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An Sofm Classifier for Improved Convergence for Detection of Picks Syndrome Using Wavelet Transforms

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Abstract: This research addresses the problem of detection of brain images into corresponding diseased and Non-Diseased Picks syndrome types for functional Magnetic Resonance Images. The images differs with capturing intensity and noise content formed during motion capturing. A Daubechies Wavelet Transform, acting as a smoothening filter, was applied playing a dual role in denoising and extraction of feature components. A modified median filter removes the random noises better. A fourth level order level of Daubechies Discrete Wavelet decomposition was used for feature vector formation. The approximated sub-band images were chosen from the input images to train the network. A Self-Organizing Feature Map technique was involved in designing a network using a competitve neural network as a sub-class to classify the normal and abnormal image type into corresponding diseased and non-disease types. On comparing to the earlier implemented competitve network, the trained network using using Linear Vector Quantization was efficient for classification.

Key words: Pick's disease-PD · Artificial Neural Network-ANN · Discrete Wavelet Transform-DWT · Daubechies Wavelet-DW · Self -Organized Feature Maps-SOFM · Functional Magnetic Resonance Image- fMRI

INTRODUCTION

Brain Properties and Pick's Disease

Picks Disease: Pick's disease is one form of frontotemporal dementia (FTD). FTDs are a group of rare brain disorders that affects primarily the frontal and temporal lobes of the brain, which controls speech and personality. Pick's disease is a rare form of dementia which accounts for about 5% of all dementia types. The clinical picture is fairly similar to Alzheimer's but differences can be detected at autopsy. In Pick's disease, affected areas of the brain contain abnormal brain cells called Pick's bodies. The cause isn't known. FTD's often show personality changes first. They may become more impulsive and uninhibited, causing them to be socially inappropriate, to make poor decisions, can lose language skills as the disease progresses, marked shrinkage called atrophy of the frontal lobes of the brain, increased interest in sex, change in sexual behavior, rudeness, impatience, aggressiveness, inappropriate remarks in public, linked to loss of inhibition-disturbing, mood changes, often biased towards euphoria, disinhibition and deterioration in social skills, may become extrovert or withdrawn, gross over eating or increased alcohol intake, have difficulty in maintaining a line of thought, be easily distracted, difficulty in maintaining a conversation for any length of time, may compulsively put objects in their mouth, tend to be memory impairment and the behaviour becomes more bizzare [1].

Diagnosis and Treatment of Pick's Disease: A psychologist can help establish the type of dementia. At present time, there are no drugs available that cure or help Pick's disease. Drugs can be helpful to try or deal with some of the more disturbing behavior that can occur [2]. Good nursing, caregiver skills, occupation activities and support groups have to help to manage this type of dementia. It is important that families of people with

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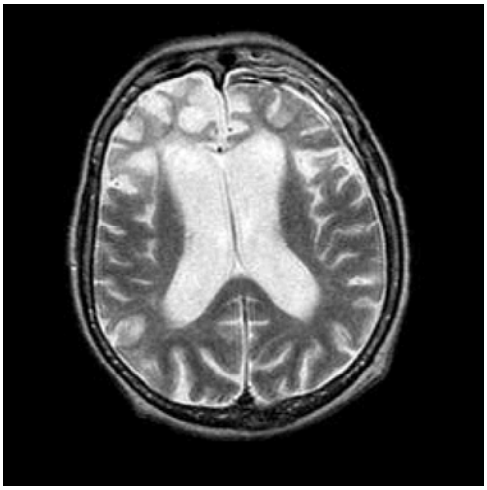

Fig 1: T2 Weighted fMRI Brain Image.

Fig 2: T1 Weighted fMRI Brain Image.

Pick's disease get as much support to help them cope. Prognosis in Pick's Disease, sadly someone with Pick's disease will show a progressive decline in their abilities [3]. The length of progression varies in individuals from less than 2 years.

Image Pre-preprocessing

Pre-Processing

Gray Level Conversion: The images are in jpeg format while assessing the sets. They need to be converted into a gray scale image inorder to operate with the wavelet domain. To operate with the co-efficeints, they need to be converted into gray scale images. The fMRI images normally consists of white and black pixels along with Gaussian noise and random noises. These base images used for training the network and the corresponding testing image sets were converted into gray scale images before subjecting to wavelet decomposition [4].

Thresholding: Thresholding is a method of segmentation, where a threshold point setup progressess in an iterative method. The method is known as Global Thresholding [4]. There are some parts of the image which doesn't play an active part which are removed by thresholding. This process removes some amount of noises in general. The entire images are converted into white and black pixel images [5].

Median Filter: A median filter is similar to an averaging filter. Every output pixel is set to an average of the pixel values in the neighbourhood of the corresponding input pixel. In a median filter, the value of the output pixel is obtained by calculating the median of the neighbourhood pixels. But in an average filter, mean is taken instead of the median. The median filter is less sensitive than the mean of the extreme values. The noise does not get integrated or merged with that of the image before it is smoothened. This reveals that median filter gives a better resolution without disturbing the sharpness of the image. A median filter is applied before wavelet decomposition. This removes the noise content present in the image sets assesed for training and testing [6].

Wavelet Transform: Wavelet Transform Theory can be applied with other techniques like vector quantizations or multiscale. Wavelets had been chosen depending upon the ability to analyze the signal on particular applications. A wavelet transform normally removes a gaussian noise. The discrete cosine and sines are not localized whereas the Wavelet Transforms are localized in space. Even a smallest point or feature or information gets tapped or localized in space in a Discrete Wavelet Transform [7]. The extraction of features also gets eased enough with the use of wavelets. The important characteristic of wavelets is the production of ripples [3, 8].

Discrete Wavelet Transform: The most interesting characteristic of Wavelet Transform is that the wavelets are localized in space. An image consists of a number of pixels which is subjected to DWT. DWT's are applied to two dimensions of n = 2^k number of elements. The images obtained were of the order of 2^n of 256 by 256 matrix. Wavelet Decomposition is performed until a suitable level, for carrying out too many levels of wavelet

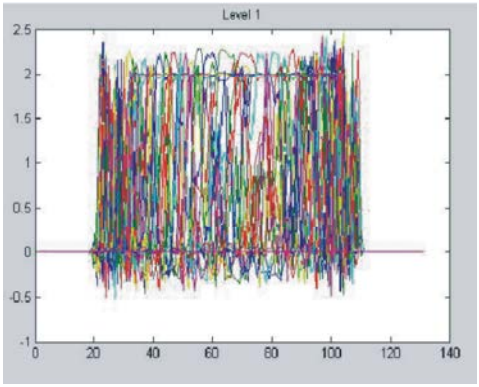

Fig 3: Level-I Wavelet Decomposition.

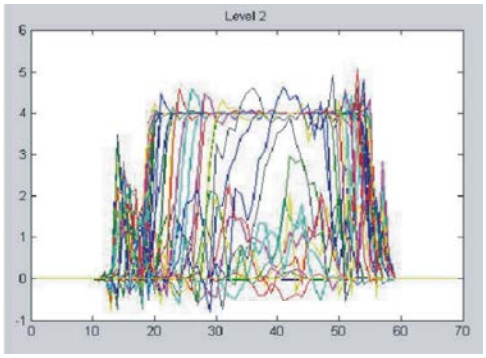

Fig 4: Level-II Wavelet Decomposition.

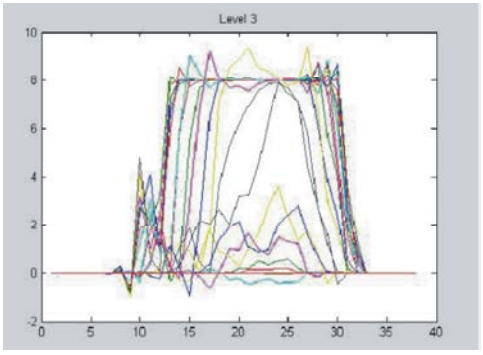

Fig 5: Level-III Wavelet Decomposition.

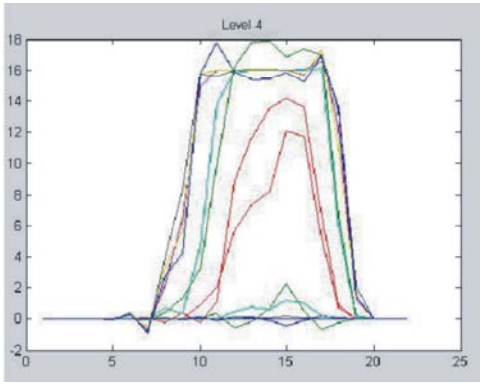

Fig 6: Level-IV Wavelet Decomposition.

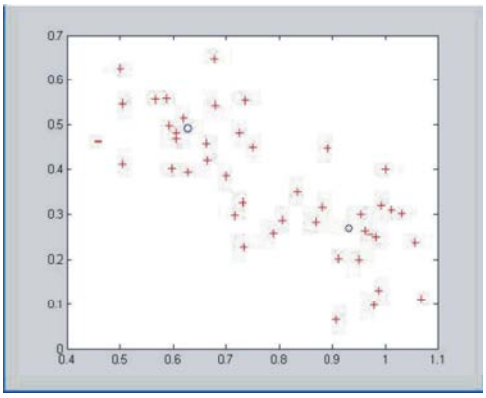

Fig 7:

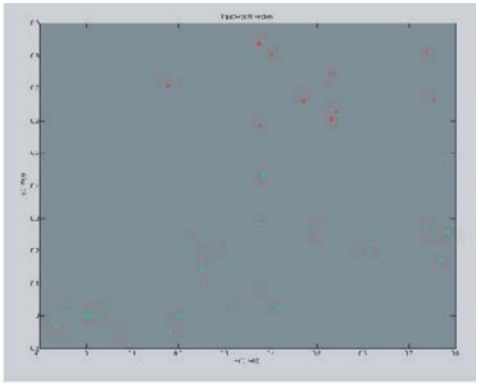

Fig 8:

decomposition will make the original features lost. A desired optimum level of wavelet decomposition needs to carried out. The number of co-efficients were obtained from fourth order level. There were twenty two valuable co-efficient values. They were obtained as a result of the Wavelet decomposition obtained from the approximated sub-band images [7-9].

Wavelet Selection: The choice of the mother wavelet depends on the application and the prototype of the type of image selected. The noise content of the image needs to be considered. 'Daubechies Wavelet' of order 4 is applied. The fourth order level was compact. This wavelet type perfoms better comparing other wavelet types [8-10].

Feature Vector-approximate Subband Image: The feature vector was framed out of the twenty two co-efficients obtained from the approximated sub- band images. The approximated sub-band images contains most of the information details of the image. A fourth order level of approximated sub-band image was chosen, which was compact enough to handle the vector while training [11].

Neural Network: Artificial Neural Networks are biologically inspired imposed elementary model performing the function of a biological neuron. A neural network normally performs the functions of classification, approximation and signal processing [12].

Self-Organized Maps: SOM training gives invaluable favours in research. It gives good results even in the presence of noise. Unsupervised learning is far more plausible model of learning in the biological systems. On comaparing, Supervised Learning Techniques are implausible. A target vector has been specified in Supervised Learning whereas it is not in Self-Organized Maps. A teaching process is involved by giving a target vector to make it Supervised. The target vector is got from the competitive learning trained network. The target vector fed to SOFM was obtained competitive learning output used as a sub-class.

Self-Organized Feature Maps (SOFM): One characteristic of SOFM is the production of a vector quantizer. There will be a larger neighbourhood in the beginning of the training which helps us to escape local minima of the minimized function and updation of several vectors. During each training sample, the absence of bias speeds up convergence rate and convergence of minimization. [10, 13].

RESULTS AND DISCUSSION

Experimentation Results

Total	Normal	Abnormal	Classified	Mis-Classified	Accuracy
20	20	0	20	0	100
25	23	2	20	5	80
30	25	5	27	3	90

DISCUSSION

Though a median filter is used and the Daubechies Wavelet Transform performing good, it acts as a smoothening filter which leads to the smoothening of the image. There is a possibility of valuable information getting lost. This needs to be resolved.

CONCLUSION

The efficiency can be estimated from the type of patterns that can be input from the images. The efficiency gets enhanced using the Linear Vector Quantization. The network was used up as a base model for future purpose like 3D implementation, volumetric segmentation, determining the volume and for differentiting the difference between Picks disease and Alzheimers Disease [12, 14, 15].

REFERENCES

1. Yan Li and Zheru Chi, 2005. MR Brain Image Segmentation based on Self-Organizing Map Network, International Journal of Information Technology, 11: 8.
2. Udayakumar, R., V. Khanaa and K.P. Kaliyamurthie 2013. Optical Ring Architecture Performance Evaluation using ordinary receiver, Indian Journal of Science and Technology, ISSN: 0974-6846, 6(6): 4742-4747.
3. Jianxun Zhang, Quanli Liu and Zuang Chen, 2013. A Medical Image Segmentation based on SOM and Wavelet Transforms, Journal of Communication and Computer, volume 2, No.5, May2005. T. Saravanan, V. Srinivasan and R. Udayakumar, A Approach for Visualization of Atherosclerosis in Coronary Artery, Middle-East Journal of Scientific Research, ISSN:1990-9233, 18(12): 1713-1717.
4. James, S., Walker and Eau Claire Wisconsin, A primer 2000. on Wavelets and their scientific Applications, Edition.
5. Emmanuelle FRENOUX, Vincent BARRA, Jean-Yves, 2001. BOIRE. Segmentation of the striatum using data fusion, In proceedings-23 Annual conference IEEE/ EMBS Oct 25-28, Istanbul, TURKEY.
6. Yong Fan, Tianzi Jiang and David J. Evans, 2002. Volumetric Segmentation of Brain Images Using Parallel Genetic Algorithms, IEEE Transactions on Medical Imaging, 21: 8.
7. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. Detection of Material hardness using tactile sensor, Middle-East Journal of Scientific Research, ISSN:1990-9233, 15(12): 1713-1718.
8. Gonzales, R.C. and R.E Woods, 2003. Digital Image Processing, Second Edition Pearson Education.
9. Arne Jensen and Anders la Cour-Harbo, 2001. Ripples in Mathematics: The Discrete Wavelet Transform, Springer, Edition.
10. Matsumae, M., R. Kikinis, I.A. Morcoz, A. Lorenzo, M. Albert, P.M.c. Black, A. Ferenc and F. Jolesz, 1996. Intracranial compartment volumes in patients with enlarged ventricles assessed by MRI based image processing. Journal of Neurosurgery, 84: 972-981.

11. Matsumae, M., R. Kikinis, I.A. Morcocz, A. Lorenzo, T. Sandor, M. Albert, P.M.c. Black, F. Jolesz, 1996. Age-related changes in intracranial compartment volumes in normal adults assessed by Magnetic Resonance Imaging. Journal of Neurosurgery, 84: 982-99.
12. Saravanan, T., G. Saritha and R. Udayakumar, 2013. A Robust H-Infinity Two Degree of Freedom Control for Electro Magnetic Suspension System, Middle-East Journal of Scientific Research, ISSN:1990-9233, 18(12): 1827-1831.
13. Robi Pollikar, 0000. A Wavelet Tutorial Part I, "Fundamental Concepts and an Overview of Wavelet Theory", Second Edition.
14. Thooyamani, K.P., V. Khanaa and R. Udayakumar, 2013. Blue tooth broad casting server, Middle-East Journal of Scientific Research, ISSN: 1990-9233, 15(12): 1707-1712.
15. Warfield, S., Dengler, J. Zaers, C.R.G. Cutmann, W.M. Wells III, G.J. Ettinger, J. Hiller and R. Kikinis, 1995. Automatic identification of grey matter structures from MRI to improve the segmentation of white matter lesions. Journal of Images Guided Surgery, 1: 326-338.