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Bilateral Filtering Allied with Neural Network Based on GLSZM Characteristic Mining and Typical Classification of Human Brain Images

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Abstract*: This article proposes an automatic classification support system to perceive the brain tumor and categorize the human brain images utilizing neural network allied with bilateral filter for medical relevant application. Hands-on medical image has perverted into a self-motivated exploration and investigative analysis is done in the region of Image processing. Noise expulsion in MRI (Magnetic Resonance Image) medical image is important and decisive for a extensive collection of handling image process presentations. In this research article, the proposed method consists of pre-processing and post processing technique using with the neural network allied with bilateral filtering and segmenting to eradicate the noise and GLSZM congregation algorithm segments and categorize the human brain images by countenancing for longitudinal information in sequence and also hypothesis preliminary association matrix unsystematically. The outcomes will be accessible as segmented medical image descriptions and classification takes place by means of neural network algorithm.

Index Terms*: Neural Network, bilateral filter, Image processing

I. INTRODUCTION

Human brain tumor is a germ in which cells disseminate irrepressibly in the human brain. Brain tumors are predominantly of two types, early one is benign tumors which are powerless of scattering outer surface the brain itself. Benign tumors in the brain mostly do not signify to be preserved and conserved of their growth is restricted. Occasionally they can ground problems as of their locus and surgical procedure or radioactivity can be sympathetic and supportive. The second one is malignant brain tumors are typically termed as brain cancer. These tumors can extent the level freestanding of the brain. Malignant tumors of the human brain will persistently change into an unambiguous problem if left untreated or unprocessed and a violent methodology is almost always essential. Brain distortions can be separated into two classifications: Principal brain cancer devises in the brain. Auxiliary or metastatic brain cancer magnitudes to the brain from deputy site in the human body. Brain tumor ascends as soon as cells in the body split without any regulator. In universal, cells divide into an ordered manner. If brain cells conserve unraveling irrepressibly when innovative brain cells are not required, a physique of tissue forms, called a development of brain tumor. The word human brain tumor typically refers to malignant brain tumors, which can foretell adjoining tissues and can extent to supplementary parts of the human body. A benign brain tumor does not expand to anyway. A neural network (NN) habitually is a computational model or numerical model that is inspired by the structure and determined of functional characteristics of genetic neural networks. A neural network comprises of a dependable group of probabilistic neurons, engaged in union to resolve comprehensive complications. The NN is an adaptive association that translates its configuration based on external or internal data that runs throughout the network in the information phase. Contemporary neural networks are non-linear mathematical data displaying utensils. They are frequently cast-off to model comprehensive links between inputs data and output data or to discover various patterns in the given data. Conclusion making was achieved in two stages: 1. Feature extraction using GLSZM feature and the categorization using NN-Bilateral Filter network [1]. The presentation of this organized categorization was evaluated in terms of training ratification and arrangement of categorization precisions. The system generated outcomes will be shown that segmentation and classification affords better-quality.

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II. BASICS OF NEURAL NETWORK

Multi Feed-forward NN or Multilayer Preceptor with various concealed stratums in artificial neural networks is consistently approved as Deep Neural Networks (DNNs).Convolution Neural Networks (CNN) is one apprehensive of multified feed-forward neural network. During1960s, Hubel and Wiesel scrutinized the neurons cast-off for original inquisitive direction cum discriminatory in the categories graphical sub system and they commence the characteristic network configuration which can meritoriously minimize the sophistication of multified Feed-back NN and its pointed Convolution Neural Network. CNN is an imaginative appreciation algorithm which is frequently and roughly utilized in image processing and a range of prototype acknowledgement and image acknowledgment. It has plentiful topographies such as ingenuous structure, rarer drill parameters and elasticity uniqueness. It has renowned a

scorching theme in tone investigation and medical image requirement. Its weight equally shared with network array make it more resultant to natural NN. It reduces the obstruction of the network characteristic and the magnitude of extend weights. Consistently, the collection of NN divides into two layers. Initial one is the characteristic extraction layer; the contribution of every neuron is emotionally involved to the unique accessible fields of the prior layer, and summaries the inventive characteristic feature. Once the distinctive features are extracted, the positional association between it and corresponding features also will be found. The analogous is feature map layer, each presuming the layer of the system is secured of a collection of feature map[2]. Each typical plan is even, the importance of the neurons in the plane is indistinguishable and equivalent. The congregation of characteristic map performs the sigmoid task as insight utility of the convolution neural network, which creates the quality record which have variation invariance. Also, as the neurons in the related devious level surface stake weight, the quantity of unhindered parameters of the network is determined. In the same way the convolution level in the convolution neural network is anticipated by a figuring level which is used to calculate approximately the unique typical average and the following non-representational; this fractional two feature simplification structure moderates the declaration.

III. RELATED WORKS

Medical image segmentation for revealing of brain tumor from the magnetic resonance (MR) images[3] or from further applicative medical imaging modalities is an extremely significant process for choose accurate remedy at the exact time. Many method have been projected for categorization of brain tumors in MR images, mainly remarkably, support vector machine (SVM)[4], fuzzy clustering means (FCM)[5], artificial neural network (ANN)[6], expectation-maximization (EM) algorithm technique[7] and knowledge-based techniques[8], are a few of the admired method utilized for province base segmentation and so as to dig out the significant in sequence from the medical imaging modalities. A summary and conclusion of several of the current and important do research are accessible here. [8] Offered a neural network based method for brain tumor recognition and categorization. In this technique, the quality rate is formed independently for segmentation of CSF, GM, WM, and tumor region and maintain a correctness of 85% using neural network base classifier. [9] Offered a method for automatic cataloging of brain tumor from MR images utilizing an SVM based classifier. To progress the accurateness of the classifier, significant features are extort using prompt Fourier transform (FFT) and diminution of features is achieved using Minimal-Redundancy-Maximal-Relevance (MRMR) method. [7] Offered an extremely proficient system which maintain accurateness of 100% in the cataloging of brain tumor from medical MR images. This technique is using texture-primitive features with artificial neural network (ANN) as noted segmentation and modified classifier tool. [6] Functional a localized fuzzy clustering with spatial in sequence to structure a purpose of minute medical MR image.

IV. PROPOSED WORK

In this research article, the proposed method consists of pre-processing and post processing feature practice using with the bilateral filtering and neural network connected with the bilateral neural network framework contains of two major phases: Training and testing and segmenting to remove the invalid noise and the GLSZM algorithm identifies and organize the brain images by countenancing for additional information as adjoining pixels are highly consistent and also hypothesis initial association matrix irregularly. The outcomes will be accessible as segmented valid image descriptions and classification takes place by means of neural network algorithm.

Stages involved in the proposed method

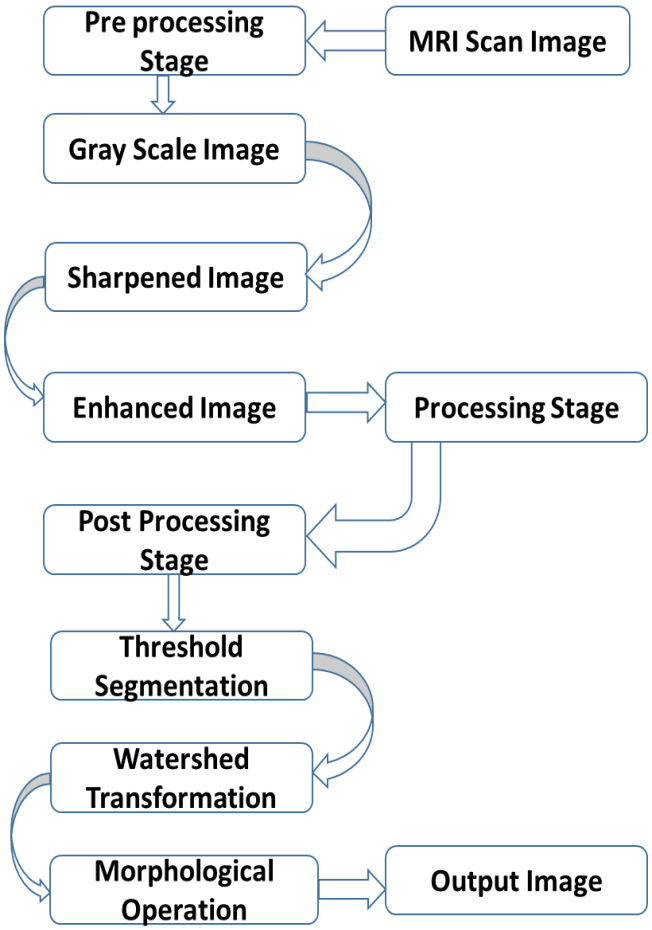

Figure 1. Stages involved in the proposed method

Statistical Performance of Tumor Identification

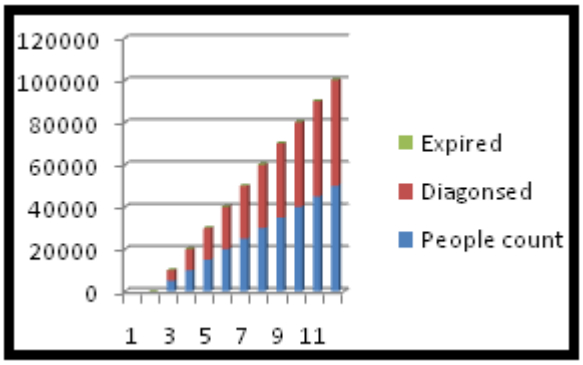

Figure 2. Statistical Performance of Tumor Identification

V. METHODOLOGY

MEDICAL IMAGE PREPROCESSING

The pre-processing[10] components are utilized to execute preliminary control takes the nature of observance image. Pre-processing[11] is a part where the requisites are generally noticeable and forthright, similar to ancient rarities eviction from medical pictures. The major point of this method is to increase the photo with high fortitude and to represent the picture for the following stride by warning the complementary bits in the setting of authentic image. Initially, the magnitude of MRI pictures of the intelligence tumor is congregated from the human amenities organization. The images of cerebrum tumor might be riddled by MRI examine device. A portion of the collective methods are utilized for practicing the left-over substance like high-points, scream, and groundwork from the image. These work exploitations the particular channel for the commotions from MRI image. Meticulous channel which has been twisted out to be a capable and worthwhile technique for commotion drop.

In this phase medical image is improved in the way that better-quality details are enhanced and noise is detached from the image. Most frequently used enrichment and noise diminution techniques are promoted that can provide most excellent achievable results. Improvement will outcome in more important edges and a sharpened medical image is obtained; noise will be condensed thus sinking the blurring outcome from the selected image. In accumulation to development, images segmentation will also be practically applied. This enhanced and improved image will be of assistance in detecting boundaries and civilizing the eminence of the overall medical image. Border detection will guide to discover the exact location of human tumor. Subsequent steps will be followed in the preprocessing phase.

VI. ALGORITHMS

A. *Bilateral Filtering:*

Bilateral filtering is a recognized non-linear filtering method that can unite medical image data from together of the space area and the characteristic area in the modern filtering method. It can be elaborated to by the mathematical equation

$$h(x) = \frac{1}{k(x)} \sum_{y} I(y) c(x,y) s\big(I(x), I(y)\big) \quad \ldots\ldots\ldots\ldots\ldots (1)$$

where,

I and h are the input and output images correspondingly,

x and y are pixel situation over the image grid,

c(x,y) and s(I(x),I(y))calculate the spatial and photometric similarity between pixel x and pixel y correspondingly, and

$$k(x) = \sum_{y} c(x,y) s\big(I(x), I(y)\big) \quad \ldots\ldots\ldots\ldots\ldots (2)$$

is the normalization factor at pixel x. The functions c(·) and s(·) are frequently selected as follows:

$$c(x,y) = \exp\left(\frac{-\|x-y\|_2^2}{2\sigma_c^2}\right) \ldots\ldots\ldots\ldots\ldots (3)$$

$$s(u,v) = \exp\left(\frac{-\|u-v\|_2^2}{2\sigma_s^2}\right) \ldots\ldots\ldots\ldots\ldots (4)$$

The above equations can be further tuned with GLSZM for our proposed method as shown below as

W(n) = c(x,y) + S(u,v) ----------(5)

The emphasizing consideration of the consequent filtering is to do the smoothing as per pixels secure in the space area, as well as close in the ingredient space also, consequently the edge unevenness is saved by staying away from the cross edge leveling. Consequent filtering is definitely acknowledged with other edge preservation strategies, for consideration, versatile smoothing and nonlinear scattering.

B. *GLSZM*

The gray level size zone matrix (SZM) is the preliminary point of Thibault matrices. It is a progressive statistical matrix used for texture classification. For a texture image **f** with **N** gray levels, it is represented by $\mathbf{GS_f}$ and delivers a statistical demonstration by the approximation of a bivariate provisional probability compactness purpose of the image distribution standards. It is considered according to the revolutionary run length matrix principle (RLM): the worth of the matrix $\mathbf{GS_f(S_n,g_m)}$is identical to the numeral of zones of size$\mathbf{S_n}$ and of gray level $\mathbf{g_m}$. The resultant matrix has an unchanging number of lines equivalent to N, the number of gray levels, and a forceful number of columns, unwavering by the size of the principal zone as well as the size quantization. The more standardized the consistency, the wider and flatter the matrix. SZM does not essential computation in several directions, different to RLM and co-occurrence matrix (COM). Conversely, it has been empirically demonstrated that the degree of gray level quantization motionless has a significant impact on the texture cataloging performance. For an all-purpose application it is frequently required to test numerous gray-level quantization to discover the finest one with respect to a one of the training dataset.

1	2	3	4
1	3	4	4
3	2	2	2
4	1	4	1

Level	Size zone, s		
g	1	2	3
1	2	1	0
2	1	0	1
3	0	0	1
4	2	0	1

Figure 3. Example of the GLSZM filling for an image texture of size 4 × 4 with 4 gray levels.

C. *Architecture of NN*

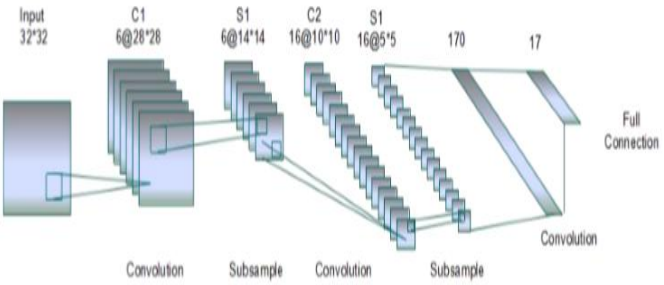

Figure 4. Preprocessing Technique

In view of the 32 × 32input after the techniques of pre-processing, there is a total of 17 dissimilar images. C1 layer for intricacy, convolution layer implements.

D. *NN Algorithm*

(i) Forward pass

Output of neuron of row k, column y in the lth convolution layer and kth characteristic pattern：

$$O_{x,y}^{(l,k)} = \tanh\Big(\sum_{t=0}^{f-1}\sum_{r=0}^{k_h}\sum_{c=0}^{k_w} W_{(r,c)}^{(k,t)} O_{(x+r,x+c)}^{(l-1,t)} + Bias^{(l,k)} \Big) \dots\dots\dots (5)$$

Where,

f is the number of difficulty cores in a feature pattern.

Output of neuron of row x, column y in the lth subsample layer and kth feature pattern:

$$O_{x,y}^{(l,k)} = tanh\Big(W^{(k)}\sum_{r=0}^{S_k}\sum_{c=0}^{S_k} O_{(x\times S_h+r,\ y\times S_w+c)}^{(l-1,k)} + Bias^{(l,k)}\Big) \dots\dots\dots (6)$$

The output of the jth neuron in lth hide layer H:

$$O_{(i,j)} = \tanh\Big(\sum_{k=0}^{s-1}\sum_{x=0}^{S_h}\sum_{y=0}^{S_w} W_{(x,y)}^{(j,k)} O_{(x,y)}^{(l-1,t)} + Bias^{(l,j)}\Big) \dots\dots\dots (7)$$

Where,

S is the number of feature patterns in sample layer.

Output of the ith neuron lth output layer F

$$O_{(i,j)} = \tanh\Big(\sum_{j=0}^{H} O_{(l-1,j)}\, W_{(i,j)}^{l} + Bias^{(l,j)}\Big) \dots\dots\dots (8)$$

VII. RESULTS AND DISCUSSION

Input Image

Figure 5. Input Image

Filtering Process

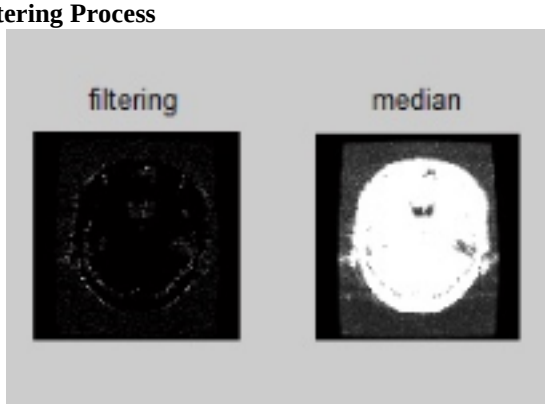

Figure 6. Input Image after Filtering Process

Watershed Segmentation

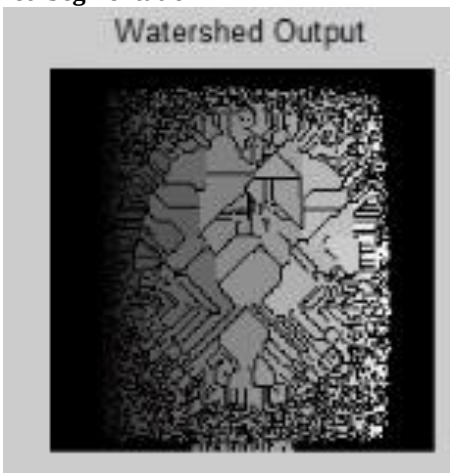

Figure 7. Input Image after Watershed Segmentation

Output Image
Identified Tumor Part

Figure 8. Output Image Identified Tumor Part

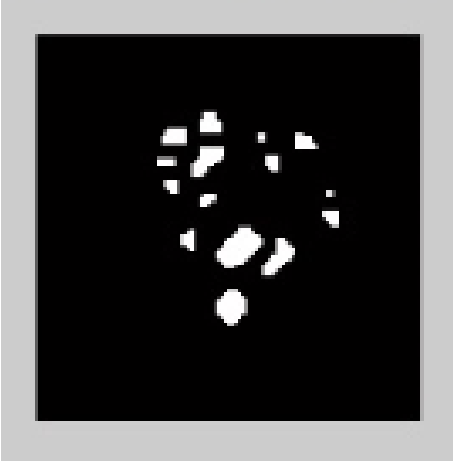

Figure 9. Identified Tumor Part Output

Figure 10. Help Dialog

VIII. CONCUSION

In this paper, we have proposed technique of pre-processing and post processing technique utilizing with the bilateral filtering allied with neural network based on GLSZM characteristic mining and segmenting to remove the noise segmental areas and classifies the human brain images by expressing for longitudinal features in sequence information. The conclusions are accessible as segmented image descriptions and categorization are considered by using advanced neural network algorithm.

REFERENCES

1. He and I. R. Greenshields, (2009), "A nonlocal maximum likelihood estimation method for Rician noise reduction in MR images," IEEE Trans. Med. Image., vol. 28, no. 2, pp. 165-172, 2009.
2. S. Damodharan and D. Raghavan, "Combining tissue segmentation and neural network for brain tumor detection," International Arab Journal of Information Technology, vol. 12, no. 1, pp. 42–52, 2015.
3. M. Alfonse and A.-B. M. Salem, "An automatic classification of brain tumors through MRI using support vector machine," Egyptian Computer Science Journal, vol. 40, pp. 11–21, 2016.
4. Q. Ain, M. A. Jaffar, and T.-S. Choi, "Fuzzy anisotropic diffusion based segmentation and texture based ensemble classification of brain tumor," Applied Soft Computing Journal, vol. 21, pp. 330– 340, 2014.
5. E. Abdel-Maksoud, M. Elmogy, and R. Al-Awadi, "Brain tumor segmentation based on a hybrid clustering technique," Egyptian Informatics Journal, vol. 16, no. 1, pp. 71–81, 2014.
6. Thamarai P., Karthik B., Effect of feature fusion for PF tumor segmentation with modified ams algorithm, Middle - East Journal of Scientific Research, V-20, I-12, 2245-2251, 2014
7. P. Kumar and B. Vijayakumar, "Brain tumour Mr image segmentation and classification using by PCA and RBF kernelbased support vectormachine,"Middle-East Journal of Scientific Research, vol. 23, no. 9, pp. 2106–2116, 2015.
8. S. Damodharan and D. Raghavan, "Combining tissue segmentation and neural network for brain tumor detection," InternationalArab Journal of Information Technology, vol. 12, no. 1, pp. 42–52, 2015.
9. M. Alfonse and A.-B. M. Salem, "An automatic classification of brain tumors through MRI using support vector machine," Egyptian Computer Science Journal, vol. 40, pp. 11–21, 2016.
10. Karthik B., Arulselvi, Noise removal using mixtures of projected gaussian scale mixtures, Middle - East Journal of Scientific Research, V-20, I-12, 2335-2340, 2014
11. Karthik B., Kumar T.K., Dorairangaswamy M.A., Logashanmugam E., Removal of high density salt and pepper noise through modified cascaded filter, Middle - East Journal of Scientific Research, V-20, I-10, 1222-1228, 2014.