



## International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 10 • Number 30 • 2017

### ACPT- A Method for the Implementation of Disease Diagnosis

**B. Buvaneswari<sup>a</sup> and T. Kalpalatha Reddy<sup>b</sup>**

<sup>a</sup>Research Scholar, Dept. of Computer Science & Engg., Sathyabama University, Chennai, India

E-mail: buvanraj77@gmail.com

<sup>b</sup>Professor & Dean, Dept. of Electronics & Communication Engg., S.K.R Engineering College, Chennai, India

E-mail: drkalpalatha.thokala@gmail.com

**Abstract :** Many human's life have been driven into the danger due to the lack of the non-intelligent, self adaptive knowledge about pain, symptoms experiencing in the body. The Human- assisted Devices for the above mentioned case will be more useful. Many researches has been conducted for this detection of the pain in relevant to the diseases but till now it is the real challenge .Hence the new and novel technique has been proposed by using the method of CBT(Cognitive Behavior Theory) and we use fusion of Signals and Images for further processing. Based on the technique, we have proposed the algorithm called ACPT (Adaptive Cognition Permutation Theory) which works on the fusion of Facial categorization with Bio-Signals and proved to provide pre-information about the symptoms through the facial expressions. ACPT works on the principle of new Cognitive Rule sets which has been tested with different inputs and proved to be vital for the detection and determination.

**Keywords:** CBT, ACPT, Cognition, non-intelligent, self-adaptive, fusion of Images.

#### 1. INTRODUCTION

In today world, non-communicable diseases are responsible for 68% of all deaths globally in 2012, up from 60% in 2000. Out of which 50% of the diseases has occurred due to the inadequate knowledge of the disease that has occurred in the body. The prevention is possible but the inadequate knowledge of relating the pain with symptoms still remains in darker side. Many Systems has been used for detection but the results needs crystal clear mechanisms.

Taking into an account ACPT has been proposed which is based on the Cognitive Behavior Therapy in the Medicine Field. Cognitive Behavior Therapy is the form of treatment for depressions but it deals with many diseases. Most therapists working with patients are dealing with various problems like anxiety and depressions use a blend of cognitive and behavioral therapy. This technique acknowledges that there may be behaviors that cannot be controlled through the traditional therapies; rather emerge based on prior conditioning from the environment and other external and/or internal stimuli. CBT is problem –focused with the action orientation concepts for the treatment of diseases.

The proposed algorithm called ACPT (Adaptive Cognition Permutation Theory) is based on the above principle. In the same way, ACPT works on the principle of Signal-Focused with Facial Images Characterization for the predetermination of the diseases through its symptoms from the face.

Every Disease alarms the person through its symptoms which the person fails to recognize it properly. The paper deals with the ACPT algorithm which forms the facial expression coding systems in relation with the Bio-signals in which the brain signals (EEG) has been taken into account for processing. The results are proved to be good which can illustrate some of the diseases along with facial expressions.

The remaining part of the paper is organized as follows. Section II deals with the related works. Section III deals with the proposed working mechanisms. Section IV deals with the datasets. Section V deals with the Result analysis and Conclusion.

## **2. RELATED WORKS**

In the related works, Part-I deals with the methods of the Seizure detection with the EEG Signals Processing. Part-II deals with Facial Expressions Algorithms works for the different mechanisms.

### **2.1. Part-I**

The different methods of the detection of Seizures using EEG Signals Processing has been discussed in [1]. In this paper, Seizure has been detected based on zero-crossing detection method where the diseases will be diagnosed based on the above mentioned parameters. Also this describes the linear classifier for the decision which provides more robustness. But it deals with lesser no of problems like head-aches and fever.

The paper[2] proposes the new algorithm for Lie Detecting mechanisms using EEG Signals. The System Consists of new method called Hierarchical grouping methods for the concealed information systems. The main advantage of this system is less computational time but the algorithm proves to be more complex for the diagnosis of different diseases.

The new method of FACS mechanism has been proposed in the paper[3]. The paper describes about different AU codes for the facial Expressions. The facial Expressions have been taken into account in which the codes are encoded manually for the description of different facial actions. The system proves to be so accurate which has been taken as the base for the FECS but the proposed system, no where connects the diseases detection through the facial actions.

The paper [4] proposes the new method for emotion detection through the facial expressions. The method adopted is ANN for emotion detection but it detects only emotions. The System proves to be more robust which makes it more complex for the analysis.

Proposed Algorithms

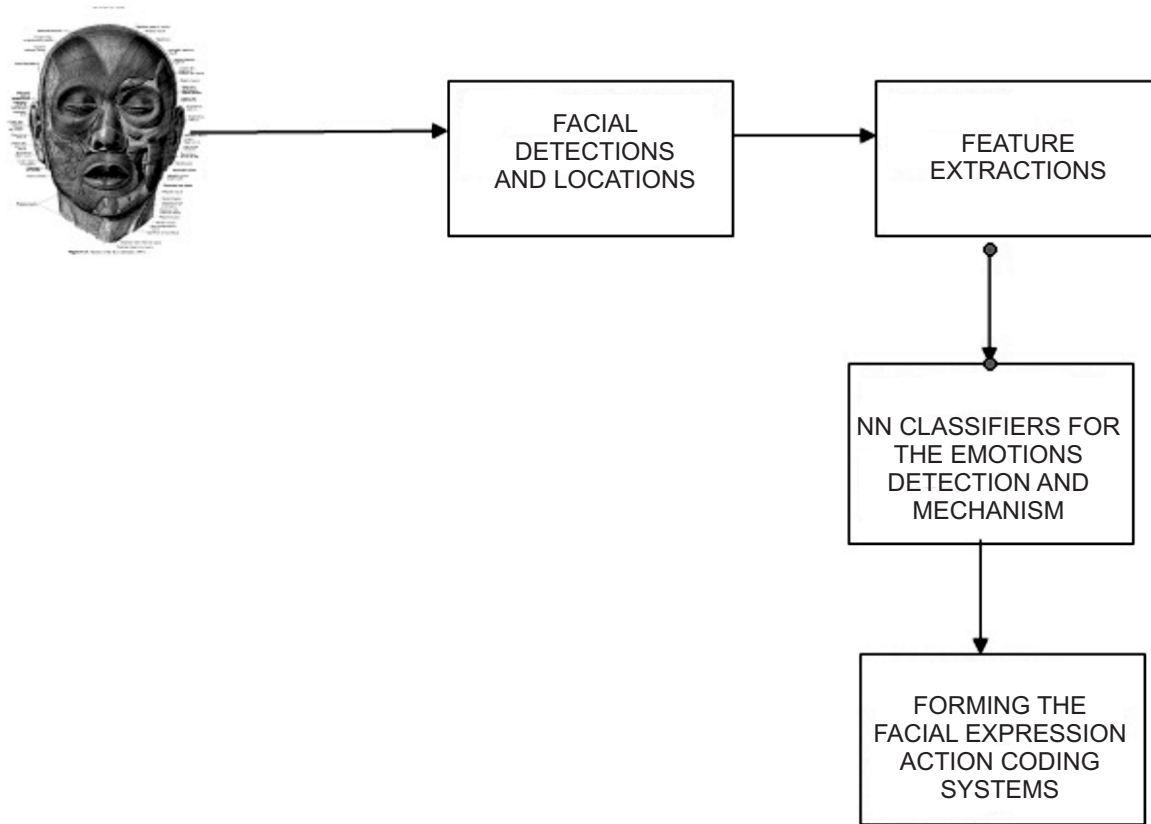
### **2.2. ACPT - Working Mechanisms**

ACPT works in the three-phase mechanism which are given as follows

1. EEG-Signal Processing- Signal Extraction Phase
2. Facial Expression Actions Coding Systems-FECS Phase
3. Cognition Framework for the Detection and Indication systems.

### **2.3. Facial Expression Actions Codings Systems**

A FECS mechanism has been converted form of FACS Systems suggested by Paul Ekman. Reference the Algorithms further classifies the facial expressions depending on the different symptoms of the diseases. The working mechanism of this phase is shown in Fig 1



**Figure 1: FECS Working Mechanisms and Its Different Stages for the Detection**

The Novelty of this phase takes the relationship of muscular activities in the face with pain which reflects the diseases.

As mentioned above section, FECS is next version of the FACS Systems where the facial expression deals with the muscle which is in controlled by the Brain Signals. The FECS constructs the Expression Coding (EC) manually which depends on the muscle contraction and relaxation. These coding has been taken into the account for the analysis which has been illustrated in the Table 1

**Table 1**

<i>Sl. No</i>	<i>Disease</i>	<i>Facial Expressions Symptoms</i>	<i>EC Units(FACS Based)</i>
1.	Parkinson Diseases	1. Fear	1 + 2 + 4 + 5 + 7 + 20 + 26
		2. Anxiety-HL	1 + 2 + 5B + 26
2.	Ataxia	Rapid Movement of the Eyes	45
			AU61, M61, AU62

FACS deals with the extraction of features such as eye-brows, lips, chin, etc by using the formula which is given by

**Table 2**  
**Basic Formula for the derivations of FACS in respect to the different parts of the FACE**

Permanent features (Left and Right)		Other features	
Inner brow motion ( $r_{binner}$ )	Inner brow motion ( $r_{bouter}$ )	Eye height ( $r_{cheight}$ )	Distance of brow ( $D_{brow}$ )
$= \frac{r_{binner} (bi - bi_0)}{bi_0}$ <p>If <math>r_{binner} &gt; 0</math>,                      Inner brow move up</p>	$= \frac{r_{bouter} (bo - bo_0)}{bo_0}$ <p>If <math>r_{bouter} &gt; 0</math>,                      Outer brow move up</p>	$= \frac{r_{cheight} (h1 + h2) - (h1_0 + h2_0)}{(h1_0 + h2_0)}$ <p>If <math>r_{cheight} &gt; 0</math>,                      Eye height increase.</p>	$= \frac{D_{brow} - D_0}{D_0}$ <p>If <math>D_{brow} &gt; 0</math>,                      Two brows drawn together</p>
Eye top lid motion ( $r_{top}$ )	Eye bottom lid motion ( $r_{btm}$ )	Cheek motion ( $r_{cheek}$ )	If $W_{left/right} = 1$ , Crows-feet wringkes $W_{left/right}$
$= \frac{r_{top} (h1 - h1_0)}{h1_0}$ <p>If <math>r_{top} &gt; 0</math>                      Eye top lide move up.</p>	$= \frac{r_{btm} (h2 - h2_0)}{h2_0}$ <p>If <math>r_{btm} &gt; 0</math>,                      Eye bottom lid move up.</p>	$= \frac{r_{cheek} (c - c_0)}{c_0}$ <p>If <math>r_{cheek} &gt; 0</math>,                      Cheek move up</p>	If $W_{left/right} = 1$ , Left/right crows feet wrinkle present

The new FECS system has been formed based on the FACS Systems by using the formula above mentioned in Table 1. The new formulation is as follows

The FECS coding consist of the three different parts such as High frame, Low Frame and medium Frame. For example in analysis of Parkinson disease, the symptoms are identified as the Fear and Anxiety, in which the Fear level is considered to be normal and Anxiety level is considered as the abnormal. With the help of this expressions, new FECS has been formed which is given in the table 2

**Table 3**  
**Method for Formation of the FECS Systems**

Facial Expressions	In FACS Systems	New FECS Systems	In FECS Systems
Fear-Normal	63	92 + 5B	N0H1
Anxiety-Abnormal	29 + 5B		

The N0H1 represents the N- Normal 0-Fear, H- High 1- Anxiety. By using this, we can form generalize the Formula as  $NxHy-x$  and  $y$  represents the combinations of the Symptoms.

### 2.4. II EEG-Signal Processing- Signal Extraction Phase

This Phase deals with the EEG Signals Extraction from the Brain. The process of giving the EEG Signals as the Input is shown in Fig 3

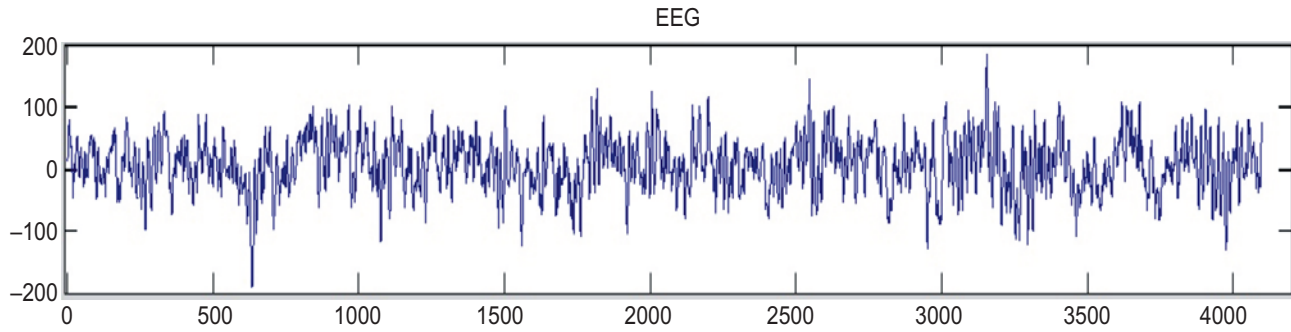


Figure 2: EEG Signals for the Input Analysis

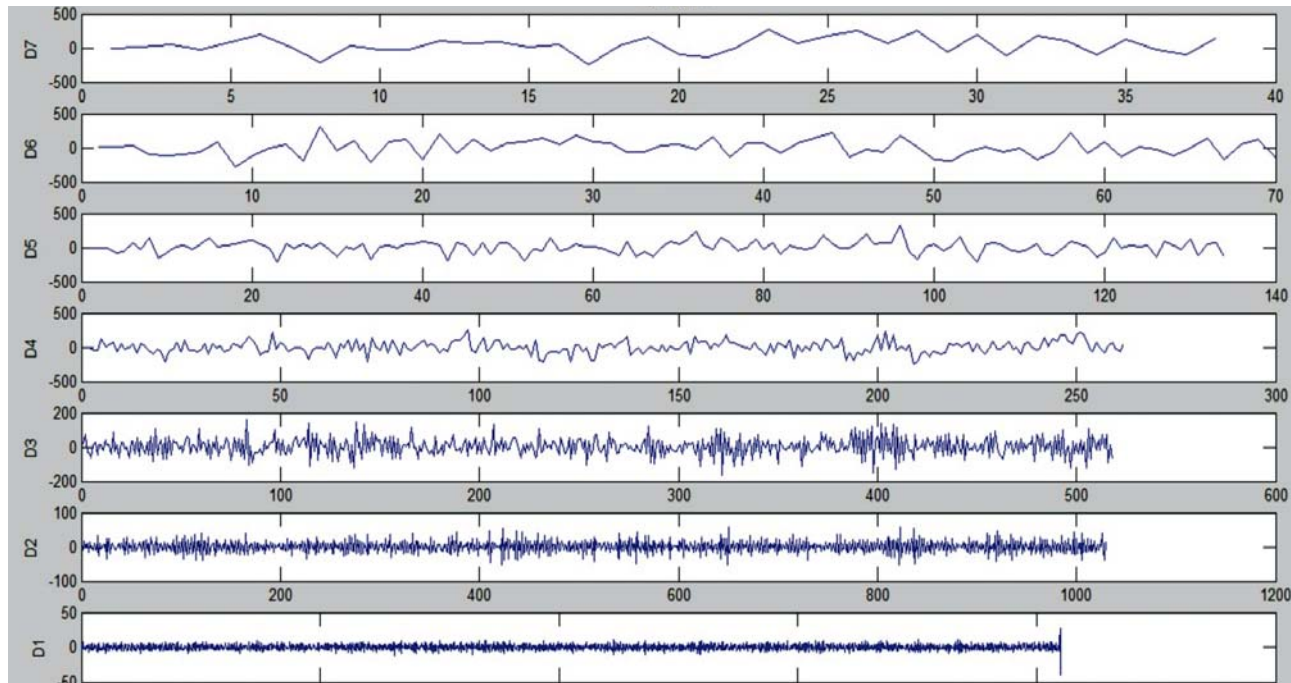


Figure 3: Signal Analysis from Different positions of the Brain

The EEG Signal Extraction detection systems works based on the Spike detection logics. The EEG Signals are sampled at the discrete time intervals using the CWT (Continuous Wavelet Transforms). The detection of the spikes in the noisy waveforms of EGG is little bit tricky. The signal has been fed into TW mechanisms (Travelling Window) Methods in which the predefined time - varying threshold (MU) has been taken as the outputs which depends on the different diseases. The threshold value can be determined as the  $S + D$  where S-Mean and D-Variance. The two parameters have been obtained from the TW Mechanisms.

The proposed system works on the fetch the databases and the program has been written into the ASCII format. The SR (Success ratio) can be calculated with the formula given by

$$SR = Nz/N$$

where

$$Nz = \text{False rate/Missing N}$$

$$= \text{No of Trails.}$$

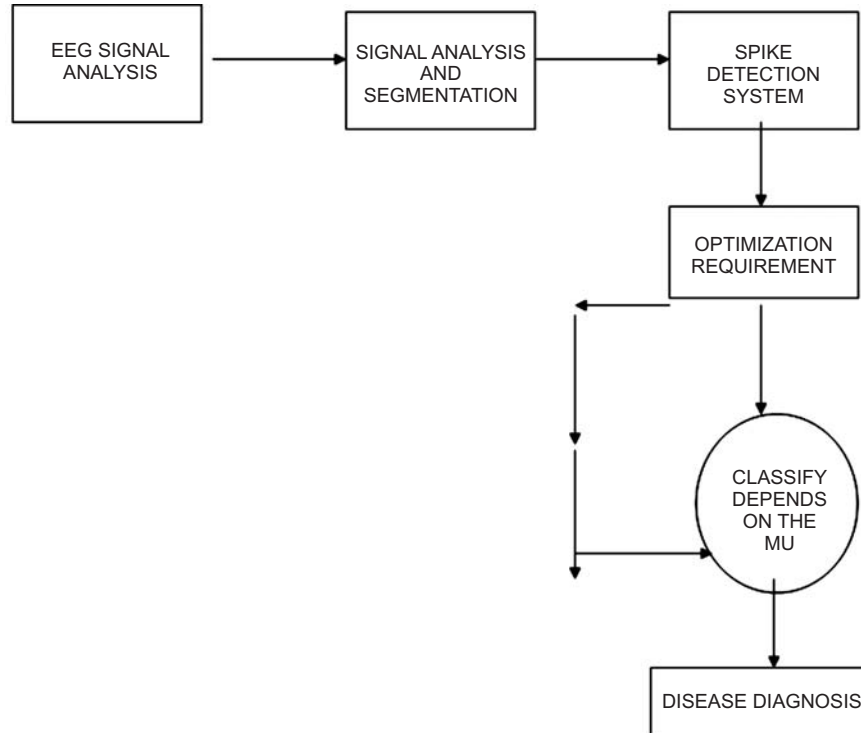


Figure 4: Working Mechanisms for the EEG Signal Extraction

### 2.5. Cognition Framework for the Detection and Indication systems

The Third Phase of ACPT which combines above two phases for the decision of the Symptoms. In this method we introduce the new method called the Cognitive Rule Sets for the Decision Mechanisms which is given in Fig 5

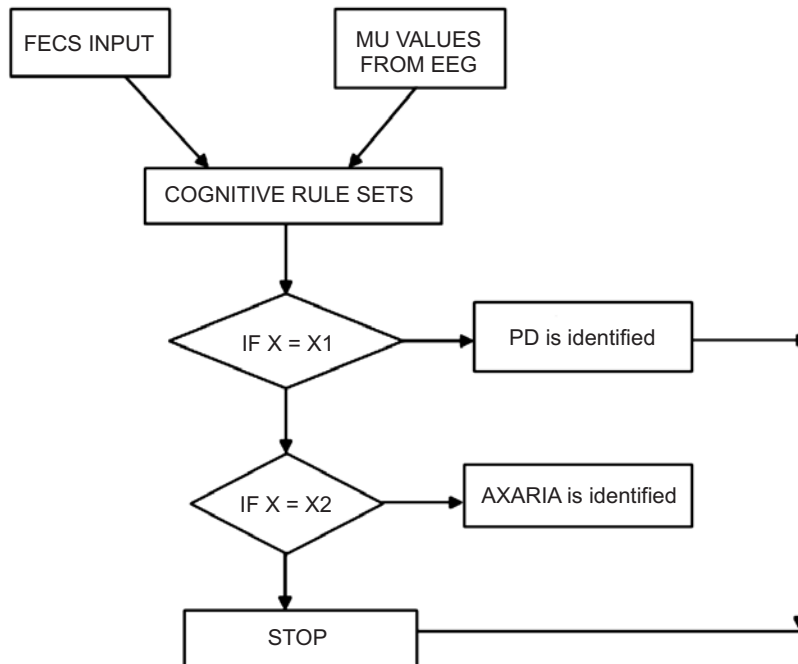


Figure 5: Flow Diagram for the Cognitive Phases of the ACPT Algorithms

Cognitive Rule Sets has been formed and it depends on the different values of the FECS and brain Signal Inputs.

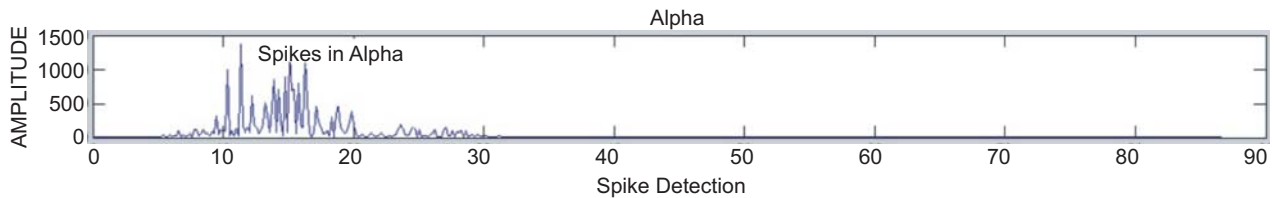
**Cognitive Rule Sets:**

If a1 (FECS) && b1 (EEG) → X  
 If X = X1 then X1 is Defined  
 If a2 (FECS) && b2 (EEG) → Y  
 If Y = X2 then X2 is Defined .....  
 If an (FECS) && bn(EEG) → n  
 If n = Xn then Xn is Defined

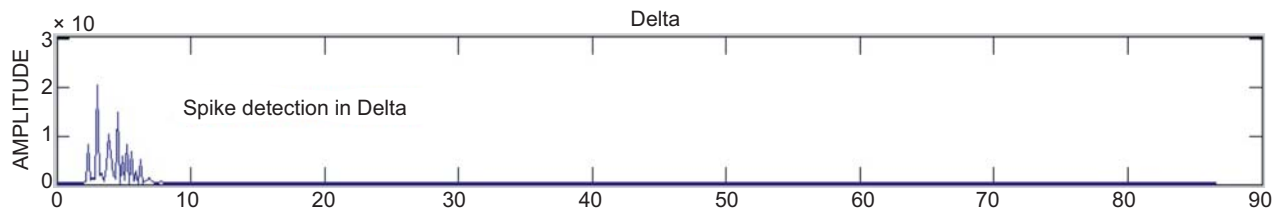
By the Combination of the Different mechanisms we can obtain the required symptoms for the different inputs.

**3. RESULTS**

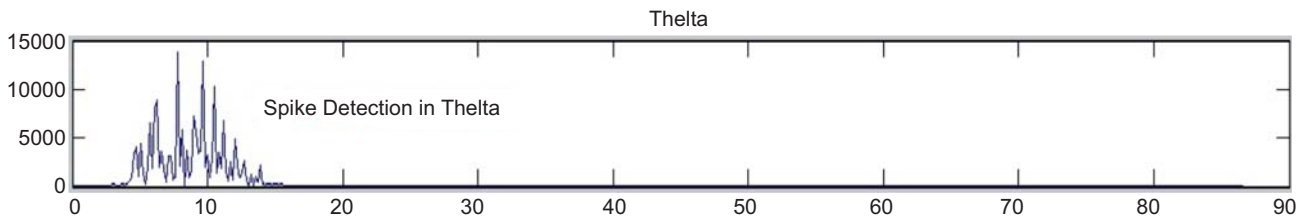
The Simulation Results has been taken with the MATLAB by using the common available open-source datasets. The following results has been given as follows as



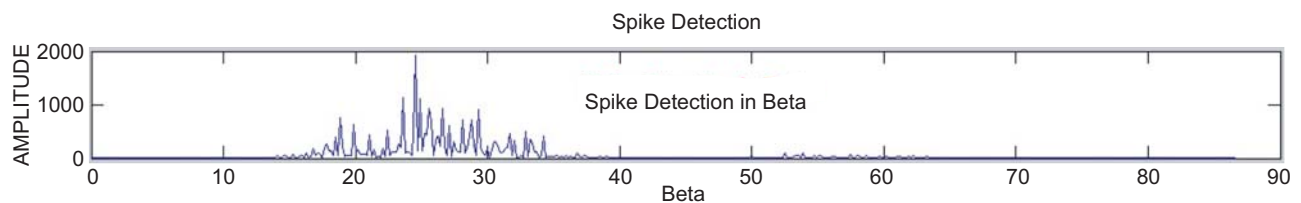
**Figure 7: Shows the Alpha Signals with the Different Spikes before proceeding to TW Phases**



**Figure 8: Shows the Delta Signals Spike Detection before proceeding to TW Phases**



**Figure 9: Shows the Theta Signal Spike Detection before proceeding to TW Phases**



**Figure 10: Shows the Beta Signal Spike Detection before proceeding to TW Phases**

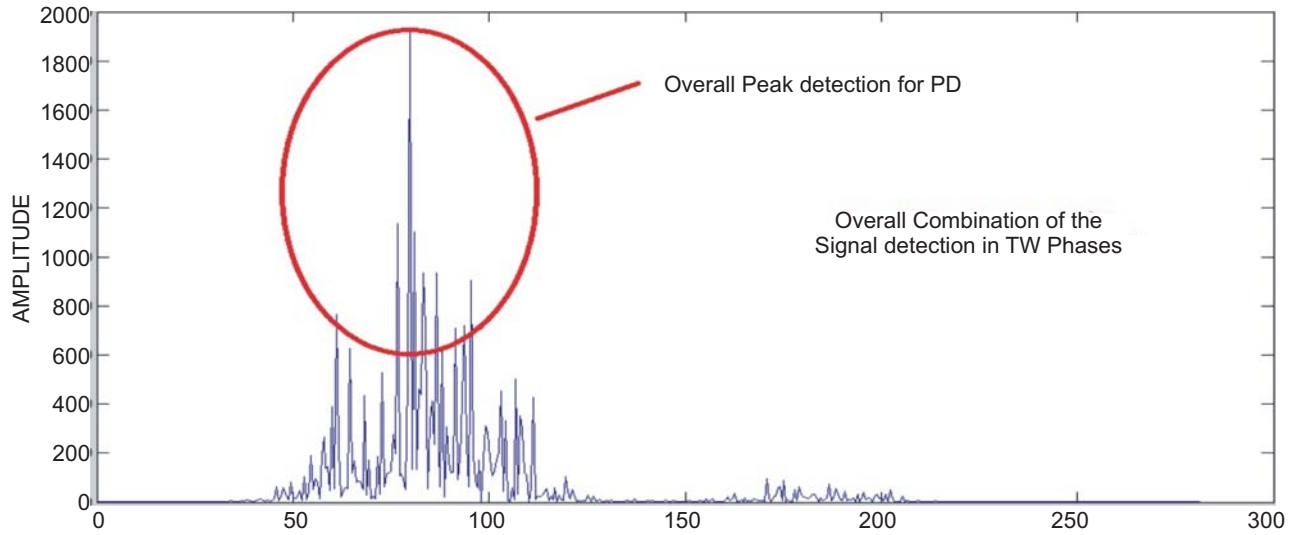


Figure 11: Shows the Overall Signal Spike Detection for the PD affected Signals

### 3.1. Comparative Analysis

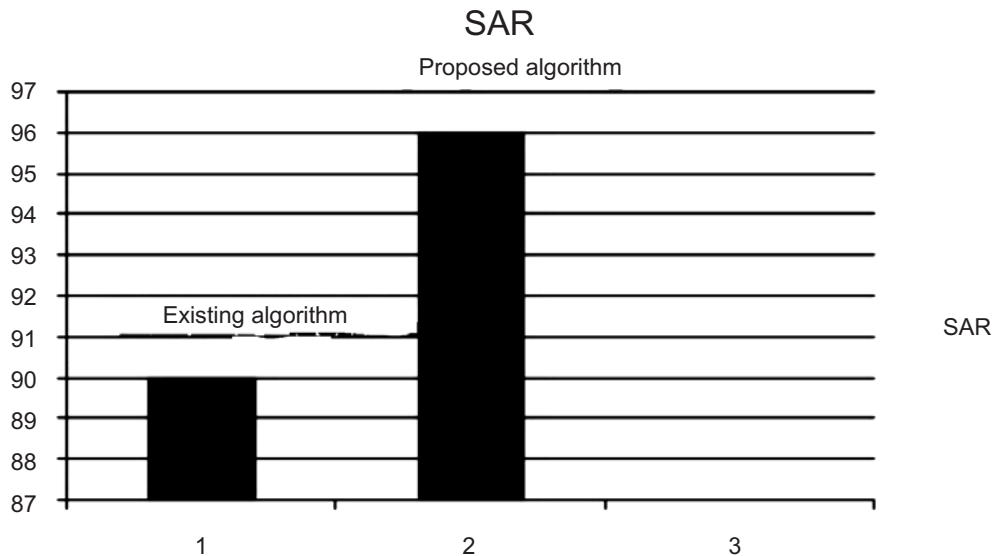


Figure 12: Comparative Analysis of the Systems –Proposed and Existing One

The result has been compared with different existing systems and the input has been taken from the different open-source datasets for the testing. These testing shows the increase in the accuracy shown in Fig so that these methods has been used for the detection of the diseases accurately

## 4. CONCLUSION

The ACPT method gives the good accurate results for the diagnose of the diseases. The ACPT has been tested for the Parkinson Diseases Symptom Analysis. Further the algorithm can be improved for the different diseases identifications. But as the First step, it has been tested with the open-source datasets. This algorithm can be improved further taking the real-time data sets for the better accuracy.



## REFERENCE

- [1] Turkey N Alotaiby, Saleh A Alshebeil<sup>2</sup>, Tariq Alshawi, Ishtiaq Ahmad and Fathi E Abd El-Samiel ‘EEG Seizure detection Systems –Its Survey’ EURASIP JOURNAL OF SIGNAL PROCESSING -2014
- [2] Deng Wang, Duoqian Miao, and Gunnar Blohm ‘ A New Method for EEG-Based Concealed Information Test’ IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY, VOL. 8, NO. 3, MARCH 2013
- [3] Michel F. Valstar, Timur Almaev, Jeffrey M. Girard, Gary McKeown, Marc Mehu “FERA-SECOND FACIAL RECOGNITION AND EXPRESSION ANALYSIS “ IEEE TRANSACTION -2015
- [4] Javed Ruzzi “ Automatic Emotion Recognition through Facial Expression Analysis in Merged Images Based on an Artificial Neural Network ““ IEEE TRANSACTION -2015
- [5] Tiago Matias and Rui Araujo, 2013. Genetically Optimization Algorithm for Engineering Problems: Optimized Extreme Learning Machine, IEEE Dierential Evolution Algorithm, Turkish Journal of Conference on Emerging Technologies & Factory Electrical Engineering & Computer Sci., 12(1): 53-60.
- [6] Jay Prakash Gupta, Pushkar Dixit, Nishant Singh, Vijay Bhaskar Aemwal “Analysis of Gait Pattern to Recognize the human Activities “International Journal of Artificial Intelligence and Interactive Multimedia, Vol. 2, NO 7.