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Academic Year 2018-19

Sr. No.	Name of the Teacher	Title of the book/chapters published	Title of the paper	Department	Evidences
1	Prof. N.M. Kandoi	--	A review paper on Content Based Image Retrieval Techniques	Computer Science and Engineering	Click Here
2	Prof. N.M. Kandoi	--	Image Search Engine for Retrieval of similar images using CBIR, SVM, SIFT	Computer Science and Engineering	
3	Prof. N.M. Kandoi	--	Image search engine For Retrieval of Similar Images using feature extraction based on contents of query and database images	Computer Science and Engineering	
4	Dr. S.R.Paraskar Pavan Tapre Dharmendra Singh	--	Implementation of Improved Lion Algorithm for Generator Scheduling in Deregulated power system using IEEE 30 bus System"	Electrical Engineering	Click Here
5	Prof. R.S.Pote Prof. S.S.Jadhao Prof. G.N.Bonde	--	Discrimination of power quality events using power modal signal	Electrical Engineering	
6	Prof. R.S.Pote Ajinkya Yeul	--	Monitoring of solar power plant and load control	Electrical Engineering	
7	Prof. U.A.Jawadekar Swati D Ingale	--	To investigate power quality issue of Hybrid System using DVR and STATCOM	Electrical Engineering	
8	Prof. U.A.Jawadekar Siddhesh Gade	--	To improve power flow capability by using unified power flow controller	Electrical Engineering	
9	Prof. U.A.Jawadekar	--	Simulation of fault current limiter (FCL) for voltage sag mitigation	Electrical Engineering	
10	Dr. A.U.Jawadekar	--	Reactive Power Management using TCS TCR	Electrical Engineering	
11	R Z Fulare , S S Jadhao	--	Fault Analysis Technique for Protection of Thyristor Controlled series Compensated Transmission Line	Electrical Engineering	

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11	Prof. R.Z.Fulare Prof. S.S.Jadhao Prof.P.R.Bharambe	--	Identification of Sympathetic Inrush Current of a Transformer	Electrical Engineering	Click Here
12	P. R. Wankhede,Dr. K. B.Khanchandani	--	Refine Blood vessel Segmentation in fundys images using improved graph out method	Electronics and Telecommunication Engineering	Click Here
13	D. P. Tulaskar, Dr. K. B. Khanchandani	--	Design and analysis of Planar wideband Antenna for RF front End multi standard Transceivers	Electronics and Telecommunication Engineering	
14	Dr. M. N. Tibdewal	--	ANN Based Automatic detection and classifications of OA and NON artifucts EEG	Electronics and Telecommunication Engineering	
15	V. N. Bhonge	--	Face Authentication and Auto Sharing Using Deep Learning Algorithm	Electronics and Telecommunication Engineering	
16	Dr. R. S. Dhekekar	--	SVM classifier approach to explore effect of OM mantra on brain	Electronics and Telecommunication Engineering	

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This is to certify that

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has successfully presented a paper entitled

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in the International Conference on Inventive Research in Computing Applications (ICIRCA 2018), Organized by RVS College of Engineering and Technology, during July 11-12, 2018 at Coimbatore, Tamil Nadu, India.

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presented his/her research paper titled *A Review Paper on Content Based Image Retrieval Techniques*

during the "International Conference on Recent Trends in Engineering & Technology (ICRTET-2018)"

held at Vemana Institute of Technology, Bengaluru, Karnataka on 20th and 21st June 2018.

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Faculty Publications: International Conference (09)

Academic Year 2018-19					
Faculty Publication			International Conference		
Sr. No	Title of the Paper	Author	Details	Impact Factor	Citation/Index
01	Implementation of Improved Lion Algorithm for Generator Scheduling in Deregulated power system using IEEE 30 bus System"	Dr. S.R.Paraskar	International conference of smart electric Drives and power system (ICSEDPS-2018) organized by GHRaisony college of engg Nagpur 12-13 June 2018 **DOI:** 10.1109/ICSEDPS.2018.8536070	9.107	IEEE
02	Discremination of power quality events using power modal signal	Prof. R.S.Pote Prof. S.S.Jadhao Prof. G.N.Bonde	ICETSMI 2018, 02 sep 2018 (Acadamic Science)	2.52	Acadamic Science
03	Monitoring of solar power plant and load control	Prof. R.S.Pote	Third ICITEASM 2018. Hydarabad telangana 24th june 2018	2.52	Acadamic Science
04	To investigate power quality issue of Hybrid System using DVR and STATCOM	Prof. U.A.Jawadekar	Third ICITEASM 2018. Hydarabad telangana 24th june 2018	2.52	Acadamic Science
05	To improve power flow capability by using unified power flow controller	Prof. U.A.Jawadekar	Third ICITEASM 2018. Hydarabad telangana 24th june 2018	2.52	Acadamic Science
06	Simulation of fault current limiter (FCL) for voltage sag mitigation	Prof. U.A.Jawadekar	4th ICAEASM-2018 Chandigarh India on 1st july 2018 ISBN: 978-93-87433-28-1	2.52	Acadamic Science
07	Reactive Power Management using TSC-TCR	Dr. A.U.Jawadekar	International conference on Robotics,CommunucationTechnology, Electronics and Electrical Engineering(ICRRCTEEE) Bengalure, India on 02nd June 2019	3.2	IRAJ
08	Fault Analysis Technique for protection of Thyrister controlled	Prof. R.Z.Fulare Prof. S.S.Jadhao	ICEEE pune, on 8th july 2018 Proceedings of WRFER International Conference, 08th July, 2018, Pune, India	3.2	IRAJ

	series compensated transmission line				
09	Identification of Sympathetic Inrush Current of a Transformer	Prof. R.Z.Fulare Prof. S.S.Jadhao Prof.P.R.Bharambe	4th ICAEASM 2018 Chandigarh India on 1st july 2018 ISBN: 978-93-87433-28-1	2.52	Acadamic Science

Implementation of Improved Lion Algorithm for Generator Scheduling in Deregulated Power System using IEEE-30 Bus System

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Abstract—

In competitive electricity market, congestion is a serious economic and reliability concern. Congestion is a common problem that an independent system operator faces in open access electricity market. This paper presents a reliable and efficient meta-heuristic based approach to solve congestion problem. Numerous algorithms are reviewed in literature work to overcome such problems, yet it suffers from disadvantages like reducing congestion with least rescheduling cost. Hence this paper attempts to minimize the congestion as well as rescheduling cost by introducing an Improved Lion Algorithm (LA) termed as Lion Plus Grey Wolf (LPGW) algorithm. The proposed algorithm is tested on IEEE 30-bus system compared with other existing strategies like conventional LA-based rescheduling strategy in terms of analyzing congestion, cost, and convergence respectively, and the obtained results show the efficiency of proposed LA by minimizing congestion with less rescheduling cost.

Keywords— Power System; Congestion Mangement; Rescheduling strategy; Levy Flight; Improved Lion Algorithm

I. INTRODUCTION

From the last two decades, the deregulation of power sector has incurred a drastic change in the viewpoint of power sector setup [2]. Due to this deregulation aspect, the competition has been familiarized in the marketing area, which makes the cost-based power to goes into price based market service [6][20][18], and anticipated the individual creating service to retail their produced power to the consumers or clients. Thus, they have tried for the accommodation of their respective produced power on the transmission line, which leads to congestion in transmission line [7][16][17].

Normally, congestion is defined as lack of capacity to supply their waiting consumers. Moreover, it may ground vast problems to the strength of the power networks, which also adventures the incompetence and price or value scramble for power in the market. In order to manage congestion, Independent system operator (ISO) is effectively liable in the line of transmission with confidence or security. For the purpose of alleviating this congestion, which arises in the transmission line, more Congestion Management (CM) procedures are suggested and experienced in the power industry.

Besides, if the congestion is frequently predicted, more measures are there to control and recover from congestion. Some of the recovering measures are demand minimization in the congested zone; by mandating managing sequences; by hosting many producing services everywhere desirable and further by accumulating new transmission lines for the transmission of electricity from distance generators [11] [1] [24]. Some of the standard practices for managing the congestion are restriction in load, FACTS controllers' adjustment and rescheduling the generator output [27] [28] [29]. Further, it is more vital to maintain the security of power system in the dependable limit for the purpose of granting unceasing electric supply to the customers without distressing the system [25] [26] [30]. Indeed, due to the random deviation in the transaction of power, it is really crucial to lighten the congestion in the electricity market.

This paper intends to develop a new congestion management method for deregulating the power system with the aid of progressive soft computing method. Though there present various congestion management methods; it is intended to adventure the idea of generation rescheduling. Further, an Improved LA optimization algorithm is adopted to resolve the objective aspects, and thereby, the congestion management is successfully accomplished. The rest of the paper is organized as follows: Section II review the literature work, Section III explains the model of congestion management via rescheduling basis. Section IV details the optimal rescheduling based congestion management by Improved LA algorithm. Section V

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"To investigate power Quality's issue of Hybrid system using DVR and STATCOM"

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This is to certify that

Uday A. Jawdekar

SSGMCE, Shegaon, India

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"To improve power flow capability by using unified power flow controller"

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Certificate of Presentation

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Presented a paper Titled as

"SIMULATION OF FAULT CURRENT LIMITER (FCL) FOR VOLTAGE SAG MITIGATION"

in the conference organized by Conference Info in association with Academic Science at Indian Council of Social Science Research , North West Regional Center , Punjab University Campus Chandigarh, India on 1st July 2018

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FAULT ANALYSIS TECHNIQUE FOR PROTECTION OF THYRISTOR CONTROLLED SERIES COMPENSATED TRANSMISSION LINE

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Abstract - Electrical Power System is most of time affected with transmission lines faults which disturb the system reliability, security and delivered energy quality. There are different types of Transmission line faults viz L-G, L-L, L-L-G, L-L-L. Fault classification is an area of continuous research in power system. To design accurate protection system, for the economic operation and stability of the power system network, it is of vital important to classify transmission line faults as quickly as possible.

This dissertation work proposes a new technique for fault analysis of transmission line faults in power system. The power system network considered in this study is "2 BUS TEST SYSTEM" which is simulated in PSCAD and the wavelet Transform technique is used for analysis of different types of transmission line faults and classify with the help of Artificial Neural Network.

Keywords - Wavelet, Discrete Wavelet Transform, Neurons, Feed Forward Propagation Neural Network.

I. INTRODUCTION

Transmission lines constitute the major part of power system. Transmission and distribution lines are vital links between the generating unit and consumers to achieve the continuity of electric supply. To economically transfer large blocks of power between systems and from remote generating sites, High voltage (HV) and Extra high voltage (EHV) overhead transmission systems are being used. Transmission lines also form a link in interconnected system operation for bi-directional flow of power. Transmission lines run over hundreds of kilometers to supply electrical power to the consumers. They are exposed to atmosphere, hence chances of occurrence of fault in transmission line is very high which has to be immediately taken care of in order to minimize damage caused by it. It will also facilitate quicker repair, improve system availability and performance, reduce operating cost and save time and effort of maintenance crew searching in, sometimes in harsh environmental conditions. It has always been an interest for engineers to detect and locate the faults in the power system as early as possible. Fast clearing and restoration is very essential as it not only provides reliability but sometimes also stops propagation of disturbances which may lead to blackouts. Various fault detection and location methods have been proposed for this purpose, which can be categorized as below [1].

- Technique based on fundamental frequency currents and voltages, mainly on impedance measurement.
- Technique based on travelling wave phenomenon.
- Technique based on high frequency components of currents and voltages generated by faults.
- Knowledge based approaches.

Techniques based on high frequency components of currents and voltages generated by faults mainly comprise wavelet based protection system [2]-[6]. Wavelet transform in conjunction with AI/Fuzzy/expert system based technique have the advantage of fast response and increased accuracy as compared to conventional techniques [7]-[9]. Wavelet transform in conjunction with AI/Fuzzy/expert system based techniques have the advantage of fast response and increased accuracy as compared to conventional techniques [7]-[9]. Recently, a lot of research efforts have been focused on fault location techniques both in transmission and distribution network using knowledge based (artificial intelligence) methods, such as artificial neural networks, fuzzy set theory and expert systems[10]-[24].

This paper includes a new approach based on wavelet multi-resolution analysis and feed forward propagation neural network. When a fault occurs in transmission line, it initiates a transition condition. These signals have a finite life i.e. they decay to zero in a finite time. Transients produce overvoltage and over currents in the power system, which can damage it depending upon its severity; they also contain useful information which can be used for analyzing disturbances in transmission lines [10] [25]-[34]. The consequences of transients are presence of high frequency components in voltage and current fault signals. Various methods have been proposed to extract useful information from these high frequency components or harmonics. These methods are based on Fourier transform, wavelet transform, artificial neural network, fuzzy logic or combination of these techniques. Fourier transform and wavelet transform

Wavelet transform based technique with the combination of ANN is presented in this work. The statistical parameters are provided as input to ANN for classification of fault. The same result is obtained with proposed structure of ANN for various fault inception angle and loading angle. The proposed method is tested on 2 bus system for different fault conditions with faults at different phases, at different locations and at different fault inception angles and performance of the proposed scheme was investigated, and it is capable to classify the fault occurred on power system accurately.

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IDENTIFICATION OF SYMPATHETIC INRUSH CURRENT OF A TRANSFORMER

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Abstract:-*This paper presents a preliminary study of sympathetic inrush - a phenomenon when an already energized transformer experiences unexpected saturation during the energizing of another transformer connected in parallel. Power transformer can be saturated, giving rise to transients which leads to overvoltage and overcurrent. With the increase of distributed generations that can exaggerate more switching events, transients will become prevalent in such an operating environment. Simulation model is developed to observe the sympathetic inrush interaction and wavelet transformation is used to identify sympathetic inrush current in the power transformers. The data obtained from the simulations are given to the wavelet transform for computing the coefficients of the signals which differentiate the magnetizing inrush current and sympathetic inrush current of transformer.*

Keywords - Sympathetic inrush current, magnetizing inrush current, power transformer.

1. INTRODUCTION

In any electrical supply network, the stability and reliability are the most important concern. Some of the issues that could pose a problem is the voltage and current disturbance triggered by transformer energization, unbalanced loading, transformer tap changing, lighting strokes. load switching, power system faults, etc. Conceptually, power transformer can be saturated and give rise to a number of transient issues which leads to overvoltage and overcurrent[1]. With the increase of distributed generations that can exaggerate more switching events, transient could become prevalent in such a complicated electrical environment. This can also cause power quality variation.

Energization of the transformer malfunctioning the transformer differential protection or generator differential protection. The reason is that when transformer energise during no load will produce excitation current which passes the system resistance causes asymmetrical fluctuation of the busbar voltage, resulting in saturations generating sympathetic inrush current in adjacent transformer. Sympathetic interaction between transformers can cause significant inrush currents that may lead to voltage sags. It often happened that transformer energization draws large inrush current, and then decays down to a small magnetizing current. The decay duration for the inrush current is dependent on the circuit resistance, circuit reactance, and magnetizing reactance of the transformer. Since the transformer's magnetizing inductance is high, the inrush current will take a longer time to reach its steady state. It was suggested that smaller transformers have higher inrush currents and decay more quickly, while larger transformers have smaller inrush currents and decay more gradually.

A transformer inrush event is actually magnetizing inrush current. The windings in a transformer are linked magnetically by the flux in the transformer core. The exciting voltage drives the flux in the core. An increase in the exciting voltage therefore increases the flux. To maintain this additional flux, which may be in the saturation range of the core steel of the transformer, the transformer draws more current which can be in excess of the full load rating the transformer windings. This additional current is the inrush current necessary to supply the magnetizing branch of the transformer [8].

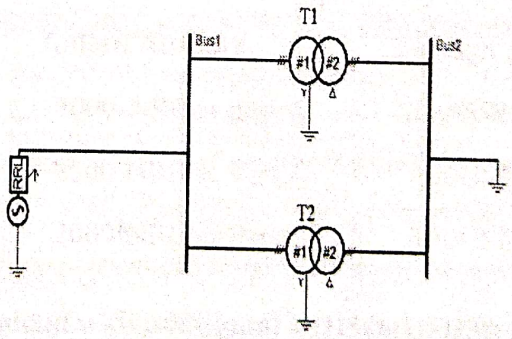

Fig. 1: simplified one line diagram for parallel connection of transformer

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Session: 2018-19

3.3.3 Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during year

Sl. No	Name of the teache	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / International	Year of publication	ISBN/ISSN number of the proceeding	Affiliating Institute at the time of publication	Name of the publisher
1	P. R. Wankhede,Dr. K. B.Khanchandani	---	Refine Blood vessel Segmentation in fundys images using improved graph out method	Journal of IEEE International conf. on Smart System & Incentive Technology (ICSSIT-2018)	IEEE International conf. on Smart System & Inventive Technology (ICSSIT-2018)	International	2018	IEEE #: CFP18P17-POD ISBN: 9781538658741	SSGMCE	IEEE
2	D. P. Tulaskar, Dr. K. B. Khanchandani	---	Design and analysis of Planar wideband Antenna for RF front End multi standard Transceivers	Journal of IEEE International conf. on Smart System & Incentive Technology (ICSSIT-2018	IEEE International conf. on Smart System & Inventive Technology (ICSSIT-2018)	International	2018	IEEE #: CFP18P17-POD ISBN: 9781538658741	SSGMCE	IEEE
3	Dr. M. N. Tibdewal	---	ANN Based Automatic detection and classifications of OA and NON artifucts EEG	Journal of IEEE Conf. ICCS	IEEE International Conference on Communication Systems (ICCS)	International	2019	IEEE Catalog Number: CFP18806-ART ISBN: 978-1-5386-7864-0	SSGMCE	IEEE
4	V. N. Bhonge	---	Face Authentication and Auto Sharing Using Deep Learning Algorithm	Journal of 4th International Conference on Computations Communication control & Automation	4th International Conference on Computations Communication control & Automation	International	2018	Ieee conference record # 44295 Ieee xplore compliant isbn # 978-1-5386 6947-1	SSGMCE	IEEE
5	Dr. R. S. Dhekekar	---	SVM classifier approach to explore effect of OM mantra on brain	Journal of 3rd International Conference on Traffic Engineering and Transportation System (ICTETS 2019)	3rd International Conference on Traffic Engineering and Transportation System (ICTETS 2019)	International	2019	(MSE)(ISSN: 1757-8981)	SSGMCE	IEEE

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Retinal Blood Vessel Segmentation in Fundus Images using Improved Graph Cut Method

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***Abstract* — the ophthalmologist uses retinal image features for early detection and possible treatment of retinal diseases. It is necessary to segment blood vessels automatically from retinal images to avoid manual time consuming processes. In our previous work, we presented graph cut based algorithm for segmentation of blood vessels from retinal images. We show that this method is robust for segmentation of blood vessels. In this paper we present the extension of our previous work. We address central light reflection problem associated with retinal images and 'shrinking bias' problem associated with graph cut algorithm. We introduced modified Gaussian filter for removing central light reflection from retinal images. The geometric concept of flux of a given vector field and length/area combined within the global optimization framework of graph cuts. We will show how to integrate flux concept in graph cuts for improving segmentation of long thin blood vessels which helps to remove 'the shrinking bias' problem.**

***Keywords* —** *Vessel enhancement; central light reflection; modified-Gaussian filter, graph cut method, blood vessel segmentation*

I. INTRODUCTION

The extraction of blood vessels is a challenging problem in retinal screening programs for disease classification due to their complex and variable anatomic structures in fundus images.. Several methods have been proposed in literature for segmentation of blood vessels from retinal images [1-8]. Recently, graph-cut based approach has been very popular in image segmentation [12-16], because global optimal value of the predefined energy function could be achieved by graph-cut methods. Also, the user can interact in graph cut segmentation process easily. With the use graph cut method [12-13], a method to extract the blood vessels in fundus images is proposed in [9]. Initially, pre-processing steps are used for enhancement of fundus images. Then, graph cut method is used to segment blood vessels. In this paper, we present detail analysis for removal of central light reflection from blood vessels. Central light reflection occurs due to variable light absorption rate of blood vessels. A modified Gaussian filter is proposed for removal of central light reflection. Later, we will show how to integrate flux concept in graph cuts for improving segmentation of long thin blood vessels which helps to remove 'shrinking bias' problem.

Section II presents preprocessing steps including modified Gaussian filter for removal of central light reflection. It also present shrinking bias problem associated with thin long blood vessels. It also deals with proposed integration method of flux and length / area into the graph cut. Performance measures and experimental results are demonstrated Section III. Finally, Section IV concludes the proposed work and highlights its features.

II. METHODOLOGY

This Section explains preprocessing and segmentation of blood vessel in fundus images.

A. *Pre-processing*

Pre-processing on fundus images is performed to remove central light reflection and non-uniform illumination and contrast enhancement.

1) Removal of central light reflection: in retinal images a bright strip is observed at the central of vessels throughout the length called as the central light reflection occurred due to light reflection at the back of blood vessels [19]. Central light reflection in blood vessels is shown in figure 1.

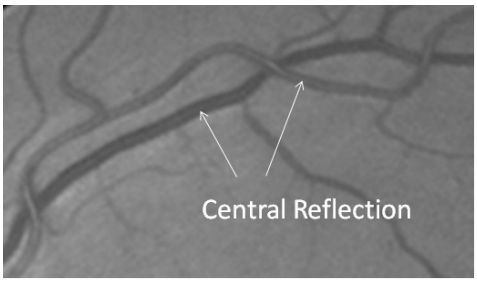


Fig. 1 blood vessels with central light reflection

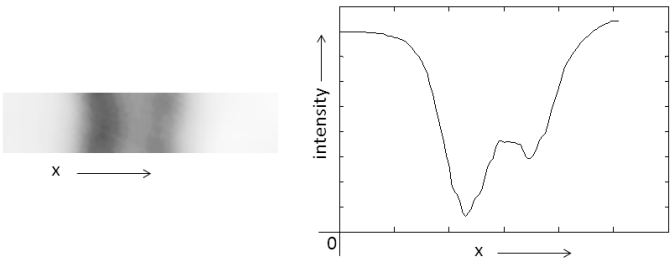


Fig. 2 intensity profile of blood vessel (a) part of blood vessel (b) intensity profile corresponding to one row vector of (a)

An intensity profile of part of blood vessel approximated as Gaussian shape is show in figure 2. But the shape is not exact Gaussian curve and hence needs a modified Gaussian filter [19] to remove central light reflection removal for proper segmentation and detection of blood vessels.

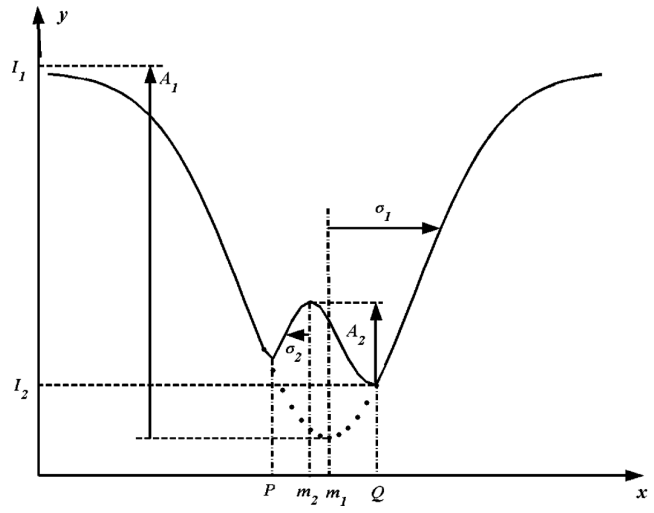


Fig 3 Modified Gaussian model

Modified Gaussian model in (1) can be used to describe vessel profile considering central light reflection from x left to right direction.

$$y = f(x) = \begin{cases} -A_1 e^{-\frac{(x-m_1)^2}{2\sigma_1^2}} + I_1 & x < P, x > Q \\ A_2 e^{-\frac{(x-m_2)^2}{2\sigma_2^2}} + I_2 & P \le x \le Q \end{cases} \quad (1)$$

A modified Gaussian filter with above model removes central light reflection accurately. Arturo Aquino et al [3] have shown that same task can be performed by applying a simple morphological opening operation. An opening operation with 3-pixel diameter disc as structuring element is used to remove central light reflection. Both methods show same results for the central light reflection removal in fundus images. Following table shows description of each variable in intensity profile.

TABLE I
Modified Gaussian profile variables

A1	Height of the Gaussian
m1	Peak position of Gaussian
σ1	Gaussian width
A2	Height of central reflection
m2	Peak position of central reflection
σ2	Gaussian width distribution of central reflection
I1	Intensity of nearest retinal background
I2	Minimum intensity in profile
Q	Left minimum position on intensity profile
P	Right minimum position on intensity profile

2) Removal of non-uniform illumination: in this step first a 3x3 mean filter is applied. Then modified Gaussian filter (1) of dimensions $m \times n = 9 \times 9$ is convolved. Shade correction is used to reduce variations in background intensity. Global thresholding is then used to get homogenised image.

3) Vessel Enhancement: vessel enhancement is achieved by using contrast limiting adaptive histogram equalisation (CLAHE). CLAHE operates on small tiles in image. As the each tile is enhanced and all tiles combined together to give enhanced image. The contrast enhancement amount in intensity is directly proportional to the slope of the cummulitive distribution function (CDF) at that intensity level. Limiting the slope of CDF, contrast enhancement can be limited

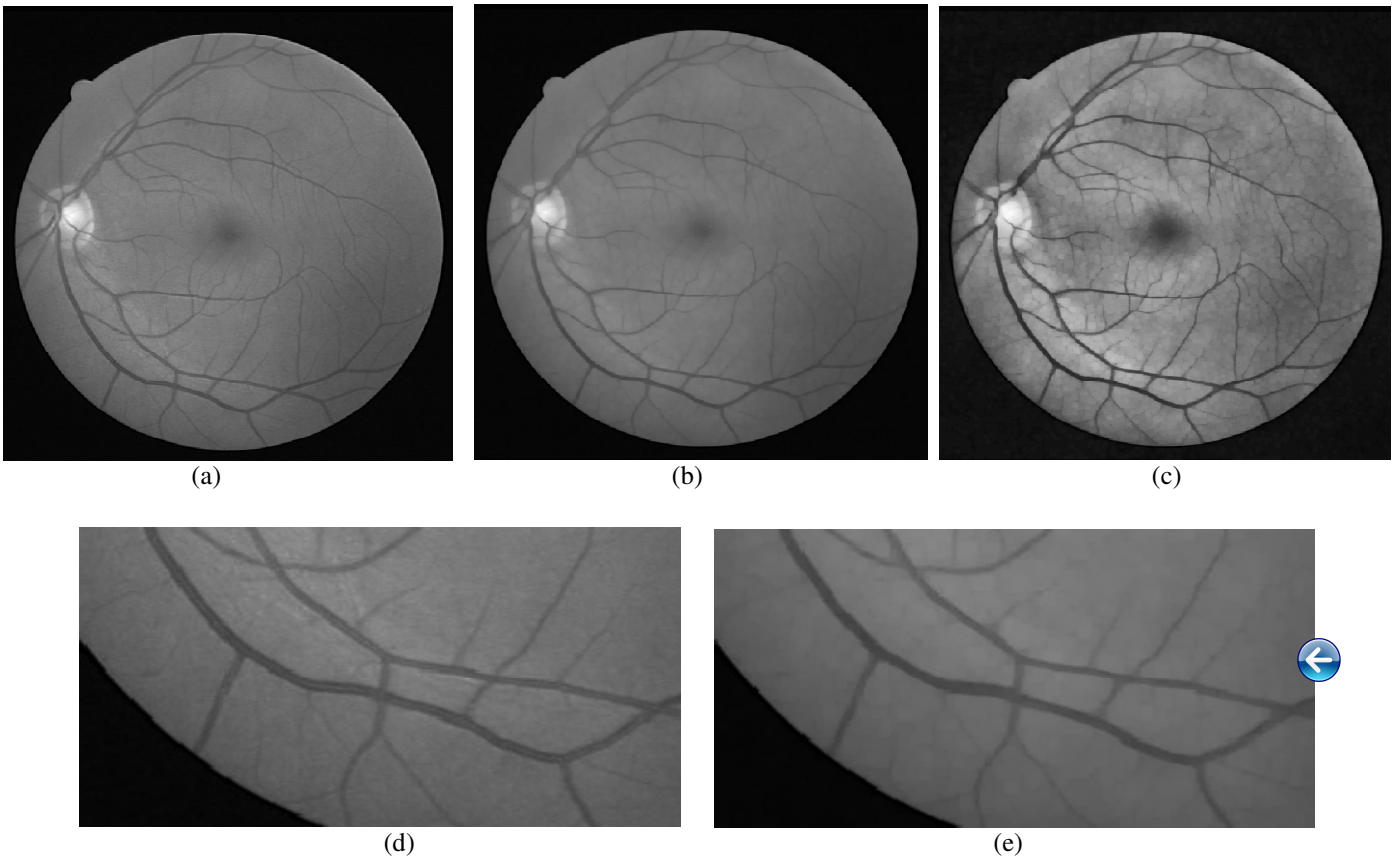
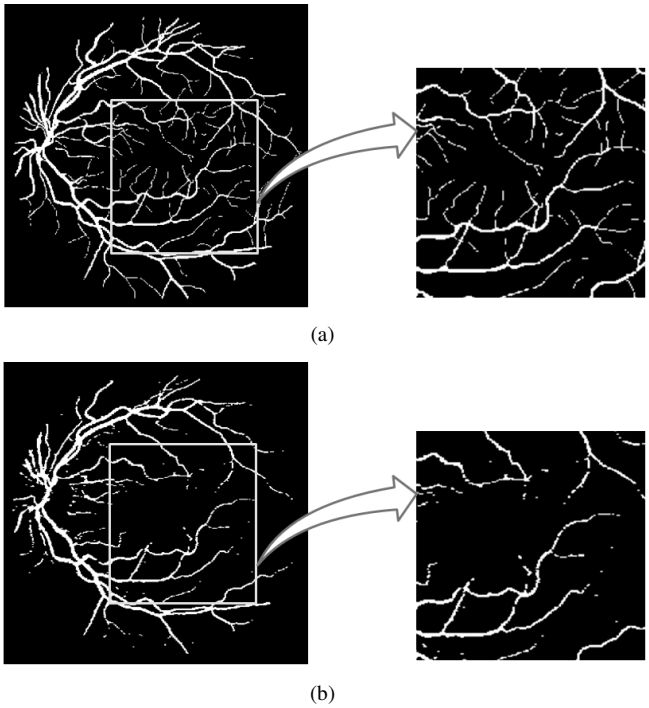


Fig 4. Pre-processing (a) Green Channel of fundus image (b) Result after modified Gaussian filter (c) Image enhancement using CLAHE (d) Central reflection in original image (e) removal of central reflection using modified Gaussian filter

B. Blood vessel segmentation

The proposed method using graph cut for blood vessel segmentation is described in [9]. It is observed that the complete image can be divided into *"foreground"* terminal (source *S*) nodes and a *"background"* terminal (sink *T)* nodes. A graph is created with undirected edges to connect these neighboring nodes. Energy function *E* is formed containing regional properties and boundary properties and minimum cost cut of graph is determined by using max-flow / min- cut algorithm [13].

It is observed that while segmenting long and thin blood vessels in retinal fundus images using graph cut, boundary properties allow to follow only short edges while neglecting long edges, this phenomenon is called as "the shrinking bias" problem [9][15]. This degrades the performance of the graph cut algorithm on thin blood vessels. Figure 5 shows blood vessel segmentation by first observer and using proposed graph cut method. It clearly shows thin blood vessels are segmented in ground truth image whereas not segmented by proposed graph cut method [9].



(a)

(b)

Fig 5 (a) blood vessel segmentation by first observer, insight view shows thin blood vessels (b) blood vessel segmentation by proposed method, insight view shows no thin blood vessels

To address "the shrinking bias" problem, special graph formulation is required in addition to the graph cut. We used and explored the method presented by [15] which removes the shrinking bias problem by adding connectivity prior of the object (thin objects) where user decides connectivity constraints. But using connectivity constraints by user makes it user dependent (supervised). Same authors had presented full automated segmentation of images by using mechanism of vector flux in formulation of graph which helps to segment thin and long blood vessels [14]. The integration of vectors flux in graph keeps a balance between shrinking (length) and stretching (vectors flux) along thin vessels improving edge alignment and allows the segmentation thin and long blood vessels. Fig. 6 shows flux of blood vessels vectors passing through a given surface. The image gradients of blood vessels as vectors and the flux (magnitude and direction) of these vectors are integrated into the graph construction then optimized. Thus the shrinking effect of the minimization energy on the boundary properties is equilibrated with the spreading effect of vectors flux.

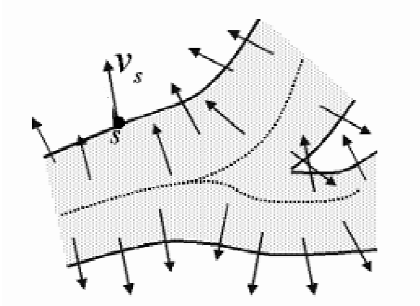


Fig 6 the flux of blood vessels vectors passing through a given surface

"The shrinking bias" problem addressed in this paper is seen in Fig. 5, we have constructed a graph consisting of a symmetric part (shrinking) and an anti-symmetric part (stretching) by considering the flux of blood vessels vector into the graph construction. The symmetric part of the graph corresponds to a blood vessels length and is related directly with the n-link connections and the anti-symmetric part is equal to flux of vector field over the cut geometric and it is used to derive the t-links. This method helps to keep track on thin and long blood vessels. Thus the blood vessels can be segment by keeping a good balance between shrinking and stretching (flux) throughout the image boundary.

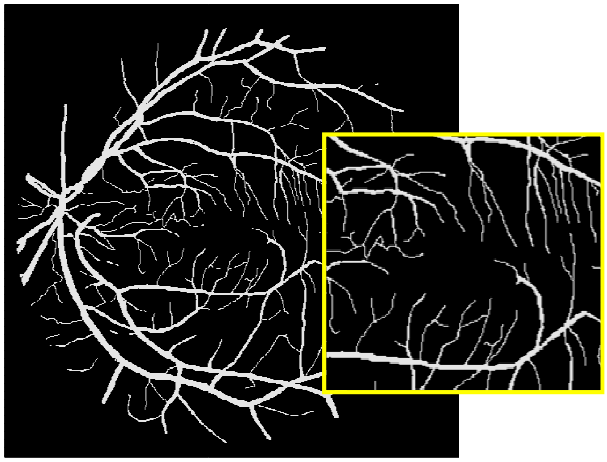


Fig 7 blood vessel segmentation by proposed method incorporating flux and length/area concept in graph, insight view shows that long and thin blood vessels able to segment by proposed method.

III. EXPERIMENTAL RESULTS

The public database images of DRIVE dataset (20 images) were used to test proposed method. Performance measures: sensitivity, specificity and accuracy are calculated to find the performance of method. The first human observers results in DRIVE dataset are considered as ground truth to compare results of proposed method. The performance comparison show that proposed method with integration of flux and length/area in graph cut method is performing well.

TABLE II. PERFORMANCE COMPARISON

Method	2nd Human observer (6)	Proposed method (9)	Proposed method with flux concept
Sensitivity	0.7761	**0.7261**	**0.7429**
Specificity	0.9725	**0.9806**	**0.9712**
Accuracy	0.9473	**0.9626**	**0.9723**

IV. CONCLUSION

In this paper the extension of previous work of [9] is presented. We addressed different problems associated with our previous work such as central light reflection in retinal images and "the shrinking bias" problem associated with graph cut algorithm. We introduced modified Gaussian filter for removing central light reflection from retinal images. We have shown integration of flux concept in graph cuts for improving segmentation of long thin blood vessels which helps to remove 'shrinking bias' problem. Results show that by using the flux concept in graph cut formulation improves the sensitivity and accuracy of algorithm.

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Design and Analysis of Planar Wideband Antenna for RF Front-end Multistandard Transceivers

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Abstract: **Planar Patch Antenna(PPA) is designed on FR4 substrate (ϵ_r=4.4) and simulated in Keysight's Advance Design System (ADS) Momentum Microwave Software. The resonant frequency of the designed patch antenna is 3.5 GHz. It covers the Wi-MAX band between 3.25GHz to 3.65GHz. The return loss for designed antenna over the given band is -27.71dB, with gain 6dB.This antenna can give the best performance for recent RF Front-end multistandard traneivers**.

***Keywords*-Planer antenna,RF, FR4 , Return Loss, Wi-MAX, Multistandard,Front-end,Transceivers etc**

I. INTRODUCTION

Planar antennas are useful and can be printed directly onto a circuit board. Planer Antennas are having low profile.They can be easily fabricated[2] with low cost. Planar are widely used in communications and radar applications since it provides many different types of designs, either planar or conformal. In this paper a planar patch antenna is designed in ADS momentum microwave simulator. The multi-service needs of the 3G, 4G and 5G communication systems, and their backward compatibility create challenges for the antenna and RF front-end designers. We can design planar patch with multiband and wideband functionalities .Planar wideband RF circuits can reduce the circuit size and also output ports, which can help in solving problems related to board size , isolation and antenna switch insertion loss[11-12].

Planar Antennas have many different types of applications. For example, mobile communications within aircraft, spacecraft, ships, or earth vehicles require planar patch antennas. Planar antennas are most popular in broadcasting situations where one transmit terminal can serve an unlimited number of mobile receivers(users inside car, radio etc). The planar patch antennas can also be used in non-broadcasting type radio applications like municipal radio (police, fire, rescue etc), amateur radio, and wireless personal communications etc.. They can also be used in many non-communication applications as in[14-15].These include remote sensing and industrial applications etc. Remote sensing systems can either be passive (e.g., radiometry) or active (e.g., radar) and they receive inherent emissions or scattered energy from objects .

These planar patch antennas has widest and demanding applications. They can used in dual characteristics, circular polarizations, dual frequency operation. Frequency agility, broad bandwidth, feed line flexibility and beam scanning etc can be easily acheived from these patch antennas[9].

II. PLANAR MICROSTRIP PATCH ANTENNA

A planar microstrip patch antenna is a low-profile antenna and has ease of fabrication, lightweight, inexpensive, compatibility with integrated circuit technology, and conformability with a shaped surface. So they are planar antennas.[1]-[4]

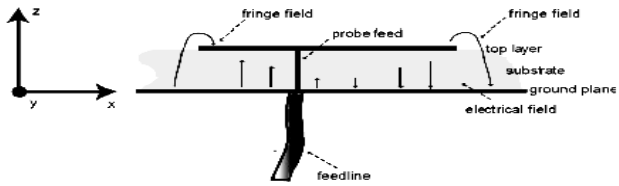

Fig1-Planar Patch Antenna(PPA)[12]

The fig1 shows a planar patch antenna in its basic structured form.The electric field distribution of a planar patch excited in its fundamental mode i.e.,TM10 or TM01.

The electric field is zero at middle of the patch, greater (positive) at one side, and lower (negative) on opposite side[6].. The minima and maxima always change their side as per the instantaneous phase of applied signal. As in a cavity , the electric field does not stop suddenly at the patch's periphery .Rather, it extend to outer periphery to some degree. These field extensions are popular by the name as fringing fields and they cause planar patch to radiate.Few popular analytic modeling methods for planar patch antennas are relying on this leaky cavity concept[3-13]. Hence, the fundamental mode of a planar patch is everytime denoted using cavity theory as the TM10 mode or TM01 mode.

III. ADS MOMENTUM MICROWAVE

Momentum is one of the parts of Advance Design System tools and it givess the simulation tools for evaluatation, performance analysis and design of advanced communication systems. Momentum is an electromagnetic solver. It computes the S-parameters for planar circuits including slotline, microstrip, stripline, coplanar waveguides and many more topologies[3]-[5]. ADS Momentum can serve better for multilayer communication circuits and printed circuit boards for accurate results. Momentum is a complete tool of evaluation of the performance of high frequency circuit boards, antennas and integrated circuits.

IV. DESIGN AND RESULTS

A. Design of a Planar Patch Antenna for WI-MAX

$$w = \frac{c}{2fr} \times \sqrt{\frac{c}{\varepsilon r + 1}}$$

$$= 26.08202\text{mm}$$

$$\varepsilon reff = \frac{\varepsilon r + 1}{2} + \frac{\varepsilon r}{2}\left(1 + 2 \times \frac{h}{w}\right)^{-\frac{1}{2}}$$

$$= 3.990198$$

$$=0.73400\text{mm}$$

$$L = Leff - 2 \times \Delta L$$

$$= 19.9868 \text{ mm}$$

where, $Leff = \frac{c}{2 \times fr \times \sqrt{Ereff}}$

A planarpatch with TM10 mode is simulated in ADS Momentum Microwave software. Width of the patch is 26.08202mm, length of the patch is 19.9868 mm, and height of the patch is 1.6mm. Permittivity of FR4 is 4.4 and tuning frequency is 3.5 GHz. [1-14].

B. Gain and Directivity

The planar patch's radiation at the fringing fields gives far-field radiation pattern. This radiation pattern indicates that the antenna radiates maximum power in a specific direction than all other directions which is termed as directivity[8]-[9]. Graphs of the gain and directivity of the designed antenna system are obtained. Fig. 5 shows the gain and directivity of the planar patch antenna which is simulated in ADS

Momentum.

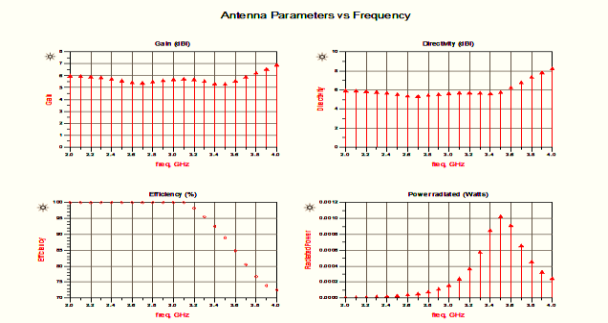

Fig-2 Antenna parameters Vs Frequency

Planar patch has its fundamental mode with high directivity for the normal patch. By reducing the directivity, can move away the elevations from the boreside. 3dB beam width is directly proportional to the twice the angle of high directivity, where this directivity has rolled off to 3dB with respect to the high directivity.

C. Bandwidth

Bandwidth is defined as "range of frequencies over which operational performance of the antenna, in relation to some characteristics, sticks to a specified standard". Bandwidth is the range of frequencies on both sides of the center frequency and antenna characteristics are nearer to center frequency [7]. The combination of directivity and efficiency are called as gain bandwidth.

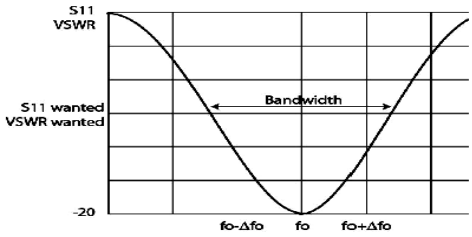

Fig3-Return loss(S11) vs bandwidth

V. SIMULATION & RESULTS

Impedance matching is obtained at 3.5 GHz using RL section as shown in fig4

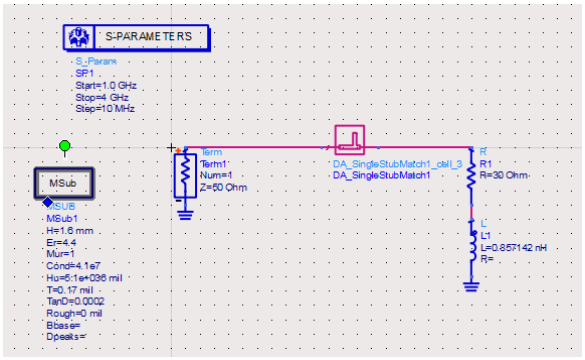

Fig4-Single-stub matching using RL circuit

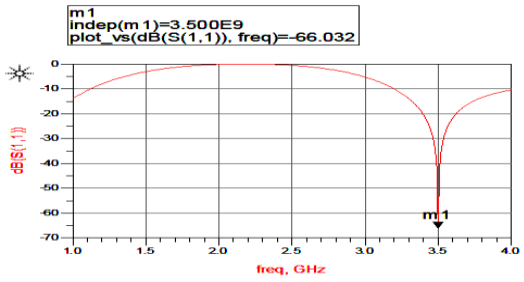

Fig5- Return loss at 3.5 GHz for RL circuit.

Circuit model in ADS for 3.5GHz with matching section shown in fig6

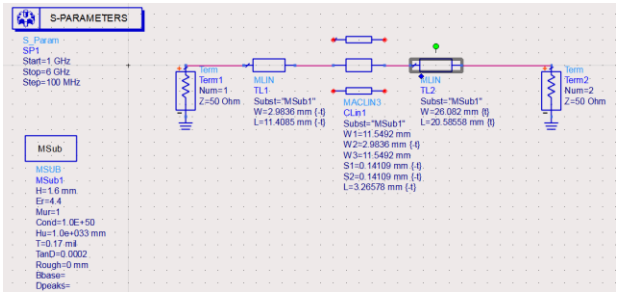

Fig6- Circuit model of PPA at 3.5 GHz .

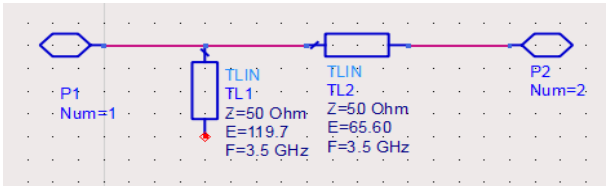

Fig7- Matching section of transmission line at 3.5 GHz

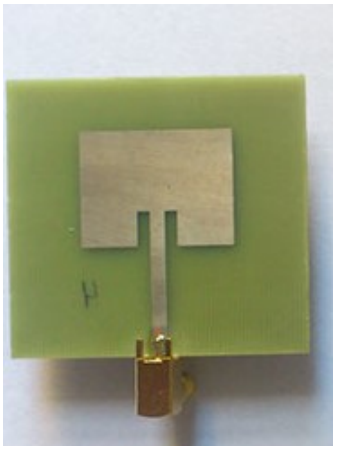

Fig8-Designed prototype at 3.5 GHz

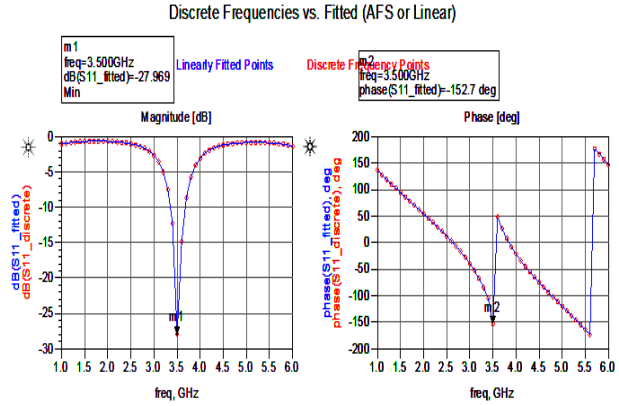

Fig9-Simulted Return loss Vs frequency

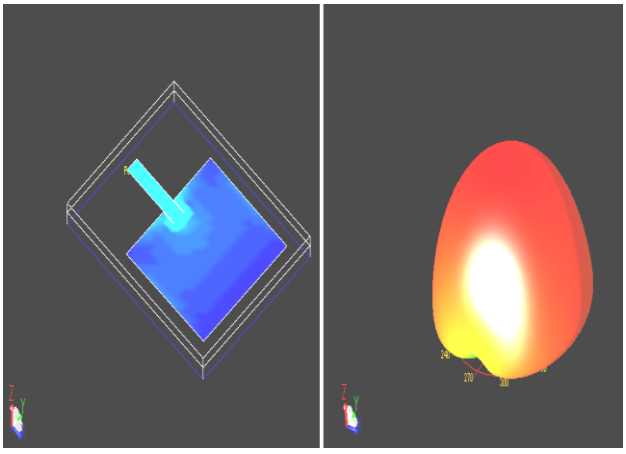

Fig10-Radiation pattern and Current distribution of PPA at 3.5 GHz.

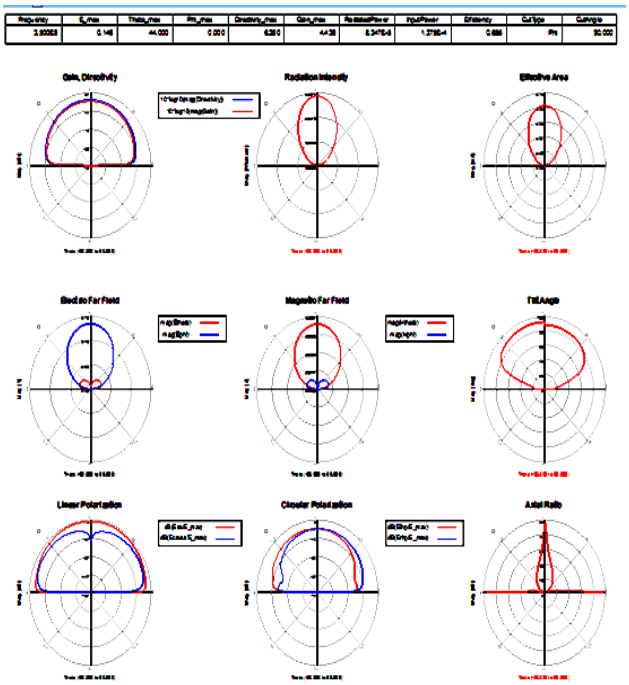

Fig11-Theta and Phi cuts for 30 and 90 degrees.

This planar microstrip patch antenna is accurately designed in ADS Momentum for the given band. It gives perfect matching at 3.5 GHz.

VI. CONCLUSION

A planar patch antenna is designed on FR4 substrate using ADS momentum. The layout is simulated in momentum microwave simulator. The designed antenna gives a resonant frequency 3.5GHz with good return loss.The results are obtained on Rohade and Shward's Vector Network Analyser.

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ANN Based Automatic Identification and Classification of Ocular Artifacts and Non-artifactual EEG

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***Abstract*- The electroencephalogram (EEG) signal plays an eminent and consequential part in the diagnosis and evaluation of treatment in neurological disorders. EEG artifact is a sequence with higher amplitude and different shape, size, morphology, statistics compared with non-artifactual EEG and other signals (ECG, EMG, etc.). This paper presents first time, ANN incorporated with three classes for better classification and the new way for automatic identification of ocular artifacts through variance feature. Training and testing is done using variance of ocular artifacts (Eye blinks artifacts-EBA/Eye movements artifacts-EMA) and non-artifacual EEG signals. These will fed to the three classes ANN model. Supervised ANN is used to build an automatic classification for Eye blink, Eye movement artifacts and non-artifactual EEG. The variance of different OAs and non-artifactual EEG will create three classes target tables. These variance values are assigned as the input labels for the training data sets. Sensitivity, specificity and classification accuracy for EBA is estimated as 96.66%, 96.66%, and 96.66% while for EMA is figure out as 100%, 96.66% and 98.33%. With more EEG datasets for all classes the classification accuracy can be further improve**.

Keywords−Electroencephalograph(EEG), Artificial Neural Network (ANN), Ocular Artifacts (OA), Eye Blink Artifacts (EBA), Eye Movement Artifacts (EMA), Variance.

I. INTRODUCTION

Human brain is complex organ of nervous system possesses rich spatio temporal .This single organ controls body activities, ranging from heart rate to emotions, learning, and memory. Brain consists of 1-100 billions of nerve cells. These nerve cells known as neurons are produced, grew, and organize themselves into effective and functionally active systems that ordinarily remain in working order throughout a person's lifetime [1]. While recording the EEG signals for various channels, many times non-cerebral signals will be added in these signals are called as artifacts. As per IFCN (International Federation of Clinical Neuro- physiology) the term artifact as- any potential difference due to an extra-cerebral source recorded in EEG tracings and also include in more generally any modification of the EEG caused by extra-cerebral factors such as alterations of the media surrounding the brain, instrumental distortion or malfunction and operational errors [2].There are different kinds of artifacts may be present in EEG recordings. The most difficult issue in the data analysis of EEG is the ambiguity of the discrimination of the signal and noise [3]. Among all these artifacts, OA is the mostly observed one, which has much larger magnitude compared to EEG [4].

EBA and EMA these signals are also called Electro-oculogram (EOG) signals. EEG signals are useful in numerous clinical applications for interpretation of brain disorders and diseases. The influence of the EBA and EMA creates difficulties in analysis of the EEG signals. Hence, encounter a new method which can be useful in identification and classification of ocular artifacts from the EEG recording. A neural network is computational model which inspired from the functioning of cell structure of a neuron and simplified as biological nervous system. The neural network handles the data by incorporating learning algorithm. Neural networks able to work parallel with an input layer, hidden layers and an output layer. The hidden layers consist of processing elements called neurons which are interconnected. Neural network have been trained to detect ocular artifact in EEG signals. ANN is especially advances in sector of complex pattern recognition and classification operations. Neural networks which differ fundamentally in the process according to various domains, types and architectures of through which they undergo the process of learning [5].

Many algorithms developed up now for the detection of EEG signal, feature extraction of the signal and classification of EEG signals. Chadwick et al. conducted a study on classifying eye and head movement artifacts in EEG using decision trees and Hidden Markov Models (HMM). They used statistical analysis of both the EEG signal and the first derivative of the signal as feature for classifying [6]. V. Lawhern et al. performed autoregressive (AR) modeling of artifact contaminated EEG signals [7]. AR coefficients as features are used for classification of EEG signals and it is performed using the support vector machine (SVM) classifier. A.Jafarifarmand et al. discussed basic approach of ANC used for the elimination of artifacts and ANN is trained to work as adaptive filter. For the consequent part of the fuzzy rules constructed by RBF neurons, proposed filter uses a Chebyshev FLN [8]. Ksiezyk et al. presented work to find out the classificationcum-detection problem of artifacts in EEG using Artificial Neural Network. The study shows that the signal is pre-processed with help of wavelet transform (WT) and it fed to ANN in order to remove detected artifactual signals [9]. G. Inuso et al. has used the statistical parameter to analyse the EEG signals and detect the artifacts which are producing undesired alteration in the EEG data [10].

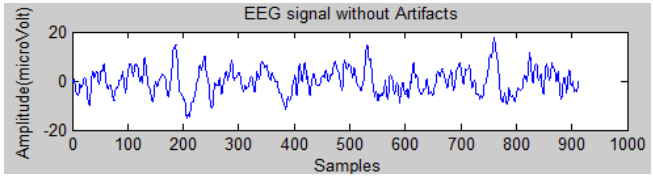
Further the literature depicts methods to detect artifacts in EEG using Independent Component Analysis (ICA) and higher order statistics [11], [12], [13]. Chatterjee et al. have also performed work on the wavelet feature generation from the EEG signals [14].Tibdewal et al. proposed the work to detect the presence of artifact and its actual position with extent in EEG recording. For the purpose of classification of ocular artifacts or non-artifactual activity Artificial Neural Network (ANN) was used. And for detection of OA contaminated zone the Time-Amplitude algorithms was compared with DWT [15], [16]. V Krishnaveni et al. demonstrated the work using JADE algorithm to obtained independent components and these are classified into either artifact component or neural component [17]. C.Y. Sai et al. proposed a hybrid method without any need to apply an arbitrary threshold in identifying the artifactual components [21].

This paper mainly demonstrates ANN as a supervised attempt for three class classification of OA and non-artifactual signals. Also introduces the variance as feature for identification of OA. The threshold value of variance is set, whether EEG has EBA, EMA and non-artifactual EEG. For these three classes the variance is fed to an ANN model design separately for training and testing. Three classes classification of OA involves various steps, including data collection, feature extraction and most important the supervised ANN model design. This paper organized as, the methods and materials discussed in section II. Feature extraction and identification is given in section III. A three class ANN model narrated in section IV while results are demonstrated in section V. Finally section VI presents conclusion and discussion.

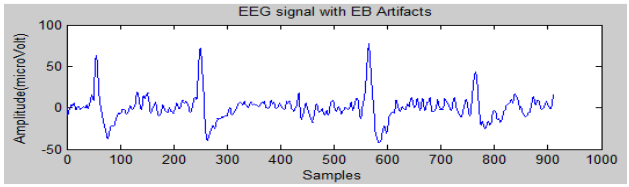
II. METHODS AND MATERIAL

EEG is a test that measures and records the electrical activity of the brain. They are captured by multiple-electrode along the scalp and can be recorded in different formats. EEG signals taken for this work contained eye blinks, eye movements' artifacts and non-artifactual signals, acquired from subjects of different age groups. 'Medicaid Neuro-Compact 2400' system is used to collect EEG signal from subject. EEG data collected as artifactual and non-artifactual signals are judged through visual inspection. The 10-20 placement electrode system is commonly standardized used for data collection records EEG data using 19 channels: C3, C4, Cz, F3, F4, F7, F8, FP1, FP2, Fz, etc. Eventually the eye movements/blinks artifacts are noticeable at these positions. Sometimes it may occur in other electrodes also. Prominent peaks of artifacts with rapid increase and decrease in EEG recordings can be observed particularly in FP1 and FP2 channels and these are more close to eyes. The EEG signals are sampled at 114 Hz over 8 second time duration. Each montage for every channel has a total of 912 samples. All the dataset used are processed using the MATLAB 8.1.0.604 (R2013a) platform.

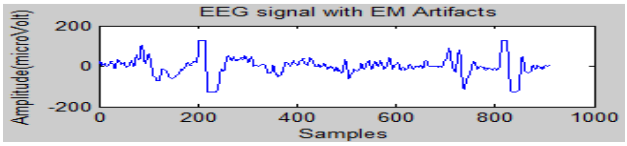
For the sake of clarity, the single channel morphology for EEG signals is shown. "Fig.1," shows the EEG with and without artifacts." Fig.1," a presented non-artifactual EEG (C4), "fig.1," b presented EB artifactual EEG, and "fig.1,"c shows EM artifactual EEG. It is observed that the peaks of high amplitude are present in EB/EM artifactual signals.



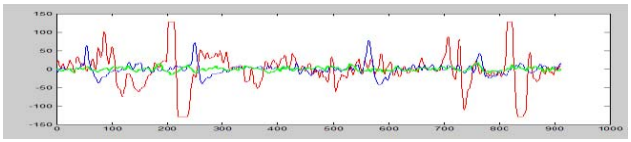
(a)



(b)



(c)



(d)

Fig.1. A systematic representation of different morphology of EEG signal (a) Normal EEG signal (green) (b) Eye blink artifactual EEG signal (blue) (c) Eye movement artifactual EEG signal (red) (d) Combined EEG signal

III. FEATURE EXTRACTION

For classification and understanding the difference between ocular artifacts and non-artifacts, this paper uses variance as feature extraction. In this variance (Var) of the each channel is calculated for different subjects and this computation is carried out for both non-artifactual and ocular artifact EEG data which show considerable difference. For 5 subject's total of 10 channels EEG data were analysed separately for eye blink, eye movement artifactuals and non-artifactuals using statistical parameters. The table I. shows the comparison of the variance for OA and non-artifactual EEG used for the classification through ANN. The EEG signals' variance is calculated using "(1)," . From the results obtained threshold is set such that the EEGs, which are contaminated by eye blink/ movement artifacts having higher variance than the non-atifactual EEG.

Signal Variance:

$$\sigma^2 = \frac{1}{n} \sum_{i=0}^{n} (xi - \mu) \qquad (1)$$

TABLE I. COMPARISON OF VARIANCE FOR OA AND NON-ARTIFACTUAL EEG

Subjects	EEG Channels	Variance (Var.)		
		Eye Blink Artifact	Eye Movement Artifact	Non-Artifactual EEG
1	FP1	143.22	4919.60	6.98
	FP2	218.14	3739.70	5.98
2	C3	251.89	3218.00	12.55
	C4	302.50	939.29	14.42
3	F3	312.18	3570.20	15.65
	F4	156.20	4684.40	13.92
4	F8	283.62	2846.30	21.83
	F7	248.95	3191.60	9.53
5	CZ	117.90	5282.40	7.20
	FZ	228.52	3180.40	7.03

IV. NEURAL NETWORK FOR CLASSIFICATION

The artificial neural network used is built for the three class classification method based on supervised learning shown in "fig. 2,".This algorithm creates a function that maps inputs to get desired outputs. Supervised learning is fairly common task in the classification problem: firstly learner needs to learn a function which maps different inputs into one of several classes by looking at several input-output. The ANN is used to solve three classes classification problems is the back propagation feed-forward neural network, in which data flows forward from the input to the output with three hidden layers are used as shown in "fig. 3,".

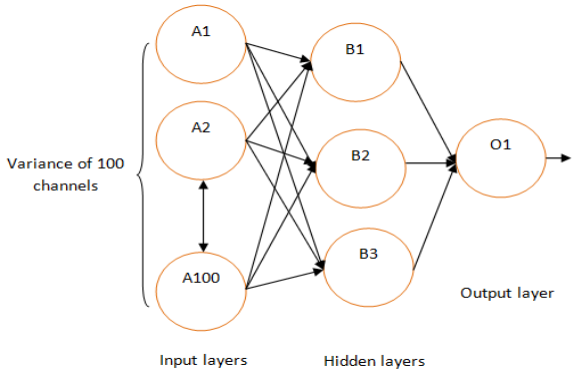


Fig.2. Supervised Artificial Neural Network Model

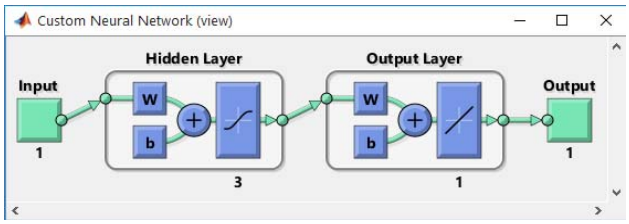


Fig.3. Feed Forward Neural Network

The data is divided into three classes: lower variance data corresponding to non-artifactual signals and higher variance data corresponding to EBA and EMA signals. For training purpose, a dataset has EEG signals of total 100 channels obtained from the collection of 32 subjects and the variance of all the 100 channels are fed to the ANN. The classifier is trained using the obtained variance, and it classifies the signal as artifactual or non-artifactual signal. The input dataset has 33 channels consisting EB artifacts having middle range variance, 34 channels of EM artifacts having higher range variance and remaining 33channels of non-artifactual EEG signals having lower range variance as shown in table II.

TABLE II.TRAINING DATA SET

EEG Signals	EEG Channels	Input Dataset Variance	Target Dataset
Eye Blink Artifacts	Channel 1-33	60.73-482.49	1
Non-Artifactuals	Channel 34-66	13.72-12.17	2
Eye Movement Artifacts	Channel 67-100	7453.50-3743.40	3

Visual inspection of EEG signals and comparing their variance the training dataset and target dataset is created as per the table. II. When the training is completed the ANN is ready to the testing of EEG signals for classification of EBA, EMA and non-artifactual activities. The training performance of the ANN can be observed in terms of MSE plotted against the epochs. As depict in "fig. 4," with 15 epochs the network error is observed.0.16139

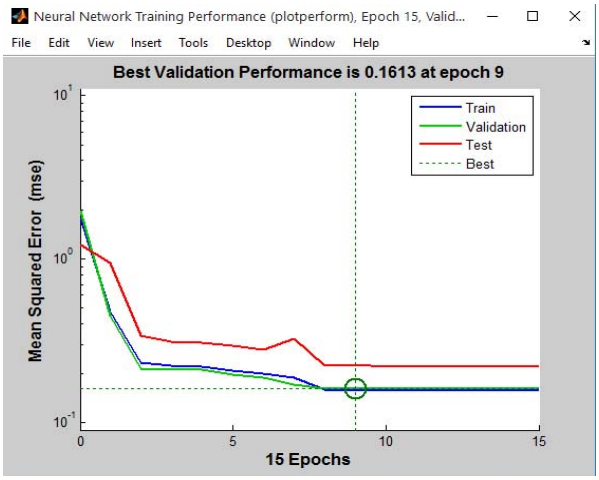


Fig. 4 Performance of ANN MSE Plotted Against Epochs

V. EXPERIMENTAL RESULTS

This work is mainly based on eye blink/eye movement artifact and non-artifactual EEG signal classification. It can be said to be of three class classification problem. The answer required from the neural network is only that whether the test EEG signal has Eye Blink /Eye Movement artifacts or not. A total of 60 channels for eye blink and non-artifactual signals and another 60 channels for eye movement and non-artifactual signals from 30 subjects were used for the system testing. Samples of EEG with ocular artifacts are analyzed using variance as a feature extraction statistical parameter. The result of confusion matrix based with ROCs parameter as shown in table III and in table IV.

TABLE III. RESULTS OF CLASSIFICATION USING PROPOSED METHOD FOR EB AND NON-ARTIFACTUAL EEG SIGNALS

Total 60 Channels For EB and Non-Artifactual EEG	**Receiver Operating Characteristics: ROCs**			
	TP	*TN*	*FP*	*FN*
	29	29	1	1
Performance Rate (%)	*Sensitivity*	*Specificity*	*Accuracy*	
	96.66	96.66	96.66	

The performance parameters are calculated from the ROCs results. The table III. shows the rate of sensitivity, specificity and accuracy for Eye Blink artifacts with reference to non-artifactual are found to be same i.e. 96.66%.

TABLE IV. RESULT OF CLASSIFICATION USING PROPOSED METHOD FOR EM AND NON-ARTIFACTUAL EEG SIGNALS

Total EM and Non-Artf. of EEG Channels 60	**Receiver Operating Characteristics: ROC**			
	TP	*TN*	*FP*	*FN*
	30	29	1	0
Performance Rate	*Sensitivity*	*Specificity*	*Accuracy*	
	100%	96.66%	98.33%	

Also for the Eye Movement artifacts with reference to non-artifactual is depicted in table IV. The rate of sensitivity is 100%, rate of specificity is 96.66% and accuracy is found to be 98.33%.

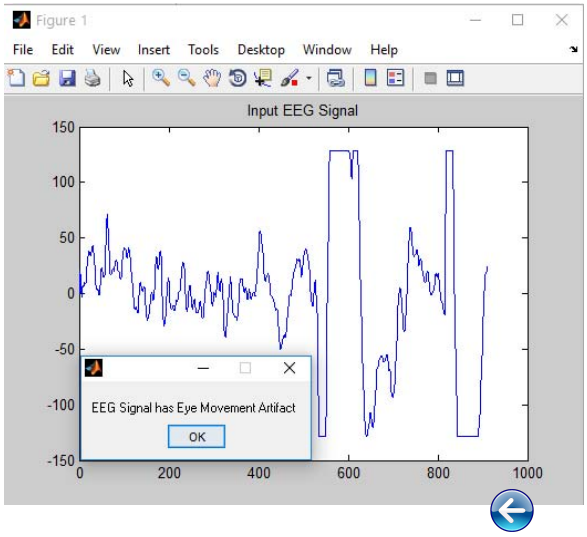


Fig. 5 (a)

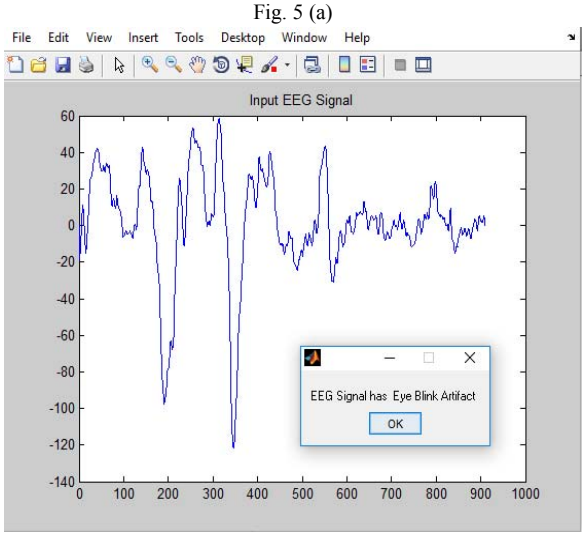


Fig. 5 (b)

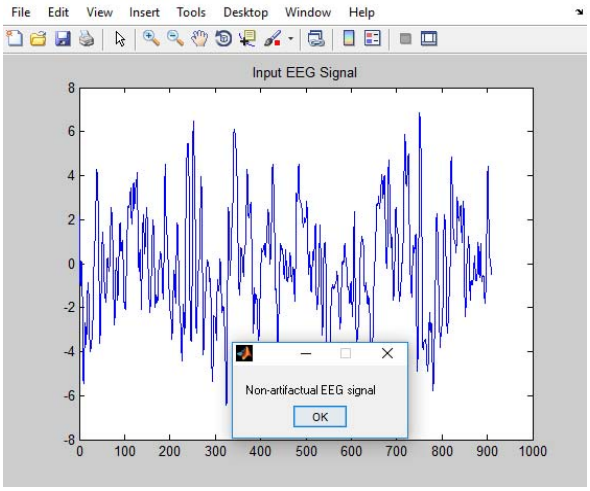


Fig. 5 (c)

Fig. 5 Classification result of Ocular Artifacts and Non-Artifactual EEG signal using ANN
(a) Eye Blink Artifact, (b) Eye Movement Artifact and (c) Non-Artifactual EEG Signal

Finally the three classes' classification result obtained from EEG dataset for ocular artifacts and non-artifactual EEG data after ANN testing demonstrated in figure 5. From this obtained result "fig.5", (a), (b) demonstrates that the signal having ocular artifact having higher variance as per the statistical analysis and magnitude also, they are classified as eye movement and eye blink artifacts (Ocular Artifacts) EEG signals and the "fig. 5",(c) demonstrates signal having lower variance and magnitude is classified as non-artifactual EEG signal.

VI. DISCUSSIONS AND CONCLUSIONS

This work provides automatic identification and classification of ocular artifacts using three classes ANN model. Artifacts classification and identification is essential to improvement of EEG signals interpretation. Ocular artifacts and non-artifactual EEG having different magnitude which show considerable difference in variance, shown in table I., that OA have higher variance than Non-artifactual EEG .Compared to previous work the results obtained for the classification accuracy was found 95.83% for EBA and 97.50 % for EMA. For the proposed methodology the classification accuracy is 96.66% for EBA and 98.33% for EMA by variance method which plays important role in the analysis. While investigating the work in respect of identification and classification of OA, it is realized that accurate classification output is found and result provides separately classified OA (EBA/EMA/Non-artifactual) during testing of EEG. ANN implementation proved to be more capable for this three class classification model. At the same time, the ability of the ANN model implementation for high accuracy of classification, the more EEG data channels makes it highly intelligible and strong for the training. Comparing the variance it is found that variance of EMA is greater than EBA and non-artifactual EEG. Future work may seek the solutions for classifications of other types of EEG artifacts correctly. These other artifacts will produce difficulties in analysis of the EEG signals. Also implementation of automatic identification and classification of OA and non-artifactual from EEG on hardware platform will be a great help in neuroscience medical field.

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Face Authentication and Secure Auto Sharing Using Deep Learning Algorithm

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***Abstract*—Face authentication is one of the critical unsolved problems in computer science, a lot of time and energy is spent to invent a robust solution for it. Face authentication can play a significant role in security, Biometric verification, auto detection of criminals in a crowd, etc. The paper presents a unique model that authenticates the faces in the image, and securely shares the images. Firstly, the deep learning algorithm identifies all the faces in the image, extracts the invariant features of each face. The invariant feature of the face is studied to compute the emotions. The model captures the friends list of the user and securely shares the image to the known persons in the image.**

Keywords—Face recognition; Biometric verification; auto detection; feature extraction; facial authentication.

I. INTRODUCTION

The success of the Face Authentication largely depends on robustness and accuracy of Face Authentication Algorithm. Over the years, many different approaches have been proposed and used like SIFT, Bag-of-Features, but their performance on recognition system is still not widely accepted in the machine learning community because these networks are unable to handle selectivity-invariance dilemma and also suffer from the problem of vanishing gradients [1,2]. Earlier approach of Face Recognition extracts features (local) from an image for analysis but due to the non-availability of robust and distinctive local feature, this approach was deprecated and a holistic approach was developed which takes whole face region as an input to the recognition system[19,22]. However, the holistic approach was nonperformance for images that have a variation of the face due to pose and variation in the angle of taking an image [2]. A computer technology that is able to identify human faces in a given digital image is called as Face Detection, whereas Face Recognition is one of the models of Face Detection, it describes a biometric technology that attempts to identify the person in the image, count the number of human faces in the image[20]. Face Authentication takes a step further; it studies the face in the image and confirms the identity of a person in the image. The paper builds a single system that is capable of detecting faces in the image, analyzes those using by taking the reference of Deep learning techniques to recognize and authenticate the face [3]. The paper presents an Algorithm to recognize and authenticate the face in the image along with identifies the emotions of the person, and provides one of the models of the paper is securely auto-sharing the image with the known person's in the image by using the face recognition, authentication, and auto-sharing algorithm.

Compared to conventional methods like SIFT (Scale Invariant Feature Transformation) and Bag-of-Feature, Dominant SIFT, deep convolutional neural networks (CNNs) have achieved excellent performance in a number of image classification tasks [1,2,3].

Even though a face is generally processed as a two-dimensional object, it is not, more ambiguities arise and some hypotheses fail because of the 3D structure of the face and its motion in space [1]. Its real-time implementation suffers from long latency, heavy computation, and high memory storage because of its frame level computation with iterated Gaussian blurs operations [5].

II. DEEP LEARNING

The typical deep learning models include convolution neural networks, deep belief networks, and deep auto encode. In our research, we will be using Convolution Neural Networks (CNN), as the performance of CNN is found to be better than other two methods [5]. The main difference between SIFT, Bag of Feature and CNN based methods are as follows: First, the dimensionality reduction and pooling in the classification pipeline of SIFT, Bag of Feature are fully unsupervised[7-14], whereas deep CNNs can automatically obtain discriminative local filters trained with class labels using the back- propagation algorithm. Second, deep CNNs have a multi- layer structure that can gradually increase the size of local filters by repeatedly combining neighboring features and finally obtaining more discriminative features. Third, the average classification rate of deep CNN is improved from 52.4% to 70% as compared to other technique [6]. As the conventional methods had low accuracy in identifying an object in the image, sometimes securely sharing the image with them was problematic [15-19]. Using the deep convolution neural network, the average classification rate is improved significantly as compared to the conventional methods [2]. It is the first truly successful learning algorithm of training multilayer network structure. It uses spatial relationships to reduce the number of parameters need to learn in order to improve the training performance. The training algorithm is divided into two stages:

1) Forward propagation stage

Taking a sample (X, Yp) from the sample concentration, and inputting X into the network, through gradual transformation, it is transmitted to the output layer calculating corresponding actual output Op.

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$$Op=Fn(\ldots(F2(F1(XW1)W2)\ldots.)Wn) \quad \text{(Eq. 1)}$$

2) Back propagation

Calculate the difference between the actual outputs Ox the corresponding desired output Yp, and according to the method of minimizing the error, back propagation to adjust the weight matrix.

$$Ep = \frac{1}{2}\sum_{j}^{0}(Ypj - Opj)^2 \quad \text{(Eq. 2)}$$

A. *Use of Neural Network for Face Authentication and Emotion detection*

As the conventional methods had low accuracy in identifying an object in the image, sometimes securely sharing the image with them was problematic. Using the deep convolution neural network, the average classification rate is improved significantly as compared to the conventional methods.

Neural Network is a powerful and efficient way of getting a solution using pattern recognition. It is a widely used method to recognize the pattern where in my research I have used it to authentication of image and emotion by remembering the pattern of an invariant feature, for example here we take lips region.

B. *Training the Network*

To train a neural network to perform some task, we must adjust the weights of each unit in such a way that the error between the desired output and the actual output is reduced. This process requires that the neural network compute the error derivative of the weights (EW). Feed-forward network also use for the training but there are some limitations of multi-layer feature extraction we use in this paper the back-propagation algorithm [22]. In other words, it must calculate how the error changes as each weight is increased or decreased slightly. The back-propagation algorithm is the most widely used method for determining EW. The Back Propagation Algorithm works the following way.

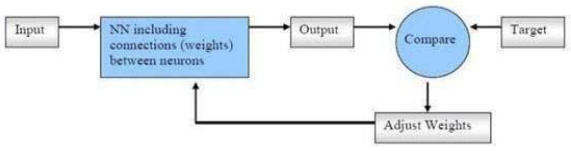

Fig. 1: Training with the back propagation algorithm

I have used two set of training images, one set for Authentication of Person in an image, and another set of images for emotion detection. Here, I am considering one of the sets of training images that was used for emotion detection.

Fig. 2: A portion of the training set

After our training is successful then we will see if out network able to recognize any given pattern.

Fig. 3: Input for testing.

Fig. 4: Output Recognized by the system

This shows that the System is perfectly recognizing the Emotion of the given input.
By this Technique, I have tested 50 times with different Images with Different Emotion and in the same way, I recognize the face.
The Performance that the method showed is given below.

Table 1: Accuracy measurement

Emotion	% of Detection
HAPPY	100%
NEUTRAL	98%
SAD	96%
ANGRY	98%
CALM	92%
CONFUSED	97%
DISGUSTED	93%
SURPRISED	86%

III. ALGORITHM

In this Model the focus would be on identification of face in the image, recognizing them and auto share the image to the user's registered friends. To achieve this we would need to train the model with the information of individuals, the model would then store the information and use it whenever required. The algorithm for it is as follows:

1) Initialize the system
2) Register the User; take user image, the Email Id, and Password

3) The system executes the deep learning algorithm on the image.

4) The deep learning algorithm will study the image and store the face information in the system. The system will generate unique identification number for each face (FId), and this will be used for further analysis.

5) The system saves the friend list of the user. This information would be used to securely share the images.

6) The system will ask the user to upload other images of self and friends

7) Deep learning algorithm will be executed on the uploaded images; the algorithm will identify all the faces in the images and returns the details.

8) The system will check the face details in the data store of trained images to ensure if the face details already exist, and if it found out a match, it will mark it for auto-share.

9) The system will then auto share all the images marked in #8 to only to those people who are in the image and are user's friends.

10) Finish.

IV. Implementation

To demonstrate the use of our algorithm, we have developed an model in .NET that executes the image processing algorithm on the images. The single model provides three unique capabilities – Face Detection along with invariant features and Emotions, Face Recognition, and Securely Auto Sharing the image, such model does not exist today.

The model uses Deep Learning algorithm that is executed on each image. The algorithm first identifies faces in the image, and then for each face extracts the invariant features that are saved in MongoDB along with the User information. The Deep Learning algorithm matches the invariant features of the face in the image with the training set and identifies the Emotion, and authenticates the face.

The images are stored on Amazon S3 which is a secured store for images. To access the images, we need to pass the "Access Key" and the "Secret Key" which is provided by Amazon only to the owner of the account, in this case, our model. The images are not accessible to anyone else even when they have the URL and thus provide additional security to the model.

The model is logically divided into four sections:

a) Registration Section
b) Image Processing Section
c) Friend Management Section
d) Auto Sharing Section

A. Registration Section

The registration section allows the user to register in the model by providing Email ID, Password, and their Image. The uploaded image is stored in Amazon S3 which is the Image Store for us Registration Section. The image is then passed on to the Image processing section for processing the image which returns a FaceId. The Email ID, Password, and FaceId are stored in MongoDB.

B. Image Processing Section

Here we are writing a function that will take an image and return face encoding for that image.

C. Friend Management Section

The model provides User the ability to search friend who has also registered in the model and allows User to send a friend request to that person. The model also provides a screen for the User to load the friend details that specifies the list of friends, along with that it also shows the friend request the User has received. The user can accept or decline the friend request. The model allows the User to remove the person from the friend list as well.

D. Auto Sharing Section

The Image processing algorithm stores all the relevant information of the uploaded images in the Mongo DB. This information contains the name of the person in the image as well. The model has the Friends management section that captures the User's friend information. Both this information are combinedly used to auto-share the image securely.

The model uses Amazon S3 as the image store which is highly secure as it requires a secret key to access the images. If anyone tries to access the image without secret key, then "Access Denied" error is returned. The secret key is defined by the model and is passed to the entire request to get the images by the model.

The model first gets the list of friends of the User from the Mongo database and then for all the images uploaded by the friends of the user, the model checks the output result of the image processing sections to determine if the User exists in any of these images. If the model identifies any of such images, then only those images are shared with the User automatically.

V. Model Result

In our study, we have used various kinds of images like images with multiple faces, images of different emotions, images of people with different age group, gender. The proposed model was executed on each of these images, and their outputs were studied. It was observed that the accuracy of the deep learning algorithm used in the model was on higher side, and the algorithm was able to correctly identify the Age, Gender, and Emotions of all the faces as well. The algorithm
provides the list of all exacted feature of the face that are used to authenticate all the faces in the image. After authenticating the faces, the algorithm securely shared the images to the known person in that image.

A. Registration

The registration section allows the user to register in the model by providing Email ID, Password, and their Image. The result of registration is the "Registration Successful" message displayed on the screen. Below is the snap for the registration page.

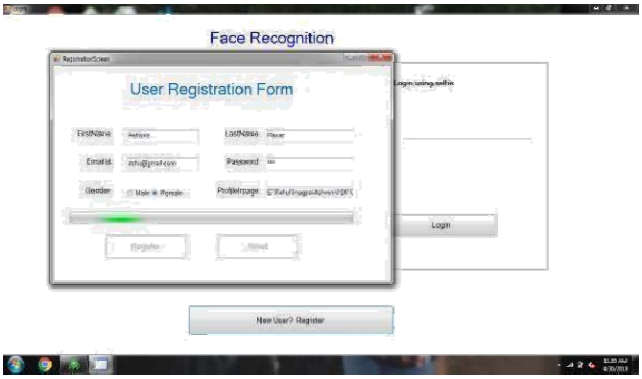

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Fig 5: User Registration screen

B. Login by Email Id and Password or by Image

The user needs to provide the Email Id and Password, if these details matched in the database, User are navigated to the Homepage; else an appropriate error message is displayed.

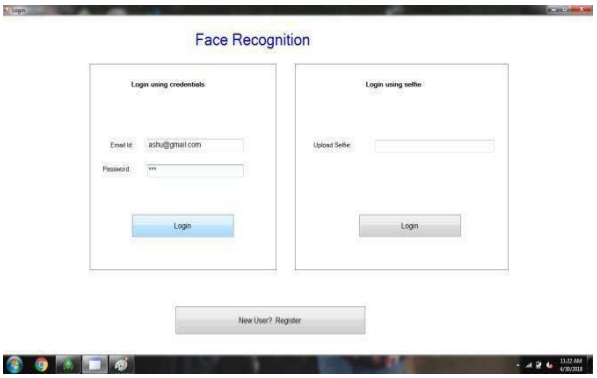

Fig 6: Login by Email Id and Password.

The user can upload an image that contains the face of one and only one person in the login using selfie section.

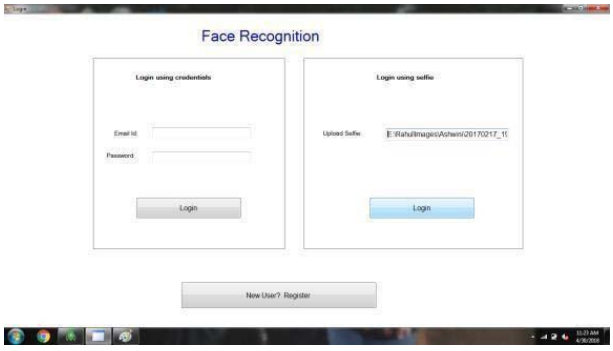

Fig 7: Login by uploading Image

C. Image Analysis

a) Detect Face

The user can use the first tab – "Image Analysis" to analyze the image using Deep Learning Algorithm. Once the user uploads the image, it is first to save in secured image store. The uploaded image is displayed on the screen as well. The user can click on "Detect Face" button to execute the deep learning algorithm to identify the number of faces in the image. The detected faces are assigned a temporary face identifier. Once the execution is complete, the screen will show the output of analysis which has the following information:

a. FaceId – Contains the number indicating the face number
b. Invariant Features – Contains the Invariant features identified for each face
c. PositionInImage – Provides the X and Y coordinates of the image for the feature
d. Image Details – Details like Age, Gender, and Emotion identified for each face
e. Value – The associated value of Image details
f. Confidence – The confidence percentage of the image details identified by the algorithm

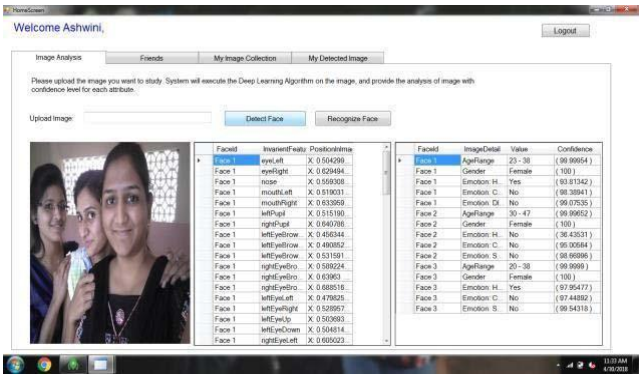

Fig 8: Detect Faces in the uploaded images.

b) Recognition of Face

Once the faces in the image are identified, the Model provides the capability to recognize the face in the image. The user can click on "Recognize Face" to execute the deep learning face recognition algorithm on the image. The algorithm compares the faces in the image with the face details of all the registered Users in the system, if it finds the match then the name of the User is appended in the Face Id column.

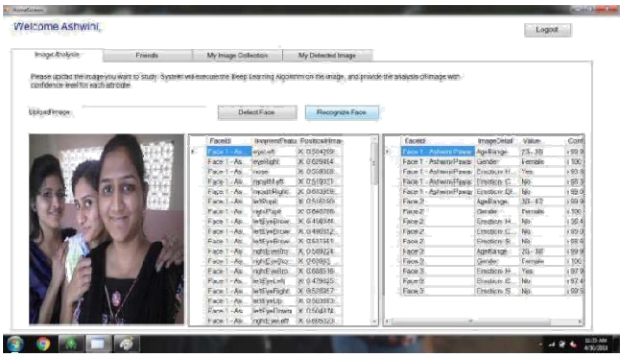

Fig 9: Recognize Faces in the uploaded images.

c) Emotion detection along with Age and Gender

The Detect Face algorithm also identifies the emotion of the person in the image. Along with this, the algorithm tries to identify the Age of each face, and this information is displayed as a range. The algorithm also identifies the Gender of each face and the same is displayed in the table.

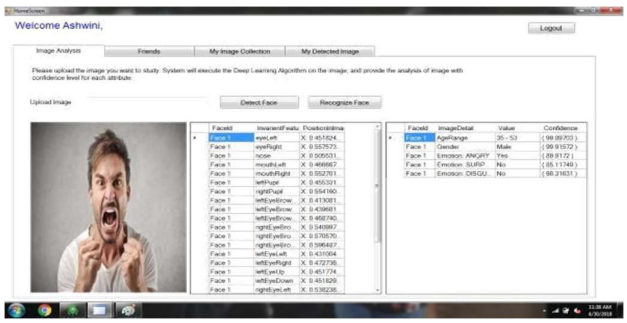

Fig 10: Example of Angry Emotion with Age and Gender.

D. Friend Management

The user can navigate to Friends section to search for a friend, send a friend request, accept the friend request and load the current friendship status. To search friend User need to provide the first name or the last name of the person he wants to search, the system will list down the entire registered user having the searched name. The user can then send the friend request to the person.

The manage friend section lists the current friendship status, allows the User to accept the friend request. This information will be used by the system to auto -share the images to the friends. The complete workflow of the friend lifecycle is explained in the adjacent images in a sequential manner.

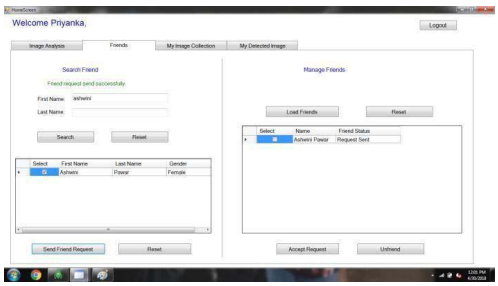

Fig 11: Search Friend and sent a friend

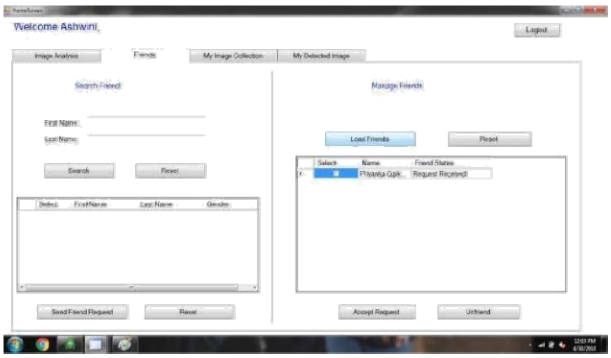

Fig 12: Accept friend request.

E. My Image Collection

My Image Collection allows User to upload the images and maintains the collection. The images uploaded by the User in the collection are used for auto-sharing them with the other registered User in the images

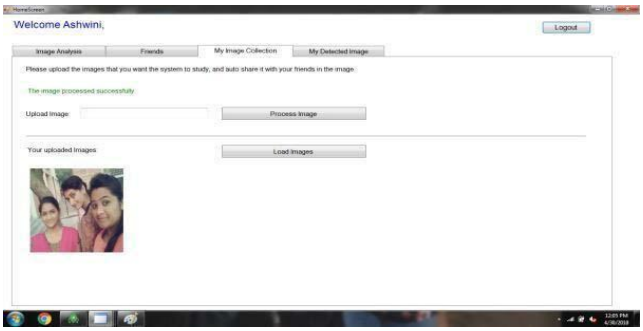

Fig 13: Upload Image to Image Collection.

F. My Detected Images

The images uploaded by the User in the My Image Collection section and the User friendship status stored in the database are combinedly used by the system to first recognize the face in the uploaded image and then using the friendship status, securely auto-sharing the image with the other registered User in the image.

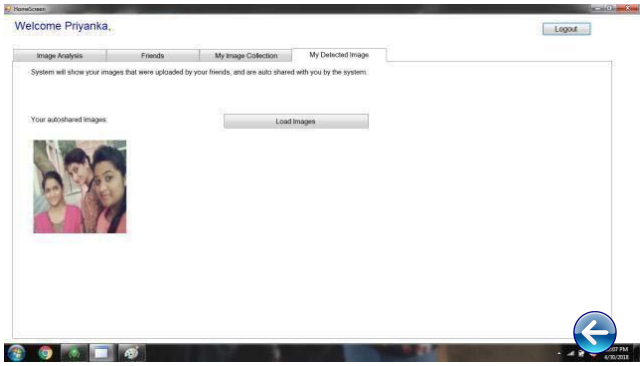

Fig 14: Auto detected images

The above example showed that the User – Ashwini has uploaded the image which has her friend Priyanka in it. The System analyzes the image, recognizes Priyanka, and auto shares the image with Priyanka. So when Priyanka logs into the model, she can view the same image in "My Detected Image" section, as shown below.

VI. CONCLUSION

The proposed model provides three unique capabilities – Face Detection along with invariant features and Emotions, Face Recognition, and Securely Auto Sharing the image; in a single model. The proposed model is able to recognize faces but when an invariant feature of two images is near about similar that time it gets confused to take decision correctly. The advantage of this model is that it is able to detect more than 15 faces in the single image, recognize a face from the group of image and detect emotions of all faces present in the image. The model is also able to share the detected image automatically to the registered friend of that recognized face in a secure way.

VII. FUTURE SCOPE

In future, it can be extended to recognize the persons using video capture which will be helpful in getting identities from CCTV cameras that can police to identify the person in on time. It can also be implemented in a home security system as well. The current model is a desktop model; it can be enhanced by creating a mobile model. Also, the current version of the Model relies on the User to manage friend, this capability can be extended and the Model can have integration with the social networking sites like Facebook.

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SVM classification of EEG signal to analyze the effect of OM Mantra meditation on the brain

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***Abstract*— Meditation can significantly contribute to improving physical and mental health in modern stressful life. "OM" mantra is very easy to practice for meditation .This study is undertaken to classify the EEG band to observe abrupt changes in band as an effect of Om mantra meditation. Twenty-three naive meditators were experimented to chant OM mantra for 30 min and EEG signal recorded before and after meditation. The stationary wavelet transform is used to exact five bands from the EEG. The different statistical features were calculated. SVM classifier with Radial Basis Kernel is employed to classify the band. Results show the significant changes in the delta band which represent the brain in deep sleep. Thus OM meditation gives the experience of deep sleep. Thus study can be helpful to give new direction towards the meditation.**

Keywords—EEG, OM Mantra, Multi-class features, SVM, Radial Basis Kernel

I. INTRODUCTION

Stress becomes a part of everyday life that leads to different states such as anxiety, anger or fear [1] which may pose a major effect on heart and brain function [2]. To overcome the stress and get relief from, relaxation is the activity which keeps a person calm. Yoga and meditation are part of relaxation may reduce the level of anxiety and depression which helps to improve mental and physical health [3]. Om mantra meditation is used for meditation [4].Many researchers have found the effect of OM mantra meditation on human beings using an auditory middle latency evoked potentials [5-6], skin resistance level, heart rate, respiratory rate [7-8], Functional magnetic resonance imaging [9-12]. All these analyses revealed the positive impact of this meditation on the human being. Our studies [13-14] are the first EEG studies on Om mantra meditation. Initially, the research work on this meditation [13] attempted to investigate the effect of OM chanting on the brain by checking the complexity of the EEG signal after this meditation on the basis of the Higuchi fractal dimension. The author found a decrease in the dimension of after Om meditation. But OM chanting was not of fixed duration for each subject. Second study [14] with FFT spectral analysis observed oscillatory changes in the standard frequency bands (delta, theta, alpha, and beta) before and after OM chanting of 30 minutes. The results show that a 30 min OM mantra meditation practice change theta EEG patterns significantly more than baseline EEG brainwave patterns. In the third study [17], the Effect of meditation was observed with spectral analysis discrete wavelet transform. All regions of the brain show higher theta power after Om meditation. Second and third study confirms the role of Om mantra meditation in relaxation. Our previous two studies [14] [17] used a traditional method. To explore more about Om mantra meditation with EEG, the present study used the feature exaction method with wavelet and classifier. The objective of the study is to classify before and after the EEG band to observe the abrupt changes in the band as an effect of Om mantra meditation.

II. MATERIALS AND METHODS

A. *Subjects and data acquition*

EEG signal have been recorded from 23 naive meditator (F=14, M=20.99, SD=0.99, 18-22 years). All subjects where new meditators and all the selected subjects were a non-smoker, not habitual to drinking. Subjects were chosen from the college of engineering so that they can present valuable knowledge for meditation practice. The data has been obtained while, the subject asked to take a rest just lying down with closed eyes and at this moment the EEG data were recorded for 2 min. this new data is an EEG signal of before OM chanting. In a second moment, the subject asked to relax and chant i.e. OM mantra for 30 with closed eyes and in correct posture of meditation. After chanting mantra respective subject asked to get relax while lying down with closed eyes and then EEG data were recorded for more than 2 min. This recorded data is an EEG signal of after OM meditation. The signal were acquire with a sampling [illegible] of 256 Hz with Sixteen channel EEG activities were recorded using monopolar montages, according to international standard 10-20 from 16 channels using the RMS India system.

B. *Stationary wavelet transform*

The stationary wavelet transform (SWT) is used to study the non- stationary characteristics of the EEG signal over a

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Discrete wavelet transform(DWT). It has a lack of antialiasing capacity and is not shift invariant thereby to increase the describing ability for features [22]. In our work Daubechies, Symlet, and Coiflet series wavelet were considered .By comparing the performance of all three series the symlet3 wavelet function (sym3) is turned out to be good candidate for extracting the features with 6 levels decomposition based on the dominant frequency component. The six level decomposition is shown in fig 1. Statistical features were calculated for each of the bands from all the obtained segments.

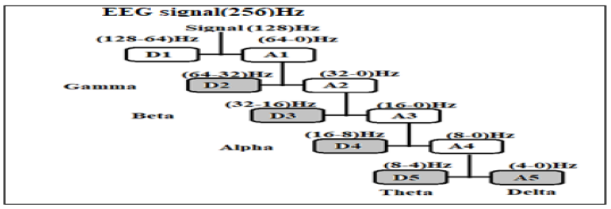

Fig. 1 Six level decomposition with wavelet

C. *Features*

One of the applications of wavelet transform is to compute and manipulate data in compressed parameters. These compressed parameters are called "features". These parameters describe the behavior of the signal [23].In this work, 10 features were extracted for data analysis such as Mean, Standard deviation(STD), Variance, Kurtosis, and the electrical feature such as Zero crossing rate(ZCR), Interquartile range (IQR), Hurst exponent(Hurst), and Band power [24-29].

D. *Support vector machine*

Support Vector Machine is supervised learning algorithm and proves to give a promising result in classification. It has good accuracy as well as a better ability to deal with a large number of predictors hence it is frequently used in biomedical Signal Processing [30]. In the proposed work the SVM classifier to distinguish the two classes of before OM chanting and after OM chanting EEG signal have used a radial basis function (RBF) kernel function shown in eq.1.

$$F(y, y_i) = \exp(\gamma \|y - y_i\|^2) \qquad \gamma > 0 \qquad (1)$$

Where γ - radius of the RBF.

E. *System description and preprocessing*

Fig. 2 shows a block diagram with the different steps followed in this study. Initially, EEG signals from each channel for each of the subjects were segmented. These segments were then decomposed into five constituent bands using stationary wavelet transform. Ten statistical parameters were calculated for the band derived from the segments. These parameters were averaged over all the segments. Furthermore, the SVM classifier is applied to discriminate each post EEG band from pre EEG band.

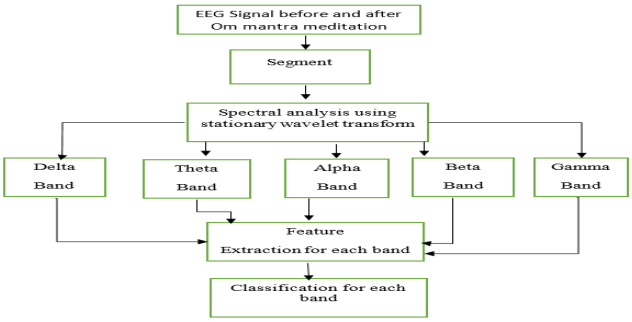

Fig. 2 Block diagram of classification between before and after EEG signal to observe the abrupt changes as an effect of Om mantra meditation

III. RESULTS

Ten features of each band were calculated. Out of 10 features, only Mean, STD, Variance, IQR and Hurst exponent of delta band show good variation in the EEG signal captured after Om mantra meditation. The blue lines in fig.3,fig.4.fig.5, fig.6, fig.7 represent the mean, STD, variance, IQR, and Hurst Exponent in before and the black lines represent in after meditation condition respectively for the delta band. The Same variation is not observed for any other band. Decreased mean, standard deviation, variance, Hurst Exponent and IQR of delta band are observed after Om meditation.

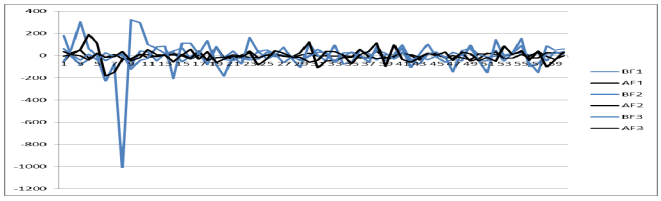

Fig.3 Mean of delta band of EEG before and after OM meditation

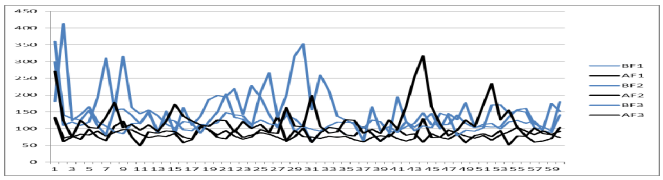

Fig.4 Standard deviation of delta band of EEG before and after OM meditation

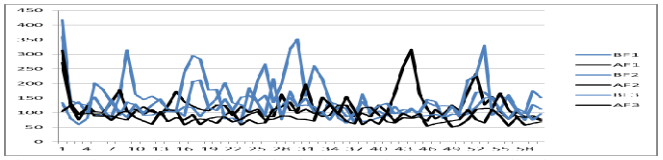

Fig. 5 Variance of EEG signal for before and after OM meditation

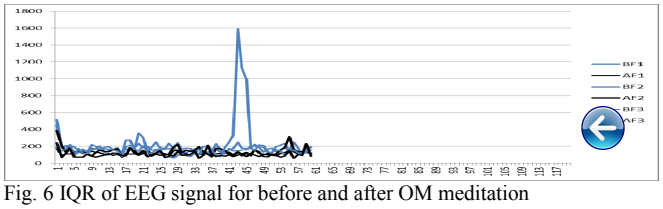

Fig. 6 IQR of EEG signal for before and after OM meditation

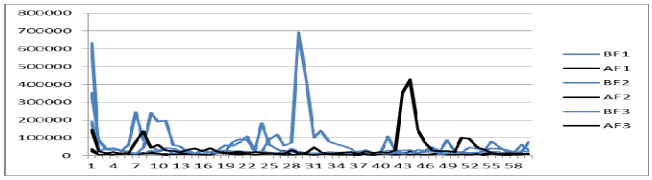

Fig. 7 Hurst exponent of EEG signal for before and after OM meditation

The main aim of this work is to design the classifier to classify the two different classes i.e. before and after EEG band to explore the effect of OM mediation. For this purpose, the extracted features were applied in pair, out of the extracted features 17 subjects multi-channel data were used as an input vector for the training purpose to the SVM classifier and 6 subjects feature values of the multichannel for testing purpose. The table I shows the accuracy for all bands.

Table I Accuracy of all EEG band

Features	gamma	beta	Alpha	theta	delta
Mean-variance	42.26	48.33333	61.111111	50.72	70.13
STD-IQR	41.38	41.25	53.194444	50.97	67.5
STD-Hurst	62.5	53.75	44.722222	49.72	55.97
STD-variance	47.03	49.16667	58.333333	50.27	69.3
STD-Mean	48.8	50	59.305556	50.69	72.5

By evaluating classification performance analysis with the accuracy which is expressed in figure 12 delta band low-frequency bands shows the high amount of changes in EEG signal whereas gamma, beta, alpha, and theta show less activity after OM meditation. As delta band carries the highest accuracy among rest of the band, classification results for delta band are as shown below:

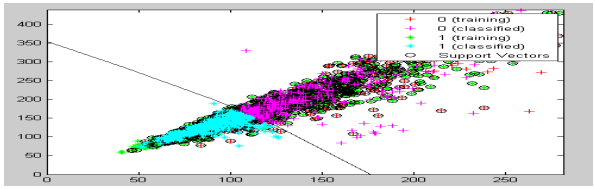

Fig. 8 Clustering analysis for before and after delta band with mean-variance

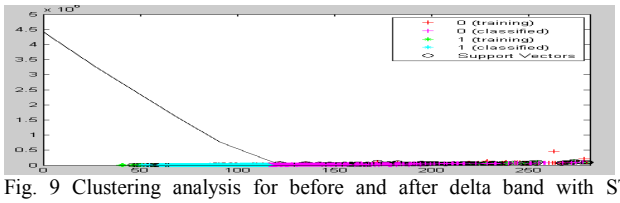

Fig. 9 Clustering analysis for before and after delta band with STD-variance of delta band classification

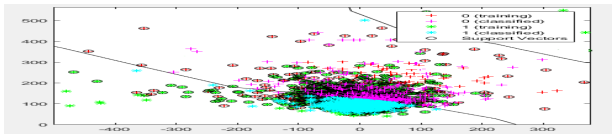

Fig. 10 Clustering analysis for before and after delta band with mean-STD of delta band

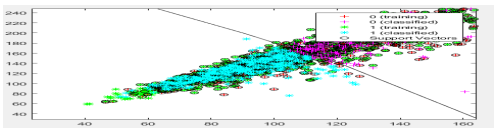

Fig. 11 Clustering analysis for before and after delta band with STD-IQR of delta band

Performance analysis of Delta band is shown in table 2.Seen from table all combined features achieved a better result in the clustering compared with the results obtained for other bands. Table 3 demonstrates classification performance of the proposed method for delta band.

IV. DISSCUSSION

In the present work, the EEG signal was analyzed for 23 naïve meditators to observe the alteration in each EEG band as an effect OM mantra meditation. To achieve this, feature extraction from the EEG signals was performed by the computation of wavelet coefficients obtained by the Stationary wavelet transform. The selected features were used as the inputs of the SVM classifier. Results revealed that OM Meditation minimizes the abrupt electrical activity of the human brain which mostly reflects in the delta band. Delta band shows a clear distinction between EEG signal before meditation and after meditation with the after condition having lower values of mean, variance, STD, IQR and Hurst exponent. It signifies the behavioral changes in the transient electrical activity of the EEG signal.

In a previous study [14] [17] on OM mantra meditation shows the activity in the theta band and the present study on the same meditation reflects changes in the delta band. It signifies that OM meditation moves the brain from a higher frequency band to a lower frequency band. Delta and Theta band represent the brain in deep sleep and light sleep activity respectively [31-32]. Thus OM meditation gives the experience of deep sleep. The strength of this study is that; it is a first study on OM meditation with the SVM classifier along with the performance analysis.

V. CONCLUSION

This work provides an effective way to detect the abrupt changes in two classes i.e., Before and after OM chanting with a system designed using statistical features with less computation time and complexity. Results found the comparison for 23 naive meditators with 30 min of OM chanting that alters in a lower band (delta band) which shows the positive aspect of our study. This work mainly focused on the method having high computational accuracy with less complexity and less computational time with the SVM classifier. Furthermore, this study can be extended with different techniques of wavelet transform and classification. This study can also be helpful to give new direction towards the meditation.

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