

# *Book of Abstracts*

INTERNATIONAL e-CONFERENCE ON  
**INTELLIGENT SYSTEMS AND SIGNAL PROCESSING**  
(e-ISSP2020)

28 – 30 December, 2020



Edited by:

Dr. Rahul Kher, Dr. Falgun Thakkar  
Dr. Deven Trivedi, Prof. Pradip Shah

*Organized by:*

Department of Electronics & Communication Engineering

**G. H. Patel College of Engineering & Technology**

Bakrol Road, Vallabh Vidyanagar-388120,

Gujarat, India

*(A Constituent College of CVM University)*

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## CHARUTAR VIDYA MANDAL

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*Blessings from:  
Chairman, CVM*

### **Message from Chief Patron**

It is indeed heartening to know that GCET is organizing the International e-Conference on Intelligent Systems and Signal Processing (e-ISSP2020). In this age of highly competitive globalization, the higher education, particularly the technical education, has assumed newer dimensions. When global interdependence and competition are upon us, we must offer the best and the brightest in the world to our youngsters and I am sure that e-ISSP 2020 will definitely fulfil this. Keeping this in mind Charutar Vidya Mandal has the tradition of offering the best possible technical education. It is really inspiring to know that over a span of just two and a half decades GCET has become one of the premier technical institutions not only in the state but also in India. But the path towards excellence is never ending. Therefore, our collective efforts should be directed towards all round improvement of GCET in all frontiers of modern technical education. We should also see that the technological advances and research outputs should be beneficial to all human beings and to the society.

I convey my blessings and good wishes to one and all members of GCET family. I also congratulate the members of organizing committee of e-ISSP 2020.

  
(Bhikubhai B. Patel)

Chairman, Charutar Vidya Mandal, Vallabh Vidyanagar, Gujarat, India



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*Message from:  
Principal, GCET*

**Message from Conference Chair**

I take this opportunity to welcome all the conference delegates to the "International e-Conference on Intelligent Systems and Signal Processing (e-ISSP2020)" during 28-30December 2020. I congratulate EC Department for taking initiative to organize this event on e-platform, especially in this time of a global pandemic. The objective of the conference is to keep abreast the researcher about the latest trends of research and development in the diversified field engineering. The need of the hour is to keep pace with the changing world by adapting to new technological advancement. Such conference provides a common platform for deliberations and conversation for people from academia and industry. This conference will definitely provide a platform to discuss the issues and upcoming new technological advancement in domain of Intelligent Systems and Signals Processing. The conference has received overwhelming response not only from each part of the country, but also from various countries like Malaysia, Indonesia, UAE, Bangladesh, Ethiopia and Nigeria.

I congratulate the organizing committee, supporting staff and team e-ISSP2020 for their initiative and wish them all success in their endeavor.

**Dr. Himanshu B. Soni**, Principal, GCET.



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**Message from Conference Co-Chairs**

The very first International conference of GCET (and probably of Gujarat) was organized by EC department in 2009 in form of ICSSA- 2009. Continuing that legacy three more international conferences- ICSSA 2011, ISSP 2013 and ISSP 2017 were organized by EC department. e-ISSP 2020 is the fifth version of this series and it is being organized in a virtual mode using online platform. Like ISSP 2017, the accepted and presented papers of e-ISSP 2020 too will be published in Springer's Advances in Intelligent Systems and Computing (AISC) series in form of a proceedings. e-ISSP received an excellent response from the global research community with about 140 submissions that includes 38 international papers. We are fortunate enough to have internationally acclaimed academicians- Prof. Ami Wiesel, Prof. Latif Ladid, Prof. RangarajRangayyan and Prof. Ram Bilas Pachori on the Keynote panel of e-ISSP 2020. The participants and attendees will be hugely benefited with their expertise and knowledge.

We would like to thank Charutar Vidyamandal and CVM University as well as the authors and reviewers who are the real pillars of the success of e-ISSP 2020.

**Dr. Hitesh Shah**

Professor & Head- EC Dept.

**Dr. Rahul Kher**

Associate Professor- EC Dept.

## **About Vallabh Vidyanagar**

Vallabh Vidyanagar, established seventy-two years ago, carries a rarity of purpose behind its origin and a variety of education with its development and growth. Strategically located between Ahmedabad and Vadodara, Vallabh Vidyanagar today has emerged to be an Active Educational Hub in the Western parts of India. Just six kilometers from India's milk city--Anand, it has made its distinct identity in the sector of education by offering numerous emerging and innovative educational programs and by attracting students from across the globe. Anand is situated between Ahmedabad and Vadodara on the main rail-link and also NH8, about 75 kms from Ahmedabad and 40 km from Vadodara.

Vallabh Vidyanagar is blessed with the beauty of nature. Its lush green trees of different types and kinds have not only made the town environment-friendly, but also created a serene and ever-enjoyable peaceful atmosphere generating synergistic pleasure on the campus. The pollution-free climate, attracting many to make the town their permanent home, adds value to the academic life on the campus.

Vallabh Vidyanagar has all the amenities which major metropolis have; rather it has best of both the worlds - glamour of a big city and simplicity of a small town. On one hand, it captures the current trends of the youth, while it attempts to make those trends meaningful by making the presence of different spiritual centers felt.

The town is the synthesis of varied cultures, which enable it to evolve and expand the quality life, as well as to foster the environment of creativity amongst the student citizens. Those who stay here always cherish the golden moments of life on the campus. Today, the town has compounded in strength and consolidated itself to take on the challenges of emerging future.

## **About Charutar Vidya Mandal**



The Charutar Vidya Mandal (CVM) is one of the largest and oldest education trusts in Gujarat, which manages 48 institutions from Junior KG to Higher education including four Engineering colleges. The trust was established in 1945 along with the birth of Vallabh Vidyanagar. Great Personalities like Bhaikaka (a renowned Engineer), Dr. H M Patel (Former Home and Finance Minister, Govt. of India) served as Chairman of CVM for long time. Dr. C L Patel is the present Chairman of CVM since 1994. He is proactive and visionary, very effective and dynamic as well as devoted leader. Under his tenure as a Chairman he has not only maintained the existing institutes very well but started number of new courses in existing institutes and established number of new institutions in Vallabh Vidyanagar as well as in New Vallabh Vidyanagar. In fact New Vallabh Vidyanagar is a brain child of Dr. C.L. Patel.

Charutar Vidya Mandal was established in the year 1945 as a charitable trust with a prime objective of rural development through education to bring about the social awakening, social up-liftment and enrichment.

## **About GCET**



CVM decided in 1995 to set up a private engineering college as per the norms of the All India Council for Technical Education (AICTE) and the policy of the state Government.

Shri. GordhanbhaiHathibhai Patel, an eminent philanthropist of Gujarat, made a generous donation for the new college. In honor of his magnanimous gesture, the college was named G H Patel College of Engineering & Technology, popularly known as GCET. The college started functioning in year 1996. The institute is built on more than 10 acres of land. The architecturally imposing college building houses class rooms, offices, well-equipped laboratories, several computer centers, drawing halls, audiovisual rooms, workshop and other facilities. Spacious corridors linking different sections, various 'open-to-sky' quadrangles and a garden with central fountain in front of main building - all these add up to a pleasant and harmonious academic atmosphere. In keeping with today's needs, computing facilities with 943 computers having minimum i3 processors on network and an internet connection through 48Mbps shared radio link have been provided for use students and staff of the college. The entire campus is Wi-Fi enabled. A silent Diesel Generator of 125 kVA is installed for power backup. A boys' hostel, a girls' hostel, a library building and staff quarters, centrally air-conditioned auditorium and a seminar hall are also located on the campus.



## **About Department:**

### **Department of Electronics & Communication Engineering**

The Department of Electronics & Communication Engineering established in 1997, offers undergraduate program with Bachelor of Engineering in Electronics & Communication along with two Post Graduate programs with Masters of Engineering in Communication System Engineering and Embedded Systems. The Department has 17 qualified faculty members out of which 8 faculty members are holding Ph.D. degree and 4 faculty members are pursuing Ph.D.

Due to excellent teaching methodologies followed by the faculty members, campus placement record, outstanding students' performance in University Exams and the resources provided for laboratories, EC Department is accredited by National Board of Accreditation for six years years since 1st July 2015.

The Department has excellent placement record and the graduates of the Department have secured many milestones in their carrier. Along with formal way of Education in class room and laboratories, EC Department also executes informal way of education where students are trained based of Co-curricular activities like Project competitions, Workshops, Seminars, Poster Presentations etc.

The Department is having well-equipped state-of-art laboratories along with dedicated industry funded Texas Instruments Laboratory as a part of an MoU signed with Texas Instruments India. Under Industry – Institute linkages, the Department initiates various activities like Workshops, Expert Talks, Seminars, Project Competitions in association with companies like Texas Instrument, E-infochip, Matrix Comsec, ISRO, Aratsu Systems etc. for the Engineering skill development required by the Industries.

To give thrust to the Research in the domain of Electronics & Communication Engineering, Department has successfully organized three International Conferences. The Department has close interactions with leading institutes and industries for research and development with its active involvement in handling R&D projects from Department of Science and Technology, GUGCOST and CSIR, New Delhi.

## **About Conference & Conference Statistics at Glance:**

The International e-Conference on Intelligent Systems and Signal Processing (e-ISSP 2020) aims to spread awareness in the research and academic community regarding the cutting-edge technological advancements revolutionizing the world. The emphasis of this conference is on dissemination of information, experience and research results on the current topics of interest through in-depth discussions and participation of researchers from all over world. The objective is to provide a platform to the scientists, research scholars and industrialist to interact and exchange of ideas in a number of research areas. This will facilitate communication among researchers in different fields of Electronics & Communication Engineering and Information Technology.

e-ISSP2020 has received an overwhelming response of about 140 research papers including 38 papers from foreign authors. Out of the received papers, 69 papers have been accepted (including 19 foreign papers) which makes an acceptance rate of just under 50%. All the accepted papers, presented during the conference, will be published by Springer's Advanced in Intelligent Systems and Computing (AISC) in form of a proceedings. The conference is an amalgamation of four keynote speeches, pre-conference workshops/ tutorials and poster session in addition to the regular paper presentation. All the registered participants in the conference will be entitled to attend all the sessions of the conference.

**International e-Conference on  
Intelligent Systems and Signal Processing (e-ISSP2020)  
28-30December, 2020**

**Chief Patron**

***Er. Bhikhubhai Patel***

Chairman, Charutar Vidya Mandal

**Patron**

***Shri Manishbhai Patel***

Vice President, Charutar Vidya Mandal

***Dr. S. G. Patel***

Hon. Secretary, Charutar Vidya Mandal

**Conference Chair**

***Dr. Himanshu B. Soni,***

Principal, GCET

**Conference Co-chairs**

***Dr. Hitesh Shah***

Professor and Head, EC Department, GCET

***Dr. Rahul Kher***

Associate Professor, EC Department, GCET

**Technical Program Committee**

***Dr. Peter Robinson***, University of Cambridge, United Kingdom  
***Dr. Xiao-Zhi Gao***, University of Eastern Finland  
***Dr. Dale Carnegie***, University of Victoria, New Zealand  
***Dr. Latif Ladid***, University of Luxembourg  
***Dr. P K Sahoo***, Cheng Gung University, Taiwan  
***Dr. Mohammad Atiquzzaman***, University of Oklahoma, USA  
***Dr. Yu-Chen Hu***, National Tsing Hua University, Taiwan  
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**Dr. M. V. Joshi**, DA-IICT, Gandhinagar  
**Dr. Aditya Tatu**, DA-IICT Gandhinagar  
**Dr. Sanjay Chaudhary**, Ahmedabad University  
**Dr. Mehul Raval**, Ahmedabad University  
**Dr. Dhaval Pujara**, Nirma University, Ahmedabad  
**Dr. Deepak Adhyaru**, Nirma University Ahmedabad  
**Dr. Chirag Paunwala**, Sarvajanic College of Engg & Tech, Surat  
**Mr. Anup Shah**, CEO, Insignex, Anand  
**Dr. VithalKamat**, Baroda Electric Meters, V U Nagar  
**Dr. T. D. Pawar**, BVM Engineering College, Vallabh Vidyanagar  
**Dr. D M Patel**, BVM Engineering College, Vallabh Vidyanagar  
**Dr. J M Rathod**, BVM Engineering College, Vallabh Vidyanagar  
**Dr. Hetal Patel**, A D Patel Institute of Technology, New V V Nagar  
**Dr. Narendra Chauhan**, A D Patel Institute of Technology, New V V Nagar

### **Organizing Committee**

**Dr. Mehul Shah**, Associate Professor, EC Department, GCET  
**Prof. Nilesh Desai**, Associate Professor, EC Department, GCET  
**Prof. GeetaliSaha**, Associate Professor, EC Department, GCET  
**Prof. Pradeep Shah**, Associate Professor, EC Department, GCET  
**Dr. Falgun Thakkar**, Associate Professor, EC Department, GCET  
**Prof. Mayank Mahant**, Associate Professor, EC Department, GCET  
**Dr. Samir Trapasiya**, Assistant Professor, EC Department, GCET  
**Prof. Ashish Christian**, Assistant Professor, EC Department, GCET  
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**Prof. Nirav Desai**, Assistant Professor, EC Department, GCET  
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**Prof. Rohit Parmar**, Assistant Professor, EC Department, GCET  
**Dr. Deven Trivedi**, Assistant Professor, EC Department,GCET  
**Prof. PartheshMankodi**, Assistant Professor, EC Department, GCET

## Brief Introduction of Keynote Speakers:

### ✚ Keynote Talk - I: "Three examples of 'easy' Non - Convex Optimizations"



**Ami Wiesel**

The Rachel and Selim Benin School of Computer Science and Engg, Hebrew University of Jerusalem

Ami Wiesel received the B.Sc. and M.Sc. degrees in electrical engineering from Tel-Aviv University, Tel-Aviv, Israel, in 2000 and 2002, respectively, and the Ph.D. degree in electrical engineering from the Technion - Israel Institute of Technology, Haifa, Israel, in 2007. He was a postdoctoral fellow with the Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, USA, during 2007–2009. He is currently an Associate Professor in the Rachel and Selim Benin School of Computer Science and Engineering, Hebrew University of Jerusalem, Israel. Since 2018, he is also a Visiting Researcher in Google. He is an IEEE SPS Distinguished Lecturer for 2020.

### ✚ Keynote Talk - II: "IPv6-based Internet empowering Super IoT, 5G, SRv6, Blockchain and Cloud Computing"



**Latif Ladid**

Research & Development Specialist, Faculty of Science, Technology & Medicine, University of Luxembourg

Latif LADID is the Founder & President, IPv6 FORUM ([www.ipv6forum.org](http://www.ipv6forum.org)); Member of 3GPP PCG (Board) ([www.3gpp.org](http://www.3gpp.org)); IEEE 5G Future networks Initiative Steering Committee Membe; IEEE IoT Initiative Steering Committee Member; Emeritus Trustee, Internet Society - ISOC ([www.isoc.org](http://www.isoc.org)); IPv6 Ready & Enabled Logos Program Board ([www.ipv6ready.org](http://www.ipv6ready.org)); World summit Award Board Member ([www.wsis-award.org](http://www.wsis-award.org)); Chair, ETSI IPv6 Industry Specification Group <https://portal.etsi.org/tb.aspx?tbid=827&SubTB=827>; Member of 3GPP2 PCG ([www.3gpp2.org](http://www.3gpp2.org)); Member of Future Internet Forum EU Member States (representing Luxembourg).

**✚ Keynote Talk – III: “Computer-aided Diagnosis: Engineering Improved Health Care”**



***Rangraj Rangayyan***

**Professor Emeritus of Electrical and Computer Engineering, University of Calgary**

Dr. Rangaraj M. Rangayyan is a Professor Emeritus of Electrical and Computer Engineering at the University of Calgary, Calgary, Alberta, Canada. He received the Bachelor of Engineering degree in Electronics and Communication Engineering in 1976 from the University of Mysore at the People's Education Society College of Engineering, Mandya, Karnataka, India, and the Ph.D. in Electrical Engineering from the Indian Institute of Science, Bangalore, Karnataka, India, in 1980. He served the University of Manitoba, Winnipeg, Manitoba, Canada and the University of Calgary in research, academic, and administrative positions from 1981 to 2016. His research interests are in digital signal and image processing, biomedical signal and image analysis, and computer-aided diagnosis.

Dr. Rangayyan has published more than 170 papers in journals and 270 papers in proceedings of conferences. He has supervised or cosupervised 27 Master's theses, 17 Doctoral theses, and more than 50 researchers at various levels. He has been recognized with the 1997 and 2001 Research Excellence Awards of the Department of Electrical and Computer Engineering, the 1997 Research Award of the Faculty of Engineering, by appointment as “University Professor” (2003 to 2013) at the University of Calgary, and with an Outstanding Teaching Performance Award of the Schulich School of Engineering (2016). He is the author of two textbooks: “Biomedical Signal Analysis” (IEEE/ Wiley, 2002, 2015) and “Biomedical Image Analysis” (CRC, 2005). He has coauthored and coedited several other books, including “Color Image Processing with Biomedical Applications” (SPIE, 2011). He has been recognized with the 2013 IEEE Canada Outstanding Engineer Medal, the IEEE Third Millennium Medal (2000), and elected as Fellow, IEEE (2001); Fellow, Engineering Institute of Canada (2002); Fellow, American Institute for Medical and Biological Engineering (2003); Fellow, SPIE (2003); Fellow, Society for Imaging Informatics in Medicine (2007); Fellow, Canadian Medical and Biological Engineering Society (2007); Fellow, Canadian Academy of Engineering (2009); and Fellow, Royal Society of Canada (2016).

**✚ Keynote Talk – IV: “Fourier- Bessel Series Expansion-Based Empirical Wavelet Transform for Signal Processing”**



***Ram Bilas Pachori***

Professor, Department of Electrical Engineering, Indian Institute of Technology Indore

Ram Bilas Pachori received the B.E. degree with honours in Electronics and Communication Engineering from Rajiv Gandhi Technological University, Bhopal, India in 2001, the M. Tech. and Ph.D. degrees in Electrical Engineering from Indian Institute of Technology (IIT) Kanpur, Kanpur, India in 2003 and 2008, respectively. He worked as a Postdoctoral Fellow at Charles Delaunay Institute, University of Technology of Troyes, Troyes, France during 2007-2008. He served as an Assistant Professor at Communication Research Center, International Institute of Information Technology, Hyderabad, India during 2008-2009. He served as an Assistant Professor at Department of Electrical Engineering, IIT Indore, Indore, India during 2009-2013. He worked as an Associate Professor at Department of Electrical Engineering, IIT Indore, Indore, India during 2013-2017 where presently he has been working as a Professor since 2017. He was a Visiting Professor at School of Medicine, Faculty of Health and Medical Sciences, Taylor’s University, Subang Jaya, Malaysia during 2018-2019.

He worked as a Visiting Scholar at Intelligent Systems Research Center, Ulster University, Northern Ireland, UK during December 2014. He is an Associate Editor of Electronics Letters, Biomedical Signal Processing and Control journal and an Editor of IETE Technical Review journal. He is a senior member of IEEE and a Fellow of IETE and IET. He has more than 200 publications which have around 7200 citations with h index of 46 (Google Scholar, December 2020). He has been listed in the top h index scientists in the area of Computer Science and Electronics by Guide2Research website. He has been listed in the world’s top 2% scientists in the study carried out at Stanford University, USA. He has served on review boards for more than 100 scientific journals and served for scientific committees of various national and international conferences. He has delivered more than 125 talks in various conferences, workshops, short term courses, and institutes. His research interests are in the areas of Signal and Image Processing, Biomedical Signal Processing, Non-stationary Signal Processing, Speech Signal Processing, Brain-Computer Interfacing, Machine Learning, and Artificial Intelligence in Healthcare.



## Conference Schedule



29 <sup>TH</sup> - 30 <sup>TH</sup> DECEMBER 2020	International e-Conference on Intelligent Signals and Signal Processing (e-ISSP 2020)
TECHNICAL SUPPORT	SPS CHAPTER, IEEE GUJARAT SECTION
ACCEPTED PAPERS, PRESENTED AT THE CONFERENCE, WILL BE PUBLISHED IN THE <b>SPRINGER'S ADVANCES IN INTELLIGENT SYSTEMS AND COMPUTING (AISC) SERIES</b> IN FORM OF THE PROCEEDINGS.	

TIME		PROGRAM SCHEDULE		
DAY 1 (29 <sup>TH</sup> 12/2020)	10:30 AM	INAUGURAL		
	11:30 AM TO 12:30 PM	KEYNOTE SESSION 1	Dr. Ami Wiesel The Rachel and Selim Benin School of Computer Science and Engg, Hebrew University of Jerusalem	TOPIC Three examples of "easy" Non - Convex Optimizations
	2:30 PM TO 3:30 PM	KEYNOTE SESSION 2	Dr. Latif Ladid R & D Specialist, Faculty of Science, Technology & Medicine, University of Luxembourg	TOPIC IPv6-based Internet empowering Super IoT, 5G, 5Rv6, Blockchain and Cloud Computing
		TRACK 1	Signal Processing Communication PAPER IDs: - (21,27,32,33,42,43,45,47,63,66,67,70,76,80,81)	
	4:00 PM TO 6:00 PM	TRACK 2	Applied Electronics and Emerging Technologies PAPER IDs: - (40,55,62,75,85,86,88,99,107,109)	
		TRACK 3	Computer Vision and AI PAPER IDs: - (3,10,16,23,36,39,46,49,53)	
		TRACK 4	Big Data IoT and Cloud Computing PAPER IDs: - (25,26,30,56,59)	
		TRACK 5, 6 Industrial Automation and Robotics & Interdisciplinary PAPER IDs: - (7,11,73,104,134,135)		
DAY 2 (30 <sup>TH</sup> 12/2020)	10:00 AM TO 11:00 AM	KEYNOTE SESSION 3	Dr. Rangraj Rangayyan Professor Emeritus of Electrical and Computer Engineering, University of Calgary	TOPIC Computer-aided Diagnosis: Engineering Improved Health Care
	11:00 AM TO 01:00 PM	TRACK 1	Signal Processing Communication PAPER IDs: - (82,89,93,94,100,106,114,124,126,127,128,129,136)	
		TRACK 3	Computer Vision and AI PAPER IDs: - (58,77,79,83,90,98,101,105,111,116)	
	2:30 PM TO 3:30 PM	KEYNOTE SESSION 4	Dr. Ram Bilas Pachori Professor, Department of Electrical Engineering, Indian Institute of Technology Indore	TOPIC Fourier- Bessel Series Expansion-Based Empirical Wavelet Transform for Signal Processing
	4:00 PM	VALEDICTORY		

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## **Track-1 Signal Processing & Communication Engineering**

### **SPCE21**

#### **Design and Analysis of Modified Split Ring Resonator Structured Multiband Antenna for WCDMA and WiMAX Applications**

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A miniaturized slotted multiband antenna is presented. The antenna consists of a square Split Ring Resonators shaped slot in the radiating patch. The split ring resonators structure based antenna presents operational capability at 2.18GHz, 2.56GHz and 3.52GHz respectively. The achieved return loss at the resonance frequencies are 21.38 dB, 12.00 dB and 25.46 dB and the bandwidth of the proposed antenna are 2.51%, 2.01% and 3.27% for respective frequencies. The standard low loss cost-effective FR-4 laminates of 1.6mm thickness substrate were used for design. The proposed prototype antenna was fabricated and measured; the results show reliable agreement with the simulated results. The antenna possesses adequate gain values at all resonating frequencies. The reflection coefficient, radiation pattern and other antenna parameters are exhibiting quite satisfactory results, fulfilling the requirement for WCDMA and WiMAX applications.



**SPCE27**

**A WEARABLE FINGER EXOSKELETON FOR MOTOR REHABILITATION  
USING MOBILE APPLICATION**

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Major stroke affected persons suffer with a poorly operating hemiparetic broad palm (metacarpus), and require treatments that include physical therapy directed with intense activity and movement. This paper presents a novel finger exoskeleton device to facilitate therapy exercises while keeping it lightweight, compact, and affordable. The self-operated exoskeleton is designed to assist fingers flexion and extension motions for the restoration of voluntary function, which is driven using servos and string mechanism, and controlled using the mobile application. Testing results show that this wearable finger exoskeleton can produce required torque to flex each finger towards the broad palm for rehabilitation with 90% accuracy.

**SPCE32**

**Game theoretical approach for cluster-based routing protocol in Wireless  
Sensor Network**

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One of the emerging optimization techniques formulating on the interest of conflict or cooperation for achieving maximum outcome on the bases of prediction is the Game Theory. From the last two decades it has gradually been used in wireless communication and slowly stepped into wireless sensor networks. Wireless sensor networks are made up of wireless nodes working on batteries and so the life of network depend on the life of battery. Applying the best cluster-based routing protocol with appropriate game has increased network lifetime, and enhanced its energy efficiencies. Present paper summarizes the literature and the research carried out for cluster-based routing protocol in wireless sensor network using game theory.

### **SPCE33**

#### **Advanced Digital Signal Processing for Interference Mitigation in Very High Throughput Satellite**

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The telecom market is eyeing the reasserted interest toward satellite communication to deliver the future ultra-high rate demand. These requirements lead to the excess reuse and sharing of limited frequency resources. In the field of satellite communication, ultra/very high throughput satellites (V/HTS) with multiple and aliquot spot-beams are the key solutions for distributing the future high data rate services. The performance of V/HTS is limited due to inter-system and intra-system generated interference rather than classical system generated thermal noise. The paper presents the literature survey of the mitigation techniques for interference generated due to excessive/full frequency reuse in V/HTS. The implementation aspects and progress of digital signal processing for MIMO based approaches (Pre coding, Non-Orthogonal based Multiple Access, and Pre distortion) in V/HTS are also reported.

### **SPCE42**

#### **Low-Power Endoscopic Image Compression Algorithms Using Modified Golomb Codes**

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The design of image compressor for wireless capsule endoscopy is challenging due to the stringent constraints on size and life-time of battery. In this paper, we present a single-pass endoscopic image compression algorithm which combines differential pulse-coded modulation (DPCM), color space transformation, sub-sampling, uniform

quantization and Golomb codes. Two methods are employed in order to improve the performance of existing DPCM-based endoscopic image compression algorithms. These are applying two-dimensional sub-sampling scheme for chrominance components of image and modifying Golomb codes. Computationally efficient hardware architecture is proposed which uses computationally simple operations: binary shift operations, logical operations, addition and subtraction operations. It doesn't need buffer memory. The hardware implementation of the architecture consumes  $4.89 \mu W$  power for transmitting two full-color images of  $256 \times 256$  resolution. Experimental results show that the proposed image compression method achieve a good balance between compression ratio (11.02), reconstructed image quality (40.55 dB of peak signal-to-noise ratio) and computational complexity. The obtained performance improvement is significant as compared to the existing image compression methods for wireless capsule endoscopy application.

### **SPCE45**

#### **Image Steganography Using Ridgelet Transform and SVD**

**Mansi Subhedar**

Image steganography involves embedding the secret information into a cover media without creating noticeable changes in it and keeping its presence hidden. In this paper, transform domain image steganography is proposed that benefits from the ridgelet transform and SVD matrix decomposition technique. The principal component obtained by singular value decomposition of ridgelet coefficients acts as an embedding location. Stego image is obtained by embedding the secret image in it. Experimental results in terms of imperceptibility, and robustness are verified using standard image quality metrics. Simulation results validate superior visual quality with a large payload. Proposed approach is also robust to several image processing attacks like noise addition, geometric transformations, histogram equalization, JPEG compression, etc.

**SPCE63**

**Performance evaluation of prediction algorithm based tracking methods in a recovery of a lost target using Wireless Sensor Network**

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The prediction algorithm can help select the foremost nodes to supervise the target position by preserving network energy. The unreliable prediction mechanism may hamper tracking by causing temporary loss of target, which is a major issue in critical applications. However, very few methods are available in the literature to unfold target loss issues during tracking. This paper evaluated the effect of various prediction algorithms, including regressive neural networks on sensor network energy consumption. The Kalman filter, Interacting Multiple Model, and Time Delay Neural Network-based tracking methods are compared for different target motion scenarios. The simulation results show the numerical analysis of all prediction algorithms in terms of tracking accuracy, tracking energy, recovery energy, total network energy used, and instance of a target lost.

**SPCE66**

**An Efficient Convolutional Neural Network for Acute Pain Recognition using HRV Features**

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The pain of any individual can be felt only through experience. Therefore, clinicians are using self-report measures to assess acute pain after surgery. Thus, there is a need to predict and monitor acute pain effectively without self-report measures. In this study, Heart Rate Variability (HRV) from the ECG signal is used to objectively assess the acute pain. The BioVid Heat Pain Database is utilized to evaluate the acute pain recognition task. HRV features such as time domain, frequency domain, and nonlinear features are extracted and are utilized for this study. These features might be impacted without lies, therefore, applied normal distribution and removed the outlier using standard deviation. After the data learning process, the best pain

associated features are selected using One-way ANOVA and Post Hoc test. Finally, the pain level classification is performed using the modified Convolutional Neural Network (CNN) and compared its performance with other baseline systems such as ELM and SVM. It reveals that the proposed system outperforms the other baseline systems with 99.2% classification accuracy.

### **SPCE67**

#### **Design and development of LSTM–RNN model for the prediction of RR intervals in ECG signals**

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Traditional machine learning models are common to classify ECG signals. In comparison, ECG prediction with such models is rare. The proposed work aims to predict the RR Interval (RRI) for a 10-second Normal Sinus Rhythm (NSR) ECG signals by designing and developing a Long Short Term Memory (LSTM)-Recurrent Neural Network (RNN) based model. The ECG signals from the Chapman University and Shaoxing People's hospital have 10 seconds of sample data of each patient used in this study. Signal processing techniques to detect the R peaks and RRI were calculated further and provided as the model's input. LSTM-RNN model based on univariate time series predicted the RRI for the subsequent 20 ECG cycles. The model underwent 500 epochs of training before the accurate ECG prediction. The model's error value started at 0.8 and ended at 0.000001, which provided a good fit for the predicted data. The LSTM-RNN model predicted the RRI from the 10<sup>th</sup> to the 30<sup>th</sup> ECG cycle based on 9 RRI. The model's error rate decreased exponentially as the epoch's number increased, stating the model's accuracy, helping determine the intra-individual Heart Rate Variability (HRV).

**SPCE70**

**FHSS Signals Classification by Linear Discriminant in a Multi-Signal Environment**

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Frequency-hopping spread spectrum (FHSS) spreads the signal over a large bandwidth where the carrier frequencies change quickly according to a pseudorandom number making signal classification difficult. Furthermore, classification becomes more complex with the presence of additive white Gaussian noise (AWGN) and interference due to background signals. In this paper, a linear discriminant (LD) method based on the Euclidean distance is proposed for the classification of FHSS signals in the presence of AWGN and background signal. Probability of correct classification (PCC) of the FHSS signals is performed by the LD method for the signal-to-noise ratio (SNR) range of -6 to 15 dB. Results show that the proposed method has achieved 90% detection rate at the SNR range of -1.6 to 3.5 dB in the presence of AWGN only while its performance is degraded to 0.9 to 12 dB when the background signal is present.

**SPCE76**

**Non-Invasive Thyroid Detection Using Thermal Imaging Technique**

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Thyroid disorder is due to variation in TSH hormones which helps the human body by controlling metabolism. Thyroid hormones are generally generated in response to a different hormone which is released by pituitary gland. There are four main types of thyroid disease Hyperthyroidism (too much thyroid hormone), Hypothyroidism (too little thyroid hormone), Benign (noncancerous). A thyroid disorders is an abnormal growth of cells within the thyroid gland or inside the throat, which can be cancerous (malign). Thermal distribution in human body is a natural indicator of abnormalities. Thermal imaging is a non – invasive screening method

for monitoring the distribution of body temperature. In the view of study we propose classification of Thyroid abnormalities using thermal image. The proposed technique is based on the following computational methods; the median filter for pre-processing, Active Contour segmentation is used to segment the selected Region of Interest and then the features are extracted. Feature extraction was done from the taken images and correlation was estimated between the normal subjects and the thyroid subjects. Various classifiers have been tested for their accuracy and some classifiers such as Multilayer Perceptron, Bayes Net and KNN showed high accuracy. The accuracy estimated by these classifiers was tested in Weka tool and their ROC curves with AUC scores have been derived. These classifiers can be used for feature classification and be efficiently used for the performance of non-invasive thyroid diagnosis.

### **SPCE80**

#### **Non Orthogonal Multiple Access Techniques for Next Generation Wireless Networks: A Review**

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Future needs of wireless and cellular communication in current, as well as the next decade, requires to support many services like system average throughput, mobile traffic explosion, live HD streaming, enhanced location-based services(LBS), M2M communication, cloud computing, etc. These bring many challenges in capacity, coverage, data rate, and spectral efficiency. Traditional Orthogonal Multiple Access techniques (OMA) can't fulfill these basic requirements of next-generation networks. However, by allocating the same radio resources to many users the system capacity, and user throughput can be improved. Non-Orthogonal Multiple Access technique has recently been recommended for the fifth generation (5G) and beyond fifth-generation networks (5G+) which can address such issues. By non-orthogonally allocating many users the capacity and spectral efficiency can be improved. NOMA scheme can be categorized into two main classes Power domain and Code Domain. This survey paper centers on the Power domain NOMA technique with superposition coding plus Successive interference cancellation at transmitter and receiver respectively as well as sum-rate analysis of NOMA in uplink and downlink. The blend of NOMA with MIMO and massive MIMO in addition to the performance of NOMA in the cellular network has been discussed and analyzed.

### **SPCE81**

#### **Triple band circular patch antenna using complimentary split ring resonators**

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This paper presents a triple-band microstrip circular antenna which uses two different sized complementary split ring resonators *in the ground plane*. The proposed antenna works on 2.4GHz, 3.58 GHz and 5.58 GHz frequencies. The complementary split ring resonators stimulate 2.4GHz and 3.58 GHz in antenna. The complementary split ring resonators have minor effect on 5.5GHz frequency. The prototype antenna is fabricated and tested. There is good matching observed between simulated and measured results. The proposed antenna is simple to construct.

### **SPCE82**

#### **Features Analysis of Electroencephalography (EEG) for Mindfulness Meditation Effect on Cancer Patient toward Stress Level**

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Cancer diagnosis can cause patients hard to accept the fact which easily lead to the emotional upheaval and affecting the mental healthiness, and more bring negative impact on their quality of life. Consequently, strategies aimed at reducing psychological symptoms and encouraging relaxation are required. Mindfulness meditation has become one of the ways to treat physical and psychological symptoms together with conventional allopathic care. In this study, the meditation intervention effect toward the psychological perceived stress is investigated by using



Electroencephalogram (EEG). Thus, a portable and lightweight Muse Headband was used as the EEG data acquisition device to collect 13 cancer patients. Besides, KNN, SVM and Bagged Tree classifiers was used to conduct classification to analyze EEG of the cancer patients and compared the accuracy between three classifiers for mindfulness meditation effect and the perceived stress level. The outcome shows that the Bagged Tree is the most suitable classifier for the classification, which the highest accuracy of classification is 66.67 % compared to KNN (62.65 %) and SVM (55.45 %). The meditation practices were found significantly affect beta and gamma band of cancer patients, which the highest accuracy for the classification of meditation effect at both bands are 66.21 % and 66.67 %, respectively. Lastly, perceived stress level was found correlated with beta and gamma band as well, which the highest accuracy for the classification of perceived stress level at both bands are 59.29 % and 66 %, respectively. In short, we can conclude that perceived stress level is interrelated with meditation practice.

### **SPCE89**

#### **Effects of menstrual cycle on atrial ECG components**

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Cyclic variation of sex hormones occurs throughout the menstrual cycle in reproductive women. This variation causes physiological alteration of cardiovascular activities and ultimately affects Electrocardiogram (ECG) parameters. The aim of this study is to analyze the changes happening in the atrial ECG in reproductive women during menstruation. Thirty-five healthy women volunteers aged between 20-25 with regular menstrual cycles were enlisted for this study. ECG was recorded during the first phase of menstrual cycle (study group) and other phases of menstrual cycle from 14<sup>th</sup> to 26<sup>th</sup> days (control group) using the EDAN PC ECG system. Among all atrial ECG components, the P-wave duration (PWD) decreased in the study group. Menstruation caused alteration in the P wave axis, and P wave amplitude in ECG Leads II and aVF. PR Interval, PR segment, and PP Interval did not show significant variation between the groups. Hence cyclic alteration of sex hormones and electrolytes concentration may cause decreased PWD at the time of menstruation. Therefore reproductive women have a lower occurrence of Atrial Fibrillation (AF).

**SPCE93**

**Performance Assessment of Waveform Modulation Methods for Fifth-  
Generation Wireless Systems**

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The 5G cellular network systems feature several innovative strategies such as cognitive radio, large scale antenna arrays installed on macro base stations, extensive adoption of small cells, use of mm-wave communications for short-range links, cloud-based radio access network etc. In addition to this, 5G cellular networks have more stringent requirements than LTE in terms of data rates, energy efficiency, and latency. However, all these strategies are impacted by the modulation format used at the physical layer. In spite of their success in LTE, the existing modulation scheme such as orthogonal frequency division multiplexing (OFDM) cannot fulfill all the requirements of 5G wireless networks. Hence, the choice of efficient waveform modulation scheme is crucial to meet the requirements of the new 5G cellular network systems. In this paper, we analyze and compare the performance of OFDM, Universal filtered multicarrier (UFMC) and Filter bank multicarrier (FBMC) in terms of peak to average power ratio (PAPR) and bit error rate (BER). A detail performance analysis is done by varying the parameters that affect the performance of these the modulation techniques such as number of subcarriers, number of FFT, guard bands, and mapping schemes. The simulation results show that FBMC outperforms both OFDM and UFMC in terms of BER, which makes it more suitable in noisy wireless channels. In terms of PAPR, UFMC gives best performance among the three modulation schemes. Hence, it is a preferable modulation scheme in applications where the power consumption of transmitter power amplifier is critical. The contribution of this work is significant in supporting the selection of efficient modulation technique for the upcoming 5G wireless system standards.

**SPCE94**

**Design and Fabrication of CPW fed Jeans antenna working at 2.4 GHz ISM band**

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The wearable antenna working at 2.4 GHz for Industrial, Scientific and Medical (ISM) radio bands has been presented in this paper. The proposed antenna is having a coplanar waveguide (CPW) feeding on the jeans as the substrate material. This antenna is a hexagonal shaped monopole having heptagonal cut inside. The antenna has a size of dimensions of 80 × 97.48 mm<sup>2</sup>. This compact size antenna is suitable for wearable applications. The antenna parametric analysis is carried out to observe the performance of the antenna. The simulated and measured results are compared and they match with each other.

**SPCE100**

**Effect Of Artifacts On The Interpretation Of Eeg Based Functional Connectivity Estimation Using Partial Directed Coherence**

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The proposed work investigates the design of an algorithm to enhance the functional connectivity for human brain using Electroencephalogram (EEG) signals. The partial directed coherence (PDC) approach was used to estimate the right analysis of the functional connectivity. However, the presence of artifacts due to eye movement/blinking and muscles movement affects the correct estimation of functional connectivity. Therefore, the time-average differencing (TAD) method was developed to remove the artifacts. Two methods based on discrete wavelet transform (DWT) denoising and moving average filter are used, and comparison is made to access their effectiveness. Between the two methods, the TAD MA method removes all artifacts and ensures correct estimation of functional connectivity using PDC.

**SPCE106**

**Development of Optimal Corrected PTa Interval formula for different heart rates**

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The standard 12-lead Electrocardiogram (ECG) system is the most commonly used technique for obtaining the electrocardiographic signal to evaluate the heart's electrical activity. In the surface ECG, atrial repolarization (Ta wave) is not observed. However, during the exercise stress test, ST-segment depression validates the existence of Ta wave. To record the Ta wave and enhance atrial depolarization (P wave) in Sinus Rhythm (SR) ECG, Modified Limb Lead (MLL) system is used. PTa Interval (PTaI) represents the duration from the beginning of P wave to the end of Ta wave. This study aims to develop a corrected PTaI (PTa<sub>c</sub>) formula to correct the PTaI from MLL ECGs for different heart rates. ECGs were recorded from 35 volunteer sin SR and Sinus Tachycardia (ST) condition of mean age  $24 \pm 5$  years using EDAN PC ECG system. Regression analysis was implemented on the recorded data to derive the slope for PP Interval (PPI) vs. PTaI plots in both groups. In SR group, PPI correlated well with PTaI ( $r = 0.48$ ) compared to the ST group ( $r = 0.17$ ). A new corrected PTaI (PTa<sub>cN</sub>) formula was developed from the slope values of SR and ST and was compared with the previously developed PTa<sub>c</sub> formula. The developed PTa<sub>c</sub> formula of this study showed accurate results with the least slope in different heart rates. Implementation of new PTa<sub>c</sub> formula in automatic algorithms further improves the clinical diagnosis related to atrial ECG components.

**SPCE114**

**Medical Image Fusion using Lifting Wavelet and Fractional Bird Swarm Optimization**

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This paper concentrates on an eminent technology of medical imaging data science called image fusion. A unique pixel level image fusion method is presented here. The various multimodal MRI brain images are taken from BRATS database and an effectively fused and a comparatively more informative image called fused image is obtained. The two multimodal images are first decomposed by Haar Wavelet to obtain high and low frequency coefficients. Intermediately Bayesian fusion is performed on these extracted information rich coefficients. Later on proposed fusion rule is adopted which is basically an optimization technique called fractional Bird Swarm Optimization(Fractional-BSA).It is observed that the proposed scheme called fractional BSA-Bayesian Fusion outperformed the other contemporary existing methods of image fusions like wavelet and HW fusion, SWT and NSCT and NSCT .The better results of assessment parameters like Mutual information, Peak signal to noise ratio (PSNR) and Root mean square error (RMSE) is proving the merit of proposed method.

**SPCE126**

**Review on Beamforming Techniques for Millimeter Wave Massive MIMO**

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To meet the demands of the increasing wireless data traffic there is need to explore the new spectrum region to meet the demands. This leads to the exploration of the millimeter wave band which will be able to handle the traffic. The principle target of this paper is to give survey of the diverse beam forming procedures for the massive MIMO framework. Classification and comparison of different optimal beam forming techniques are reviewed for energy as well as for spectral efficiency, throughput, inter-cell and intra-cell interference to decide which technique gives the better performance for the millimeter Wave massive MIMO system. By analyzing different beam forming algorithm an optimal beam forming algorithm is suggested that will enhance massive MIMO system performances and also satisfy the demands of future generation of wire- less communication system.

**SPCE127**

**False Arrhythmia Alarms Detection through ECG Signals**

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Patients with life threatening illness and injuries are often admitted to intensive care units (ICU) as they require constant support from life support machines and medical care. Their vital signs need to be continuously monitored, and electrocardiogram (ECG) signals are often used for this purpose. Any irregular ECG signals or arrhythmia will be closely monitored in intensive care units (ICU) and timely medical intervention is provided to critical patients. However, occurrence of false arrhythmia alarm hinders the monitoring process. Therefore, this research focuses on predicting the false alarms associated with arrhythmic ECG signals. Discrete wavelet Transform (DWT) based nonlinear entropies and morphological features are utilized for the study. Due to the imbalanced nature of the dataset, adaptive synthetic sampling (ADASYN) technique was used to create synthetic data. The principal component analysis (PCA) based dimensionally reduced features were trained with supervised classifier such as fuzzy K-nearest neighbor (FKNN), Random Forest and Ada Boost classifiers to quantify predictive rate of the false alarm. The proposed method was able to provide accuracies above 80% for all the testing instances.

**SPCE129**

**Human recognition using Omni-directional Camera for Service Robot  
Application**

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Service robots have received increasing attention in mobile robotics field with the recent advancement in technology and computing power. One of the important aspects of service robots is the vision recognition system. This system is crucial for the robot to navigate through the surrounding and detect the objects such as obstacles and targets. Most of the recent service robots use costly sensors such as LIDAR and high-end vision system in order to recognize its environment. This paper proposes to use a cost effective sensor which is an omni directional camera to obtain a full 360° field of view (FOV) of the surrounding environment. The images from the camera were then used to identify the location of the human in any direction from the robot. From the results, the optimal method to unwrap the omni directional image and recognition of human is promising. In addition, the direction and heading of the robot is also configurable in future works using the proposed method.



**Track-2 Applied Electronics and Emerging Technologies**

**AEET40**

**Grid synchronization for three-phase grid-tied converter using Decouple Second-order generalized integrator**

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As universally well-known, the phase-angle of the grid voltage is a crucial parameter to the control performance of the grid-tied power converters. These paper emphases on robust grid synchronization technique for three-phase grid-tied photovoltaic system in order to detect fundamental frequency, phase, and amplitude. However, the accuracy of the estimated frequency depends on the type of abnormal grid voltages and the structure of the phase-locked loop or frequency-locked loop control scheme. The widely accepted phase-locked loop (PLL) algorithm has a complex architecture and requires a tedious tuning process to obtain a good stability margin. Decouple second-order generalized integrator based frequency- locked loop (SOGI-FLL) is proven to have the most promising performance by eliminating both the negative and harmonic distorted components under non-ideal grid voltage conditions. Moreover, even in the absence of any PI controller, when the grid voltage has characteristics such as dips, swells, harmonics, unbalance, and frequency changes, it can accurately track the frequency of the grid voltage. The simulation results show that the proposed DSOGI-FLL is effective under all abnormal grid voltage conditions. The results are verified through experiments to prove the superior performance of DSOGI-FLL under adverse conditions

**AEET 55**

**Regression Based Model of Low Cost Air Quality Monitoring System**

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In this paper, an attempt has been made to build a prediction model based on regression analysis of air quality data. Proposed prediction model will help in air quality monitoring and analysis with less number of sensor data. For this linear and polynomial regression models have been created and tested. Air quality monitoring data has been used, which has been collected through air quality monitoring devices. The compositions of air have been also explored. The dataset consists of information about the composition (different gases) of air at different times. Among all the components of air, CO (Carbon Mono-Oxide) is a major air pollutant. Hence, the regression analysis based model is used to predict the readings of CO sensors through specified sensors. This study contributes towards the modeling and development of low cost devices for monitoring air quality in the environment. In future devices may be developed based on the presented model that fits in budget and used widely in cities at different locations.

**AEET 62**

**Initial Results on High Sensitivity Magnetic Induction Spectroscopy Circuit for Metal Detection in Human Body**

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Abstract. Bone fracture healing has a relative close connection with the fixation stability. A dislocation of the bone screw may cause the screw loosening and future lead to screw defect. Early detection of the position shifting of the metal (bone screw) is the key for faster healing. Therefore, a high sensitivity Magnetic Induction Spectroscopy (MIS) is proposed to identify the relative position of the implanted metal in human body. The purpose of this study is to investigate the potentials of MIS for metal detection in human body. In this project the MIS circuit are design, simulate using NI Multisim Software and hence fabricated on the PCB. This study has found that a magnitude measurement technique of MIS system is sufficiently sensitive for metal detection in human body, due to the conductivity of the biological tissues is million times lower than metallic object. The study also proven that the developed MIS circuit capable in detecting the position shift of metal in human body at operating frequency of 500 kHz.

**AEET 85**

**Comparative Performance of CMOS Active Inductor**

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In this work, a Gyrator-C based CMOS active inductor is designed using 180nm and 90nm CMOS technology. Moving from 180nm to 90nm technology will diminish the cost of the system and provide more functionalities. The nominated circuit is designed using a three-stage Common Source (CS) configuration, and the resemblance is made with the recent work. From the simulation results, it is monitored that the maximum quality factor ( $Q_{max}$ ) lifts, and the area sinks as we wane the technology. The consequences depict the  $Q_{max}$  of 311 at 478.63MHz and an area of  $216.04\mu\text{m}^2$  for 180nm technology. Whereas, the ensue for 90nm technology gives the  $Q_{max}$  of 659 at 10.96GHz and an area of  $68.73\mu\text{m}^2$ .

**AEET 86**

**Continuous Monitoring of Banana Plantations**

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The growth and production of fruits from crops are influenced by many factors. Light, temperature, nutrients, and water are the four major factors that influence the crop's growth [7]. The main factor left to be controlled is water and nutrients. An array of electro-conductive sensors are used to figure out the soil moisture throughout the farm. Each moisture sensor is paired with a stem diameter sensor to measure plant health and growth. This pair of sensors are used to measure the growth of crops over time. This allows for continuous monitoring of the crops to help the farmer understand how the crops are progressing. Continuous monitoring and history of information provided by these sensors help the farmer make changes to the watering schedule and nutrients in the soil to ensure optimal crop growth.

**AEET88**

**An experimental study to evolute performance of PV module at workplace**

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This paper investigates the performance of a polycrystalline solar module at Government Engineering College, Patan, Gujarat, India. The experiments were carried out during the September month on a 10-W PV module under variable climate conditions. The open circuit voltage and short circuit current observed. The PV module has the facility to change tilt angle and direction manually. The performance graph designed based on monthly average solar irradiation and ambient temperature, variable tilt angle and panel orientation. Results show that the PV module performs better when it is inclined and placed at 24-degree tilt angle and panel orientation at south direction. It is also observed that, PV module generated 78% power of its rated maximum on average irradiation of 695.6 W/m<sup>2</sup>/day and average temperature of 30.6°C. Experimental results compared with the HOMER Pro microgrid software data for the same location and received good agreement between them. Similar system design can be applied for future large-scale projects for same location.

**AEET 99**

**Automatic Capacitor Switching Method for Power Factor Improvement with HMI Interface and Cloud Data Logger**

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This research aims to improve the power factor in a power grid. The large inductive load of power factor is less than 1 which results in the high value of the electric current and the installed power cannot be used optimally. The correction system is designed using an automatic switching method of 4 capacitors equipped with Solid State Relay drivers to produce 14 combinations of capacitor values. The interface is designed to use a TFT HMI display and a cloud data logger to be able to display the value of the power factor in real-time. The test sample used two 36 watt fluorescent lamps or tube lamps and one 1-phase motor with 1/4 HP of power that had an average cos phi of 0.40. From the tests that have been done with some variation of load, the results show that the system has been able to make improvements with the final power factor value above

0.80. Furthermore, the results also show that HMI display TFT and Cloud systems are able to display data from power factors in real-time.

### **AEET 107**

#### **Analysis of novel 15Gbps WDM-FSO system employing hybrid amplifier under various weather conditions Preet Kaur<sup>1</sup>, Maninder Singh<sup>2</sup>, Manish Sharma<sup>3</sup> Rajeev Kumar<sup>4</sup>**

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This paper presents high capacity WDM (Wavelength Division Multiplexing) based FSO system which utilizes two EDFA (Erbium Doped Fiber Amplifier) .It used for long distance transmission as booster amplifier and SOA (Semiconductor Optical Amplifier) as pre-amplifier. The proposed system supports 15Gbps transmission over optimized link length on various weather conditions i.e. haze, light rain, medium rain and heavy rain. This novel system provides Q-factor and BER of 17.55, 2.5e-69 respectively for heavy rain conditions whereas conventional system provides Q-factor and BER of 9.14, 1.55e-20 respectively for same weather condition. This paper increases Q-factor and BER respectively for heavy rain condition.

### **AEET 109**

#### **Optimized Molecular Structure, Vibrational Spectra and Frontier Molecular Orbitals of 1,4-Benzene Diamine with Palladium Electrodes As a Molecular Switch -A Computational Analysis**

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Molecular electronics focuses on shrinking the electronic circuit with functional single molecular devices. Molecular logic circuits have the potential to replace the conventional semiconductor logic circuits very shortly. This emerging field aims at investigating molecules

with exciting properties and discovering strategies to acquire reliable and replicable contacts between the molecular backbone and the nanoelectrodes. Here, molecular structure and vibrational spectroscopic studies of 1,4-benzene diamine (BDA) with palladium nanoelectrode have been investigated as a molecular electronic switch using the Density Functional Theory (DFT) and Hartree Fock (HF) method with BPV86 (Becke Perdew 1983 functional modified by Vosko) and basis set Stuttgart/Dresden (SDD). The noticed vibrational spectra and frontier molecular orbitals have been resolved and analyzed in detail for the comparison of both the OFF and ON state of electrical conductivity. This paper provides salient information regarding enhancing the conductivity of benzene based single molecular switches with metal nanoelectrodes by maintaining the stability and switching property. The current flow in 1,4-benzene diamine with the Palladium nanoelectrode has been analyzed using theoretical simulations and it is extensively reconcilable with the recent experimental results.

## **Track 3. Computer Vision and Artificial Intelligence**

### **CVAI 3**

#### **Bag of Visual Words Methodology in Remote Sensing – A Review**

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With the increasing popularity and use of geographical data processing, more and more research efforts have been placed on geographical scene classification. Not only in the field of satellite imagery, but considering the recent overall, overwhelming increase in the amount of visual information such as digital images present, there's an urgent need of developing a model that aids in complete representation of an image and its features and also its retrieval. To obtain a complete representation of satellite images from a high spatial resolution satellite, bag of visual words model is emerging as a significant tool with quite promising results in the fields of image classification and image retrievals. This paper gives a detailed review to the introduction of BoVW (bag of visual words) methodology in the field of satellite imagery, its implementation, results and future scope of BoVW method in the remote sensing science and technology.



**CVAI 10**

**Automated segmentation and classification of Psoriasis hand thermal images using machine learning algorithm**

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Psoriasis is an autoimmune disorder which affects the skin and causes inflammation in the skin regions which leads to lesions in hand, leg, shank and upper back regions. The objectives of the study are to compare the performance of hybrid automated segmentation algorithm with fuzzy c-means algorithm for segmenting the hand region of psoriasis and normal subjects and to extract the handcrafted features from the segmented image and implement the classification process using SVM classifier. In this specific study, hybrid algorithms of k-means clustering and region growing have been used for segmentation. The GLCM features are extracted and classification of psoriasis and normal hand region was performed using machine learning classifier. The percentage difference of 7.9% is achieved between the normal and psoriasis subjects. The mean average temperature difference of 2.5 0 C was found between the normal and psoriasis subjects. The feature such as contrast and entropy exhibits highest percentage difference of 12.8% and 9.05% respectively between the normal and psoriatic hand. The sensitivity, specificity and accuracy of the classifier were found to be 83.3%, 73.3% and 78.3% respectively. The Proposed hybrid algorithm provides better segmentation results compared to fuzzy c-means algorithm in segmenting the psoriasis hand thermal image. The thermal imaging technique can be used as screening diagnostic tool for analyzing and detecting the psoriatic lesions.

### **CVAI 23**

#### **Thermal imaging analysis in detection of childhood obesity in cervical region using machine learning classifiers**

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Thermal imaging which uses infrared radiation can be used to quantify obesity in children. The aim of this study is to determine mean temperature in three body regions and to classify normal and obese children using machine learning algorithm. Participants were 7-10 years ( $8.17 \pm 1.58$ ) boys (N=30) and girls (N=30). All children underwent thermal analysis at anterior cervical, anterior fingerbed and posterior thigh region. Fingerbed region showed highest percentage temperature difference (13.559 %) between normal ( $30.69 \pm 1.1$ ) and obese ( $35.15 \pm 0.7$ ) children. The SVM classifier showed best performance accuracy (96.67%) for both anterior cervical and anterior fingerbed region. The thermal imaging along with machine learning approach can be utilised as a screening diagnostic tool for evaluating and classifying obesity in children.

### **CVAI 36**

#### **Real-Time Tomato Detection, Classification and Counting System Using Deep Learning and Embedded Systems**

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Detection of healthy tomatoes and discrimination of infected ones is quite desirable for yield estimation. Automating this process can ease up the cultivation and harvest process for the farmers. Real-time in-field conditions like soil and background, varying illuminations, occlusions due to leaves or other tomatoes pose as a challenge for Tomato detection and counting. In this paper, we propose a deep learning based Tomato detection system that discriminates healthy, ripe, and unripe Tomatoes from the infected ones and also provides a count for each of them. Different versions of the YOLO architectures are used for detection and

a comparison of their performance in real-time is presented. From the experimental results, it is observed that YOLOv4 achieved high mean average precision, while YOLOv3 Tiny gave a better performance in terms of fps. These models were deployed on an embedded platform, NVIDIA Jetson TX1 for real-time testing in a Tomato farm.

### **CVAI 39**

#### **A Standard Proposed Voice-Based Application for Virtual-Assistance on Cloud Service Platforms**

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Virtual Assistants that associates with the clients that utilizing natural language processing with the like human language. Implementation of custom skill application can analyze client's choices and return in- tended responses. Subsequently, the virtual assistance is becoming an integral of customers services. The main motivation for analyzing the customer's order data is that the consumer can pass commands on fly and in response get the details for the ordered products. In this research, the order related data is taken from Cim Commerce Platform and analyzed. This paper is an implantation of an intelligent virtual assistant in finding the order data on Mobile Application. This virtual based application which would gather the user preferences and model collective user knowledge base, which will improve the user to machine communication.

### **CVAI 46**

#### **Covid-19 Detection Using CNN and Decision Tree**

**Uttaran Roychowdhury · Mansi Subhedar**

Currently, the outbreak of COVID-19 is a global challenge to be addressed. To address this issue, this paper presents a novel method to determine the pneumonia and COVID - 19 infection in lungs caused by the virus. This method is assisted by a decision tree algorithm based on the data collected during the initial breakout in china. The database of patient symptoms is used

primarily detect pneumonia infection and uses a sequential convolutional neural network to further identify COVID-19 infection. The proposed system is implemented using open-source resources and is optimal for use. Due to this, the execution of proposed work can be achieved with much ease and high speed. The proposed convolutional neural network model, initiated after the decision tree model offered detection accuracy of 92.81%.

### **CVAI 49**

#### **A Novel Approach for Spoken Language Identification and Performance Comparison using Machine Learning based classifiers and Neural Network**

**Vishal Tank<sup>1</sup>, Dr. Manthan Manavadaria<sup>2</sup> and Krupal Dudhat<sup>3</sup>**

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Spoken Language Identification (SLI) is the process of capturing a type of language of a speaker. In this research paper, the used database is created in three different languages Gujarati, Hindi and English. Language classification is performed using features like MFCC (Mel Frequency Cepstral Coefficients), Pitch and average energy. Accuracy values of the created database are evaluated and compared using various pattern classifiers namely Fine Tree, Linear Discriminant, Gaussian Naïve Bayes, Linear SVM, Fine KNN and feed forward neural network in MATLAB 2019. Performance using individual speech features and hybrid features are compared. Training time of all the classifiers are also evaluated to decide the best among all classifiers.

### **CVAI 53**

#### **A Systematic literature review on Health Recommender Systems**

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In the present computerized world medical care is one of the significant region of the clinical space. A medical services framework is needed to break down a lot of patient information which assists with determining experiences and help the prediction of diseases and treatments. Subsequently, this framework ought to be astute enough so as to anticipate a medical issue by dissecting a patient's way of life, physical wellbeing records and social activities. Hence, Health recommender systems (HRS) have developed as a driver for giving patient-driven customized medical care services. The principle target of recommender frameworks is to give recommendations dependent on recorded data on the clients' inclinations. In the case of HRS, rich health information gathered through wearable gadgets and different sensors to survey the physical and mental condition of the patient. Hence, to comprehend the best in class advancements in the medical care area, this paper gives an extensive overview on Health recommender systems. This study additionally gives the comprehensive survey on the Health recommender systems and the types of Health recommender systems. At last, the open issues and challenges associated with the HRS are discussed.

### **CVAI 58**

#### **DNA Cryptography based Speech Security System**

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Speech is one of the most vital forms of communication in today's age. We communicate with others through speech in the form of audio calls over the internet or mobile networks. While communicating with others, it is imperative to transfer speech securely. This paper proposes a novel Speech Security System (SSS) which leverages DNA cryptography to provide security to the transmitted speech signal. Our proposed method encrypts the speech signal into a DNA strand which works as a camouflage to the original speech signal. The DNA strand is decrypted at the receiver end and the original speech signal is retrieved. The proposed SSS is significantly

robust against any cryptanalytic, statistical, and brute force attacks by an intruder and thus improves the security of the speech signals.

**CVAI 77**

**Obesity detection in thermal imaging using convolution neural network: A comparison with machine learning models**

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The purpose of the proposed study is to classify the thermal images of abdomen, forearm and shank regions in obesity and normal subjects using SURF based machine learning classifiers compared to convolutional neural network. Total populations of sixty subjects, among which 30 normal and 30 obese subjects were recruited for the proposed study. The thermal images were acquired in abdomen, forearm and shank region using FLIR thermal camera (FLIR A300). SURF based feature extraction method is used along with SVM classifiers for binary classification of adult obesity and normal subjects. After data augmentation process, Convolution neural network VGG19 is used for classification of obesity and normal subjects and its performance is compared with SVM classifiers. The SURF based SVM classifier provides the accuracy of 93% compared to VGG19 net. The machine learning classifier provided the better results compared to pre-trained models in CNN in the thermal image obesity analysis.

**CVAI 79**

**Non-Invasive Technique for Detecting Neonatal Jaundice**

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Neonatal jaundice is a common ailment observed in infants. There a lot of diagnostic approaches being made to detect it currently. When the infant's bilirubin level goes beyond 5mg/L(85mmol/L) it is indicative of jaundice. Bilirubin level increases often in infants just after birth till about a week. Almost 60 and 80 percent of full term and premature babies respectively have jaundice. This paper aims for the early detection of jaundice in newly born infants. 15 jaundice affected and 22 normal infants were considered for the purpose of this study, including babies of varied skin tones. A smartphone camera was used to capture images of the infant's skin. MATLAB was used to process the images that were taken, using algorithms for skin and facial detection. Colour map transformations like RGB, YCbCr were used. Multiple quantitative features such as energy, entropy, mean, standard deviation and skewness were studied. PCA (Principle is the main technique that is used to reduce data redundancy. PCA uses energy and the other features to come to a well-defined conclusion. It was noticed that the standard deviation and energy is much higher in jaundice affected infants than normal. This research comes to a conclusion that images can be used to identify the occurrence of neonatal jaundice.

**CVAI 83**

**Augmented Reality Implementation on Physical Therapy Exercise**

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Physical therapy exercise (PTE) is a planned physical activity that is enabled to enhance the body functions, reduce risk and improve overall health of a person. In this research, range of motion (ROM) for shoulder PTE was investigated. There are three types of shoulder PTE involved: shoulder horizontal flexion and extension, shoulder external rotation and shoulder flexion and extension. To compare the conventional shoulder PTE with the shoulder PTE that is implemented with current technology, an augmented-reality (AR) application is designed and implemented to those shoulder PTE. In this research, it is found that ROM of shoulder horizontal flexion and ROM of shoulder flexion were classified well between the group with AR and the group without AR. This is due to their classification accuracy is quite high in KNN classifier (accuracy >80%). Lastly, the group with AR and group without AR for each ROM of shoulder PTE is compared using paired sample t-test. The result showed that all the ROM of shoulder PTE has high significant difference (when p-value < 0.05) between group with AR and group without AR as the p-value is extremely small.



**CVAI 90**

**Deep Learning Based Body Mass Index (BMI) Prediction Using Pre-trained CNN Models**

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Automatically predicting body mass index (BMI) from face images is an interesting and challenging problem in the field of computer vision. Extracted facial features are the most important requirement for estimating BMI readings. The experiment was conducted on a visual BMI database containing 4206 face images. This work studies how to detect and to crop face images through image processing methods for BMI prediction. The face detector used in the image pre-processing stage is Multi-Task Convolutional Neural Network (MTCNN). This method was based on Convolutional Neural Network (CNN) and Keras framework. Throughout this research, deep pre-trained CNN models were implemented to go through the training task and to evaluate the performance of those models for the BMI prediction system. Also, the aim of this research is to predict BMI score and BMI classes from detected face images using three pre-trained CNN models. This research provides some deep insights which are images pre-processing method using MTCNN algorithm performed better than traditional methods such as Haar classifier or Adaboost algorithm, and also pre-trained CNN models resulting in better accuracy with less computation time.

**CVAI 98**

**An Effective Approach to Classify White Blood Cell using CNN**

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The white blood cell plays an important role in the human body, protecting the human body from infection by WBC by eliminating parasites, fungi, viruses and bacteria. There are many types of white blood cells, such as eosinophils, lymphocytes, monocytes, and neutrophils. Identification and classification of white blood cells is an important application in medical diagnosis. The WBC count provides information about the health status of the human body. Many diseases and infections depend on the white blood cells in the bloodstream, thus identifying and classifying different WBCs. Nowadays, blood cell analysis is performed by laboratory pathologists. Symptomatic testing, however, is a time-consuming, expensive, and error-prone major test method. The in-depth learning approach, especially the implementation of interactive neural networks, offers additional-general benefits to the medical field, where a large number of images are analyzed and processed. CNN is expected to acquire more semantic features, which will affect the classification accuracy to some extent. CNN automatically captures features from a single image and identifies specific white blood cell types from different images. In this study, it is proposed to classify different WBC types such as eosinophils, lymphocytes, monocytes and neutrophils from confusing neural network architecture images. The experiment will take place on the WBC dataset with 12,436 images. The developed model was evaluated to provide an accurate result with a classification accuracy of 97% for all classes. Keywords: Image Processing, White Blood Cells, Deep Learning, Convolutional Neural Network.

### **CVAI 101**

#### **Video Summarization for Multiple Sports Using Deep Learning**

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This paper proposes a computationally inexpensive method for automatic key-event extraction and subsequent summarization of sports videos using scoreboard detection. A database consisting of 1300 images was used to train a supervised-learning based object detection algorithm, YOLO (You Only Look Once). Then, for each frame of the video, once the scoreboard was detected using YOLO, the scoreboard was cropped out of the image. After this, image processing techniques were applied on the cropped scoreboard to reduce noise and false positives. Following that, the processed image was passed through an OCR (Optical Character Recognizer) to get the score. A rule-based algorithm was run on the output of the OCR to generate the timestamps of key events based on the game. Finally, clips of length 30 seconds around every detected event (15 seconds before and after the event) were extracted from the video file and stitched together to form the highlights video. The proposed method is best suited for people who want to analyze the games and want precise timestamps of the occurrence of important events. The performance of the proposed design was tested on videos of Bundesliga, English Premier League, ICC WC 2019, IPL 2019, and Pro Kabaddi League. An average F1 Score of 0.979 was achieved during the simulations. The model was also tested on different video formats, these were .mp4, .avi, .mov, .mkv. The algorithm was trained on five different classes of three separate games (Soccer, Cricket, Kabaddi). The design was implemented using python 3.7.

### **CVAI 105**

#### **Extraction and Recognition of Handwritten Gujarati Characters and Numerals from Images Using Deep Learning**

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Automated recognition of Indian scripts from a document or image is a challenging problem. Gujarati is an Indian script meant for expressing the language Gujarati. Gujarati is the official language of the West Indian state of Gujarat and is spoken and written by nearly 60.3 million people. Gujarati script can be considered as more complicated for machine recognition owing to the presence of complex consonant, vowel modifiers compound character called 'Jodakshar' etc and absence of 'Shirorekha'. The problem becomes all the more challenging when the script to be recognized is handwritten rather than printed. Two basic approaches exist in the literature on the topic: Offline as well as online handwritten Gujarati script recognition. Online method takes the input in real time whereas offline systems work on scanned images making the recognition task more lengthy and complicated. The main aim of this paper is twofold. First, A dataset of images of handwritten Gujarati characters and numerals is made available and second, offline Gujarati character recognition from images of handwritten Gujarati text. Hence, the primary objective of the paper is to present an approach which could extract Gujarati characters from an image and then recognize them with deep learning. The accuracy of the system obtained in most of the cases is more than 98%. The best accuracy obtained when tested with unseen character images is 82.15%

### **CVAI 111**

#### **Application of Machine Learning for Estimating Empirical Parameters for Rectangular Microstrip Patch Antenna**

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Antenna is a rudimentary element in the communication technology. Combination with trending technology is apparent with certain zenith for advancement in the domain. Approach of predicting the resonant frequency, return loss and input impedance by taking hundreds of combinations of length and width of rectangular radiating patch is made by considering rectangular microstrip patch antenna. Design of this is made by using Ansys High Frequency Structure Simulator (HFSS) software. Design and optimization is made on 2.4 GHz patch antenna. Optimization of parameters is done by extracting the dataset from simulated design and optimization. Ridge regression, Linear regression and Decision tree regressor algorithms are used for training the model, moreover model works more efficiently with decision tree regressor. However, model works very well for decision tree by predicting practical resonant frequency, input impedance and return loss with 99.66%, 99.98% and 80.04% accuracy respectively on unseen data.

**CVAI 116**

**Leveraging Transfer Learning for Binary Classification of Images with CNN**

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Machine learning and deep learning approaches are widely used for various real-world applications. For the conventional machine learning methodologies, datasets from the same domain are generally used viz. the training and test data for keeping the same input function space and the same data distribution characteristics. However, this approach is not very effective in scenarios where the cost of training data is high, or they are hard to access or gather. Hence, there is a requirement for trained high-performance learners on the data that is easily accessible in different domains. This technique is called learning transfer, relaxing the hypothesis of independent and identically distributed data set for test and training data and leading us to solve the problem of inadequate training data. Transfer of knowledge improves learning performance by drastically avoiding costly data labelling efforts. This work is the study and investigation of modern CNN architecture models used through Transfer Learning and checking the accuracy and efficiency with new image dataset. We compared the most widely used CNN transfer learning models available and observed that results were quite comparable with decreasing complexity of the latest highly dense neural network models. We also drew a comparison of models in terms of both training and validation accuracy based on model parameters and the layers present in the model.

## **Track 4. Big Data, IoT and Cloud Computing**

### **BDICC 26**

#### **Shortest pathfinder for Air Traffic Network: A Graph based Analysis**

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Air Traffic Management is the dynamic, integrated management of air traffic. There has been a dramatic increase in people who are preferring airways over the traditional transportation system as it saves time. The growth will generate countless new routes and require hundreds of new airports and thousands of new planes and pilots. Most of the traffic management is done throughout the flight to help the pilot with ongoing traffic above there. Due to this rapid growth of passengers and the increasing environmental concerns, there is a need to find the shortest and efficient path for any flight considering distance and time. Using graph theory's Dijkstra algorithm shortest point between a source and a distance could be calculated. The shortest path based on parameters including distance and time has been implemented with Neo4j and Apache Spark and hence a comparative study between the two software has also been done. The model was trained using a dataset of air routes of Oceania and was able to predict the best route in terms of distance and time separately. Neo4j provides visual results in the form of a graph while spark provides the shortest distance and route followed in the path. An optimal path that is derived using the shortest distance on the cost of time or vice versa would not only findings of the system. An equation could be derived that would balance both distance and time. That equation can also be extended to take care of parameters like traffic, weather conditions, and country borders or restricted areas.

**BDICC 30**

**Power Constrained Performance Evaluation of AODV, OLSR and DSDV  
Routing Protocols for Vehicular Ad-hoc Networks**

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VANET is a subclass of MANETs, in that individual vehicle armed with on-board sensor units, which pays to route by advancing data for other vehicles. Now a days VANETs is an emerging area in wireless sensor ad-hoc networks with special features such as multi-hop communications, high speed vehicle density, dynamic and heterogeneous network, bandwidth, security, QoS and high node energy consumption brand the designing of routing protocols a key interesting challengeable research field. Meanwhile many routing protocols inherited from MANET used for VANET and they have been also executed using NS-2. Recently, NS-3 is well known simulator to swap NS-2 has not borrowed for implementing VANET routing protocols. Here, the main goal of this paper is to compare the power constrained performance between routing protocols ADOV, OLSR and DSDV. ADOV is on-demand reactive routing protocol which determines a route to the destination only, when desired source node wants to send a packet to the destination where packet holds and keeps a table holding information about the destination packet. OLSR and DSDV are table-driven proactive routing protocol mainly developed for MANET which can be also extended for VANET. Finally, these three routing protocols are compared by quantitative metrics like an average throughput, packet delivery ratio, and overhead are evaluated using SUMO and NS-3. Simulation results show that AODV affords a realistic performance rather than OLSR and DSDV, and acclimates well for highly dense vehicular networks.

**BDICC 56**

**Remote Monitoring and Predictive Maintenance on Medical Devices**

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Equipment maintenance is the primary task performed by mechanical and electrical equipment personnel to ensure the optimum output, good efficacy and long service life. Conventional types of traditional equipment maintenance, such as calendar-based maintenance, are most referred to as preventive maintenance schedules (PPM). PPM is a scheduled event performed by qualified personnel for the systematic analysis, detection, and repair of incipient failures. However, this scheduled PPM is not effective in preventing equipment malfunction, as it occurs only bi-yearly depends on the requirements or even worse, during the unconditional failure which is time-consuming, costly and affect the total on-going process. The improvement of the typical preventive maintenance strategy through incorporating the Internet of Things (IoT) enabled by Industrial Revolution 4.0 is indeed advantageous. The Internet of Things (IoT) is used to facilitate the continuous transmission of data from tracked sensors on the equipment underuse to the person in-charge As a result, it shows that the maintenance person in-charge will remotely monitor the equipment. Continuous monitoring system will help the maintenance team identify any unusual activity that may cause device failure and predict the equipment downtime.



**BDICC 59**

**A review of approaches to Energy Aware Multi-Hop Routing for Lifetime  
Enhancement in Wireless Sensor Networks**

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Enhancing the network lifetime is one of the most challenging tasks in research involving wireless sensor networks. The phenomenon of the ‘hotspot issue’ that is the uneven energy depletion of sensor nodes becomes more prominent as the number of sensor nodes increase. These sensor nodes disperse their energy quickly and finally die down. Since immediate battery replacement is not possible in operational environments, researchers have suggested various alternative methods to address the issue. This paper brings out a comprehensive and exhaustive literature review discussing methods and techniques used in sensor networks outlining the improvements achieved so far. Moreover, many theoretical and numerical calculations have been illustrated to substantiate the practicability of these various methods.

**Track 5 & 6. Industrial Automation and Robotics & Interdisciplinary  
Research**

**IARI 11**

**Sensor Based Smart Glove for Rehabilitation of Paralysis patients**

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This work aims at representing the design of a system which helps the robotic arm controlling through a sensory glove which can be used for a purpose of rehabilitation for the disabled. The smart glove, consists of the controller component that features sensors which include the Inertial Measurement Units (IMUs) and a sensor board (MPU6050). We only tested the smart glove with MPU6050IMU, which is a sensory IMU board. We have also used Encoders for the measurement of the rotational movement of the hand. The result showed that the sensor glove successfully showed the finger and the wrist flexion movements. However, the glove requires further changes due to a few drawbacks which includes accuracy. Nonetheless, an improved glove design could even help us increase its applications like the manipulation of the robotic hand to mimic the actual hand movements, or for gesture recognition for the disabled or as a diagnostic tool for finger movements.

**IARI 73**

**Wireless Robot Control Using Wrist Movements from Surface Electromyogram  
Signal**

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Nowadays, the rates of disability are increasing in part due to aging populations and an increase in chronic health conditions. Human-Computer Interaction (HCI) system become vital for helping the tempo-rary and permanently disabled patients. In this framework, sEMG signals of

five motions which are neutral, left, right, up and down will be performed and recorded from subjects by using AD Instruments PowerLab 4/25T device. Then, the signal will be filtered with 4th order band-pass Butterworth filter and an additional 50 Hz notch filter used to remove the noise of the power line. Empirical Mode Decomposition (EMD) method and wavelet packet decomposition method were implemented for extracting the 11 features. Classifiers used are probabilistic neural network (PNN) and generalized regression neural network (GRNN) in order to analyze the performance of controlling the wireless patient remote system prototype via wrist sEMG signal. From the results obtained, PNN is the best classifier with the highest recognition rate of 87.0 % by using the 10 % of testing data and 90 % of training data compared with GRNN which is 86.25 %. After that, the graphical user interface (GUI) will be connected with the Blynk app to show the IoT platforms that allows patients for controlling the robotic system.

### **IARI 104**

#### **COVID-19 in Malaysia: A Correlation and Regression Analysis on the Imported Cases and Local Transmission**

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COVID-19 pandemic has been seen to be uncontrollable with some countries suffer several surging waves. This pandemic will continue to threaten many nations in the foreseeable future, particularly the health government, public health systems, socio-economy and national economy. Different countries use dissimilar containing measures in combating the pandemic. In Malaysia, lockdown has been implemented in different phases, namely Movement Control Order (MCO), Conditional Movement Control Order (CMCO) and Recovery Movement Control Order (RMCO). Nevertheless, the border control has been loosely adhered with the spiking of cases that leads to several clusters, namely Sivagangga and Benteng LD clusters. Therefore, the consequences of imported cases in local transmission cannot be neglected. The aim of this study is to apprehend the correlation and relationship between the imported and local occurrences in every MCO phase. Through the correlation analysis, the imported cases have greatly affected the local transmission at the onset of the MCO. From the regression analysis, results showed a positive relationship of the local and imported cases in the MCO phases. Thence, the returnees to Malaysia should be strictly observed and quarantined in avoiding the surging of the COVID-19 cases. The proposed analysis in this work will help us to comprehend the dynamics of COVID-19 in Malaysia, which helps to verify the effectiveness of MCO.

**IARI 135**

**AROgyAKAVACHAM- Automatic Hand Sanitizer Dispenser with  
Temperature Measurement**

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The prevention steps taken in coronavirus disease outbreak are to use the mask and frequent cleaning of hands is becoming common in our daily routine along with social distancing. In schools, colleges, malls and restaurants additionally, temperature is also measured with IR temperature sensors. The device named AROGYAKAVACHAM -An automatic hand sanitizer dispenser with contactless temperature measurement device was designed, developed and tested for a small group of Registrar Office of Anand Agriculture University and G. H. Patel College of Engineering and Technology, Gujarat, India. It consists of 12V, 1A adapter, voltage regulator LM7805, two Arduino Uno, one ultrasonic sensor, MLX90614 Infrared temperature sensor, motor driver L298, sanitizer container, DC submersible pump, display with I2C module and a buzzer. Initially, the device was powered by rechargeable DC battery which was charged by the solar panel. For cutting down its cost and make the device more compact it was connected to AC supply through a 12V, 1A adapter. Additionally, ambient temperature was also measured along with respondent temperature. It was in good agreement with the actual ambient temperature. Although there was some difference in temperature of the respondent when compared with MLX90614 readings and temperature gun readings. This developed device will be a boon to the society as it reduces the risk of transmission of severe acute respiratory syndrome coronavirus 2.