



## MRI BRAIN IMAGE ENHANCEMENT USING TRANSFER LEARNING AND QUATERNION MATRIX ANALYSIS- A REVIEW

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### ABSTRACT—

This paper provides the information about an effective method for MRI brain image enhancement. The automatic segmentation of brain-tissue has led to the variation in the images due to different scanning and the imaging protocols which makes the image unclear and thus application is hampered. The transfer learning with weighted SVM enables training data to minimize classification errors as the classification scheme needs only a small amount of representative data. Therefore a new optimally standardized method is presented for scanned image segmentation using Transfer Learning with Weighted Support Vector Machine and then further improving the training data quality by Vector Sparse Representation using Iterative Algorithm for Quaternion Matrix Analysis over Reflexive Matrices.

**Keywords**—Transfer Learning, Quaternion Matrix Analysis, Iterative Algorithm

### INTRODUCTION :

The development in the segmentation process in the biomedical imaging field has led to the advancement of the classification scheme in the study of the brain tissue in the last two decades. It has played very crucial role in the medical field for clinical research and development. The automatic

segmentation of the tissue has led to the various development but also poses a challenge due the differences and variations in the scanning protocols and the imaging protocols

The above mentioned situations is avoided by the Transfer learning [1] which provides similarity techniques which can cope with differences in distributions between training and target data, and therefore may improve performance over supervised learning for segmentation across scanners and scan protocols. It enables the training of data sets and labels them for the new method of classification. The transfer learning is enabled by using support vector machine [1], but the transfer learning did not use any fixed protocol and led to over segmentation. Thus the supervised method which uses optimized algorithm is presented. The segmentation of the brain image will be done using watershed segmentation. This method uses fuzzy classification and parameter optimization algorithm. Then the feature extraction will be done with the help of 2DLDA and 2DPCA [5] which enables 2D projection of the brain images. These images will be given as an input into the Weighted SVM, expecting to show consistent performance. This will lead to tissue segmentation in proper manner.

The images still may show some noise and low resolution. Hence there will be need for quaternion matrix analysis [2] using Iterative algorithm on reflexive matrix.

### NECESSITY AND OBJECTIVES

The main objective is to define a standardized method which increases the efficiency and gives an image of better visual quality.

- MRI brain image will be taken as an input to segment.
- Extract features of same image taken as an input.
- Train and label the datasets using Transfer Learning with Weighted Support Vector Machine.
- Use Iterative Algorithm for quaternion matrix analysis to reduce the noise and impaints.

### LITERATURE REVIEW

Annegreet van Opbroek et al [1] presented the use of transfer learning for image segmentation. The use of transfer-learning techniques can deal with the different distribution sources between training and target data and may improve performance over supervised learning for segmentation across scanners and scan protocols. Transfer learning classifiers focuses on storing the knowledge gained and applying it on different distributions with small or limited training data. Four transfer classifiers when compared with standard supervised classification on MRI brain image segmentation better showed better result and outperformed the result.

Ning Li et al [2] proposed an iterative algorithm for solving the quaternion matrix equation over generalized  $(P, Q)$ -reflexive matrices. The sequence  $\{(k)\}$  generated by the introduced algorithm converges to the least Frobenius norm a generalized  $(P, Q)$ -reflexive solution of the quaternion matrix equation when the matrix equation is consistent over generalized and when an appropriate initial iterative matrix is chosen. An optimal approximate generalized  $(P, Q)$ -reflexive solution for a given generalized  $(P, Q)$ -reflexive matrix can be derived using this algorithm.

Yi Xu, et al [3] proposed a model that represents the color image as a quaternion matrix, where a quaternion-based dictionary learning algorithm is presented using the K-quaternion singular value decomposition (QSVD) (generalized K-means clustering for QSVD) method. A sparse basis selection method in quaternion space is conducted that uniformly transforms the images into an orthogonal color space and the inherent color structures are preserved which is a significant property during vector reconstruction. The proposed sparse model is more efficient when compared with the current sparse representation tasks as the lower redundancy between the atoms of different color channels and avoids the hue bias issue successfully.

Sebastien Derivaux, et al [4] proposed a method for supervised segmentation with watershed segmentation using parameter optimization algorithm and genetic algorithm. They proposed this method because while dealing with very high resolution remotely sensed images, the homogeneity of the pixels does not hold any more. Applying a hard classification technique would produce a binary membership map, which is of

limited usage when given as an input to a segmentation algorithm. As applying watershed segmentation on the membership map, it rather needed a more descriptive data representation. Thus reduces the redundant data first by fuzzy classification and then maps those classified data for watershed segmentation. The result obtained gives a better result than other classification method.

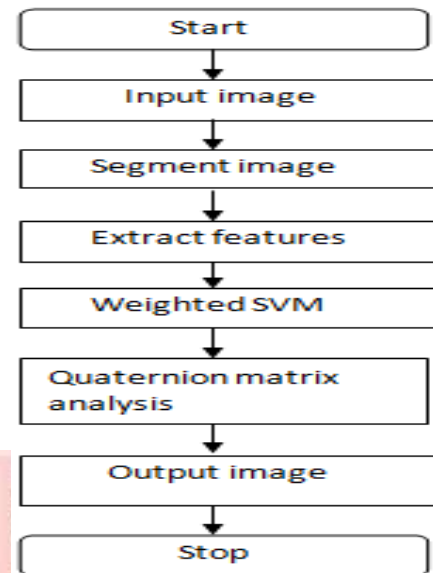
For the purpose of feature extraction, Liwei Wang et al [5] proposed to reduce the computational efforts and the singular possibility in feature extraction so as to overcome the disadvantages while working directly on 2D matrices. It is obtained through vectorization procedure i.e. 2DPCA and 2DLDA. In this discussion the computational effort and the possibility of singularity in feature extraction is significantly reduced. This matrix based 2D algorithm partitions each image into several block and then perform 1D PCA OR LDA on the aggregation of all the image blocks. It facilitates the bilinear projection of the image block and thus provides a better understanding of the 2D feature extraction approaches.

## METHODOLOGY

An MRI brain image from the CT scanner which is hampered will be taken as an input. First the segmentation algorithm will be applied. The images will be more precise due to fuzzy classification. Then the feature extraction will be done. After that the data for training will be given to the Weighted Support Vector Machine and the data will be classified using Transfer Learning. The weighted SVM is the most consistent classifier and gives the accurate results for small samples of data. After the transfer learning the data still

remains noisy, so the quaternion matrix analysis will performed to de-noise the MRI brain image. The Iterative Algorithm will be applied on the image via reflexive matrices.

Data flow diagram



Thus an enhanced image which will be clearer and more efficient for the medical purposes will obtained as an output.

## CONCLUSION

In this paper review of image segmentation, feature extraction, Weighted Support Vector Machine and Iterative Algorithm has been studied. The future work is to increase the efficiency of the system and improve the image quality with the standardized method. The resultant image after the transfer learning and the quaternion matrix analysis is expected to be denoised, super resolute and enhanced.

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