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FUSION OF CT AND MRI FOR THE DETECTION OF BRAIN TUMOR BY SWT AND PROBABILISTIC NEURAL NETWORK

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Abstract - *The multimodal medical image fusion is organized to reduce the redundancy while extracting the necessary information from the input images acquired using different medical sensors. In this article the major aim is to yield a single fused image, which could be more useful for clinical analysis. This paper presents fusion framework using Stationary Wavelet Transform (SWT) with neural network classifier for the detection of Brain Tumor. The first stage employs enhance the feature using GLCM and finally the tumor part is segmented by k-means clustering. The performance model provides the result whether it is benign or malignant tumor from the resultant fused image and also gives the detailed view of morphological structure of detected tumor part.*

***Key Words*: Medical image fusion, MRI, CT, SWT, GLCM, PNN.**

1. INTRODUCTION:

The Medical analysis and its applications are extremely challenging and complicated in many versions. By the way, one of the most challenging domain in the medical field is human brain analysis. The manual process by domain specialist is more time consuming task. -Still, there is need for efficient technique. In this article, the MRI and CT images are fused for the detection of brain tumor which provides the way to efficient analysis. Medical image fusion is the process of merging two or more medical images in order to extract efficacious features for medical evaluation. They can more efficiently identify normal and abnormal regions of the human body. The unpredictable cases in medical field mostly comes under in tumor detection. This paper involves the detection of the brain tumor from the fused image. The combination of anomalous cell in brain causes brain tumor. Therefore, from the fused image of MRI and CT, the more detailed information on brain tumor is obtained. Thus, there are various stages in this process such as image pre-processing, fusing of image and clustering for segmentation. Finally, the detected tumor is validated in three parameters like its sensitivity, specificity and accuracy. From the extracted morphological structure of tumor radiologist can easily identify its location, shape, size and its intensity.

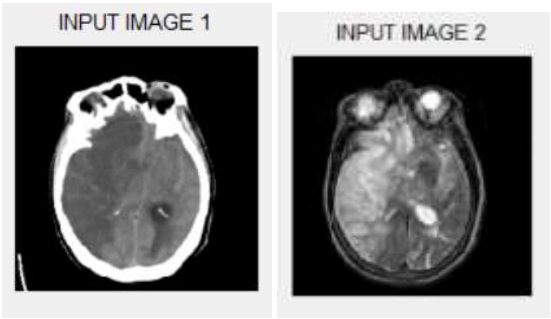


Fig 1 shows input images of CT and MRI

2. OBJECTIVE:

The problem statement mainly involves why do we need image fusion. Image can be fused to reduce the amount of data and also to construct images for better analysis. Usually medical field has various complications in analyzing inner organs. The fusion of scanned images provides the more efficient information rather than the individual scanned images. Therefore, image fusion pave important role for the better analysis and treatment in medical field.

3. EXISTING METHOD:

[1] Principal Component Analysis (PCA)

[2] Discrete Wavelet Transform (DWT)

[3] Dual tree complex discrete wavelet transform (DTDWT) with Non Sub-sampled contourlet transform (NSCT)

[4]Fuzzy C means clustering

Due to averaging method, contrast information loss occurs. By means of discrete wavelet transform spatial distortion is high which leads to limited performance of edge and texture representation.

4. PROPOSED METHOD:

[1]Stationary Wavelet Transform (SWT) is used in the process of fusing the image which has properly of shift invariance and redundancy than the Discrete Wavelet Transform (DWT).

[2]Inverse Stationary Wavelet Transform (ISWT) for the reconstruction of fused image and also reduce storage cost. Thus provides better edges and texture region.

[3]The process of feature extraction is done using gray level co-occurrence matrix (GLCM) algorithm where the parameters such as homogeneity, energy, contrast and correlation. After the feature extraction, the image is segmented using k-means clustering which detects the brain tumor.

[4]Finally, the stages of the brain tumor are classified using PNN Classifier.

5. LITERATURE SURVEY

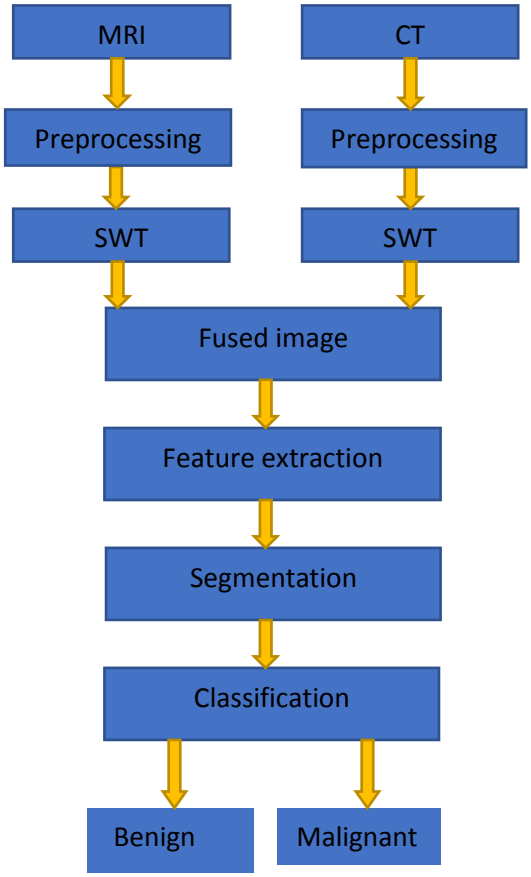
5.1. R Yuqian Li and Xin Liu, Feng Wei, "An Advanced MRI and MRSI data fusion scheme for enhancing unsupervised brain tumor differentiation" Proton Magnetic Resonance Spectroscopic Imaging has shown the great potential in human tumor diagnosis since it provides localized biomedical information on the basis of different tissue types, although it typically has low spatial resolution. Magnetic Resonance Imaging (MRI) is widely used in brain diagnosis as tool due to its high resolution and excellent brain tissue discrimination. This paper presents the advanced data fusion scheme in tumor differentiation and accuracy of MRSI alone. Non-negative Matrix Factorization of the spectral feature vectors from MRSI image data and the image fusion with MRI is completely based on wavelet analysis which are implemented. Hence, it takes advantage of the biomedical tissue discrimination of MRI. The suitability of the resultant frame work is evaluated by comparing the given mean correlation coefficients for the tumor source of 0.97 and Dice score of tumor region overlap of 0.90 for detection of tumor.

5.2. Tian Lan, Zhe Xiao, Yi Li, Yi Ding, Zhiguang Qin, "The Multimodal Medical Image Fusion using the wavelet transform and human vision system". The process of combining the similar information of multiple images to obtain single image of better quality is said to be image fusion. This process is widely used in various applications of image processing such as medical imaging, remote sensing, satellite imaging in design of intelligent robotics etc. This paper presents the review of the literature work by the different authors or researchers to get better quality of single image by using the relevant information from the multiple images. We also discuss about various image fusion techniques such as averaging, PCA with their merits and limitations and drawbacks. Diagnosis using both MRSI and MRI data to improve the tumor detection.

5.3. Ramandeep kaur, Sukhpreet kaur, "An approach for image fusion using PCA and Genetic Algorithm". The pattern of mixing multiple images so as to get a single, developed images are obtained. Various fusion methods have been advanced in the literature. This paper is on image Fusion using PCA and Genetic Algorithm. The images of equal sizes are considered for this procedure. In order to overcome the problems of conventional techniques Genetic Algorithm can be used in association with this technique of PCA (Principal Component Analysis). In Image Fusion, Genetic Algorithm can be used when optimization of features is required. Also, for the optimization of the weight value used. The various parameters are used to measure the ability of image fusion techniques are Mean Square Error, Entropy, Mean, Bit Error Rate, Mean, Peak Signal to Noise Ratio. From the above experiment we find that this method works very well and the quality of the output image is far better than previous methodology.

5.4. Sonia Kuruvilla, J.Anitha , "The Comparision of registered multimodal medical image fusion techniques" Multimodal medical image fusion is an important task to extract an image which provides as much more information of the same organ image at same time and they also helps to reduce the storage capacity of single image. In this paper, observation is done between already available image fusion technique and the proposed multimodal fusion techniques. The proposed method fuses the coefficient based on the selection rule. Processing have been done on three different sets of multimodal medical images of brain. The proposed method is visually and well compared with existing methods. For the comparison of the proposed fusion method three different metrics are used, namely peak signal to noise ratio (PSNR), Entropy and Mutual Information.

6. METHODOLOGY



7. ALGORITHM REQUIREMENTS:

7.1. MEDIAN FILTERING

The important step in image enhancement is denoising the image. Usually, MRI has higher noise property rather than CT. Therefore, median filter is used to denoise. Preprocessing is done for the enhancement of input images for better processing.

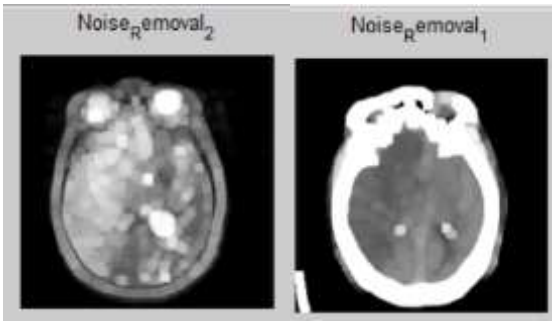


Fig 2 shows noise removed figure using median filter of CT and MRI images respectively.

7.2.STATIONARY WAVELET TRANSFORM (SWT)ALGORITHM

Stationary Wavelet Transform (SWT) is more efficient when compared to tradition Wavelet Transform. The drawback of Wavelet Transform is that, it lacks shift variant property and it is non redundant algorithm. As a result, SWT is selected for this work since it has the property of phase shift and redundancy. Instead of down sampling filter, it applies up-sampling filter operation. Therefore, the size of input images in transform domain does not modify. By its property of multi-scale decomposition, SWT extract small features of sub images in time scales and large features in coarse scales. As the result, the sub images which decomposed acquired most information of source image and therefore SWT said to be trous algorithm thus, SWT work to decompose the important features from source images into different levels by its resolution analysis power. The approximation level represents vertical, horizontal and diagonal coefficient for detail respectively. At last, the images are fused using ISWT algorithm.

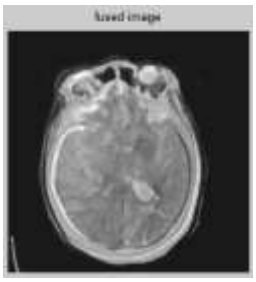


Fig 3 show the fused image of ct and mri after applying swt and iswt algorithm.

7.3. GRAY LEVEL COOCURENCE MATRIX(GLCM)

The gray co matrix function generates the GLCM (Gray level Co-occurrence Matrix) by calculating pixel values with intensity value i occurs in relationship with the pixel value j. By the way, number of intensity values are reduced in gray scale image from 256 to eight. The size of GLCM is determined by number of gray levels. Thus, they provide information about the texture of the image, contrast, homogeneity, correlation and energy. The result gives that the texture features have high discrimination accuracy and have less computation time and hence efficiently used for multimodal image.

7.4. K-MEANS CLUSTERING

The k-means is one of the simplest learning algorithms that solve the clustering problem. This algorithm finds groups in the data, with number of groups represented by variable k.

Data are clustered based on feature similarity. The centroid of k cluster is used to label new data. Each centroid of cluster is collection of feature value. Thus the images are clustered based on similarity features.

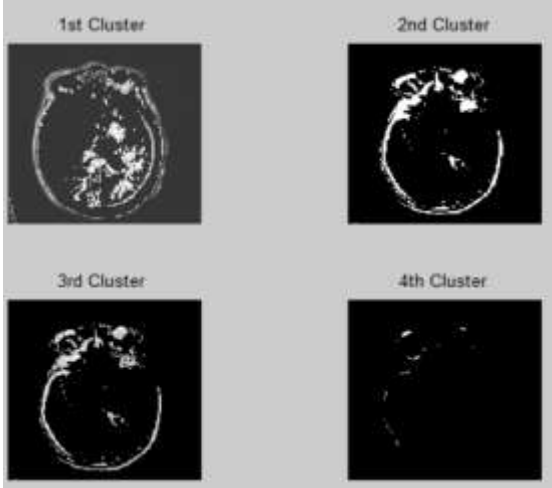


Fig 4 shows clustering stage of fused image.

7.5. PNN ALGORITHM

The probabilistic neural network is the type of Neural Network Classifier which was employed to implement the brain tumor classification. The performance of PNN was evaluated by training performance and classification accuracies. It provides fast and accurate results about severity such as benign or malignant and the classification of the brain tumor.

8. RESULT:

Although there were various fusion techniques for medical analysis, we used this process to produces the efficient outcomes rather than available methods. Thus the fused image of MRI and CT provides more efficient results for the analysis of brain tumor. We revealed the tumor part and its morphological extract efficiently for better tumor diagnosis.

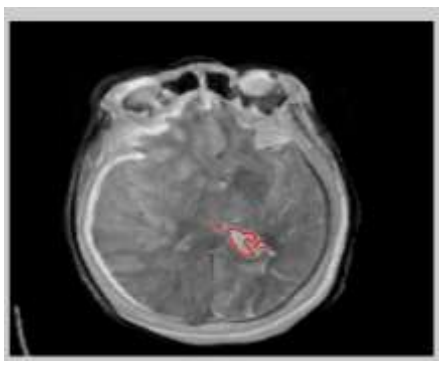


Fig 5 Final output gives detailed view of tumor.

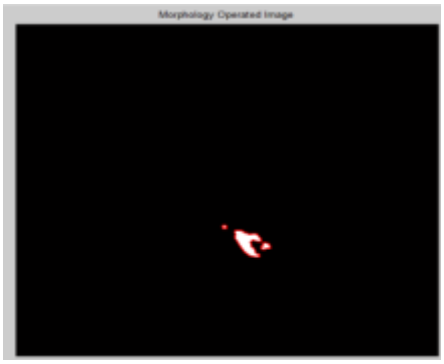


Fig 6 solely shows morphological area of tumor.

9. HARDWARE REQUIRED:

[1]Desktop Pc/laptop
[2]Dual core processor Or Higher
[3]2GB RAM or higher
[4]250GB HDD Space or higher
[5]Hardware RSA Key

10. SOFTWARE TOOLS REQUIRED:

[1]System Software: Win8 x86 or higher version
[2]Application Software: MATLAB version 2014a.

11. CONCLUSION:

Thus, medical image fusion plays a dynamic role in medical imaging application. In this study using MRI and CT images of the brain we segmented brain tumor whether it is benign or malignant. Here we used pre-processing to improve signal-to-noise ratio to eliminate the unwanted noise by median filter. Image fusion technique of CT and MRI can effectively improve the accuracy and give more information than either by only MRI or CT. This fusion MRI and CT can reduce the unpredictability for the detection of brain tumor. Therefore the process can be ultimately used for medical analysis.

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