

Enhanced Feature Extraction for Tumor Detection by using Decision based Joint Trilateral Filter

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Abstract— The brain tumor distinguishing proof is an indispensable utilization of restorative picture dealing with. The written work consider has shown that most by far of systems which are in presence has ignored the low institutionalized pictures like pictures with uproar or awful brightness. This examination works proposed another choice based joint trilateral filter and by utilizing this filter we got more effective and enhanced outcomes as correlation with the current strategies. By utilizing this procedure there will be less impact of clamor and the picture will be all the more clear as contrast with past techniques. The inspiration driving the proposed approach is simple and effective.

Index Terms: Brain segmentation, Brain tumor, Brain tumor detection techniques

I. INTRODUCTION

Image Segmentation is the path toward allocating propelled picture into various areas (sets of pixels, generally called superpixels). The goal of division is to unravel and additionally change the depiction of a photo into something that is more essential and less complex to explore. Division is routinely used to discover articles and points of confinement (lines, curves, et cetera.) in pictures[1]. More precisely, picture division is the path toward doling out a name to every pixel in a photo to such a degree, to the point that pixels with a comparative check share certain visual qualities. The eventual outcome of division is a plan of parts that all in all cover the entire picture, or a course of action of structures isolated from the photo (see edge distinguishing proof). Each of the pixels in a locale is similar with respect to some trademark or enrolled property, for instance, shading, constrain, or surface. Neighboring regions are through and through one of a kind with respect to the same characteristic(s). Exactly when associated with a heap of pictures, normal in therapeutic imaging, the ensuing structures after picture division can be used to make 3D amusements with the help of expansion computations like strolling 3D squares.

A. Brain Segmentation

The basic walk of estimation incorporates cerebrum division[3]. A few methods have been proposed to play out this operation and some of them are accessible in virtual things, for example, BrainVisa, FSL and Brainsuite. Sadly

a huge piece of them get floundered by righteousness of the closeness of a tumor in the cerebrum, particularly if organized on the edge of the mind. To manage this issue, we propose to play out a symmetry examination, in light of the uncertainty that tumors are all around not symmetrically put in the two sides of the equator, while the entire personality is by and large symmetrical.

B. Brain Tumor

A brain tumor, is an intracranial strong neoplasm, a tumor (depicted as an interesting change of cells) inside the mind or the focal spinal conduit[6]. Two or three tumors are mind sicknesses. Cerebrum tumors join all tumors inside the human skull (noggin) or in the focal spinal channel. They are made by a bizarre and uncontrolled cell division, by and large talking in the mind itself, moreover in lymphatic tissue, in veins, in the cranial nerves, in the cerebrum envelopes (meninges), skull, pituitary organ, or pineal organ. Inside the mind itself, the included cells might be neurons or glial cells (which solidify astrocytes, oligodendrocytes, and ependymal cells). Cerebrum tumors may in like way spread from illnesses fundamentally orchestrated in different organs (metastatic tumors). Any tumor is actually true blue and life-devastating in like manner of its meddling and infiltrative character in the restricted space of the intracranial trouble. All things considered, personality tumors (despite weakening ones) are not generally savage, particularly lipomas which are naturally favorable. Brain tumors or intracranial neoplasms can be risky (undermining) or non-growth causing (unselfish); regardless, the ramifications of frightful or benevolent neoplasms shifts from those regularly utilized as a bit of different sorts of hazardous or non-harming neoplasms in the body. Its danger level relies upon the mix of variables like the sort of tumor, its zone, its size and its condition of progress. Since the mind is all around secured by the skull, the early ID of a cerebrum tumor happens precisely when conclusive devices are formed at the intracranial wretchedness. All things considered territory happens in cutting edge stages when the nearness of the tumor has brought on unexplained signs. Fundamental (true blue) personality tumors are reliably masterminded in the back cranial fossa in youngsters and in the front 66% of the cerebral sides of the equator in grown-ups, despite the way

that they can affect any piece of the cerebrum. Noticeable nature of signs and manifestations of mind tumors fundamentally relies upon two fragments: the tumor measure (volume) and tumor district. The minute that responses will find the opportunity to be especially certain, either to the individual or individuals around him or her (side effect onset) is a vital pivotal occasion over the navigate of the finding and treatment of the tumor. The sign onset – in the timetable of the change of the neoplasm – depends in light of present circumstances, in travel of the tumor however a noteworthy piece of the time is in like way identified with the change of the neoplasm from "amicable" (i.e. coordinate developing/late sign onset) to more dangerous (quickly developing/early response onset). Tumors can be great or incapacitating, can happen in various parts of the cerebrum, and could be fundamental tumors.

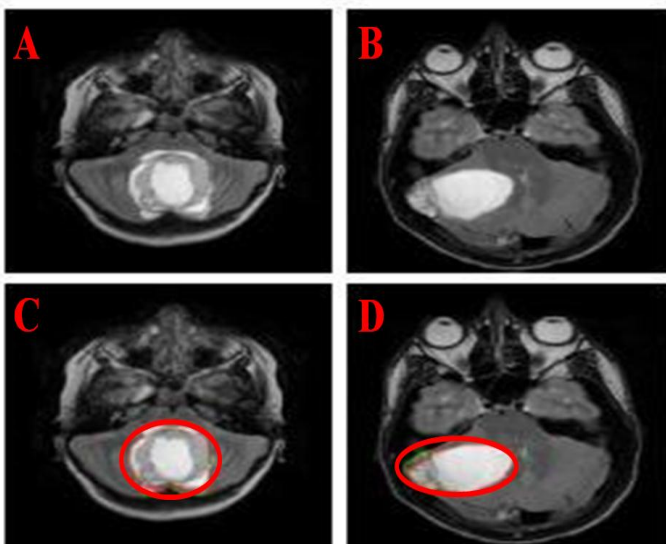


Figure 1(A) & (B) Input image; (C) & (D) Tumor detected image

A fundamental tumor is one that has started in the psyche, as opposed to a metastatic tumor, which is something that has spread to the cerebrum from another bit of the body. The event of metastatic tumors are more dominating than basic tumors by 4:1. Tumors could be symptomatic: a couple of tumors are found in light of the way that the patient has reactions, others appear by chance on an imaging channel, or at an after death. Figure 1 has shown the data picture and tumor perceived picture.

II. BRAIN TUMOR DETECTION TECHNIQUES

There are four main techniques for brain tumour detection as given follows:

A. Tumor Detection Using Active Contour:

The framework relies upon dynamic structures progressing in time as shown by regular geometric measures of the photo. The propelling structures really split and union, allowing the synchronous acknowledgment of a couple of things and both inside and outside points of confinement. This approach relies upon the association between powerful structures and the count of geodesics or insignificant partition twists. This geodesic approach for

challenge division licenses partner conventional "snakes" in light of essentialness minimization and geometric dynamic shapes in perspective of the theory of twist headway. Test eventual outcomes of applying the arrangement to veritable pictures joining objects with openings and therapeutic data imagery demonstrate its vitality. The results may be contacted 3D question division too.

B. Based on Region Growing

Area creating is a direct region based picture division system. It is also assigned a pixel-based picture division system since it incorporates the decision of starting seed centers. Along these lines to manage division takes a gander at neighboring pixels of starting "seed centers" and makes sense of if the pixel neighbors should be added to the region. The methodology is iterated on, in a vague path from general data gathering estimations.

C. Using Watershed Segmentation

A watershed is a bowl like landform portrayed by highpoints and ridgelines that slide into bring down statures and stream valleys[14]. A diminish level picture may be seen as a topographic help, where the dim level of a pixel is interpreted as its stature in the easing. A drop of water falling on a topographic mitigation streams along an approach to finally accomplish a close-by slightest. Actually, the watershed of a lightening identifies with the farthest reaches of the neighboring catchment dishes of the drops of water. In picture dealing with, unmistakable watershed lines may be handled. In graphs, some may be described on the center points, on the edges, or creamer lines on the two centers and edges. Watersheds may moreover be described in the persevering space. There are moreover an extensive variety of figurings to enlist watersheds. For a division reason, the slant measure (i.e., the length of the slant vectors) is deciphered as tallness information.

D. Using neural network

Artificial neural systems (ANNs) are non-coordinate data driven self flexible approach rather than the standard model based procedures. They are exceptional instruments for illustrating, especially when the shrouded data relationship is dark. A basic component of these frameworks is their adaptable nature, where "learning by outline" replaces "programming" in dealing with issues.

III. RELATED WORK

Abdel-Maksoud et al.(2015) [1] introduced an effective picture division approach utilizing K-implies grouping system incorporated with Fuzzy C-implies calculation. It is trailed by thresholding and level set division stages to give an exact brain tumor identification. The proposed procedure can get advantages of the K-implies grouping for picture division in the parts of negligible calculation time. Likewise, it can get favorable circumstances of the Fuzzy C-implies in the parts of exactness. The execution of the proposed picture division approach was assessed by contrasting it and some best in class division calculations if

there should arise an occurrence of exactness, preparing time, and execution. The precision was assessed by contrasting the outcomes and the ground truth of each prepared picture. The exploratory outcomes clear up the viability of their proposed way to deal with manage a higher number of division issues by means of enhancing the division quality and exactness in insignificant execution time.

Preetha and Suresh (2014) [2] has talked about that the Image Segmentation is fundamental and testing to envision the tissue of human for breaking down the MR pictures. In cerebrum MR pictures, the limit of tumor tissue is exceptionally sporadic. Deformable models and Region based strategies are broadly utilized for medicinal picture division, to find the limit of the tumor. Issues related with non-direct dispersion of genuine information, User association and poor meeting to the limit locale constrained their value. Bunching of mind tumor pictures, utilizing Fuzzy C means is hearty and compelling for tumor confinement. Despite the fact that the proposed strategy has high computational unpredictability, it demonstrates prevalent outcomes in division productivity and joining rate. The Fuzzy C implies grouping with the expansion of Feature extraction and order is exceptionally encouraging in the field of mind tumor identification.

Halder et al. (2014) [3] has proposed an effective brain tumor identification technique, which can identify tumor and find it in the cerebrum MRI pictures. This strategy removes the tumor by utilizing K-implies calculation took after by Object naming calculation. Likewise, some preprocessing steps (middle sifting and morphological operation) are utilized for tumor discovery reason. It is watched that the test aftereffects of the proposed strategy gives better outcome in contrast with different systems.

Zeljko et al. (2014) [4] has demonstrated that the MRI or CT examine pictures are essential follow up analytic devices when a neurologic exam shows a probability of an essential or metastatic mind tumor presence. The tumor tissue chiefly shows up in brighter hues than whatever is left of the districts in the cerebrum. In view of this perception, a computerized calculation for cerebrum tumor identification and restorative specialists' help with encouraged and quickened conclusion methodology has been produced and at first tried on pictures got from the patients with analyzed tumors and sound subjects.

Salah et al. (2013) [5] has introduced a calculation for completely mechanized brain tumor division from just two attractive reverberation picture modalities. The system depends on three stages: (1) rotating diverse levels of programmed histogram-based multi-thresholding step, (2) playing out a successful and completely robotized technique for skull-stripping by advancing deformable shapes, and (3) fragmenting both Gross Tumor Volume and edema. The technique is tried utilizing 19 hand-fragmented genuine tumors which indicates extremely precise outcomes in contrast with an exceptionally late strategy (STS) as far as the Dice coefficient. Enhancements of 5%

and 20% separately for division of edema and Gross Tumor Volume have been recorded.

Dvorak et al. (2013) [6] has manage programmed brain tumor recognition in attractive reverberation pictures. The objective is to decide if the MR picture of a mind contains a tumor. The proposed strategy works with T2-weighted attractive reverberation pictures, where the head is vertically adjusted. The recognition depends on checking the left-right symmetry of the cerebrum, which is the supposition for sound mind. The calculation was tried by fivefold cross-approval procedure on 72 pictures of cerebrum containing tumors and 131 pictures of sound mind. The proposed technique achieves the genuine positive rate of 91.16% and the genuine negative rate of 94.68%.

Ulku et al. (2013) [7] has talked about that the Computer-supported recognition (CAD) frameworks help to radiology specialists in mass discovery utilizing picture preparing methods. This review means to acknowledge mass location handle on mind MRI (Magnetic Resonance Imaging) pictures. The CAD framework has been exhibited which depends on histogram adjustment and morphological picture preparing procedures. The procedures are brought out through 125 MR pictures which are taken from 11 individuals that are 8 individuals with tumors, 3 individuals without tumors. In grouping stage which is the last phase of the PC helped identification frameworks, 6 arrangement calculations are tried in the RapidMiner program, and these calculations are contrasted with each other with show CAD framework precision.

Vijay and Subhashini (2013) [8] has examined that the Segmentation of pictures holds a vital position in the territory of picture handling. It turns out to be more imperative while commonly managing therapeutic pictures where pre-surgery and post surgery choices are required with the end goal of starting and accelerating the recuperation procedure. PC supported location of strange development of tissues is essentially spurred by the need of accomplishing most extreme conceivable precision. Manual division of these anomalous tissues can't be contrasted and cutting edge's fast processing machines which empower us to outwardly watch the volume and area of undesirable tissues.

Parisot et al. (2012) [9] clarified that new system for discovery, division and portrayal of brain tumor. This strategy misuses past data in the structure of an extra diagram for the benefit of the anticipated spatial places of tumor classes. Such data is as one with picture based classification systems alongside spatial smoothness limitations towards delivering a reliable acknowledgment outline an assembled graphical model plan. Towards most ideal utilization of earlier data, a two layer sorted out diagram is measured with one layer proportional to the poor quality glioma sort (depiction) and the following layer to voxel-based choices of tumor event. Capable direct programming together in states of execution and also as far as computational load is considered to recover the most reduced capability of the goal reason.

Bhattacharjee and Chakraborty (2012) [10] clarified that calculation is created to quality out tumor from undesirable mind Magnetic Resonance (MR) symbolism. This depends on quality element differentiation of two channels, versatile middle channel is decided for de-noising the symbolism. Picture cutting and acknowledgment of vital planes are finished. Consistent operations are helpful on picked cuts to obtain the prepared picture seeing the tumor segment. This calculation depends on the use of Principal Components Analysis (PCA). This calculation is helpful on exceptional uncommon symbolism and also on the handled pictures. It checks the individual effectiveness of the created picture preparing calculation to distinguish cerebrum tumor.

Ghanavati et al. (2012) [11] talked about that Automatic discovery of brain tumor is a mind boggling work because of varieties in sort, size, area and state of tumors. In this, a multi-methodology structure for programmed tumor location is offered, melding disparate Magnetic Resonance Imaging modalities including T1-weighted, T2-weighted, and T1 with gadolinium differentiate operator. The sum, layout distortion, normality, and consistency elements were extricated from each photo. The AdaBoost classifier was utilized to pick the basically discriminative skin tone and to section the tumor zone. Multi-modular MR pictures with virtual tumor have been utilized as the ground truth for direction and defense of the acknowledgment method.

Natarajan et al. (2012) [12] has concentrated that the Medical Image Processing is an intricate and testing field these days. Handling of MRI pictures is one of the parts of this field. This paper proposes a methodology for productive discovery of a brain tumor in MRI mind pictures. The procedure comprises of the accompanying strides: preprocessing by utilizing honing and middle channels, improvement of picture is performed by histogram balance, division of the picture is performed by thresholding. This approach is then trailed by the further utilization of morphological operations. At last the tumor area can be gotten by utilizing the method of picture subtraction.

Abdullah et al. (2012) [13] has proposed a brain tumor discovery strategy in light of cell neural systems (CNNs). Brain tumor is an unusual development of cells inside the skull. To analyze the area of tumor in the cerebrum, Magnetic Resonance Imaging (MRI) is utilized. Radiologists will assess the dim scale MRI pictures. This strategy is truly time and vitality devouring. To beat this issue, a mechanized recognition strategy for mind tumor utilizing CNN is produced.

Maiti and Chakraborty (2012) [14] has proposed another strategy for brain tumor location. For this reason watershed technique is utilized as a part of mix with edge recognition operation. It is a shading based brain tumor location calculation utilizing shading cerebrum MRI pictures in HSV shading space. The RGB picture is changed over to

HSV shading picture by which the picture is isolated in three locales tint, immersion, and power. After complexity upgrade watershed calculation is connected to the picture for every locale. Shrewd edge finder is connected to the yield picture. In the wake of joining the three pictures last cerebrum tumor divided picture is acquired. The calculation has been connected on twenty mind MRI pictures. The created calculation has given promising outcomes. M.Monica et al. (2012) [15] has talked about that the cerebrum tumor location is a critical application as of late. The therapeutic issues are extreme if tumor is recognized at the later stage. Consequently analysis is vital at the soonest. X-ray is the present innovation which empowers the location, analysis and assessment. In this work, the pictures acquired through MRI are portioned and afterward encouraged to a model known as Pulse coupled neural system for identifying the nearness of tumor in the cerebrum picture. The doctor could look for the assistance of this model if the info MRI cerebrum pictures are more in number and the system would help the doctor to spare time for further investigation. The work likewise uses back spread system for grouping. Both the systems are less mind boggling in nature and henceforth the handling of MRI cerebrum pictures is extremely basic. The system arranges the information pictures as typical and tumor containing. The tumor might be kindhearted and harmful and it needs medicinal support for further order.

Raza et al. (2012) [16] has proposed a denoising calculation which dispenses with salt and pepper clamor from advanced pictures that are exceptionally tainted by salt and pepper commotion. A few techniques have been acquainted with evacuate settled esteem motivation clamor (salt and pepper commotion) from advanced pictures, for example, middle channel (MF), versatile middle channel (AMF), Decision based calculations (DBA) and so forth. A significant number of these calculations fizzle while evacuating the clamor at high thickness and don't safeguard fine subtle elements of the picture. The proposed calculation (PA) demonstrates preferred outcomes over existing separating strategies. The calculation tried and contrasted for Peak Signal-with Noise Ratio (PSNR) and Image Enhancement Factor (IEF) with various existing strategies.

IV. PROPOSED METHODOLOGY AND RESULTS

For experimentation and execution the proposed system is assessed utilizing MATLAB device u2013a. Here we will think about the current and proposed strategies on the premise of different picture quality assessment parameters like Accuracy, Bit error rate, Peak signal noise ratio, Error rate and f-measure. The current approach give great outcomes in upgrading the picture however it disregards certain districts in picture, for example, blended locale and furthermore impact of obscuring is not contemplated. The proposed approach gives productive outcomes in enhancing the difference of picture. The unthinkable correlation has been done amongst existing and proposed procedure on the premise of these parameters.

A. Accuracy

Accuracy can be defined as the degree of closeness of measurements of a quantity to that quantity's true value. Higher value of accuracy, better will be the results. It can be calculated as

$$\text{Accuracy} = \frac{TP + TN}{(TP + FP + FN + TN)}$$

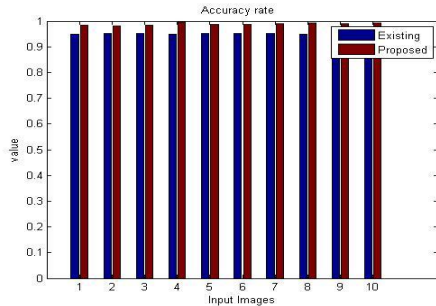


Fig 1: Accuracy Rate

B. Error Rate

It is defined as the rate at which errors occur in a transmission system. Lower the value of error Rate, better will be the result. It can be calculated as

$$\text{Error Rate} = 1 - \text{Accuracy}$$

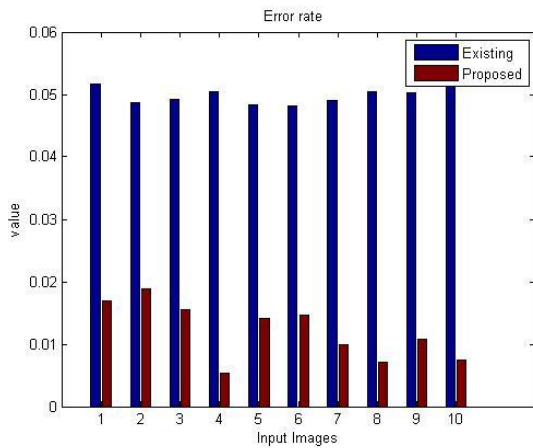


Fig 2: Error Rate

C. F-Measure

It is the measure that combines precision and recall. It is the harmonic mean of precision and recall. It is calculated as-

$$F = 2 * \left[\frac{(\text{Precision} * \text{Recall})}{\text{Precision} + \text{Recall}} \right]$$

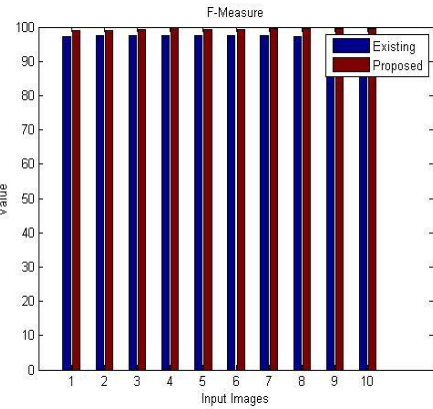


Fig 6: F-Measure

D. Bit Error Rate (BER)

It is defined as the rate at which errors occur in a transmission system. This can be directly translated into the number of errors that occur in a string of a stated number of bits. The definition of bit error rate can be translated into a simple formula:

$$\text{BER} = \frac{\text{Number of errors}}{\text{Total number of bits sent}}$$

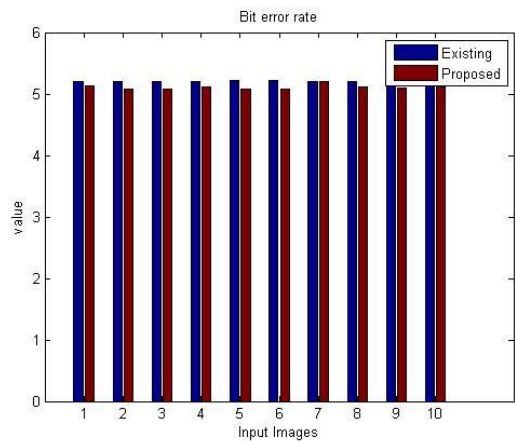


Fig 4: Bit Error Rate

E. Peak signal Noise Ratio

Peak square noise ratio is the ratio between the maximum possible value of the signal and the power of the corrupting noise. It is measured in decibels (db). It can be explained as:

$$\text{PSNR} = 10 \cdot \log_{10} \left(\frac{\text{MAX}_I^2}{\text{MSE}} \right)$$

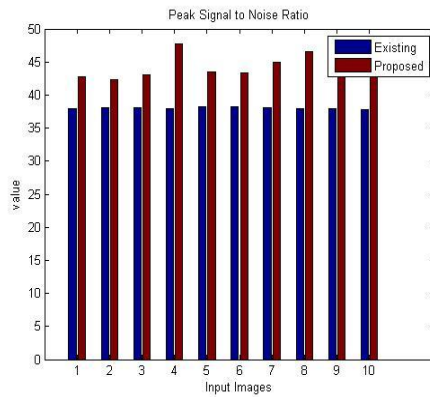


Fig 9: Peak Signal Noise Ratio

V. CONCLUSION

Image Segmentation assumes a fundamental part to analyze the pictures and its result directly affects the further phases of preparing. Division is a system of separating out unmistakable locales from a picture in order to highlight is protest of intrigue. The brain tumor identification is an essential use of therapeutic picture handling. The writing study has demonstrated that the a large portion of existing techniques has disregarded the low quality pictures like pictures with commotion or poor brilliance. Presently to improve the precision of division further, this exploration work has concentrated on by coordinated the proposed object based tumor identification with the joint trilateral filtering. The general objective of this exploration work is to propose an effective cerebrum tumor location utilizing the protest identification. The proposed system can deliver viable outcomes even if there should arise an occurrence of high thickness of the commotion. Utilizing picture flag handling tool compartment in MATLAB 2013a, the proposed strategy is actualized on different pictures taken from sites. The recreation comes about by utilizing execution measures, for example, Measure of exactness rate, top flag to clamor proportion, mistake rate, bit blunder rate and f-measure by utilizing different cerebrum tumor pictures that enhanced division precision to the more prominent degree when contrasted with the current methods. The proposed procedure has not considered fluffy sift keeping in mind the end goal to channel through commotion from the sectioned pictures in this manner sooner rather than later this strategy can be additionally enhanced by utilizing channels that will totally kill clamor from pictures and enhance division precision further.

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