A Review on EEG based Biometric Identification of Human

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Abstract : Electroencephalographic (EEG) are commonly used in medical and research area. In this article discuss about EEG measurement with building basic knowledge for performing EEG recording, and it have detailed studies in analysis, feature extraction and classification of EEG signals are still lot of investigation and issues for researchers due to the diversity of the brain signals. The main different and its features are used to identify encephalopathy's.

Objective: The human brain beings produce naturalimpulseof electroencephalographic (EEG) signals that can be used to identify subject and it matters.

Application: EEG has higher importance in access control, security, person identification and authentication. In authentication mode system determine whether the subject is who he claims to be.Indentification determine who the member is and whether he has access control

Keywords: Biometrics, EEG, signal processing, Brainwaves, Algorithms.

1.   INTRODUCTION

Biometrics is the very popular measurement and most statistical analysis of people's physical and their behavioral characteristics. Figure 1 shows the block diagram of biometrics method. Biometrics authentication has two main processes: enrollment and release process. In enrollment stage it collect user attribute included in database. The gathered information was manipulated by using algorithms; comparisons are made between sample of database and the subject details already stored in database.

2.   TYPES OF BIOMETRICS

There are two types of biometric identifiers :

2.1. Physiological characteristics

The composition or shape of the body. Examples: face detection, fingerprints, hand geometry and iris recognition.
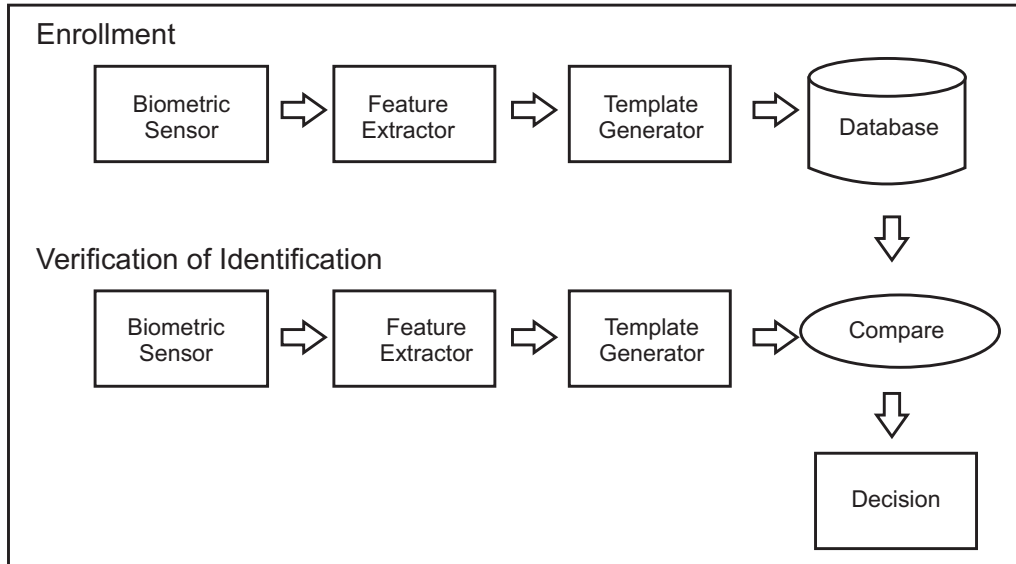
Figure 1: Block diagram of biometrics method

2.2. Behavioral characteristics

Behavioral biometrics are used information security to identify individual by their unique feature. Examples: EEG signal, signature, ECG, and voice. If any of the physiological impression is stolen it's difficult to rebuilt, but in behavioral we can rebuild, so this paper discuss about EEG signal processing. Fig 2 representsthe types of biometrics. Some example of behavioral biometrics are given bellow:
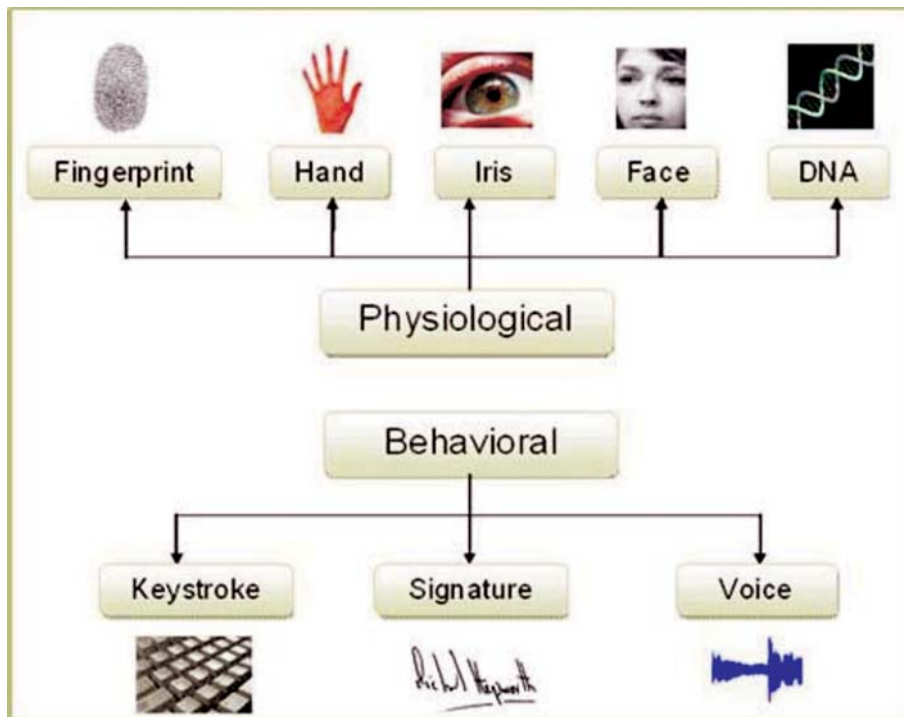

Figure 2: Types of Biometrics

2.2.1. EEG

Type of electromagnetic signal generated by brain, EEG signal are harder to steal, it provide more secure in user authentication.

2.2.2. ECG

Type of electromagnetic signal generated by heart, ECG signals are more confidential and it provide secure in user identification and authentication.

2.2.3. Gait

The way person walk, it can be the pressure used to walk.

2.2.4. Blinking Pattern

Time between blinks, how long the eyes is held to close each blink.

2.2.5. Keystroke

The way person types. It can be timing of keystroke and the pressure used to type.
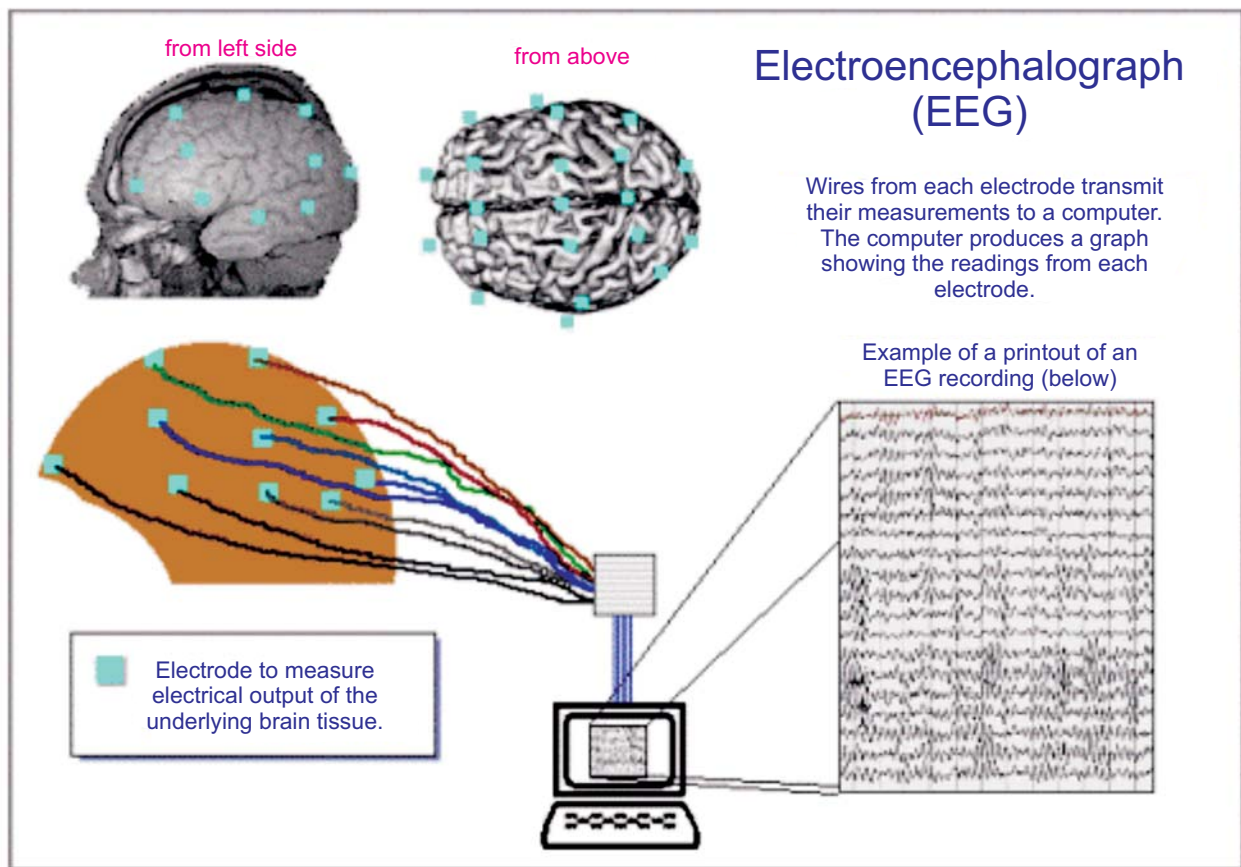
3. EEG SIGNAL PROCESSING

Figure 3: EEG Electrode transmission

EEG signal transmission by using electrode is shown in fig 3; the wire from each electrode is transmitting their measurement to the computer. It produces a graph reading for each electrode and electrical output is produce. Fig 4 shows the general authentication structure of EEG, it collect the signal and preprocess the signal and decompose by wavelet, authenticated by neural network.
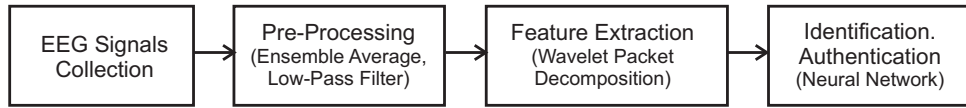

Figure 4: General Structure of the Authentication System

Quantitative electroencephalography (QEEG) is a brain imaginguniqueapproach that allows us to realize an individual's electrical brain activity and more active brain function as shown in Figure 5. Creating a way of the brain's electrical signalmovement is actually fairly truthful and takes only a couple of hours. It is also absolutely non-invasive pain-free.
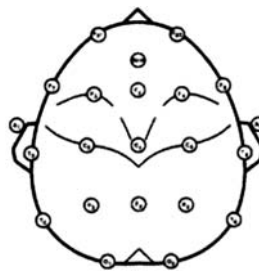

Figure 5: Quantitative Electroencephalography

4.   LITERATURE REVIEW

[1]**Q. Gui, Z. Jin, and W. Xu.** Exploringauthor research thehuman brain test about their signal in totwo methods:they are Euclidean Distance (ED) and Dynamic Time Warping (DTW).When compare the accuracy of ED and DTW, ED accuracy reaches **80%** and DTW accuracy reaches 68%, hence he concludes ED is better. The disadvantage of DTW method minimum accuracy of the channel is 33.83%,so the brain activity pattern of different individuals leads to better identification in accuracy compared to other channels.The experimental results demonstrated that the channel Oz shows stronger distinguishing capability compare to other channels around this region, which can be utilize in future study to understand the interpret the specific sub region of the brain in such cognitive tasks.[2]**Danilo P. Mandic**according to author the brain electrical biometrics has classified as Visual Evoked Potential (VEP) and EEG.VEP signal filter the power content using Multiple Signal Classification algorithm.MUSIC algorithm used to calculate the dominate frequency to filter the VEP signal.The advantage of brain signal electrical activity is a unique, therecorded brain response cannot be duplicated when the person identity is forged or stolen. KNN takes longer computation time during testing.ENN accuracyimproved for **95%,**error rate ENN was reduced by using Resilient-back propagation algorithm.[3]**Gonzalo Safont, Addisson Salazar, Antonio Soriano, Luis Vergara**author use fusion algorithm for secure brain authentication and it performance ismeasured bytwo types, they areFalse Accept Rate (FAR) and False Reject Rate (FRR). EEG can be recorded only for live people so it can also be used as aliveness control.Using fusion algorithms it increases the performance of work, sothe results for genuine subject classification rate of **93.8%**,.Feature change will happen in subject in the database and selection of subject is the part of classification stage of the system, fusion algorithm and Gaussian mixture classification and copula fusion algorithm have a future work to open the application of main advanced classification.[4]**WAEL H. KHALIFA ,ABDELBADEEH M. SALEM**author has discuss the EEG recording of electrical activity of brain, he applies the machine learning technique followed by Artificial immune systems (AIS) method, Table1 shows the Experiment protocol for

typing task here stage 1 and stage 3 was reading task they differ in corpus and typing task, the advantages is we can use the brain signal in security systems. Brain signals in nontrivial task implemented the framework of Gaussian mixture model(GMM) and Maximum a posterior (MAP)models was more secure it can also be able to rebuild authentication information if it was theft. There will always be a need for finding a more secure and reliable identification and authentication technique, the accuracy of the result **81%** whichis high identification rate was achieved by AIS by variability of EEG signals over the time. Unique signature of the user for different task is used for feature identification.

Table 1
Experimental protocol

Read silently	Transcriptional Typing	Reading silently	Hacking
(2 min)	(10 min)	(2 min)	(5 min)

[5]**Koike-Akino, T.Mahajan** used Liner decrement analysis (LDA), Quadratic discriminate analysis (QDA) algorithm and Event-Related Potential (ERP) used to achieve result of **96%** in Multi-epoch classification, hence it also decreases the error rate to archive the accuracy. Decision are made by decision tree (DT), neural network (NN) and k the nearest path neighbors are find by (k-NN), For real time EEG use wireless technique, Experimental protocol design in non-clinical settings.[6]**Ramasamy palaniappan**author usedBack propagation algorithm and Nguyen–Widow algorithm, AR model-ling of EEG signals and Linear Vector Quantization (LVQ) neural network (NN) methods for Biases are training faster it has main effective way of available neurons over purely random weights and accuracy of characteristics **97.62%.**Biases are training faster it has main effective way of available neurons over purely random weights. Disadvantage of LVQ is by selecting optical channel the size will increase. Davies bouldin index(DBI)feature reduce the size by selecting optimal channels. The result may be multi model or single identification and hence reducing the number and increase its performance.[7]**Jason K. Johansson**author discussed the millisecond resolution in EEG.Filter and wrapper methods divided the variable selection method by two lines and he achieved the result **84%.** Support vector machine (SVM) consist a gammas role in memory encoding, during memory retention it engage the data and elevate low frequency activity by Classification algorithm andthe ignoresof the performance of selected variable is the disadvantage occur here. EEG signals brain activity task may vary for different individuals,the Incorrect behavioral response indicates the higher value of the negative valences weights in future.

[8]**A. Riera, A. Soria-Frisch**author reduces the number of electrode, hereDiscriminant analysis (DA) method is used and accuracy result achieve **96.6%,** to get optimal solution and different type of coding signals is used.It is very difficult to make fake in EEG signature or to make blame an EEG system, so in feature EEG is universal. Biometrics research system highly reliable and expect the minimum level of security access is required.Single channel feature and their corresponding main different channels are the major features. [9]**Hema C.R, Paulraj M.P**author investigate about brain activity of EEG identification compare the two models.RNNmodel with better accuracy **95%** and **92%** for feed forward network. Using burg algorithm for RNN model the accuracy achieved for spell task **95%.**Recurrent neural network RNN model is better when compare to feed forward neural network(FFNN)model. Covariance algorithm and FFNN model sufficient deviation varied from 4.19 to 1.31, this was the lowest standard deviation obtained for read task. High frequency resolution is achieved by using burgalgorithm. Compared to static network model RNN model has high classification accuracy. Going forward it will be a live measurement of the signal and powerful network model used.[10]**Swetha.J** author discuss the EEG identification over person to person, EEG signals are classified byLinear discriminant analysis (LDA**)** method with accuracy result classification **70%**IT is very difficult to fake the brain signal which is not exposed, its leads to a very secured biometrics. The spectral distribution is unique that is the interclass variation of the power spectrum in the alpha band is large characteristic of EEG signal are unique, so they are suitable for the classification purpose.

[1]Q. Gui, Z. Jin, and W. Xu. Exploringauthor research thehuman brain test about their signal in to two methods: they are Euclidean Distance (ED) and Dynamic Time Warping (DTW).EEG electro channel are used for visual stimuli and the potential impact. ED and DTW method use minimal distance values to compare the subject and to identify the acceptance/rejection.**[5]Koike-Akino, T.Mahajan**author use Event related potential method to identify feature and inter subject responses for identification.Data Acquisition is the best low cost EEG.**[6]Ramasamy palaniappan**author usedBack propagation algorithm and Nguyen–Widow algorithm, AR model-ling of EEG signals and Linear Vector Quantization (LVQ) neural network (NN) methods for Biases are training faster it has main effective way of available neurons over purely random weights and accuracy of characteristics.

[8]A. Riera, A. Soria-Frischauthor reduces the number of electrode, here Discriminant analysis (DA) method is usedto get optimal solution and different type of coding signals is used.**[10]Swetha.J**author discuss the EEG identification over person to person, EEG signals are classified byLinear discriminant analysis (LDA) method. It is very difficult to fake.

5. ANALYSIS OF REVIEW

From the above literature study of relative study on method and algorithm used for EEG security, how much the study made on each methods. The qualified result said that EEG is anliveness detection method, it has a peripheral force detection on anti-spoofing capability on biometrics is higher security; No one can access our brain. EEG use balancing model which is not forgotten easy.

6. CONCLUSION

EEG identification and authentication is comparing through several dimensionality reduction techniques and classification algorithm. This paper the advantages of using the brain signal in security systems. Using the brain signals is also a nontrivial task due to the nature of the brain. By using burg algorithm for RNN model we achieved best performance of spell task with mean accuracy of 95%. It is difficult to make fake in EEG signature or to make attack an EEG system, so in feature EEG is universal. Going forward it will be live measurement of the signal and powerful network model used. The classification performances can be accuracy, senility and specificity .EEG identification and authentication has been divided into multiple stages like Database training, Decision fusion , Detection and feature extraction. The future direction there will be an online testing signal which recognizesadults using different classification algorithm.

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