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A Survey on Identification of Multiple Sclerosis Lesions from Brain MRI

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Abstract: Changes in the structure of nerve fibres cause multiple sclerosis (MS). The goal is to characterize patterns in the textures of the lesions in MRI and gauge how their orientations relate to the structure of lesions using new methods. Phase and texture alignment analysis proves to be a new approach for diagnosing such changes in lesions using MRI and thereby improve the condition of patients with MS and similar disorders.

I. INTRODUCTION

MS is an inflammatory disease of the brain and spinal cord caused by the infiltration of inflammatory cells, damage of nerve fibres, and loss of the protective nerve coating: myelin. These MS lesions will cause physical disability and functional impairment, with limited response to many of the current anti-inflammatory therapies. MRI is an ideal radiological tool for the diagnosis of neurological diseases. Image texture can be measured as fine or coarse, regular or irregular, and homogeneous or heterogeneous. Spatial frequency-based measurement methods represent a new trend in texture analysis. One such method is named phase congruency, which identifies the alignment of a structure by detecting its 'edges and corners'.

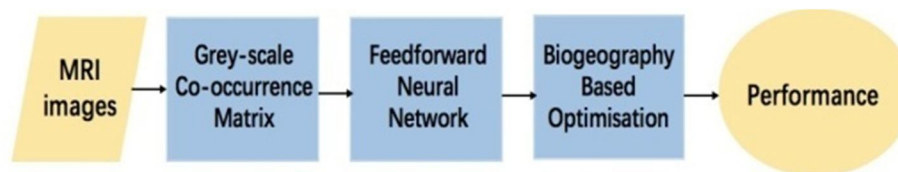
Another method is named polar Stockwell transform (PST), which is a localized, multi-scale spatial-frequency analysis technique. In this study, they used several new orientation metrics of phase congruency and the PST to evaluate the property of brain MS lesions in clinical MRI. They hypothesized that injury in nerve fiber tracts caused changes in the orientation of tissues which would be more severe in focal lesions than in the normal appearing brain tissue.

II. LITERATURE SURVEY

[1]DTI using 3T SCANNER on eighty-four patients and forty-two healthy adults, Georgios Gratsias, Styliani Kogia, Dardiotis performed the MRI studies on the 3T scanner. In conjunction with array spatial sensitivity technique, parallel imaging has been used. DTI were performed on eighty-four patients and forty two healthy adults. The Fractional Anisotropy FA and Apparent Diffusion Coefficient i.e. ADC measurements were procured. The Diffusion Tensor Imaging variables of Normal Appearing White Matter were corresponded with Expanded Disability Status Scales scores. The outcome showed the statistically vital variations in Fractional Anisotropy values and Apparent Diffusion Co-efficient between Multiple Sclerosis scans and the mirror-image NAWM where the Fractional Anisotropy values of Normal Appearing White Matter attenuated and ADC values of Normal Appearing White Matter elevated and also between Normal Appearing White Matter and the respective white matter in controls where Fractional Anisotropy values of Normal Appearing White Matter elevated and ADC values of Normal Appearing White Matter attenuated. The ADC values of the Normal Appearing White Matter corresponded with the EDSS scores. The analysis of micro-structural destruction in Normal Appearing White Matter, by Fractional Anisotropy and Apparent Diffusion Coefficient they provide quantification of the probity of the substantia Alba. Hence, DTI is employed within the diagnosis of destruction of the white matter and conjointly as a prophetic omen of the clinical end results.

[2]S.H. Kima, K. Kwakb, J.W. Hyuna, A. Jounga performed diffusion tensor imaging on 93 patients affected with NMOSD disease, 53 patients with Multiple Sclerosis and 43 HCs with 3T Scanner. The "voxel"-wise statistical analysis was performed on the DTI data. On the note of comparison they found that, the patients with MS illustrated notable higher mean diffusivity, axial diffusivity and radial diffusivity and lower mean global FA within the Normal Appearing White Matter than the patients with NMOSD and HCs.

[3]



Xiaoqing Shen detected MS lesions using magnetic resonance imaging images. Computer Vision algorithms provide an intuitive approach in detection of Multiple Sclerosis lesions. The Grey-Scale co-occurrence matrix, extracts features on Magnetic Resonance Imaging scans using grey-tone spatial distribution. Multi-layered feed forward neural network was used as the supervised classifier. Then, we selected Biogeography-based optimisation rule to train this classifier. The cross validation is employed to achieve sensitivity, accuracy and specificity. The 10 K-fold technique is employed. The statistical results obtained sensitivity as $92.75 \pm 1.31\%$, specificity as $92.76 \pm 1.65\%$ and accuracy as $92.76 \pm 1.43\%$. The efficiency of the classifier once valid against the benchmark algorithms.

[4] Hybrid segmentation, S.P.Washimkar determines the progress detection of MS is by texture analysis done on brain Magnetic Resonance Imaging images. The aim is to ascertain the progressive recognition by employing the segmentation and feature extraction techniques. The primary step in determining MS in progressive state is by using AM-FM segmentation which is 2D Signal processing technique where the images are fragmented into spatially changeable sinusoidal waves and their spatially changeable amplitudes. The second step is saliency map technique that is employed to refine or filter the antecedent obtained image. The third step is by using Fuzzy C which is a data clustering technique where the obtained filtered segmented features are clustered and these clusters are combined to create final segmentation. The fourth step is by using an adaptive repetitive threshold-based algorithm, the lesions are detected from the clustered image using the threshold values. The fifth step is by using feature extraction techniques where the diagnosed features are extracted. The sixth step is by K-NN classifier which is a linear classifier is used to classify the extracted features of fit and pathologic images. To identify progression of MS, K-NN classifier categorize the images into different classes. The experimental results obtained are very effective and provides an accuracy of ninety-seven percentage that aids to determine the accurate detection of extremity of the disease which is progressed within the patient.

[5] Koen Van Leemput, Frederik Maes have overcome the challenge of identifying MS lesions by implementing an automated algorithm. The algorithm performs the segmentation of MS lesions from MRI images. It performs tissue classification for normal brain scan images using a stochastic model whose pattern and parameters cannot be estimated precisely. It is for this reason that the base paper we have chosen serves as a legitimate paper for all our future references towards building this project. The results are compared with the lesions described by experts, showing a high total lesion load (TLL) correlation, with a low spatial correspondence.

[6] Ilona Lipp, Derek K. Jones states that white matter damage is important for analysing the effects of neuroprotective and repair strategies in MS. They have obtained 4 metrics and combining them into one, through a principal component analysis, did not yield a parameter to measure the damage. This indicated that the metrics are correlated with each other, but sensitive to the different aspects of pathology. This is a major drawback for identifying MS lesions. Thus, the chosen base paper serves as a legitimate paper for all our future references in building this project.

[7] Snehshis Roy says the lesion images obtained from magnetic resonance should be further segmented to get a clear image about the status of the disease. Hence, in this paper they have used Convolutional neural network (CNN) for the segmentation of the lesions. The CNN mechanism consists of 2 steps. The first steps consist of filters which filter the MR modalities. In the second step output of the first step is concatenated along with another set of filters being applied on the MR images. The method proposed in this paper was considered accurate as it produced a score of 90.48 in ISBI 2015 challenge. CNN is a simple end to end method to segregate the MS lesions from multi contrast MR images. It takes only few seconds to achieve the agenda.

Disadvantages: There are multiple layers present in this mechanism which causes overfitting of data.

[8] Mostafa Salem states that MRI has various applications in the field of medicine. In this paper they have proposed two input and two output CNN for distinguishing the MS lesions present in the MRI images. The model does not require manual computations as the model is trained end to end. Generation of synthetic lesions on normal images is done and a dataset of MS patients is collected. The synthetic lesions are compared with the actual lesions and they are evaluated on the basis of the similarities between the both of them. The dataset of both are summarized on different tables for ease of use.

[9] Joyce C. H thinks the multiplication of tumour in the human body differs in every individual. The identification of the disease is difficult in the initial stages as the symptoms are similar to other diseases. Once the disease is confirmed the risk factors and progression of the disease should be looked into. The basic agenda of this model is to investigate the data available in the medical records and to create a risk factor model. This makes the doctors work easier. Hence this procedure helps in prediction of the disease in the early stages.

Advantages: It helps to analyse the risk factor of the patient developing MS

[10] Ali Abbasian Ardakani and co-authors, in this paper tell us about, the microscopic tissue changes in Multiple Sclerosis in Normal Appearing White Matter (NAWM) can't be noticed in Magnetic Resonance Image and can be noticed by the human eye as

having the same features of a NWM. The main purpose of the study was to estimate Computer Aided Diagnosis system using the pronounced technique, the Texture Analysis in Magnetic Resonance Images to ameliorate accuracy in recognising minute changes in brain tissue structure. The MRI data considered had fifty Multiple Sclerosis affected subjects and fifty healthy subjects. Fisher method is used for feature reduction, to choose the best among the most effectual features to compare between Multiple Sclerosis, Normal White Matter and Normal Appearing White Matter.

[11] C.P. Loizoua,*, S. Petroudib, I. Seimenisc in this paper tell us about, the detection of subjects diagnosed with “Clinical Isolated Syndrome” (CSI) of the disease Multiple Sclerosis (MS) using Texture Analysis method on brain T2-white matter lesions. This study provides evidences that texture features of T2 Magnetic Resonance Image of brain substantia Alba lesions may have another pivotal role in the clinical evaluation of MRI scans in Multiple Sclerosis and provide some effective terminating evidence in relation to future diagnosed patients. To establish this application in use for medicine and to calculate texture features that provide information for better and earlier recognition between normal brain tissue and MS lesions we need a larger scale of study in this field.

[12]S.M.AliAsmaa Maher, the writer he talks about a diagnosis method that is used to identify the Multiple Sclerosis (MS) lesions among the other brain tissues. This method is new and effective in terms of identifying the lesions. By, conducting many digital image processing we process this identification technique. Initially, the brain MRI scans are converted to a binary format, by implementing this we extract brain tissue it is done by utilizing the threshold value, finding a root point at the centre of the binary MRI scans, then we proceed from the root point radial and we stop at the boundary of the brain material where they have zero values. By multiplying the remaining binary spots which have values one by the initial image we can find the isolating brain substance. We perform Image edge detection which based on the Convolution with Laplacian-Gaussian operation, to identify the closed borders of brain which include the lesion areas as well.

[13]Shui-Hua Wang and the co-authors tell us about the early detection of Multiple Sclerosis (MS) disease, the author came up with a method for the hardware of MRI scans, and on software for the three more successful techniques namely : Biorthogonal Wavelet Transform(BWT), Kernel Principal Component Analysis and Logistic Regression. There were 676 Magnetic Resonance scans from 38 Multiple Sclerosis affected patients, and 880 Magnetic Resonance scans from 34 unaffected healthy subjects. The statistical analysis showed that, the method used is superior to five state-of-the-art approaches in Multiple Sclerosis detection.

[14]Micheline Kamber and Rajjan Shinghal, the authors talk about: the use of brain tissue model for the segmentation of multiple sclerosis (MS) lesions in MRI scans of brain, and 2) A Significant study on comparison of statistical performance and decision tree classifiers, on Multiple Sclerosis lesion division. The MRI scans obtained from healthy subjects, the scans provided advance information of brain tissue distribution per unit “voxel” in a standard 3-D model called as the “brain space.”

[15]B. Johnston and co-authors, tell us that, to divide tissues in magnetic resonance images (MRI) of the brain, they have implemented a method which utilizes partial volume analysis for each and every brain voxel present, and operates on complete three-dimensional (3-D) data. To improve lesion breakdown they have extended the method of stochastic relaxation by pre- and post-processing the MRI scans. The pre-processing involves image intensify using homomorphic filtering to correct for non-homogeneities in the coil and magnet. The post-processing step involves application of morphological processing and threshold techniques to the discrete segmentation for developing a masked image containing only WM and MS lesions. This masked image is then segmented by again applying the s-relaxation technique which is implemented by the authors.

III. CONCLUSION

The formation of lesions in MRI indicates transformations in the structure of nerve fibres. Such changes in the microscopic scale can be reflected and detected in the alignment and angularity of MRI texture. Measurement of weighted mean phase and angular texture spectra may be a valuable new approach for detecting these subtle structural changes. This would be important for not only improving our understanding of disease evolution, but also for assessing lesion repair in the future by characterizing such changes in the alignment property of lesion voxels.

REFERENCES

- [1] A quantitative evaluation of damage in normal appearing white matter in patients with multiple sclerosis using diffusion tensor MR imaging at 3 T Georgios Gratsias • eftychiakapsalaki • stylianikogia •efthimiosdardiotis•vaiatsimourtou •eleftherioslavdas •evanthiakousi •aimiliapelekanou •Georgios M.Hadjigeorgiou • ioannisfezoulidis
- [2] Diffusion tensor imaging of normal-appearing white matter in patients with neuromyelitis optica spectrum disorder and multiple sclerosis S.-H. Kima,*, K. Kwakb,*, J.-W. Hyuna , A. Jouna , S. H. Leec , Y.-H. Choib , J.-M. Leeb and H. J. Kima
- [3] Qinghua Zhou, Xiaoqing Shen (Corresponding Author) for Multiple sclerosis identification by grey-level co-occurrence matrix and biogeography-based optimization



- [4] S.P.washimkars.D.chedeprediction of Multiple Sclerosis in Brain MRI Images using Hybrid Segmentation.
- [5] Automated Segmentation of Multiple Sclerosis Lesions by Model Outlier Detection Koen Van Leemput*, Frederik Maes, Dirk Vandermeulen, Alan Colchester, and Paul Suetens
- [6] Comparing MRI metrics to quantify white matter microstructural damage in multiple sclerosis Ilona Lipp, Derek K. Jones, Sonya Bells, Eleonora Sgarlata, Catherine Foster, Rachael Stickland, Alison E. Davidson, Emma C.Tallantyre, Neil P. Robertson, Richard G. Wise, Valentina Tomassini
- [7] Multiple Sclerosis Lesion Segmentation from Brain MRI via Fully Convolutional Neural Networks Snehashisroya,*, John A. Butmana,b, Daniel S. Reichb,c,d, Peter A. Calabresid, Dzung L. Phama
- [8] Multiple Sclerosis Lesion Synthesis in MRI Using an Encoder-Decoder u-net Mostafa Salem 1,2, Sergi Valverde1, Mariano Cabezas1, Deborah Pareto3, Arnau Oliver1, Joaquim Salvi1, Alex Rovira3 and Xavier Iladó1
- [9] Risk Prediction of a Multiple Sclerosis Diagnosis, Joyce C. Ho, Joydeep Ghosh, K.P. Unnikrishnan
- [10] Application of Texture Analysis in Diagnosis of Multiple Sclerosis bymagnetic Resonance imagingali abbasianardakani1 , Akbar Gharbali 2 , yaldasaniei 3 , arashmosarrezaii 4 & surenanazarbaghi 5
- [11] Quantitative texture analysis of brain white Matter lesions derived from T2-weighted MR images in MS patients with clinically isolated syndrome, C.P. Loizoua,*, S. Petroudib, I. Seimenisc, M. Pantziarisd, C.S. Pattichisb
- [12] Multiple Sclerosis Lesions Identification Technique Using MR Images, S.M. aliasmaa Maher
- [13] Multiple Sclerosis Detection Based on Biorthogonal Wavelet Transform, RBF Kernel Principal Component Analysis, and Logistic Regression Shui-Hua Wang, Tian-Ming Zhan, Yi chen, Yin Zhang, Ming Yang, Hui-Min lu, Hi-Nan Wang, Bin Liu, and Preetha Phillips
- [14] Model-Based 3-D Segmentation of Multiply Sclerosis lesions in Magnetic Brain Images, Micheline Kamber, rajjanshinghal
- [15] Segmentation of Multiple Sclerosis Lesions in Intensity Corrected Multispectral MRI, B. Johnston, M. S. Atkin



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