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Review on SVM Based Epileptic Seizure Detection System

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Abstract : ***Epilepsy patients encounter difficulties in day by day life because of safety measures they need to take so as to adapt to this condition. At the point when a seizure happens, it may cause wounds or imperil the life of the patients or others, particularly when they are utilizing substantial hardware, e.g., determining autos. Investigations of epilepsy regularly depend on electroencephalogram (EEG) motions so as to break down the conduct of the cerebrum amid seizures. Finding the seizure time frame in EEG accounts physically is troublesome and tedious; one frequently needs to skim through tens or even several hours of EEG chronicles. Hence, programmed identification of such an action is of extraordinary significance. Another potential utilization of EEG flag examination is in the expectation of epileptic exercises previously they happen, as this will empower the patients (and parental figures) to avoid potential risk. In this paper, we first present a diagram of seizure identification and forecast issue and give bits of knowledge on the difficulties around there.***
Keywords : Gesture Component Analysis Dual Tree Discrete Wavelet, Seizure Detection, EEG, FPGA

I. INTRODUCTION

Epilepsy is a chronic disorder that causes unprovoked, recurrent seizures. A seizure is a sudden rush of electrical activity in the brain. There are two main types of seizures. Generalized seizures affect the whole brain. Focal, or partial seizures, affect just one part of the brain [1].The unconventionality of when seizures will all of a sudden happen is an essential explanation behind the incapacity related with epilepsy, and this vulnerability drastically impacts the personal satisfaction for patients and their parental figures (Fisher et al. 2000). Notwithstanding most people with epilepsy demonstrating no impacts of the turmoil other than amid and promptly following the event of seizures, not knowing when these occasions may happen can keep them from driving, swimming, cooking, and so forth.

II. LITERATURE SURVEY

Paper(1): Lichen Feng, Zunchao Li, and Yuanfa Wang,"VLSI Design of SVM-Based Seizure Detection System"2017.This paper presents a very large scale integration (VLSI).The proposed design mainly consists of a feature extraction (FE) module and an SVM module. The presented design is verified on an Altera Cyclone II field-programmable gate array and tested using the two publicly available EEG datasets. Experiment results show that the designed VLSI system improves the detection accuracy and training efficiency.

Paper(2): A.Sharmilaand P.Geethanjali,"DWT based Epileptic Seizure Detection from EEG Signals using Naïve Bayes/k-NN Classifiers"2016.In this study, a framework is offered for detecting an epileptic seizure from EEG data recorded from normal subjects and an epileptic patient.It has been found that computation time of NB classifier is lesser than k-NN to provide better accuracy. So, the detection of an epileptic seizure based on DWT statistical features using NB classifiers are more suitable in real-time for a reliable, automatic epileptic seizure detection system to enhance the patient's care and quality of life.

Paper(3): K. Sercan Bayram, M. Ayyüce Kızrak, and Bülent Bolat,"Classification of EEG Signals by using Support Vector Machines"2013. In this work, EEG signals were classified by support vector machines to detect whether a subject s planning to perform a task or not. Various different kernels were utilized to find the best kernel function and after that, a feature selection process was realized. The results are comparable to the recent works.

Paper(4): Masashi Ebisawa, Masumi Kogure, Sho-hei Yano, Syu-ichi Matsuzaki, Yasuhiro Wada,"Estimation of Direction of Attention Using EEG and Out-of-head Sound Localization"2011.This study investigated whether a person s direction of attention can be estimated using an event-related potential (ERP) generated by selective attention to an auditory stimulus. An auditory stimulus and an out-of-head sound localization system that can create an audio image outside the head that is presented through an earphone were used instead of a loudspeaker system.

Pape(5): Leon D. Iasemidis,"Epileptic Seizure Prediction and Control"2003.This paper presents an overview of the application of signal processing methodologies based upon the theory of nonlinear dynamics to the problem of seizure prediction. Broader application of these developments to a variety of systems requiring monitoring, forecasting and control is a natural outgrowth of this field.The field of seizure prediction, in which engineering technologies are used to decode brain signals and search for precursors of impending epileptic seizures, holds great promise to elucidate the dynamicalmechanisms underlying the disorder, as well as to enable implantable devices to intervene in time to treat epilepsy.

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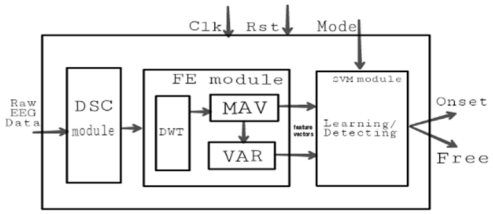
Paper(6): AA Abdullah,"Development of EEG-based epileptic detection system"2012.This paper proposed that epilepsy is one of the most common neurological disorders causing from repeating brain seizures that are the results of the temporal and sudden electrical disturbance.EEG involves recording and analysis of electrical signals generated by the brain.It is an important clinical tool for diagnosis and monitoring of neurological disorders related to epilepsy.

Paper(7): SSareen,"A Cloud-Based Seizure Alert System For Epileptic Patients"2016.This paper presents automatic detection of seizure before its occurrence could protect patient from accident and save her quality of life.This study different processing, feature extraction and classification techniques to process the sleep EEG signals.

III. METHODOLOGY

A. Architecture of Seizure Detection System

Fig below shows the architecture of the proposed SVM-based seizure detection system, which consists of a DDR2 SDRAM Controller (DSC) module, an FE module, and an SVM module. The massive raw EEG data is stored in an off-chip SDRAM. The DSC module is an IP-based industry-standard module which controls the communication between the system and the SDRAM. First, the raw EEG data are processed by FE module. The three-level db4 DWT decomposes the EEG signal into four subbands. The mean absolute values (mav) and variances (var) of the DWT coefficients in each of the four subbands are then calculated in the following submodules MAV and VAR, respectively, to produce the 8-dimensional feature vector.Then the 8-dimensional feature vector is sent to SVM module, which has the learning and detecting functions. In the learning phase, the hyper-plane of the SVM classifier with theseizure-onset side against the seizure-free side is learned using training samples. In the detecting phase, the trained SVM detects and labels the seizure onset. The signal Mode determines which phase SVM module works in.



IV. OBJECTIVES

Our aim to use DTWT (Dual Tree Wavelet Transform) instead of DWT (Discrete Wavelet Transform) for Feature Extraction.

Design and development of FE module :

Feature Extraction Module design consist of DWT submodule, MAV and VAR submodule.

Verification of design on Alteration Cyclone II FPGA **:** The proposed design is verified on an FPGA device and tested using two publicly available datasets.The fixed-point arithmetic is used in the system. The two datasets used to verify the designed system was digitized into 10 bits and 16 bits respectively. For reducing the distortion caused by transforming the floating-point format into the fixed-point format, the desired finite word length is analyzed through software simulation and a 3.12 signed fixed point format with 1 sign bit, 3 integer bits, and 12 decimal bits is determined. The Quartus II 13.1 software and Altera Cyclone II EP2C70F896C6 FPGA are applied to implement the detection system. The DSC module is generated by Altera MegaWizard Plug-In Manager.

Experiment results show that the designed VLSI system improves the detection accuracy and training efficiency.

V. APPLICATION

It is widely used in medical science to improve health of the patient.

VI. CONCLUSION

Seizure detection is a complex task. Based on SVM an automated seizure detection method is being developed. To improve classification accuracy of the EEG signals various methods are suggested, this study is presented the use of SVM along with DTWT for EEG signal classification. The extracted features like normalized once we have our input patient data for the

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classification of EEG signals which will be extracted from our DTWT block searched in trained data and tested to provide the seizure detection. Our proposed system will have achieved sensitivity, specificity and classification accuracy which will be in the range90%, respectively. The same small set of database will be utilized in this study which will be analyzed. In this analysis, the comparison of classifier based on performance accuracy has been proposed to be furnished.

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