COLLECTIVE ELECTRO ENCEPHALO GRAPH SIGNALS BY MEANS OF WAVELET TRANSFORMS

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Abstract : This examination portrays the utilization of back spread Neural Network as an order and Discrete Wavelet Transformation for highlight extraction by taking vitality esteems on each sub-band of the Electro Encephalo Graph (EEG) signal wave. The reason for this examination was to distinguish the EEG signal utilized in the cursor development. The point of this investigation was to give new correspondence and control alternatives for individuals with serious engine inability. The information utilized are EEG information got from BCI rivalry 2003 (BCI Competition 2003). This information contains class 0 information (for upward cursor development) and class 1 (for descending cursor development). Dynamic is done in two phases. In the principal organize, the vitality esteems in each discrete wavelet sub-band are utilized to extricate highlights of the EEG signal information. This element is as the contribution on back engendering Neural Network. The subsequent stage is distinguishing process into two classes (class 0 and class 1) of EEG signal information records. There are 260 preparing information records of EEG signs and 293 of the EEG signal information document testing, so the all-out is 553 information records of EEG signals.

Keywords: BCI, Wavelet Transform, EEG, DWT.

I. INTRODUCTION

To move a cursor on the PC screen, somebody typically needs a console or mouse to run it. This is preposterous with somebody who doesn't have a hand or somebody who can move his hand. At first, it might be simply unrealistic reasoning, notwithstanding, the innovative and progressive thoughts of specialists both neighborhood and outside ones to have the option to move the cursor without utilizing the hands consistently show up.

Hans Berger was a German analyst, in 1929 he guaranteed the presence of a feeble electrical flows produced by the account of the cerebrum without opening the mind. The aftereffects of cerebrum recording can be painted on a paper. He named the mind recording with Electroencephalography (EEG), so it can associate the cerebrum and the article, which is being constrained by the idea by utilizing a device called Brain Computer Interface (BCI). BCI is a framework that can break down and procure neural signs to make a correspondence channel between the PC and the mind. BCI can be molded into frameworks gave by human muscles [1]. With BCI, somebody can make an order to an electronic gadget utilizing the cerebrum [2]. Playing a straightforward game should likewise be possible with BCI a by framework [3].

A few investigations take tests of information dependent on informational collections from BCI Competition 2003 - Data Set It (EEG signal information to move the cursor all over constrained by the human brain). Among them were Mensh, BD, Werfel, J, Seung, HS, in 2004. Their information comprised of four channels and four highlights (two of the normal of the SPC and two of the gamma band power). The aftereffects of the characterization procedure were 88.7% [4].

Consequent research was by Wang et al. [5] in 2005. Analysts utilized two channels and four highlights by joining moderate cortical possibilities (SCPs) and wavelet bundle changes. The aftereffects of the order procedure is 91.47% [5]. Different specialists were Ting et al. [6] in 2007, in which, the exploration they led were utilizing six channels and took seventeen highlights with neural system as a characterization procedure.

The aftereffect of the order procedure is 90.80% [6]. In 2005, Sun and Zhang[7] utilized the 2003 challenge examine information utilizing six highlights and utilized seven highlights, to be specific RMS, phantom centroid, transmission capacity, zero intersection rate, otherworldly move off recurrence, band vitality proportion and delta range size with Bayesian as a characterization procedure. The aftereffect of the arrangement procedure is 90.44% [7]. In 2010, Kayikcioglu and Aydemir [8], what's more, utilized BCI 2003 challenge information utilizing one (channel 1) as exploratory information and took 2 highlights utilizing polynomial fitting technique by taking element of h worth and b coefficient with KNN as the characterization procedure. The consequence of the arrangement procedure is 92.15% [8].

Prochazka et al. [9] exhibited the division for EEG signal and broke down utilizing symphonious wavelet change with the EEG signal element extraction utilizing the wavelet technique. Numerous analysts utilized the wavelet technique for EEG signal element extraction. Hence, there is an element for a size of 1, 2 and 3, which incorporates three recurrence groups with various time sizes of goals [9]. Breaking down EEG signal chronicle against epileptic patients utilizing wavelet change [10] is finished by taking the estimation of the base, most extreme, normal and middle of wavelet changes for highlight extraction of EEG signals against the epilepsy illness [11].

This examination introduced another methodology dependent on Artificial Neural Networks (ANN). This can be utilized for ordering cursor developments. The sign preparing strategy utilizing the Wavelet highlight presents Transform EEG signs to move the cursor up or down on the PC screen while (simultaneously) the SCP is recorded. ANN are utilized to order cursor developments when vitality as highlights recovered from a sub-band Wavelet Transform is utilized as information.

2. SYSTEM RESOURCES

This examination utilized EEG signal dataset, which was taken from the BCI 2003 challenge information. Six EEG channels were utilized and recorded from a sound subject. At that point, in regards to testing rate, we utilized 256 Hz with a chronicle time of each 3.5 second. Each investigation was done in each channel containing 896 examples. Subjects were tried to envision about the moving cursor up or down on the PC screen while (simultaneously) the SCP was recorded. At that point, subjects got a visual criticism from SCPs as input stages. For the examination, we partitioned the dataset into preparing (containing 268 tests) and preliminaries (containing 293 analyses). This analysis was done dependent on BCI 2003 Ia in writing [12-15].

2.1 Wavelet transform

The Wavelet hypothesis brings an incorporated structure for various systems created for different sign preparing applications. Specifically, it is intriguing for non-stationary sign examination, for example, EEG, as it gives an option in contrast to the great brief timeframe Fourier Transform (STFT) or Gabor change. The principal contrast is that, not at all like STFT, which utilizes a solitary investigation window, Wavelet Transform (WT) utilizes short windows at high frequencies and long windows at lower frequencies. This is like "Consistent Q" or the general transfer speed of the regular data transmission [12, 13].

2.2 Discrete Wavelet Transform

Stationary signs are signals that don't change a lot after some time. In signal handling, all stationary can utilize Fourier Transform technique. Be that as it may, EEG has numerous signs. EEG signs can contain non-stationary signs. Along these lines, the Fourier change isn't perfect to apply for EEG signal. To defeat this, the wavelet strategy can be utilized. In wavelet investigation, the sign identifying with various testing capacities can be utilized. This investigation prompts a definitive condition for persistent wavelet change (CWT):

$$W(a,b) = \int_{-\sim}^{\sim} x(t)\frac{1}{\sqrt{a}}\psi\left(\frac{t-b}{a}\right)dt$$

symbol b is utilized in x (t) and the activity variable to shift the time size of the examining capacity is ψ. In the event that it is bigger than one, the estimation of wavelet work (ψ) can be pulled back consistently and on the off chance that it isn't littler than one (be that as it may, in any case positive) contact work. The testing capacity can be one of the few unique capacities. Also, the oscillatory structure is constantly taken with the expression "wavelet". Complex conjugation activity, and standardization factor 1/√|a| guaranteeing a similar vitality for each of the a qualities. In applications requiring respective changes, the change creates the base number of required coefficients precisely.

Discrete Wavelet Transforms (DWT) accomplish this financially by restricting varieties in scale and interpretation, as a rule to control 2. Generally for signal preparing and picture applications, DWT-based investigation is best depicted as a channel bank. The utilization of a gathering of channels to separate the sign into different ghastly parts is called sub-band coding. This method is named the multi-goals deterioration of the sign x [n]. The principal channels h [.] is the discrete, high-go in nature. What's more, the second channels g [.] is an intelligent, low-in-nature adaptation. The base yield of the example from the principal high-pass and low-pass channels gives detail, roughly A1 and separately D1 [10, 14].

By utilizing DWT, the correct wavelet choice and number of decay levels are significant in signal investigation. The prevailing recurrence part of the sign is utilized to choose the quantity of deterioration levels. The disintegration rate is picked so segments of the sign are corresponded well with the recurrence required for signal order to be kept up in the wavelet coefficients. The quantity of levels is picked to be 5 on the grounds that the EEG signal has no valuable recurrence segments over 30 Hz.

Along these lines, the sign is disintegrated into subtleties D1-D5 and one final methodology, A5. These nitty gritty gauges and records are recreated from the Daubechies 4 (DB4) wavelet channel [15, 16]. The separated wavelet coefficient gives a compact portrayal demonstrating the circulation of EEG signal vitality in time and recurrence. To additionally diminish the components of the separated element vector, the EEG signal trademark extraction is acquired by deteriorating the sign up to 5 levels utilizing discrete wavelet changes. The wavelet work utilized is db4. Representation of deterioration of a 5-degree EEG signal with a 256 Hz snap recurrence is appeared in Fig. 2. Every EEG signal is deteriorated up to 5 levels to acquire point by point signals D1, D2, D3, D4, and D5 and estimate signals A5. The normal disintegration vitality of the point by point signal per sub-band is determined by Eq. (2):

$$E_{Di} = \sum \frac{Di(k)^2}{Lenght\ Di}$$

where; k=1,2,…., Length Di., i=1,2,…. N=5

$$E_{A5} = \sum \frac{A_5(k)^2}{Lenght\ A_5}$$

Where k=1,2,…. Length A5

Since it will be the neural system input, the normal vitality of every deterioration signal is standardized by isolating the biggest normal vitality between the decay normal vitality in each sign:

$$E_{nj} = \frac{E_i}{Maks\,(E_{Di}, E_{As})}$$

where j=1,2,3…. n=4

Because of standardization, the estimation of extraction of E_{nj} properties is somewhere in the range of 0 and 1

3. RESULTS AND DISCUSSION

This investigation clarifies the recognition of cursor development of EEG signals got from BCI dataset Competition 2003. The EEG information is determined utilizing DWT as a component extraction of EEG signals. In the DWT Process, the estimation of the EEG highlight is gotten from vitality at the recurrence of the DWT sub-band.

In Fig. 1, the introduced EEG recording is separated into sub-band frequencies. It very well may be composed as wavelet coefficients in A5, D5, D4, and D3 utilizes DWT. Wavelet sub-band frequencies of (0-4 Hz), (4-8 Hz), (8-16 Hz) and (16-32 Hz) are separated to become EEG signal capabilities. The accompanying highlights are utilized to clarify the preparing time. At that point, the recurrence circulation of the watched sign is the vitality of the wavelet coefficients in each sub-band.

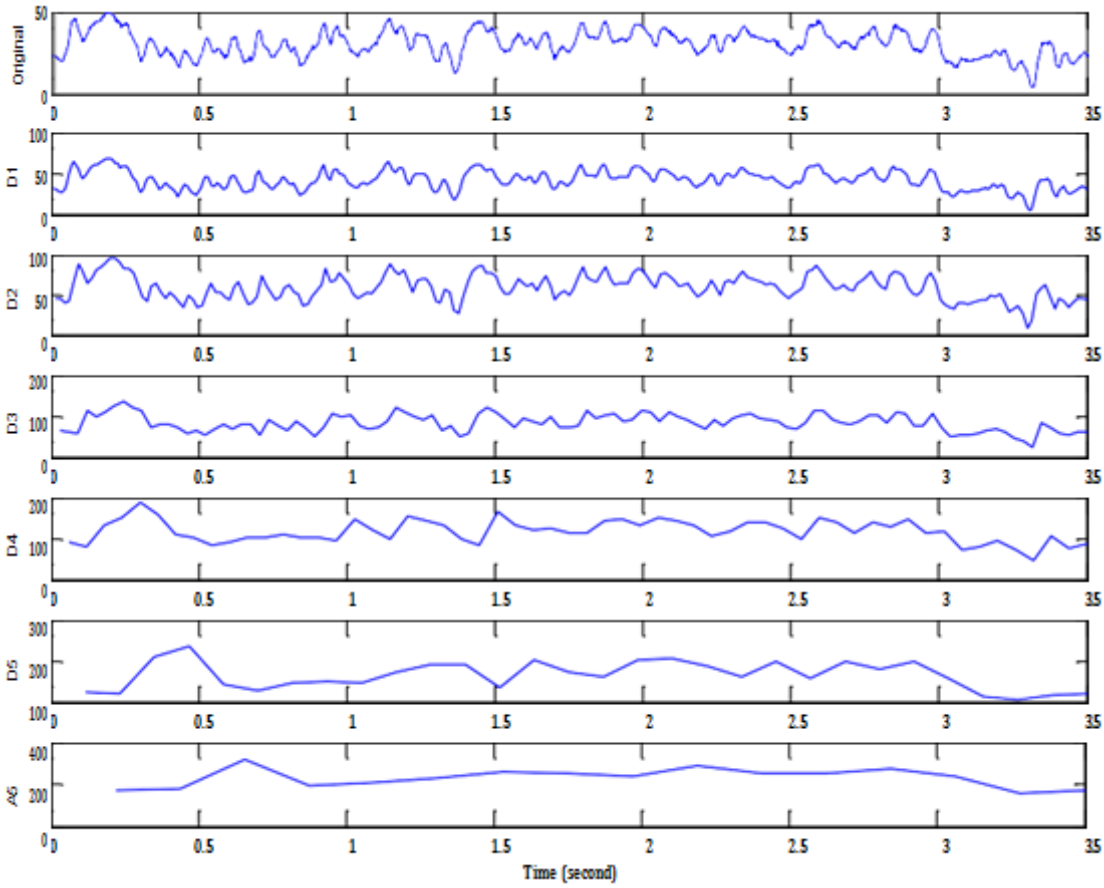

Fig. 1. EEG signal co-efficients source

Figure 2 shows that vitality in each sub-band for class 0 and class 1 has an alternate worth. Various scores of qualities show that the order rate by taking the vitality esteem is sufficient. Grouping utilizing Artificial Neural Network Back proliferation is actualized utilizing the vitality esteem highlight of the DWT procedure as info. Right now, preparing set is around 260 example information and preliminary set is around 293 example information. Moreover, we acquired 260 information tests (from ordinary subjects) for channel 1, which were utilized as preparing information. At that point, we utilized 293 example information (from typical subjects) for each channel for testing information. The class dissemination of the readied test information in preparing and testing is appeared. To expand the ability of back engendering, two parameters, (for example, preparing and testing) were developed by information got from various subjects. The informational index for the preparation procedure is utilized as preparing for back propagation, while for the testing informational index is done as the precision just as productivity of back engendering in recognizing cursor developments.

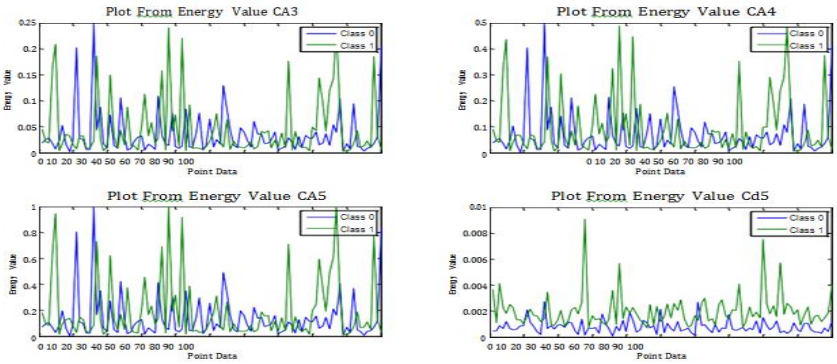

Fig.2. wavelet co-efficients of sub-bands

In light of the examination by Ting et al. [6], the degree of exactness is still lower. Be that as it may, both research contemplates utilized the neural system strategy for the arrangement procedure. For that, we need another strategy to be applied by specialists to improve grouping exactness and furthermore, searching for various element extraction models to be specific Wavelet Transform.

4. CONCLUSION

This paper acquaints the Discrete Wavelet with remove includes by taking vitality esteems on each sub-band. This investigation utilizes 553 EEG signal information documents for preparing and testing. The future research will look at the appropriate procedures for highlight extraction and EEG signal order, so the exactness level of the direction in moving the cursor would be better. The outcomes got will be contrasted and the strategies previously contemplated.

REFERENCES

1. Wolpaw, J.R.; Birbaumer, N.; McFarland, D.J.; Pfurtscheller, G.; and Vaughan, T.M. (2002). Brain-computer interfaces for communication and control. Clinical Neurophysiology, 113(6), 767-791.
2. Wolpaw, J.R.; Birbaumer, N.; Heetderks, W.J.; McFarland, D.J.; Peckham, P.H.; Schalk, G.; Donchin, E.; and Quatrano, L.A. (2000). Brain-computer interface technology: A review of the first international meeting. IEEE Transactions on Rehalibitation Engineering, 8(2), 164-173.
3. Pour, P.A.; Gulrez, T.; AlZoubi, O.; Gargiulo, G.; and Calvo, R.A. (2008). Brain-computer interface: Next generation thought controlled distributed video game development platform. Proceedings of the IEEE Symposium Computational Intelligence and Games. Perth, Australia, 251-257.
4. Mensh, B.D.; Werfel, J.; and Seung, H.S. (2004). BCI Competition 2003-Data set Ia: Combining gamma-band power with slow cortical potentials to improve single-trial classification of electroencephalographic signals. IEEE Transactions on Biomedical Engineering, 51(6), 1052-1056.
5. Wang, B.; Jun, L.; Bai, J.; Peng, L.; Li, G.; and Li, Y. (2005). EEG recognition based on multiple types of information by using wavelet packet transform and neural networks. Proceedings of the IEEE 27th Annual Conference on Engineering in Medicine and Biology. Shanghai, China, 5377-5380.
6. Ting, W.; Guo-zheng, Y.; Bang-hua, Y.; and Hong, S. (2005). EEG feature extraction based on wavelet packet decomposition for brain computer interface. Measurement, 41(6), 618-625.
7. Sun, S.; and Zhang, C. (2005). Assessing features for electroencephalographic signal categorization. Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing. Philadelphia, United States of America, 417-420.
8. Kayikcioglu, T.; and Aydemir, O. (2010). A polynomial fitting and k-NN based approach for improving classification of motor imagery BCI data. Pattern Recognition Letters, 31(11), 1207-1215.
9. Prochazka, A.; Kukal, J.; and Vysata, O. (2008). Wavelet transform use for feature extraction and EEG signal segments classification. Proceedings of the 3rd International Symposium on Communications, Control, and Signal Processing. St. Julians, Malta, 719-722.
10. Adeli, H.; Zhou, Z.; and Dadmehr, N. (2003). Analysis of EEG records in an epileptic patient using wavelet transform. Journal of Neuroscience Methods. 123(1), 69-87.
11. Garg, S.; and Narvey, R. (2013). Denoising and feature extraction of EEG signal using wavelet transform. International Journal of Engineering Science and Technology (IJEST), 5(6), 1249-1253.
12. Barford, L.A.; Fazzio, R.S.; and Smith, D.R. (1992). An introduction to wavelets. Hewlett-Packard Instruments and Photonics Laboratory, HPL-92- 124, 29 pages.
13. Chavan, A.S.; and Kolte, M. (2011). EEG signal preprocessing using wavelet transform. International Journal of Electronics Engineering, 3(1), 5-10.
14. Murugappan, M.; Ramachandran, N.; and Sazali, Y. (2010). Classification of human emotion from EEG using discrete wavelet transform. Journal of Biomedical Science and Engineering, 390-396.
15. Nakate, A.; and Bahirgonde, P.D. (2015) Feature extraction of EEG signal using wavelet transform. International Journal of Computer Applications, 124(2), 21-24.
16. Alomari, M.H.; Awada, E.A.; Samaha, A.; and Alkamha, K. (2014). Wavelet-based feature extraction for the analysis of EEG signals associated with imagined fists and feet movements. Computer and Information Science, 7(2), 17-27.