flow and finds harmful anomalies like blood clots. Deep thrombosis in the veins (not the arteries), structural vein abnormalities, and problems with blood flow in the brain are some disorders that this imaging approach may reveal. Additionally, an MRV can assist in the evaluation of diseases such as normal pressure hydrocephalus (NPH) and intracranial hypertension that may produce neurological symptoms.An MRV is performed using the same apparatus as an MRI. The information is captured by the magnets in the MRI machines and sent to a computer using software that decodes the information. Your medical state can be ascertained by using the photos created with this information. Although an MRV doesn't use radiation, in order to get the best results, patients might need to get an injection of gadolinium, a contrast agent. Injection-related allergic reactions are uncommon. The MRV is comfortable in and of itself, but because patients must lie inside a tubular imaging equipment for prolonged periods of time, it may be difficult for those who are claustrophobic. To make the treatment more comfortable, patients who are easily agitated or who find it difficult to lie on their backs may be offered a relaxant or painkiller. A screening questionnaire will be utilized to ascertain the safety of any metal objects in the body because the imaging machine uses magnets. Because the imaging equipment are rather loud, patients are advised to take off their jewelry and to listen to music while getting their exams done. Patients who have not taken any relaxing medication can resume their regular daily activities following an MRV. Their doctors will examine the pictures and discuss the findings so that, if necessary, a treatment plan can be made. With the convenience and accuracy of an MRV, patients and physicians may obtain the information they require regarding vein health, enabling them to lead the healthiest lives possible with confidence.

Cardiac Magnetic Resonance Imaging (Cardiac MRI, CMR)

Another name for it is cardiovascular magnetic resonance imaging (MRI), which is a non-invasive method of evaluating the anatomy and function of the cardiovascular system. Congenital heart disease, cardiomyopathies, valvular heart disease, aortic illnesses such as dissection, aneurysm, and coarctation, and coronary heart disease are among the conditions for which it is performed. It is also useful for examining pulmonary veins. If a person has intracerebral clips, a permanent pacemaker or defibrillator, or claustrophobia, it is not recommended.

ECG gating and high temporal resolution methods are used to modify standard MRI sequences for cardiac imaging. Research on the development of cardiac MRI is ongoing, and new and cutting-edge methods are being developed at a quick pace. When combined with other imaging modalities including nuclear medicine, cardiac CT, and echocardiography, cardiovascular MRI is a useful tool. In the evidence-based diagnosis and treatment of cardiovascular disease, the method plays a crucial role. Assessment of myocardial ischemia and viability, cardiomyopathies, myocarditis, iron overload, vascular disorders, and congenital heart disease are among the conditions for which it is used. It serves as the benchmark for evaluating the shape and function of the heart and is helpful in the diagnosis and surgical planning of complex congenital heart disease.

V. BRAIN TUMOR

When abnormal cells start to develop within the brain, a brain tumor happens. Tumors can be classified into two primary categories: benign (non-cancerous) tumors and malignant tumors. These can be further divided into two categories: primary tumors, which originate inside the brain, and secondary tumors, or brain metastasis tumors, which typically originate outside the brain and have spread from other tumors. Depending on the tumor's size and the affected brain region, all forms of brain tumors can cause a variety of symptoms. When present, symptoms could include headaches, seizures, and blurred vision, nausea, and mood swings. Additional symptoms include be trouble speaking, walking, feeling things, or even unconsciousness.

Most brain tumors have an enigmatic origin. Uncommon risk factors include ionizing radiation, vinyl chloride exposure, Epstein-Barr virus, and hereditary diseases such von Hippel-Lindau disease, neurofibromatosis, and tuberous sclerosis. Research on the use of mobile phones has not clearly demonstrated a risk. Adults with primary tumors most commonly have meningiomas (typically benign) and astrocytomas, including glioblastomas. The most prevalent kind in children is malignant medulloblastoma. The diagnosis is typically made using magnetic resonance imaging (MRI) or computed tomography (CT) in addition to a medical evaluation. A biopsy is then frequently used to confirm the outcome. The tumors are categorized into several severity grades based on the results.

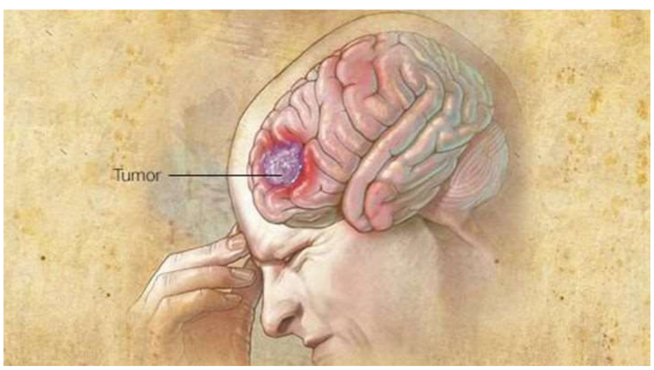

Figure 2: Tumor in Brain

A combination of radiation therapy, chemotherapy, and surgery may be used as a kind of treatment. Anticonvulsant medicine may be required if seizures occur. Medication such as furosemide and dexamethasone may be used to reduce swelling surrounding the tumor. Certain tumors progress slowly, with simply observation and perhaps no additional treatment at all. Immunomodulatory therapies are under investigation. Depending on the type of tumor and its stage of dissemination at diagnosis, the prognosis for malignant tumors might vary significantly. Benign tumors only spread to one region, but depending on their size and location, they might still pose a threat to life. Benign meningiomas typically have good outcomes, but malignant glioblastomas typically have very poor ones.

SIGN & SYMPTOMS

Broad indications and symptoms are associated with brain tumors. It is possible for people to have symptoms whether the tumor is malignant or benign (not harmful). The symptoms of primary and secondary brain tumors might be similar, depending on the tumor's size, location, and rate of growth. For instance, more substantial tumors in the frontal lobe may alter one's capacity for thought.

Headache

Increased intracranial pressure headaches might be one of the early signs of brain cancer. A headache by itself without any other symptoms is uncommon, and headaches may sometimes be preceded by other symptoms, such as anomalies in vision. There are some warning indicators for headaches that increase the likelihood that the headache is related to brain cancer. These are, according to the American Academy of Neurology, "abnormal neurological examination, headache worsened by Valsalvamaneuver, headache causing awakening from sleep, new headache in the older population, progressively worsening headache, atypical headache features, or patients who do not fulfill the strict definition of migraine". Headaches that are worse in the morning or go away after vomiting are other related symptoms.

Frontal Lobe

Tumors in this region may be linked to impaired inhibition, poor planning, incorrect social conduct, poor reasoning, altered personality, and diminished speech production (Broca's area).

Temporal Lobe

Wernicke's region is located in this lobe, and tumors there may be responsible for hearing loss, memory loss, and trouble understanding language.

Parietal Lobe

Tumors here can cause issues with speaking, writing, drawing, naming, and recognizing as well as impaired spatial and visual awareness and poor language interpretation.

Brain Stem

Brainstem tumors can result in headaches, respiratory abnormalities, vision abnormalities, endocrine issues, convulsions, and partial paralysis.

VI. METHOD OF BRAIN TUMOR SEGMENTATION

To assist doctors in identifying pathological disorders within the body, congenital defects, organ and vascular dysfunction, broken bones, and cancers, a range of medical imaging technologies are utilized. The sheer volume of clinical data generated and the growing range of medical imaging technologies make it hard to manually classify and segment the data in a timely manner. As a result, computer algorithms are used to assist with particular tasks, like tumor identification and categorization. Physicians who are currently evaluating and diagnosing medical pictures visually can benefit from the assistance of computer software that support medical imaging techniques by using image processing algorithms for quantitative analysis. These applications do, however, have certain speed and accuracy restrictions. These limits can be attributed to inter-observer variability and human mistake resulting from fatigue, inattention, and insufficient expertise. Because of this, computer analysis offers excellent supports for subjective diagnosis; hence, even for highly experienced specialists, it is crucial to increase diagnostic confidence and accuracy. Image segmentation is the process of processing an input image by dividing it into distinct regions with pixels that have similar characteristics. The rapid advancement of medical imaging technology has led to the proposal of numerous brain tumor segmentation strategies in recent times. Generally speaking, segmentation methods are categorized according to the picture data used to carry out the segmentation.

PIXAL BASED SEGMENTATION

Threshold-based approaches are another name for this kind of segmentation. They are frequently applied to two-dimensional images and represent the most basic segmentation technique conceptually. They ignore the pixels that are next to the current pixel and only take into account its intensity value. The majority of pixel-based methods basically rely on calculating thresholds using an image's histogram. Global thresholding is used when an object can be divided into segments using just one threshold. Local thresholding should be used to implement the segmentation if there are more than two items.

REGION BASED SEGMENTATION

This method is based on segmenting the image into areas based on pre-established similarity standards. It also goes by the name "region merging" and begins with a single or "seed" set of pixels. Only the pixels that meet the similarity requirements to the same structure of interest are added once the neighbors of the seeds are examined. Pixel similarity can be determined by edges in the image or by information about intensity. Until no more pixels are added to the structure of interest, the process is repeated. The capacity to divide similar regions and create related regions is the primary feature of the region growth approach. The primary drawback of area growth techniques is the PV effect, which reduces the segmentation accuracy of MR brain images.

EDGE BASED SEGMENTATION

In edge-based segmentation, the near boundaries corresponding to the objects in an image are found by analyzing the differences between pixels rather than their similarities. Edge-based segmentation requires no prior knowledge of the content of the image and is computationally quick. It is designed to be extremely sensitive to large changes in grey level values and autonomously detects if a pixel is on an edge. By using this method, the effect of the inappropriate thresholding methodology used for segmentation—which causes the segmented object's size to change—can be mitigated. The primary drawback of edge-based segmentation is that the object is not entirely encircled by the generated edges.

MACHINE LEARNING BASED SEGMENTATION

One of the best ways to automate the analysis and segmentation of medical images is through machine learning. In order to make precise decisions, it can learn the intricate relationships that are available from the empirical data. Supervised, semi-supervised, and unsupervised segmentation techniques are the three categories into which machine learning-based approaches for picture segmentation fall. The segmentation method is considered supervised once the training data has been manually labeled. The primary benefit of the supervised segmentation approach is its adaptability to various tasks with just a modification to the training set. Segmentation is referred to as unsupervised if the training data are automatically labeled by numerically grouping related pixels. This kind of segmentation divides an MRI scan into notable sections using intensities and/or textural cues. Accurate brain tumor segmentation is made more difficult and complex by the existence of over 120 tumors with varying forms and intensities, particularly when the tumors' intensities are heterogeneous and their boundaries are not clearly defined. Fuzzy C-means clustering (FCM), support vector machines (SVM), and artificial neural networks (ANN) are the foundation of most brain tumor segmentation techniques.

VII. CONVOLUTIONAL NEURAL NETWORK

A unique kind of multi-layer neural networks known as convolutional neural networks (CNNs, or ConvNets) are made to identify visual patterns straight from pixel images with little to no pre-processing. It is a unique artificial neural network architecture. Convolutional neural networks have produced state-of-the-art outcomes in computer vision problems by utilizing some of the characteristics of the visual brain. Convolutional layers and pooling layers are the two incredibly basic components that make up convolutional neural networks. These layers can be arranged in almost unlimited ways for any given computer vision issue, despite their simplicity. Convolutional and pooling layers, among other components of a convolutional neural network, are easy to comprehend. The difficult aspect of implementing convolutional neural networks in real-world applications is creating model designs that make optimal use of these basic components. Convolutional neural networks are incredibly popular because to their architecture; best of all, feature extraction is not required. The fundamental idea of how the system learns to extract features is to convolutionally process images and apply filters to produce invariant features that are then transferred to the subsequent layer. The procedure continues until it obtains a final feature or output that is resistant to occlusions. The features in the following layer are convoluted using various filters to yield more invariant and abstract features. LeNet, AlexNet, ZFNet, GoogLeNet, VGGNet, and ResNet are the convolutional neural network designs that are most frequently employed.

TYPES OF CNN MODELS

Le Net The original CNN architecture was called LeNet. One of the earliest CNNs to be effective was LeNet, which is frequently referred to as the "Hello World" of deep learning. It is among the most popular and ancient CNN architectures, and it has proven effective for a variety of applications, including handwritten digit recognition. Multiple convolutional and pooling layers make up the LeNet architecture, which is followed by a fully-connected layer. The model consists of two fully linked layers after five convolutional layers. CNNs first appeared in deep learning for computer vision applications with LeNet. However, the vanishing gradients issue prevented LeNet from training effectively.

Alex Net CNN gained popularity thanks to its deep learning architecture, AlexNet. The architecture of the AlexNet network was quite similar to that of the LeNet network, but it was larger, deeper, and featured convolutional layers stacked on top of one another. The 2012 ImageNet Large Scale Visual Recognition Challenge (ILSVRC) was won by AlexNet, the first large-scale CNN. When it was first published, the AlexNet architecture produced state-of-the-art results and was intended to be utilized with large-scale picture datasets. AlexNet is made up of two dropout layers, three fully connected layers, and five convolutional layers that combine max-pooling and other layers. Relu is the activation function that is applied to every layer. Softmax is the activation function that is employed in the output layer.

ZF Net The CNN architecture known as ZFnet combines CNNs with fully-connected layers. It was the 2013 winner of the ILSVRC. With only 1000 photos per class, the network achieves top accuracy on the ILSVRC 2012 classification test, outperforming AlexNet despite having comparatively less parameters. By adjusting the hyper parameters of the architecture, namely the middle convolutional layers' size and the first layer's stride and filter size, it performed better than AlexNet. The Zeiler and Fergus model, which was trained using the ImageNet dataset, serves as its foundation. The convolutional layer, max-pooling layer (downscaling), concatenation layer, convolutional layer with linear activation function, and stride one are the seven layers that make up the ZF Net CNN architecture.

VIII. DEEP LEARNING IN MRI

Magnetic resonance imaging (MRI) is a non-invasive in vivo biomedical imaging modality that underpins many recent breakthroughs in biology and medicine. Compared with other imaging modalities, MRI is superior in providing excellent soft-tissue contrast. MRI can be applied to a diverse range of clinical and research applications to visualize anatomical structures, measure biophysical functions and metabolism, as well as quantify perfusion and diffusion weighted microstructures in soft tissues and organs.

It is a sub-field of ML where algorithms are implemented in the form of layers and create artificial neural network that can learn and make decision without any human intervention. The smallest unit of neural network is known as neuron. Neurons process information and pass to next neuron through connecting channels. Connecting channels has a value associated to it that’s why it is also known as weighted channels. Each neuron has also a value associated with it which is known as bias.

MRI is becoming more and more susceptible to picture artifacts from subject motion and image distortion, as well as low signal to noise ratio (SNR) due to the growing demand for shorter imaging times and higher image resolution. These present significant obstacles to correctly and quickly post-processing MR images. The application of conventional image enhancement and artefact correction techniques, such as denoising geometric distortion correction and subject movement correction, has shown promise in enhancing image quality in magnetic resonance imaging. There is a lot of promise to further improve MRI picture quality with the development of artificial intelligence and machine learning, particularly deep learning algorithms, as several early studies have shown notable improvements in image quality.

IX. REVIEW LITERAURE

C. Vertan et al. [2015][1] presented that the preliminary investigation of the performance of some available methods of decolorization applied to medical color images. In this paper we proposed the preliminary investigation of the performance of some available methods of decolorization applied to medical color images. The performance of the decolorization was objectively measured by the CCPR and CCFR values averaged for three image databases containing color images of skin burns, skin melanoma and eardrum membrane. The preliminary findings will be used for the multimodal image merging and analysis, such as visible and thermal infrared.

Y. Zhu et al. [2016][2] presented that Single carrier frequency domain equalization (SC-FDE) was an alternative technology to orthogonal frequency division multiplexing to deal with the frequency selective channel fading effect in broadband wireless communication systems. In this paper, we consider a robust SC-FDE design with imperfect channel knowledge at a receiver due to the channel estimation error. Based on a statistical model for channel estimation, the optimal equalization coefficients were derived under the criterion of minimizing the mean square error conditioned on a given channel estimate. The bit error rate was further analyzed and a tight performance approximation was proposed. We also propose two robust FDE schemes in coded systems, where feedback from the channel decoder was utilized to improve the equalization and/or channel estimation performance. Simulation results show that the proposed robust FDE schemes achieve significant performance improvement over the conventional FDE schemes.

A Harshvardhan et al. [2017][3] presented that tumor regions from Magnetics Resonance Imaging (MRI image) brain images. The method incorporates the following steps during the tumor localization process namely, smoothing, skull stripping, filtering, image enhancement, followed by defining the region of interest and segmenting the identified tumor region from the input MRI brain image. Experimental results concluded that the proposed method has been better performance regarding segmentation accuracy and execution time karma when tested on 15 live brain images with significant tumor regions. The segmentation of tumor region in the MRI brain images was proposed in the paper. Even though table 3 showed the acceptable results for the proposed method regarding segmentation accuracy and execution time, the proposed method has to be validated with the implementation of feature extraction and classification phases for detailed diagnosis results. Authors would like to integrate those phases as the future work and validate the performance of the proposed method.

H Chetty et al. [2017][4] presented that Brain Tumor which was also known as Intracranial Neoplasm was a vital brain disease. This was caused when abnormal cells were formed within the brain. The two essential types of tumor were Malignant or Cancerous tumor and Brain tumor. The patient does not recover when the growth of the abnormal cells was more than the 50% mark of the brain. The describes two different algorithms of image processing. The techniques used were Segmentation method and Symmetric property with region growing approach. The paper explains the algorithm in details and does a comparison between the algorithms for a better algorithm construction in future.

Y Chen et al. [2018][5] presented that A reversible watermarking algorithm based on the integer wavelet transform (IWT) was proposed for the parenchyma areas in the medical images of lung and brain. Firstly, we use the OTSU with the regional statistics method to segment the parenchyma areas of lung and brain images. Secondly, taking the parenchyma areas as region of interest (ROI) on which an IWT was performed. Finally, the multi-bits reversible watermarking was embedded in medium-high frequency sub-band based on histogram shifting. The experimental results show that the watermarking signals could be correctly extracted if the medical image were not tampered. Additionally, compared with the traditional method, the embedding capacity was improved by more than 10% using the proposed algorithm.

S. M. Islam et al. [2019]6] presented that Image enhancement was a vital step of medical image analysis and image recognition. X-ray and ultrasound imaging were the most preferred medical imaging technologies which were important for diagnosis of disease. But the edges and borders on image were not as clear as expected due to interference and low intensity in images. This paper presents an images enhancement techniques, especially in the case of medical images. Using image enhancement, it was possible to get the details which were kept hidden as well as to improve the image contrast. In the case of analyzing image, the commencing part was that the edge of an image. Successful results of image analysis depend on edge detection & enhancement. In this research we have developed a method of enhancement by incorporating Laplacian, Sobel operator, addition operation, filter, product operation and power law transformation techniques to enhance medical images. This developed method was tested on low contrast medical images and by observing the results it can be said that these applied methods perform well for enhancing medical images.

A Hussain et al. [2020][7]presented that the brain tumor was a disease that affects or harms the brain with unwanted tissues. This was very difficult to detect brain tumor tissue from whole brain. Early detection of tumor is very important to save patient's life. Detection or segmentation techniques were used to detect and segment the brain-tumor region from the MRI images of brain and it was very useful method in recent days. In medical, magnetic resonance- imaging was a tough field in image processing because accuracy percentage must be very high so doctors could get proper idea about diseases to save patient's life. Some MRI images have been taken as inputs data. The brain tumor segmentation process was performed for separating brain-tumor tissues from brain MRI images, The MRI images should be filtering such as with the median filtering technique and skull stripping should be done in pre-processing, the thresholding process was being done on the given MRI images with using the watershed segmentation method. Then at last the segmented tumor region was obtained. Then, some images have been classified using support vector machine (SVM), this system obtained with the average accuracy of 93.05%.

A.V. Nikolaev et al. [2021][8] presented that Breast cancer was one of the most diagnosed types of cancer worldwide. Volumetric ultrasound breast imaging, combined with MRI can improve lesion detection rate, reduce examination time, and improve lesion diagnosis. However, to our knowledge, there was no 3D US breast imaging systems available that facilitate 3D US – MRI image fusion. In this paper, a novel Automated Cone-based Breast Ultrasound System (ACBUS) was introduced. The system facilitates volumetric ultrasound acquisition of the breast in a prone position without deforming it by the US transducer. Quality of ACBUS images for reconstructions at different voxel sizes (0.25 and 0.50 mm isotropic) was compared to quality of the Automated Breast Volumetric Scanner (ABVS) (Siemens Ultrasound, Issaquah, WA, USA) in terms of signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and resolution using a custom-made phantom. The ACBUS image data were registered to MRI image data utilizing surface matching and the registration accuracy was quantified using an internal marker. The technology was also evaluated in vivo.

S. Suganyadevi et al. [2022][9] presented that those Ongoing improvements in AI, particularly concerning deep learning techniques, were assisting to identify, classify, and quantify patterns in clinical images. Deep learning was the quickest developing field in artificial intelligence and was effectively utilized lately in numerous areas, including medication. A brief outline was given on studies carried out on the region of application: neuro, brain, retinal, pneumonic, computerized pathology, bosom, heart, breast, bone, stomach, and musculoskeletal. For information exploration, knowledge deployment, and knowledge-based prediction, deep learning networks can be successfully applied to big data. In the field of medical image processing methods and analysis, fundamental information and state-of the-art approaches with deep learning were presented in this paper. The primary goals of this paper were to present research on medical image processing as well as to define and implement the key guidelines that are identified and addressed.

X. CONCLUSION

In this work, it provides a review on image segmentation based on energy minimization concept. It displayed a variational level set structure for division and predisposition remedy of pictures with force in homogeneities with the help of survey work. Division and inclination field estimation are subsequently mutually performed by limiting the proposed vitality useful. It portrayed another technique called energy minimization to adjust for force inhomogeneity of pictures. By upgrading a cubic spline to limit the entropy of a dataset, a predisposition field can be evaluated and the pictures amended. The proposed technique was intended for those troublesome cases and demonstrated great outcomes for surface loops, additionally for interventional MRI, presumably the most outrageous instance of inhomogeneity.

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