A SURVEY ON CLASSIFICATION OF ATTENTION DEFICIT HYPERACTIVITY DISORDER IN CHILDREN

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***Abstract*---This Survey deals with a constantly recurring problem deals with millions of children called as Attention Deficit Hyperactivity Disorder (ADHD). It occurs on a transitional stage of physical and psychological development of adults or children. Their behavior may be impulsive, abnormally overactive and easily distracted. ADHD is not a disease; it is also called as neurobiological syndrome. Hence to find out this disorder and to cure with treatment is a necessary action. This problem can be stated as several strategies such as brain injured child, hyperkinetic child syndrome, perceptually handicapped child and deficits in attention. To analyze and diagnosis of this disorder may help to improve the emerging field to cure these syndromes. The ADHD diagnostic criteria may classify into several subtypes. Each subtype has some symptoms that will be analyzed and studied. The subtypes, risk factors, complications and co existing conditions are discussed in detail. The various researches are made with respect to the ADHD.**

***Keywords*---Attention Deficit Hyperactivity Disorder, Functional Magnetic Resonance Imaging, Neuropsychological Therapy, Artificial Neural Network.**

I. INTRODUCTION

ATTENTION Deficit Hyperactivity Disorder (ADHD) [7] is a combination of persistent problems. Due to this often children's may struggle with low self-esteem, education lagging and troubled relationships may occur. The evolution of this concept declared as post encephalitic behavior disorder in 1922, and further the brain injured child in 1947. In normally the effect appears 1 in 20 children's. Due to this problem the behaviorof child in school and home has changed, hence it results in suffering of parents and siblings with stress, depression marital discord and so on. The World Health Organization (WHO) defined lot of revisions and attention deficit hyperactivity disorder (ADHD) in 1994. The diagnostic criteria are explained below: ADHD inattentive subtype is termed without hyperactivity. These symptoms made present in terms of during schooling and play activities. The symptom are making careless mistakes, can't maintain attention, not even listening, forgot the tasks, avoiding tasks, loses things, easily distracted and forgetful. ADHD hyperactive impulsive subtype are listed below: If a child often doing interrupts,cannot wait in line or take run ,fidgety ,running or climbing excessively, talks a lot and blurts out answers to questions. The ADHD is often well noticed that a child who is in home or office may mildly restless but entering into the structure situation like school classroom child will distractible. If a one to one student staff ratio may disappear ADHD, but in large classrooms it will appear. The following subtypes are discussed, in that each subtype requires at least 6 months to diagnosis a child.

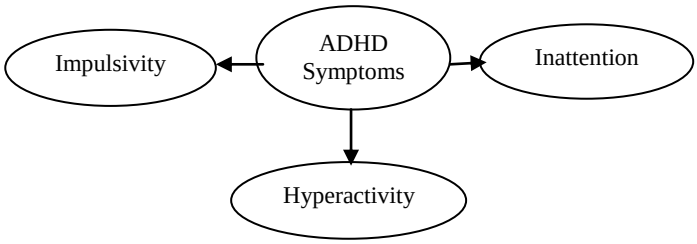

Fig 1 Symptoms of ADHD

Subtypes-Three subtypes are listed below, i.e., Inattentive type,Impulsive type and combination of both types [38]. Each subtype consists of at least 6 to 9 symptoms. To diagnosis each type's at least 6 months needed. ADHD is analyzed approximately 5 % of children and boys are affected 3 to 6 time more than girls.ADHD combined type - It deals with if both inattentive and hyperactive types present for at least 6 months. After symptoms lessened with age or treatment, it requires number of diagnosis.

The symptoms of ADHD is shown in the figure 1, many symptoms in children and teenagers are mentioned below, and they're usually noticeable before the age of six. The problems may be identified based on more than one situation, such as at home and at school.The main signs of each behavioral problem are Inattentiveness, Hyperactivity and impulsiveness. Initially the main signs of inattentiveness are having a short attention span and being easily distracted, time-consuming appearing to be unable to listen, carry out instructions. The main signs of hyperactivity and impulsiveness are being unable to sit still, especially in calm or quiet surroundings, constantly fidgeting, little or no sense of danger. In adults, the symptoms of ADHD are very risk to define. This is largely due to a lack of research into adults with ADHD. The paper is organized as follows. Section2 describes the detail survey about ADHD and other related work that follows the same strategy, section 3 states the problem definition which is analyzed throughout the literature survey and finally concluded in section 4.

II. LITERATURE SURVEY

Khoshnoud[9] presented an analysis based on the rest condition, it also investigates the non-linear dynamics of EEG signals. Probabilistic neural networks enhances the accuracy for identifying the nonlinear feature space. The proposed design made in the flow of EEG raw signals with noise and artifact removal. After all the process shown in the figure2 ,the EEG signal is 2given to the Feature Extraction and Classification. The main objective of the research is to analyze nonlinear features of the given signal. Here two nonlinear features used in this work are Laboratory for Laser Energetics (LLE) and approximate entropy (ApEn).

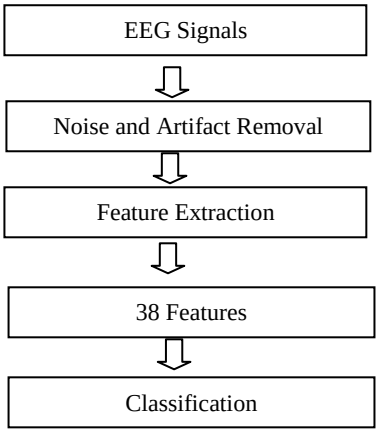

Fig 2 Flow diagram of Probabilistic Neural Network based model

TABLE I
COMPARISON OF VARIOUS ADHD METHODS

Sl. No	Citation	Methodology	Merit	Limitation
1	Wang et al.,(2011) [5]	Kernel Principal Component Analysis (KPCA) method based on connectivity matrix	By applying leave-one-out cross validation the correct classification rate is obtained	Using Matrix method analysis made more complex and it is not easier to applicable in any experimental results.
2	Rodrak et al., (2013) [2]	DSM-IV Codes	Mainly focused on Eye opened period, three factors such as coherence, Phase lag and Frequency bands are noted down.	For efficient Treatment the phase lag must be maintained accurate result else it results in big issue.
3	Sripada et al., (2014) [4]	Functional MRI (fMRI)	Task-free resting state	Reduced flexibility due to the regulatory units. Creates abnormalities
4	Deshpande et al.,(2015) [1]	Fully Connected Cascade (FCC) Artificial Neural Network (ANN)	When comparing FCC with Support Vector Machines the Accuracy were improved.	In some cases the results may vary based on sensitive data sets
5	Marcano et al.,(2016) [6]	Autoregressive Model	High accuracy and confidence were achieved	The confidence level want to be improved.
6	Khoshnoud et al.,(2015) [9]	Probabilistic Neural Network	High performance in nonlinear feature space.	The mean value of ApEn is significantly reduced
7	Chaim et al., (2014) [42]	Optimally-Discriminative Voxel-Based Analysis (ODVBA)	Analyzed based on microstructure	Further application of this study is to implement for large images.

Deshpande et al., (2015) [1] presented a fully connected cascade artificial neural network architecture for attention deficit hyperactivity disorder classification from functional magnetic resonance imaging data. Here various directional and non-directional brain connectivity-based methods are employed to extract the discriminative features. It gives better classification accuracy compared to raw data. In this work they have demonstrated the utility of Fully Connected Cascade (FCC) Artificial Neural Network (ANN) architecture for classifying subjects with ADHD from typically developing subjects. It is used as classifiers in neuroimaging, its major contribution is to demonstrate the utility of FCC ANN. Another second major contribution is that with improved classifier design and discriminative connectivity-based features, the accuracy can be greatly improved in ADHD diagnostic applications. Hane et al.,(2015) [20] discussed an learning computational models of video memorability. It mainly focused on modeling the memorability of video clips. Here the frame work is made by integrating the power of low level features and brain decoding through the functional magnetic resonance imaging fMRI. The research is mainly focused on human subjects are obtained when they watching the video clips. The brain activity is conveyed by the functional magnetic resonance imaging (fMRI). Furman et al., (2007) [21] narrated a long term memory based extended audio visual while playing movie. During the test session the 27 minutes episode were presented. Several participants were arranged and made a comparison.

Nakatani et al., (2013) [22] analyzed a person who is considered as with sleep and without sleep. Zhang et al., (2012) [23] here two neuroimaging measures were made in pattern classification that is made in between healthy controls and general epileptic patients. The work contributes and focused on cross-validated classification accuracy and sensitivity. Kuang and He (2014) [10] presented a Deep Learning, using imaging and functional biomarkers. This method is the first method that made to analyze in deep learning. Faraone et al.,(2006) [11] gave an overview about Attention-Deficit/Hyperactivity Disorder. This work deals with the imaging studies and suggested pathways to identify the disorder. It states that the ADHD indicate that correlates psychosocial, cognitive features mirror findings among the children's with ADHD. Risk factors were discussed such as pregnancy, delivery complications, maternal smoking and environment variable of families. This research focused on structural, pathways and imaging studies. The subcortical pathways, imbalances in the dopaminergic systems are given with dopamine and norepinephrine reuptake are blocked to reduce the ADHD symptoms.

Hesslinger et al., (2002) [12] described Psychotherapy of attention deficit hyperactivity disorder in adults. This work deals with structured skill training program tailored particularly for adult patients with ADHD. The treatment for borderline personality disorder is done by principles of cognitive behavioral treatment principle. This is modified to patients with ADHD to suit them and cure. The chaos, behavior analysis, dependency, depression, impulse control emotion regulation and self-respect are the elements presented. Faraone et al., (2003) [13] questioned that the worldwide prevalence of ADHD is an American condition or not. It presented that ADHD affects up to 1 in 20 children in the USA. Over past 40 years the research about his disorder is in progress, in that the ADHD is largely and American disorder and is much less prevalent elsewhere. This impression may due to the social and cultural factors that are most common in American society. It also stated that in worldwide community ADHD is presented but still not yet proved. The data comparisons are made in this to compare it with the worldwide prevalence of ADHD. Finally, it denotes that the disease is not particularly in USA it is in all over the world but still not yet focused or proved.

Huang et al., (2009) [14] examined a Nicotinic Acetylcholine Receptor α4 Subunit Gene Variation Associated with Attention Deficit Hyperactivity Disorder. The objective of this research is to analyze the genetic association between single nucleotide polymorphisms in the CHRNA4 gene and ADHD. Here the consideration are made in

family based design and case control. The children aged from 6 to 16 years were interviewed and analyzed the behavior checklist. Several control samples are made and suggested CHRNA4 gene may play a major role in the pathogenesis of ADHD.Banerjee et al., (2007) [15] presented an Environmental risk factors for attention-deficit hyperactivity disorder. The risk factors for ADHD are discussed in this concept, such as the disorder due to blood relatives, such as siblings or parents with ADHD or any mental health disorder. The environment exposure or toxins are given as a lead. Another aspect discussed is due to alcohol use or smoking during pregnancy or due to premature birth. Beyond these factors sugar is a popular suspect but it is not proved.

Muñoz et al., (2015) [16] proposed a design and Creation of a BCI Videogame to Train Sustained Attention in Children with ADHD. Medication and neuropsychological therapy have been proved that it won't cure or decrease the high incidence levels of ADHD. Here the design is made with the development of the game that uses a brain computer interface signal. This is used to monitor the neurophysiologic signal. The design is made as a name "The harvest Challenge". The main motive of this work is to prove the ability to follow the instructions, ability to plan, waiting ability and ability to receive objectives. It also relates the attention and relaxation The Electro Encephalo Graphic (EEG) signal is produced automatically inside the game allowing generating a report of the theta/beta ratio evolution. Electrode is placed in the center part of the lobe. Each result of the signal were processed and stored.

Hao et al., (2015) [17] analyzed Discrimination of ADHD children based on Deep Bayesian Network. In this research the deep Bayesian network is presented to classify the normal children and ADHD children. Mainly this network is applied to normalize and reduce dimension of Functional magnetic Resonance Imaging (FMRI) .by means of structural learning the relationships between several well performed brain areas are extracted. Based on the information of structure and probability in Bayesian network, the prediction will be subjects to control or combined.

Wang et al., (2007) [18] discussed a brain computer interfaces based on attention and complex mental tasks. In this work the Brain Computer Interface (BCI) is used for regain the movement or communications for people with disability. In the above method two applications of BCI systems are discussed. First is the BCI system is designed based on EEG signal i.e., mental tasks classification for people with motor disability. Secondly Neuro-Feed Back (NFB) system is established. It is more interesting, imaginative and interactive.Limet.,al., (2012) [19] proposed a Brain-Computer Interface Based Attention Training Program for Treating Attention Deficit Hyperactivity Disorder. Here investigation is based on new intensive BCI based attention training game system with significant inattentive symptoms. This new band monitored the attention through a head with dry EEG sensors. It is used to drive a feed forward game. The analysis showing in the EEG based BCI measure correlated with the change ADHD rating scale scores. A new treatment for ADHD is BCI based attention training game system.

Sachnev (2015) [24] proposed an efficient classification scheme with a combination of Meta Cognitive Neuro-Fuzzy Interface System (McFIS) and Binary Coded Genetic Algorithm coupled with Extreme Learning Machine (BCGA-ELM). The hippocampus features is processed by BCGA-ELM and represented as one bit value. It concentrates two major steps such as selection and classification. The combination of these system is termed as Binary Coded Genetic Algorithm coupled with Extreme Learning Machine and Meta-Cognitive Neuro-Fuzzy Inference System (BCGA-ELM-McFIS). Its frame work is given in the figure 3.

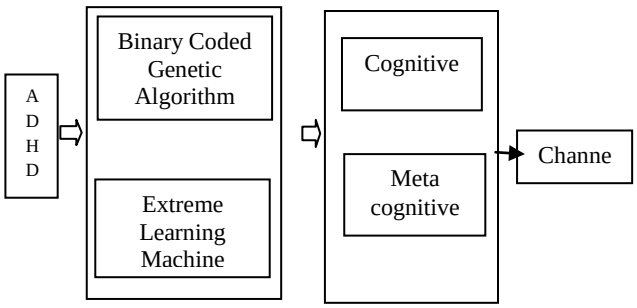

Fig 3 Frame work for BCGA-ELM-McFIS [24]

Okada et al., (2012) [25] observed the abnormal behavior of children based on the body movement. The movement of the patients were noticed by video processing by using region of interest(ROI). The amount of body movement is noted and shown in several stages with respect to the rest condition. Bansal et al.,(2007) [26] presented an Statistical Analyses of Brain Surfaces Using GaussianRandom Fields. Table II shows the related work which is similar concept of ADHD. It helps to provide an intelligent solution to problem.

TABLE II
RELATED WORK

Sl. No	Citation	Methodology	Merit	Limitations
1	Wells et al., (1996) [40]	Stochastic maximization of mutual information	Conventional correlation results in minimizing complexity. This method is effective and efficient.	For complex applications several modifications were made.
2	Sled et al., (1998).[41]	Nonparametric Non-uniform Intensity Normalization (N3)	Automatic Correction of intensity, independent of pulse sequence and insensitive to pathological data	Assumptions are considered hence accuracy is very less.
4	Leow et al., (2006) [36]	Tensor-based morphometry	Visualizing the 3D profile, rating the tissue growth helps to improve the sequence of analyze	The overall sensitivity depends on the contrast
5	Bansal et al.,(2007)	Gaussian random field (GRF)	The assumption is eliminated hence by using Euler's process the work will be simplified and Smoothing the Random Field is effective.	Spherical harmonics occurs
6	Hua et al., (2009) [27]	Non-linear elastic intensity-based registration algorithm	This method is Sensitive and reliable to detect the regional tissue changes during development.	Changes in size of the brain is detected but the exact problem is not identified in spatial domain.
7	Xie et al., (2016) [59]	Normalized Spiking Error Back Propagation (NSEBP)-Spiking Neural Networks (SNNs)	Computation capability is achieved and normalization in the weight modification applicable	Back propagate error occurs.

Hua et al., (2009) [27] focused on detection of human brain growth with high resolution. Spatio-temporal complexity and tensor-based morphometry were explored here, the non-linear elastic intensity-based registration algorithm is used with MRI scans. Based on the sensitive and finer toned growth patterns several research were made. Sowell et al., (2004) [28] shown longitudinal mapping of critical thickness and brain growth in normal children. Thompson et al., (2000) [29] presented an growth patterns detected by continuum mechanical tensor maps. For nonlinear registration the images are spatially normalized by using local shape differences, a tensor field, and it is called as Jacobian matrix. The matrix is code by different color which may indicated by following researches, the Chung et al., (2001) [31], Freeborough and Fox (1998) [32]; Riddle et al., (2004) [33]; Toga, (1999)[34]. In skull processing and other non-brain tissues were removed by using automated program it is called as Brain Surface Extractor (BSE) and

from BrainSuite stated by Shattuck et al (2002) [35].

Mazziotta et al., (2001) [36] defined an probabilistic atlas and reference system with the help of International Consortium for Brain Mapping (ICBM). From the survey report there is no cure for ADHD, but it can manage with appropriate educational support and support for parents. For analyzing a child with ADHD can be challenging. Leow et al., (2005) [39] presented an inverse consistent image registration. The minimization of the problem is made by using uni-directional algorithm. Bush (2010) [43] presented an attention-deficit/hyperactivity disorder and attention networks. Giedd et al., (2001) [44] presented a brain imaging of attention deficit/hyperactivity disorder. The following researches were focused on fronto-striatal network abnormalities, (Bush et al, (2005) [43] ;Durston, (2003) [44] ; Giedd et al, (2001) [45] ; Kelly et al,(2007) [46]; Schneider et al, (2006) [47]; Vaidya and Stollstorff, (2008) [48]; Zametkin and Liotta, (1998) [49]. Several frame work were constructed depending upon the exclusive executive function system such as dual-pathway conceptualization by Sonuga-Barke (2003) [51], Sonuga-Barke (2005) [52], Sonuga-Barke (2008) [53]. In neural network based voxel based morphometry study is made by Seidman et al., (2011) [54]. Valera et al., (2007) [55] made a quantitative analysis regarding ADHD. [57]. Gallo and Posner (2016) focusing on neural circuits implicated in the disorder.

III. PROBLEM DEFINITION

From the survey the different types of research were made in terms of risks of ADHD, controlling and diagnosing of ADHD. This survey helps to learn different types of flow assigned in neurophysiologic way. Even though the treatment for ADHD is not exactly focused. There currently available systems are used to reduce the symptoms not to cure. For some people medication reduces the hyperactivity and impulsivity and improves their ability to work and learn. It may also improve the physical coordination. It is fully based on trial and error. Hence the particular person should monitored carefully by their prescribing doctor. A stimulant is one of the medications. It increases the brain chemicals dopamine and norepinephrine, which is important in thinking and attention. But it raises blood pressure and heart rate. This also leads in side effect such as decreased appetite, sleep problems, personality changes, stomachaches and headaches. Kaspare et al., (2013) [57] stated a problem, persistence of changes in both brain structure and function. Another method is Psychotherapy to treat ADHD can help patients and their parents to deal with everyday problems. Several methods such as education and training, parenting skills training, Stress management techniques and Support groups to help families connect with others who have similar problems.

IV. CONCLUSION

The existing methods the ADHD analyzed in various types such as finding the symptoms, finding the behavior and monitoring the person who is affected by ADHD. Even the controlling and preventing stages are not at all arranged. To correct the activity each process like games will be useful. The Bayesian Network is used to find more effective method for finding brain waves. In future, design deals with investigating, detecting, controlling and curing with trials in new way. During this investigation the new drugs or any new combinations of drugs or devices or surgical procedures are compared with existing and process. If this type of design made, then the individual participants may benefit from being a part of trial. Hence the technology may improve and also the problems may get solved. Future research is needed to test the utility of FCC ANNs for classifying other disorders based on neuroimaging data.

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