

EUREKA

E-News letter



April [2021], Issue 2



EUREKA SCIENTECH RESEARCH
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EUREKA

MAY [2020]

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Insights

1

Editorial

Page-3

2

News Room

Page-4

3

Feature Articles

Article 1: Page-10,,

Article 2: Page-12,

Article 3: Page-16,

Article 4: Page-22,

Article 5: Page-26

1 Editorial Desk

Satyaban Roy



Reaching from the Editorial Desk

It is, for example, quite odd to see that even at the left end of mainstream opinion, programs such as those advocated by Bernie Sanders are considered “too radical” for Americans. His two major programs call for universal health care and free higher education, normal in developed societies and poorer ones as well.

The pandemic should awaken us to the realization that in a just world, social fetters should be replaced by social bonds, ideals that trace back to the Enlightenment and classical liberalism.

Prof. Noam Chomsky

[from his interview to *Global Policy Journal*, 14 Apr 2020]

]

The Pandemic of the century has physically pulled down the shutters in schools all across this planet. Globally, over 1.2 billion children in 186 countries are out of the classroom. As a result, mode of imparting education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. Accordingly, various stakeholders such as government and private organizations are trying their best to assist each other by sprucing up their existing online platforms, apps and providing training to teachers to use these apps and platforms to the optimum level. Research suggests that online learning has been shown to increase retention of information, and take less time. With this sudden shift away from the classroom, some are wondering whether the adoption of online learning will continue to persist post-pandemic, and how such a shift would impact the worldwide education market. While some believe that the unplanned and rapid move to online learning – with no training, insufficient bandwidth, and little preparation – will result in a poor user experience that is uncondusive to sustained growth, others believe that a new hybrid model of education will emerge, with significant benefits. There are, however, challenges to overcome given the reality that only 24 per cent of the households of students in India have internet access and in urban areas, 42

per cent of households have access to the internet as compared to 15 per cent in rural areas. For those who do have access to the right technology, there is evidence that learning online can be more effective in a number of ways. Though it is evident that online classes and assessments cannot substitute conventional mode of teaching but the role of technology and its extensive use in imparting education cannot be overlooked. To get the full benefit of online learning, there needs to be a concerted effort to provide this structure and go beyond replicating a physical class/lecture through video capabilities, instead, using a range of collaboration tools and engagement methods that promote “inclusion, personalization and intelligence”. We are simply not ready to reopen. We must instead leverage technology to ensure that no student is left behind. This issue of bulletin envisions such unbiased world picture by humble compilation of feedback from personalities of educational institutions with the objective of providing at least a drop of input to the colossal issues of continuing effective education in ongoing and post-pandemic world.



Satyaban Roy
Ex-Chief Engineer, WBEDCL

2 News Room



Dr. Debabrata Dutta

Former Professor Physical and Mathematical Sciences, Homi Bhabha National Institute, Deemed University, Mumbai, India.
Head (Retd.) Radiological Physics and Advisory Division, Bhabha Atomic Research Centre, Mumbai, Maharashtra, India
Advisor, Eureka Sciencetech Research Foundation

Thanks to Prof. Debabrata Dutta for his outstanding contribution during 2020-21

Feb 19-20: Delivered a keynote speech on “Entropy based Intelligent Decision making processes” in the 1st Virtual International Conference on Computational Intelligence and Computing. In this talk, decision making processes have been explored using entropy. Entropy being a time arrow marker, evolution of decision-making processes can be best understood by entropy. Basically, multi-criteria decision-making methods using a combination of analytical hierarchical process (AHP) and entropy has been presented and showed that entropy can organize the randomness of the attribute present in any decision making process.

We have developed a new data analytics on the basis of recent pandemic (COVID-19) data to forecast its progress and other allied protections. Forecasting or predictive models developed in the domain of pandemic analytics are based on data so called as data driven model (logistic regression) and validated its outcome using traditional epidemiological models of infectious disease. However, as the data presents some noise a probabilistic analysis of data is essential to incorporate decisions regarding the epidemic outbreak with uncertainty of basic reproduction number that gives a knowledge on number of secondary infections from a primary infective candidate. In this context, an invited talk on “Entropy Based Intelligent Computation for Decision Making Models of Pandemic Analytics” has been delivered in the 1st Virtual International Conference on Computational Intelligence and Computing (ICCIC2020).

Feb 08-13, 2021: Electrical Engineering Department of Asansol Engineering College, Asansol had organized an AICTE Sponsored Online Short Term Training Programme (STTP) Series **on Recent Advances and Trends in Machine Learning: Theory and Application during Feb 08-13, 2021.** In this program, I have delivered two talks on “Quantum Computing and Quantum Machine Learning (Part-I and Part-II) on Feb 11 and Feb 13. Summary of these two talks was an exploration of Quantum machine learning – a machine learning technique based on quantum physics and accordingly basics of quantum mechanics has been presented in these talks.

JIS College of Engineering, Kalyani, West Bengal had organized an AICTE Sponsored STTP on Digital Energy Network: IoT Applications in Smart Grid Systems during Feb 8 – 13, 2021. I have delivered an invited lecture on “IoT Big Data Analytics on Smart Grid and Its Prognostic Health Monitoring” in this STTP on Feb 11, 2021. In this talk, Prognostic health monitoring of smart grid using IoT big data analytics was presented. Prognostic health monitoring of any structure (smart grid) protects the system by scheduling a prior maintenance.



Dr. Subhas Chandra Mukhopadhyay

FIEEE (USA), FIEE (UK), FIETE (India)
Director of International Engagemet, School of Engineering,
Professor of Mechanical/Electronics Engineering, Discipline Leader,
Mechatronics Engineering Degree Programme,
School of Engineering (E6A 313)
Macquarie University
NSW 2109 Australia
Distinguished Lecturer, IEEE Sensors Council, and Topical Editor,
IEEE Sensors Journal, Associate Editor, IEEE Transactions on
Instrumentation and Measurements

Thanks to Prof. Subhas Chandra Mukhopadhyay for delivering keynote speech, IoT, Smart Homes and Smart City: From Sensors to Computing at International Conference on Computational Intelligence and Computing (ICCIC-2020ne), Organized by Eureka Sciencetech Research Foundation, S. R. Group of Institution and IETE, Kolkata held dated 19-20 February 2021. Prof. Mukhopadhyay is associated with ESRF as Advisory Committee member. We are proud of him.



Prof. Suddasatwa Chakraborty, Member, Executive Committee ESRF , Asst. Professor, Electrical Engineering Department, Jadavpur University has been Submitted Ph.D dissertation on " " from Jadavpur University and awarded the PhD Degree



Mrs Bansari Deb Majumder, Member, Executive Committee ESRF , Asst. Professor, Narula Institute of Technology, Agarpara, Kolkata, has submitted her Ph.D Thesis titled " Investigations on Multifunction and Integrated Sensors related to Measurement & Control



Prof. Dr. Asis K Mukhopadhyay, Former IIT KGP professor, Member, Advisory Committee ESRF , had been associated with International Conference on Computational Intelligence and Computing ICCIC-2020 as General Chair



Dr. Abhijit Mukherjee, Member, Executive Committee ESRF , Asst. Professor, Community medicine, North Bengal medical College & Hospitals, Darjeeling, West Bengal working as front end fighter against Corona Virus and now engaged at Program manager Vaccination Program at North Bengal Medical college.



COVID-19 Vaccination Camp in North Bengal Medical College

<https://youtu.be/G75fjrHJ18U>



Dr. Sandip Roy, member, Advisory Committee ESRF, Medical Officer at the Department of Public Health, Govt. of West Bengal involves through out pandemic period even now engaged as front row Doctor to fight Corona virus.



[» Engineering](#) [» Electronics & Electrical Engineering](#)

[Smart Sensors, Measurement and Instrumentation](#)



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Interdigital Sensors

Progress over the Last Two Decades

Editors: **Mukhopadhyay, S.C., George, B., Roy, J.K., Islam, T. (Eds.)**

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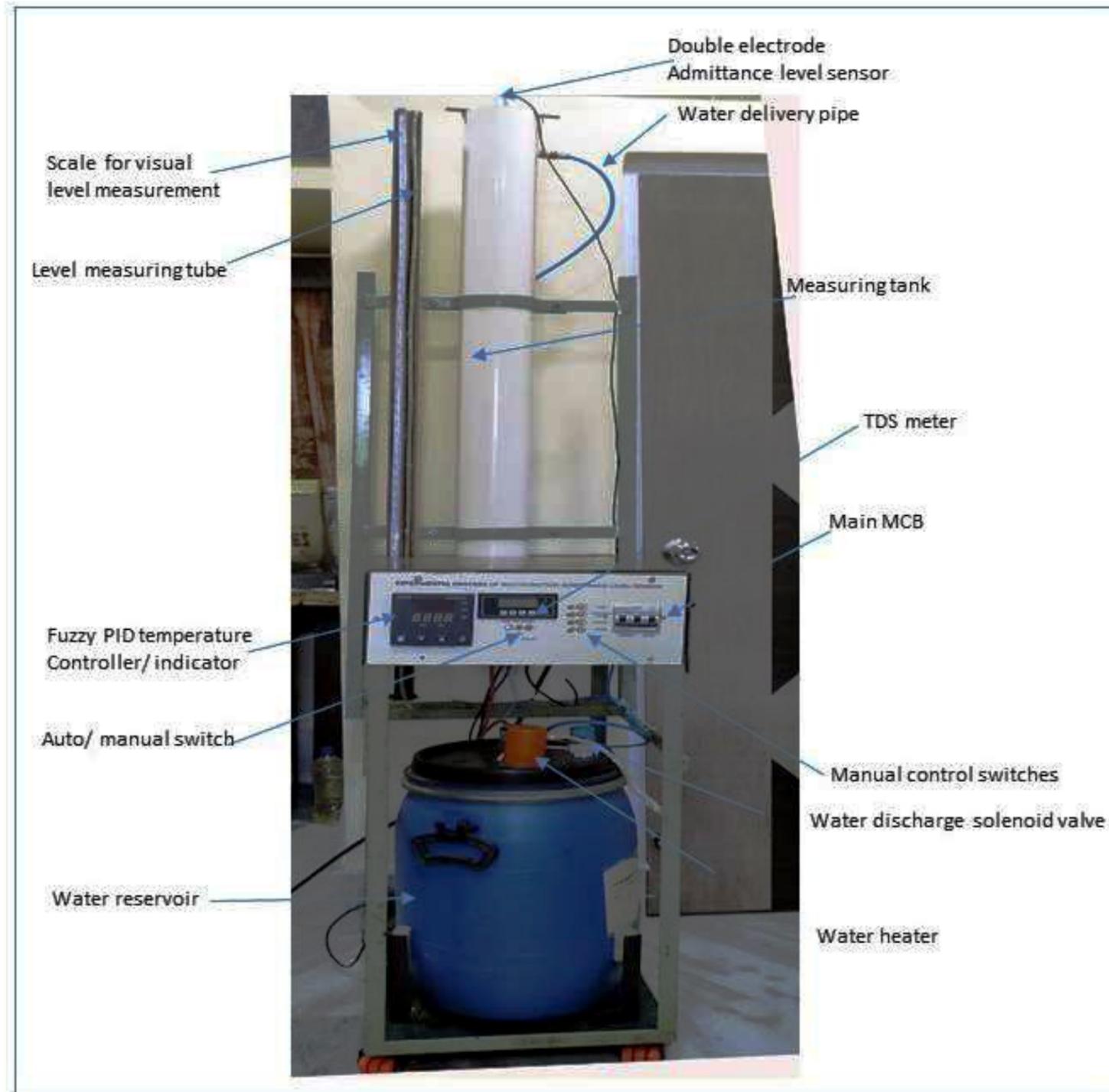


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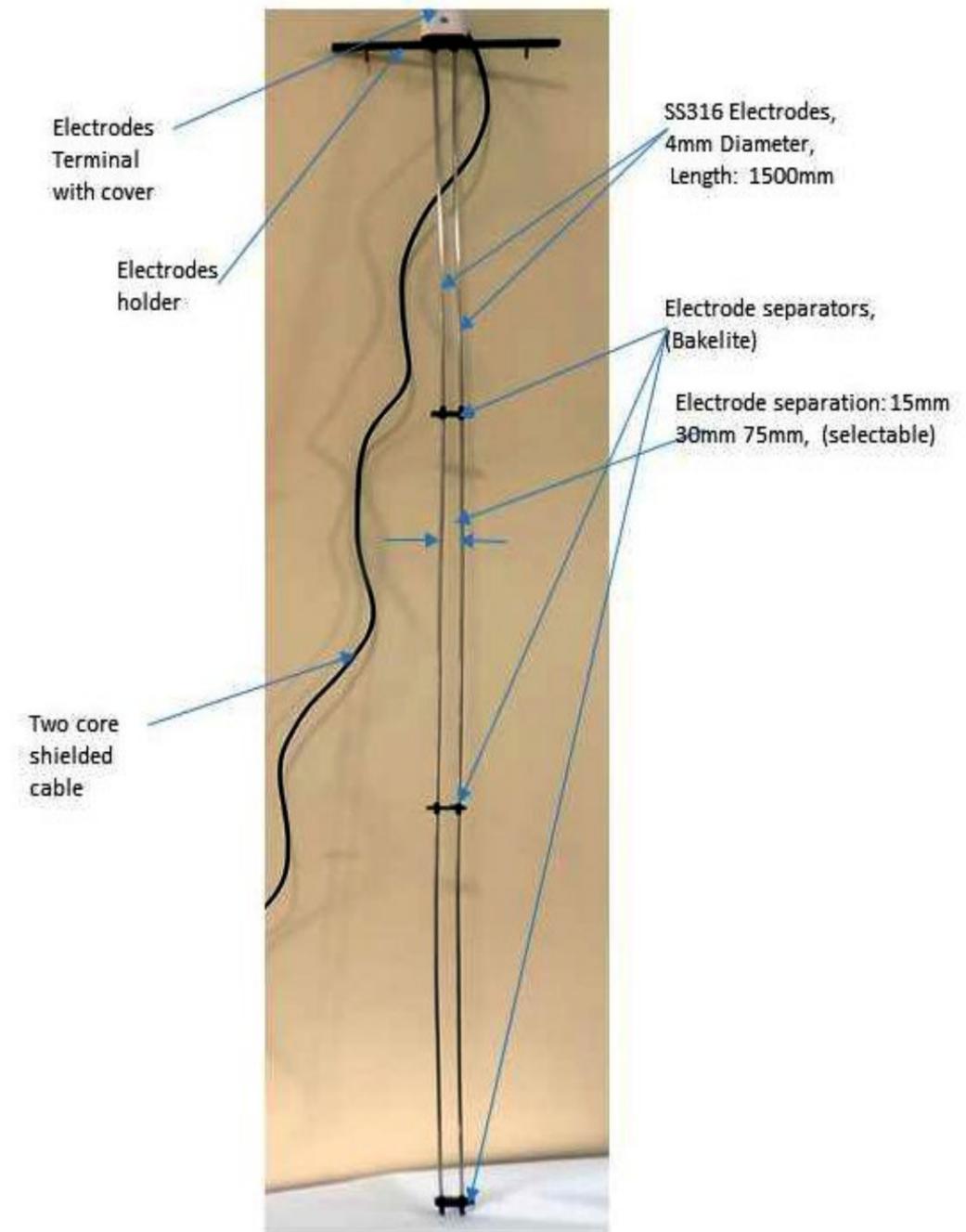
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Intelligent laboratory scale computerised process calibrator for multifunction level sensor

Developed in the Laboratory of ESRF
Developer : Prof. Joyanta Kumar Roy



Multifunction level sensor which can measure level , temperature and TDS simultaneously
Developed in the Laboratory of ESRF
Developer : Prof. Joyanta Kumar Roy

Industrial Domain

1. Design and Development of Fuzzy based Linearization method for Double Electrode type Admittance Sensor

Project Scholar: Mrs. Bansari Deb Majumder
Research Supervisor: prof. Joyanta Kumar Roy

2. Development of Multifunctional Admittance Type Sensor and its Instrumentation for the simultaneous measurement of Liquid level and Temperature

Project Scholar: Mrs. Bansari Deb Majumder
Research Supervisor: prof. Joyanta Kumar Roy

3. Model based controller design for process application

Project Scholar: Mrs. Bansari Deb Majumder
Research Supervisor: prof. Joyanta Kumar Roy

Biomedical Domain

1. Python based Heart Sound Classification and Signal Analysis using Support vector machine and Machine learning

Project Scholar: Mr. Tanmay Sinha Ray
Research Supervisor: prof. Joyanta Kumar Roy

2. Python based prediction of Valvular Heart diseases using Deep learning technique

Project Scholar: Mr. Tanmay Sinha Ray
Research Supervisor: prof. Joyanta Kumar Roy

3. Remote telemedicine technology using developed cloud based machine learning software for easy detection of valvular Heart diseases for rural application

Project Scholar: Mr. Tanmay Sinha Ray
Research Supervisor: prof. Joyanta Kumar Roy

Past Editions of Books and Book Chapters contributed from Eureka Sciencetech Research Foundation



Modern Sensing Technologies pp 103-145 | Cite as

Heart Sound: Detection and Analytical Approach Towards Diseases

Authors Authors and affiliations

Joyanta Kumar Roy , Tanmay Sinha Roy, Subhas Chandra Mukhopadhyay

Chapter

First Online: 25 August 2018

1

873

Citations Downloads

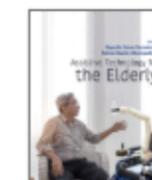
Part of the [Smart Sensors, Measurement and Instrumentation](#) book series (SSMI, volume 29)

DOI: https://doi.org/10.1007/978-3-319-99540-3_7



Assistive Technology for the Elderly

2020, Pages 107-184

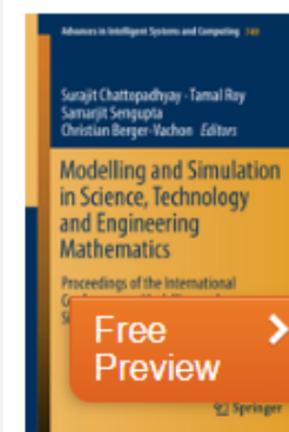


5 - Heart sound detection, analysis, and assistive technologies for the elderly

Joyanta Kumar Roy¹, Tanmay Sinha Roy², Subhas Chandra Mukhopadhyay³

DOI: [10.1016/B978-0-12-818546-9.00005-1](https://doi.org/10.1016/B978-0-12-818546-9.00005-1)

Advances in Intelligent Systems and Computing



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Modelling and Simulation in Science, Technology and Engineering Mathematics

Proceedings of the International Conference on Modelling and Simulation (MS-17)

Editors: Chattopadhyay, S., Roy, T., Sengupta, S., Berger-Vachon, C. (Eds.)

Comparative Study on Fuzzy Based Linearization Technique Between MATLAB and LABVIEW Platform

Pages 631-639

Roy, Joyanta Kumar (et al.)

Preview

Buy Chapter 25,95 €

<https://www.springer.com/gp/book/9783319748078>

Past Editions of Books and Book Chapters contributed from Eureka Sciencetech Research Foundation

Sensors in the Age of the Internet of Things: Technologies and applications

Editors: Octavian Adrian Postolache ¹; Edward Sazonov ²; Subhas Chandra Mukhopadhyay ³
[View affiliations](#) ▶
Publication Year: 2019

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IoT-enabled water monitoring and control for smart city

Author(s): Joyanta Kumar Roy ¹
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Source: *Sensors in the Age of the Internet of Things: Technologies and applications*, 2019
Publication date September 2019

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Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications

Information Resources Management Association (USA)
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PDF
[\(/gateway/chapter/full-text-pdf/237872\)](/gateway/chapter/full-text-pdf/237872)

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⊗ **Chapter 12**
Artificial Neural Network (ANN) in Network Reconfiguration for Improvement of Voltage Stability
[\(/gateway/chapter/237872\)](/gateway/chapter/237872) (pages 174-198)
 Dipu Sarkar (National Institute of Technology, Nagaland, India), Joyanta Kumar Roy (MCKV Institute of Engineering, West Bengal, India)
 Issues related to power system voltage levels have become increasingly important issue during last two and half decades. In power networks, low voltage situations may result in the loss of stability, voltage collapse and eventually...

Flagship Conference of

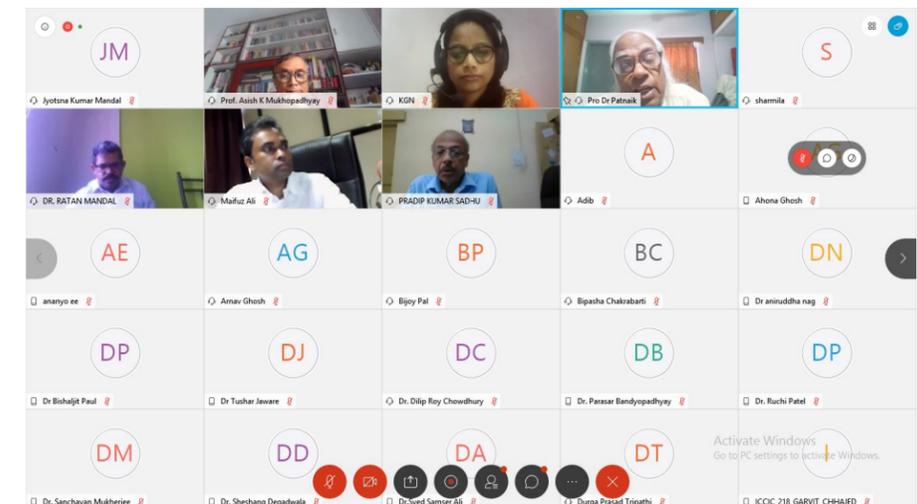
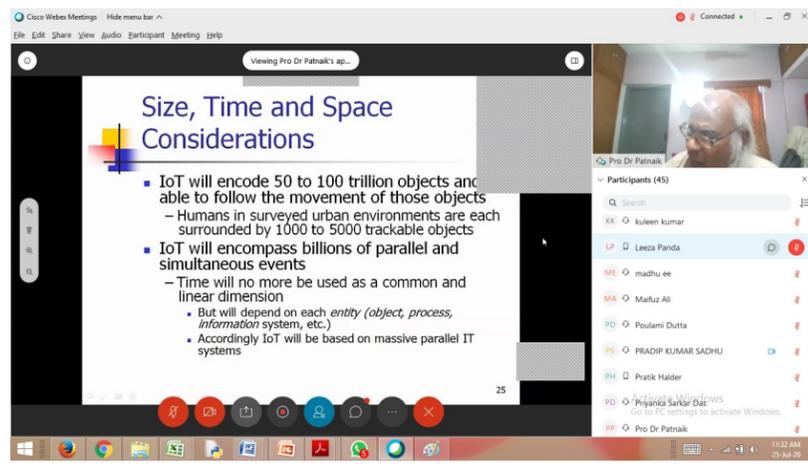
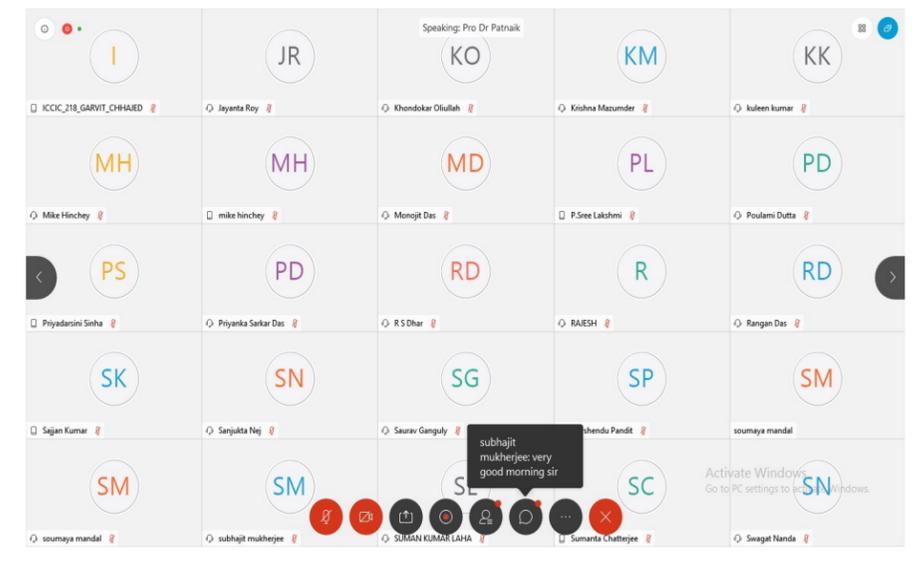
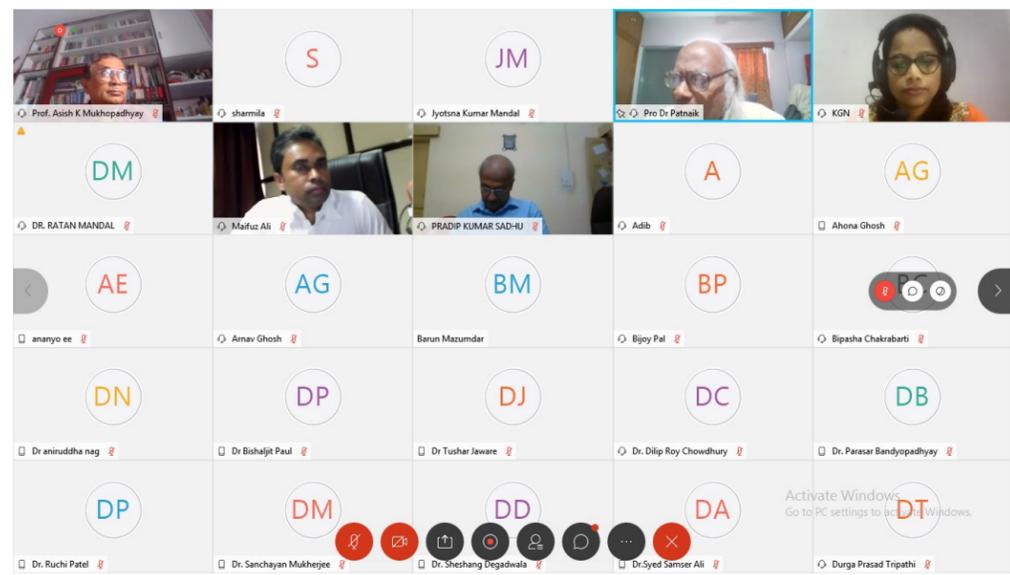


1st International Conference on Contemporary Issues in Computing

Venue: IETE Conference Hall, Plot No J1-7, EP-Block, Sector V, Salt Lake, Electronics Complex, Kolkata
Conference Room, The Institute of Engineers, Bangladesh. Ramna, Dhaka-1000
Date: 25 - 26 July, 2020 (India) & 7 August, 2020 (Bangladesh)







Success story in organizing 1st International
Conference on Computational Intelligence &
Computing held dated 19-20 February 2021

ABOUT THE CONFERENCE “

INTERNATIONAL CONFERENCE ON COMPUTATIONAL INTELLIGENCE AND COMPUTING-2020 (ICCIC-2020ne)

Organised by Eureka Sciencetech Research Foundation

With explosive growth of e-business, Artificial Intelligence and IoT based applications, the researchers in academics and industry face more and more challenging problems in computing that require computational Intelligence to cater the intelligent e-applications, high speed wireless networks, autonomous systems and in almost every application with enhanced quality of intelligence. The International Conference on Computational Intelligence and Computing -2020 (ICCIC'2020ne) has been organised by SRGI Group of Institution, Jhansi, Eureka Sciencetech Research Foundation, Kolkata, IETE, Kolkata. The Springer is the publication partner of this conference. The conference was held on virtual platform dated 19-20 February 2021 hosted by Bundelkhand University, Jhansi. The conference received 87 papers through Easy Chair from authors from various countries on various disciplines like, Soft Computing & Artificial Intelligence, Networking & Architectures, Image processing & signal analysis, Safety & security, Modelling, Simulation and Management, Internet of Things and other allied areas. The papers were process through peer review selection of high standard and therefore 30 papers are successfully presented. The inaugural session was highlighted and sparkled with the galaxy of eminent dignitaries like vice chancellor of universities, distinguish speakers of IEEE, Ex-IIT Directors, President of IETE. There are seven keynote highly learned speakers, out of them five were from various countries of the world. The conference was a truly international, since the papers received from Australia, Bangladesh, UK, Vietnam. The conference was truly interdisciplinary platform for scientists, researchers, engineers, practitioners and educators to present and discuss the most recent innovations, trends and concerns as well as practical challenges encountered and solutions adopted in the field of computational Intelligence and computing for various application. The main objective of the conference was to bring together academic and industrial experts of the research community to highlight key issues, identify trends, and develop a vision of the computational intelligence for future applications from a design, deployment and operation standpoints and the objectives were fulfilled with Grand success. This conference was Technically Co-sponsored by IEEE, CAS, Kolkata and IET (UK) Kolkata Section. There was a pre-conference one-day tutorial on Internet of Things, This Tutorial is hosted by IETE, Kolkata on Virtual platform on 7th February, 2021. This conference distributed e-certificates of Appreciations to all speakers, Participants and Reviewers. The conference was ended with Vote of Thanks with grand success.



INTERNATIONAL CONFERENCE ON COMPUTATIONAL INTELLIGENCE & COMPUTING (ICIC-2020^{ne}) February 19-20, 2021



The 1st International Conference on Computational Intelligence & Computing (ICIC-2020) is to be held at SR Group of Institutions, Jhansi (U.P) during September 11-12, 2020. Organized by the Electro-Inventor, Hindmotor (Hooghly) (www.electroinventors.com) and Eureka Scientech Research Foundation (ESRF), Kolkata (www.esrf.org.in) in collaboration with SR Group of Institutions (SRGI), Jhansi (www.srgi.ac.in) and The Institution of Electronics & Telecommunication Engineers (IETE), Kolkata Centre (www.ietekolkata.org). The proceedings will be published in the Springer Book Series "Algorithms of Intelligent Systems" (<https://www.springer.com/series/16171>) ISSN:2524-7565. For details, refer to the conference website www.icic2020.in.

ABOUT THE CONFERENCE

With explosive growth of e-business, Artificial Intelligence and IoT based applications, the researchers in academics and industry face more and more challenging problems in computing that require computational intelligence to cater the intelligent e-applications, high speed wireless networks, autonomous systems and in almost every application with enhanced quality of intelligence. The ICIC'2020 will provide a premier interdisciplinary platform for scientists, researchers, engineers, practitioners and educators to present and discuss the most recent innovations, trends and concerns as well as practical challenges encountered and solutions adopted in the field of computational intelligence and computing for almost any application. The main objective of the conference is therefore, to bring together academic and industrial experts of the research community to highlight key issues, identify trends, and develop a vision of the computational intelligence for future applications from a design, deployment and operation standpoints.

Date: February 19-20, 2021
Venue: SR Group of Institutions, Gwalior Road, Jhansi (U.P)
Pre-conference Tutorial: February, 07, 2021 at IETE Kolkata Centre
Technically Sponsored by IEEE- CAS (USA), R-10, Kolkata Chapter & IET (UK), Kolkata Network

CALL FOR PAPERS

Original research papers are invited on Computational Intelligence in the following (but not limited to) tracks and topics

Track-I : Soft Computing and Artificial Intelligence

- Soft Computing, Fuzzy Systems, and ANN
- Data mining, Computational Intelligence, and Machine Learning
- Human-Computer Interaction, Affective Computing
- Robotics, Mechatronics & Drone Applications
- Business Intelligence and Big Data Analytics
- Parallel and Distributed Computing
- Multimedia and Cognitive Computing

Track-II : Image Processing & Signal Analysis

- Image and Video Processing
- Vision and Natural Language Processing
- Signal Processing for Communications
- Biometry and Bio-informatics Bio medical signal analysis
- Cognitive Radio and AI-Enabled Signal Analysis

Track-III : Wireless & Mobile Computing

- Pervasive, Mobile Computing and Networking Technologies
- Ad-hoc and Wireless Sensor Networks
- Service Overlay Networks
- Software Defined Radio Access Network (RAN)
- Mobile Edge/Fog Computing for 5G/B5G Mobile Networks
- Vehicle Communications and control
- Air Interface, Wave-propagation, and Antennas
- Satellite & Space Communications
- Quantum Communications and Information Technology
- Personal area communications & Body area networks
- Smart Grid Communications

Track-IV : Intelligent Devices & Systems

- VLSI, SoC & Embedded systems
- Instruments and Sensor Technology
- Optical Devices, Systems and Networks
- Intelligence in Electrical Machines, Control system and Automation
- Power Electronics Devices & Applications
- MIMO and MEMS for Intelligent Applications

Track-V : Cyber Security & Privacy

- Information Security and authentication
- Remote sensing, Geographic Information Systems (GIS) and Web mapping
- Emerging Technologies for Public Safety
- Prediction and early warning systems
- Social Networking and Security

Track-VI : Intelligent Modelling, Simulation and Analytics

- Risk, damage and loss assessment
- Quality of Experience (QoE) modeling and metrics
- QoS, Reliability, Optimization & Modelling
- Modeling and simulation tools
- E-governance
- IT & Engineering Management
- Nano Technology

Track-VII : Intelligent Sensors, IoT and Applications

- Internet of Things (IoT) and Cyber-Physical Systems (CPS)
- Smart Cars and Smart Cities
- Block chain & IoT
- Industrial internet of things

IMPORTANT DATES

Last date for EasyChair paper submission: **October 31, 2020**

Acceptance notification: **January 03, 2021**

Camera ready paper submission: **January 16, 2021**

Early bird registration ends: **January 10, 2021**

Author's registration (at least one) ends: **January 20, 2021**

Tutorial proposal ends: **November 09, 2020**

Tutorial registration ends: **February 03, 2021**

Under prevailing COVID-19 Pandemic situation, please follow the conference website www.icic2020.in for latest updates on the event

Paper Submission link :

<https://easychair.org/conferences/?conf=icic2020>

www.icic2020.in

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- Significant consequences for failure.
- Role in advancing further technologies.



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ICCIC 2020ne, Jhansi February 19-20, 2021 Keynote/Plenary Speakers



Mike Hinchey
President, International Federation for Information Processing (IFIP)



S C Mukhopadhyay
Professor, Macquarie University, Australia



Ajoy K Ray, Padmasree
Former Director, ISER, Shibpur, Former Professor.



K.L. Chopra, Padmasree
Former Director, IIT Kharagpur



Celia Shahnaz
Professor, Department of EEE, BUET, Dhaka, Bangladesh, Chair, IEEE Bangladesh Section

Visit at www.ICCIC2020.in



Debabrata Datta
Ex. Scientific officer & Head, Radiological Physics, BARC



Suresh Viswakarma
BC Hydro, British Columbia, Canada



Octavian Postolache
Professor & Vice-Director of Instituto de Telecomunicações/at ISCTE-IUL, Portugal



Zdzislaw Polkowski
Jan Wyzyskowski University in Polkowice, Poland



Amit Banerjee
Technocrat, Scientific Adviser, Formerly Scientist, ECE, NUS, Singapore, RIE, Japan

Springer Publication

Paper Submission ends: 31-10-2020



Prof. Asish K Mukhopadhyay

1st International Conference on Contemporary Issues in Computing
ICCIC '20
 Jointly Organized by "The Electro Inventor", "GMIT" and "IETE Kolkata" And Technically Supported by ESRF and PKLEF
 25th - 26th July 2020

Tentative Keynote Session Schedule with Joining Link

Date	Day	Time	Session
25/07/2020	Day 1 Saturday	10.00AM-11.00AM	Inaugural Ceremony Joining Link: https://iitnr.webex.com/join?MTID=m0a42ec65aed2b3729b855b76eb96508 Meeting Number (access code): 156 084 7409 Meeting Password: 9iqW3pUdpe8
		11.00 AM-11.45PM	Key Note 1 Title: Opportunities and Challenges of Partnership of IoT and Big Data Speaker: Prof L M Patnaik, Emeritus Professor, Indian Institute of Science Bangalore Joining Link: https://iitnr.webex.com/join?MTID=m0a42ec65aed2b3729b855b76eb96508 Meeting Number (access code): 156 084 7409 Meeting Password: 9iqW3pUdpe8
		02.30PM-04.30PM	Key Note 2 Title: Emerging Trends in Computing Speaker: Dr. Zdzislaw Polkowski, Rector's Representative for International Cooperation and Erasmus Programme in Jan Wyzyskowski University in Polkowice, Poland Joining Link: https://iitnr.webex.com/join?MTID=m0a42ec65aed2b3729b855b76eb96508 Meeting Number (access code): 156 084 7409 Meeting Password: 9iqW3pUdpe8
26/07/2020	Day 2 Sunday	09.00AM-09.45AM	Key Note 3 Title: Is there anything that isn't software? Speaker: Prof. (Dr.) Mike Hinchey, University of Limerick, Ireland President, IFIP Joining Link: https://iitnr.webex.com/join?MTID=m0a42ec65aed2b3729b855b76eb96508 Meeting Number (access code): 156 084 7409 Meeting Password: 9iqW3pUdpe8
		1.30PM-02.15PM	Key Note 4 Title: Light-Life Integration - from Technology to Security Solution Speaker: Dr. Biswajit Ghosh, Vice Chancellor, The Neotia University Joining Link: https://iitnr.webex.com/join?MTID=m0a42ec65aed2b3729b855b76eb96508 Meeting Number (access code): 156 084 7409 Meeting Password: 9iqW3pUdpe8



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Some Snapshots of ICCIC 2020

**NOTIFICATION OF NEW PROGRAMS
FOR THE YEAR 2021-2022**

WORKSHOP / SORT TERM TRAINING PROGRAM WITH EVALUATION AND CERTIFICATION

Sl. No.	Name of the Program	Duration	Tentative date	Target participants
1.	Research methodologies for Ph.D aspirants	60 Hours /15 days	June 2021	ME/M.Tech / M.Sc Research scholars form Science & technology domain
2.	Art & Science of Power Station Practices	40 Hours/ 10 days	July 2021	BE/ B.Tech Students / Industry personals
3.	Virtual Instrumentation for Industry 4.0 in NI LabView Platform (level-0)	20 Hours/ 5 days	August 2021	BE/ B.Tech Students / Industry personals
4	Machine Learning and Data Science	60 Hours/ 15 days	September 2021	MSc, BE/ B.Tech, ME / M.Tech and Research Scholars
5	Sensor & Sensing technologies	40 Hours/ 10 days	October 2021	MSc, BE/ B.Tech, ME / M.Tech and Research Scholars

INDUSTRY ORIENTED INTERSHIP PROGRAM WITH CERTIFICATION

Program Duration : Level-0: 4 Weeks / 32 hours, Level-1: 8 weeks / 60 Hours, level 2: 60 Hours, level: 3 : 40 Hours, Advance level : 60 Hours

Program constituents: Theory and Practise : 40: 60 Ratio, Hands on and Skill development, Analytical ability development, problem detection and solving, Industry visit, project work and evaluation

4 | Feature articles

Article-1

School Education and Pandemic: Viewpoint of a High School teacher

Ajanta Roy ,M.Sc,B.Ed

The space-time we have been passing through almost for the last one year is featured by the restrictions in the form of the mask-covered face, the so-called social distance, and obsessed sanitization practice. All of a sudden, the planet has turned into a colony of the harmful virus. Society is suffering in terms of public health and wealth in unprecedented conspicuousness. The term LOCKDOWN has perhaps been a new addition to the list of familiar people's vocabulary - a phenomenal and unprecedented event and a lifetime experience for the living human being worldwide. Among the pandemic-hit circle stakeholders, education in general and schooling, in particular, occupies a significant share.

Technology has been considered central to school education reform and has gained unprecedented momentum during this pandemic



. It is being perceived as a panacea to combat all the education/schooling-related issues, hence the hurry to transfer classrooms into the virtual world without considering all learners' reach. A diverse country as India, considering regional, linguistic, caste, class and gender, and socioeconomic status, the school system is also characterized by stratification from elite to low fee private schools and government schools. It is creating a plethora of issues about specific educational, psychosocial, and financial needs of students as well as teachers based on gender, caste, class, and socioeconomic status. Under these circumstances, there is no way a unilateral approach to mitigate school education disruption will address these diverse and complex sets of issues of multiple dimensions.

Students and teachers also have their struggles while addressing these issues. Working in a Government-aided Girls' school, we, the teachers, have to deal with underprivileged children mostly. The question that haunted us after a few days of

lockdown could extend for many weeks or months was the procedure of reaching out to the students with some education for them.

First of all, we tried to break the ice by establishing contact with the guardians over the phone. Each of the Class Teachers was given the duty of consolidating the phone database of the guardians. After that, from the Mid-Day Meal Section of the State Government, raw food materials and sanitizing items like rice, pulses, potatoes, soap, etc., were to be distributed to the guardians under the monthly quota. Our teachers in groups, by turn, would remain in managing the distribution. At the initial period of pandemic and lockdown, survival was the priority for the underprivileged children. After streamlining this system of distribution, we paid attention to the *modus operandi* of off-class room teaching. An endeavor was taken towards the formation of WhatsApp groups class-wise and subject-wise.

Teaching was imparted in the form of a voice message. Home tasks and classwork were given as well. Students answered in the form of return text messages and got those reviewed and corrected by us. An open-book evaluation was also may be resorted to.

It may be reiterated that we had to deal with had not the personal mobile phone sets for the cross-section of students. Typically, there was only one set for the whole family in most cases, and the working person would carry the set, usually the father of the student. Consequently, lessons provided through voice messages or text could only be followed by the student at the end of the day when her father returns from the workplace.



The quest for strategies to keep the so-called distant schooling of students going is diverse in nature. Remote learning more and more depends on the dependable energy flexibly and standard Web connectivity,

which can be a fantastical factor for Tier 2 and Tier 3 cities in India. One other problem is that e-learning comes throughout as considerably inconsistent and impersonal expertise. Additionally, e-learning is more likely to witness an excessive dropout charge due to the absence of an inspecting environment. Evidence shows that low-tech mediums such as radio and television are very helpful for children belonging to disadvantaged groups. In circumstances where even these two are also out of reach, the distribution of paper-based learning materials helps, primarily for girls.

Because even if there is a radio or TV in the house, she may not get the opportunity to access it due to the burden of household chores. Therefore the option to distribute books and supplementary notebooks based on audio-video lessons should be contemplated. For low-income groups and rural areas, Chromebook or tablet loaner schemes can be initiated.

Every dark cloud comes with a silver lining; the lockdown has disturbed the education sector. However, HEIs have an option to start a new curriculum by integrating traditional and online learning. We had to cross serried of hurdles for reaching out to the students. Anyway, the guardians, students, and teachers came closer to each other through this lifetime trial. We hope that never will such pandemics recur.



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4 | Feature articles

Article-2

Education in India- an overview

Md Baijid Hissain M A

Introduction

What is education? It is a baffling question. Many great educationists, poets, writers, philosophers, and eminent personalities have contributed their views to enrich the idea. We shall start a search from our home.

"Education is the manifestation of perfection already in man." Swami Vivekananda

A kid is born of a she-goat; a chick comes out from the egg of a hen. The kids and chicks are pretty unlike in behavior to that of human babies. They are born with stronger instincts than human children. The kids feebly proceed towards its mother's storehouse of milk. The chicks search for food grains and pick the smallest grains with their beaks. They take very little time to become self-reliant.

On the other hand, human babies are dependent on their mothers or nurses for survival. They are physically and instinctively very weak. It takes years together to make them fit for survival on this planet.

Education starts from the initial stage for a human child, and the process continues till death. A mother makes every effort for the good upbringing of her baby. She shows her perseverance for days, weeks, months, and years. The mother feeds her baby, takes care of cleanliness, etc, and when the baby grows up, she holds the fingers of the baby and teaches how to stand erect, and starts walking unsteadily. Gradually the baby learns to walk and run.

Several studies have been attempted towards investigations of human performance under lighting condition since last 50 years. Fundamentally the approaches can be assessed with two quality parameters e.g. face validity and generality. Table1. depicts how the studies can be explained for the face validity and generality point of view.

Education and socialization: To socialize a child is the aim of education. This process of education begins at home and in society. All these are informal, but they take a significant role in the making of a man. The child comes to know what to do and what not to do from parents and people's advice in the family and neighborhood. Moreover, the baby learns from its experience also. From day to day experience, he/she learns that fire burns and natural calamities are harmful to individuals and society.

Informal and formal education: Unlike modern society, there was no institution like a school, college, university in ancient times. Basically, education was family and society-centric. A child, after his birth, would learn how to survive, how to protect himself/ herself from wild animals, how to collect fruits, how to cultivate lands, etc. Such a system of children's upbringing continued for centuries. The education at that time was informal. No society was formed till then. People did not know cultivation. They would rush from one place to another in search of food, and they lived the life of gypsies.

Agriculture and society: Later on, people invented cultivation and began to produce food grains to satisfy their hunger. It was a giant leap in the making of human civilization. With the growth of cultivation, the new phenomenon of surplus production became a regular feature. So, people had to build houses, granary, etc., to solve the problem. Thus people settled in particular places from that time.

With the formation of society, the concept of collective life awakened. It gives birth to social consciousness. People learned from day-to-day experiences, and they would share their experiences among themselves. Thus a warehouse of knowledge was formed, and gradually it became richer and more prosperous for the benefit of the next generations.

It was all a part of informal education for a long, long time until man discovered letters to shape their thoughts and ideas in spoken and written language. The primitive people have their means of communication. They would utter some sounds or make gestures to communicate with their fellowmen and women. They would draw pictures to express their thoughts. Some examples of such writings and drawings have come down to us from several cave walls. In the course of time, a man began to communicate their ideas among themselves, and they would write their thoughts and ideas to build up a storehouse of knowledge and preserve them. They would quickly pass them from one generation to the next generation to enrich them.

Education in the past: At this stage of social development, education was free of cost, a blessing to the teachers' disciples (Gurus). The disciples would go to the teacher's house and live there in the guru family (teacher). They would have to do all kinds of household works from cultivation to collecting fruits etc. They would beg alms around villages nearby.

There was no different system for the children of the upper section of the people. The goal of education was moral and ethical standard development, practical knowledge development, and knowledge of scriptures available at that time.

This system of education continued for thousands of years. The modern age in education came with the Europeans, especially with the Englishmen who came to India to reign after the fall of Nawab Sirajudoula in 1757. The English rulers took the initiative to mold India's education system, and William Bentinck, the Governor-General of the East India Company, implemented the English Education Act 1835.

Change in education during the British Raj: From this time onwards, the native Hindu and Muslim traditional education through Sanskrit and Persian was replaced by English. As English was the court's language, all administrative works, legal works would be done in the English language. So, the Persian, the Mughals' court language, and the Nawabs were replaced by the English language, and a significant change occurred. People began to learn English to secure good jobs for better livelihood and social prestige. With changes from time to time, this education system continued till 1947, when India got freedom.

Before independence, a few Indian men and women made a valiant effort to spread education for men and women at the grassroots level across India. Like Savitribai Phule of Maharashtra (1831-1897), some important names worked as India's first female teacher. After that, Pandit Iswarchandra Vidyasagar, an educationist and social reformer of Bengal (1820-1891) and Begum Rokeya 1880-1932) was born in Bengal and worked as a teacher and educationist who fought for modern education for the girls of Muslim families. Sir Sayed Ahmed (1817-1898) acted as a pioneer in ushering English education through his Aligarh Muslim University. He realized that Indians, especially Muslims, can compete with the Englishmen only by being equipped with modern education through the English language.

Role of various Education Commissions: The much-discussed Hunter Commission (1882) was led by William Wilson Hunter, who prepared a report and placed it for implementation.

After that, the important commission, namely University Grants Commission, appears and is better known as Radhakrishnan Commission in 1956.

Post-independence major decision on the renovation of education was made when Kothari Commission was formed (1964- 1966) and made various suggestions for improving education in India.

So far Indian Education System was following essentially the system shown by the English predecessors. However, in 1968 the New Education Policy (1968) of Indira Gandhi, the next NPE 1986 by Rajiv Gandhi, and last of all, the NPE prepared by the Modi Government have gone astray from the focal point of the public education system to private education system.

Formerly education was solely a state matter. It was financed and managed by the state agency, and pupils would learn in all levels primary, secondary, higher secondary, and university free of cost or nominal cost. However, today, the education sector has emerged as a lucrative and profitable business where the corporate sectors show interest, and education has been becoming expensive day by day. Both Health and Education were looked after by the government. These are fundamental areas where the democratic government is committed to giving service. However, with the change of time, the government, instead of taking more responsibility, avoids responsibility and indirectly pushes the people towards private education sectors.

Now in all public sectors, the PPE Models are being introduced, education, health, etc., have become a commodity, not a service, offered by benevolent government agencies.

Language Policy: Many experiments have been made in the field of education that the focal point and sole aim and purpose of education are marred. India is a multilingual country. It is a matter of argument which language will be suitable for imparting education. Will it be English, Hindi, or any regional language?

I think this is a very important problem in our country. As language is the vehicle of thought and human beings think with the help of language, express his thought through language, and communicate with others through language, preferably the language should be our mother tongue. However, we have different mother tongues in different states and zones. That is why two language policy would be better for us.

The children will learn their mother tongue and English as a second language. It will be like the following:

Bengali- English

Hindi –English

Tamil –English

Malayalam- English, so on and so forth.

So English will work as a link language, and it is a useful language for higher study and research work. The problem may be solved in this way. In association with a rich language like English, our indigenous and relatively weak languages may gain strength and flourish, and ultimately our people will be benefited.

Three language policy: Language learning is always welcome. There is no harm in it. However, a child should not be compelled to learn unnecessary languages initially. It may create pressure, and the sole aim of education may be spoilt.

For example, if a Bengali speaking child is given languages like the following:

Bengali 1st language

English 2nd language

Hindi/ Arabic 3rd language

It means a student of Bengali origin will have to learn three languages at the school level. It will be extra pressure.

Various stages in different age groups: Formerly, the stages of education according to the age group were:

3 to 5 years' preprimary

6 to 9 years primary

10 to 16 years Secondary (Madhyamik)

17-18 years Higher Secondary (10+2)

Above 18 years' college, university, etc.

Nevertheless, the New Education Act 2020 made a change in this pattern.

Now it is: 5-3-3-4

It means five years for preprimary and primary, three years for preprimary, and two years for classes one and two. Three years for upper primary, class three, four, and five. Three years for secondary for class six, seven, and eight and four years for the secondary stage for class nine, ten, eleven, and twelve.

COVID 19 and its impact on education in India:

The sudden upsurge of a deadly virus named COVID 19, commonly known as Corona, is a new threat to human civilization worldwide. This virus compelled human beings to accept self detachment and imprisonment inside the house to save themselves from mid-March 2019. All public vehicles were stopped, and millions of migratory working people faced an ordeal we never expected or experienced before.

The markets were closed, and all commercial activities came to a standstill. With all these, the educational institutions were closed to stop the spread of this virus. An alternative to school-based class teaching was suggested. It is apps-based online teaching to compensate for the ravages done by this lockdown of the education system worldwide.

Initially, people became panicky, and they obeyed all instructions and health guidelines circulated by the government. When it is observed that the affected people's mortality rate is shallow and this virus is less deadly than Ebola Virus, TB, or Cancer, people began to come out of their homes. The government also lifted lockdown phase by phase, and normalcy regained in social activities once again. The business places open up; the busses were allowed to ply besides personal vehicles. Then the trains with states and across the states began plying. Above and over everything, all political gatherings were allowed without any observance of health guidelines. The national and international flights were also allowed to start running. Now cinema halls, restaurants and other places of amusements are operating normally. The big shopping malls are open.

The educational institutions were shut down in the middle of March 2020. After normalcy regained in all social activities, it seems odd and strange that children are not allowed to go to schools. Here arises a question why?

Online teaching may be an alternative in a limited sphere in the education system. It is never a full-proof alternative in a poverty-stricken country like India. This type of education is apps-based and literate parents can help the children at home if necessary. In our urban areas, the parents' financial condition may support the cost of higher version Android mobiles, Tabs, Laptops, etc., with high-speed internet connectivity. However, this facility is only a dream for the rural-based millions of children. They have been thrown away from the arena of education by the closure of institutions. The first-generation learners of the villages come from low-income families. "Free Online Coaching" advertisement does not allure them because they cannot access it.

A distinct division of class approach is approach is becoming apparent day by day. Crores of poor and rural students are banished from the education system.

The affluent class of citizens affords required facilities for an alternative education system through online methods to their children.

A dangerous trend is lurking from behind the scene. An apprehension is peeping in the skeptics' mind whether the necessity of government sponsored education system will be considered part and parcel of our prevailing setup? If it is so, with millions of hapless children, thousands of people in the teaching profession will be jobless shortly. It is only speculation right now. If people resist government policies and retain the existing facilities, the education system will run as usual—otherwise, it is a dangerous omen for us.

Conclusion: In New Education Policy, there will be no detention students up to class eight. Moreover, there will be no Board Examination after the 10th standard and 12th standard. In schools, final examinations will replace board examinations.

It is doubtful whether the standard of education will be improved or this new approach will help students get a pass with a certificate having no knowledge required for the job.

There is another hurdle for government-sponsored schools. Side by side, there are private CBSE Schools in our education system where students of elite and affluent society will be taught better. Naturally, the employers will choose them from among the job aspirants.

So the question arises, 'What will be the fate of the multitude of students depending on Govt. sponsored schools?'



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Ancient school education



Present school education

4 Feature articles

Article-3

Nuclear Battery – An Alternate Sustainable Energy Source

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Abstract

In nuclear power plants, neutrons collide with uranium atoms, causing fission of uranium atoms to take place. Neutrons from the uranium are released due to fission and they further collide with other uranium atoms causing a chain reaction. This chain reaction is controlled with "control rods" that absorb neutrons. In the core of nuclear reactors, the fission of uranium atoms releases energy that heats water to about 520oF. This hot water is then used to spin turbines that are connected to generators, producing electricity. So, nuclear power plants are a huge source of energy known as nuclear energy and common public knows about this energy. Nuclear batteries are in fact closer to nuclear power plants than traditional batteries in that they use radioactivity to generate power instead of storing an amount of charge. When compared to chemical batteries, nuclear batteries are characterized by higher volumetric energy density (therefore longer battery life) and stronger endurance in harsh.

conditions. This report will make an attempt to explore the possible breakthrough of recent technology of nuclear battery. The potential of a nuclear battery for longer shelf-life and higher energy density when compared with other modes of energy storage make them an attractive alternative to investigate

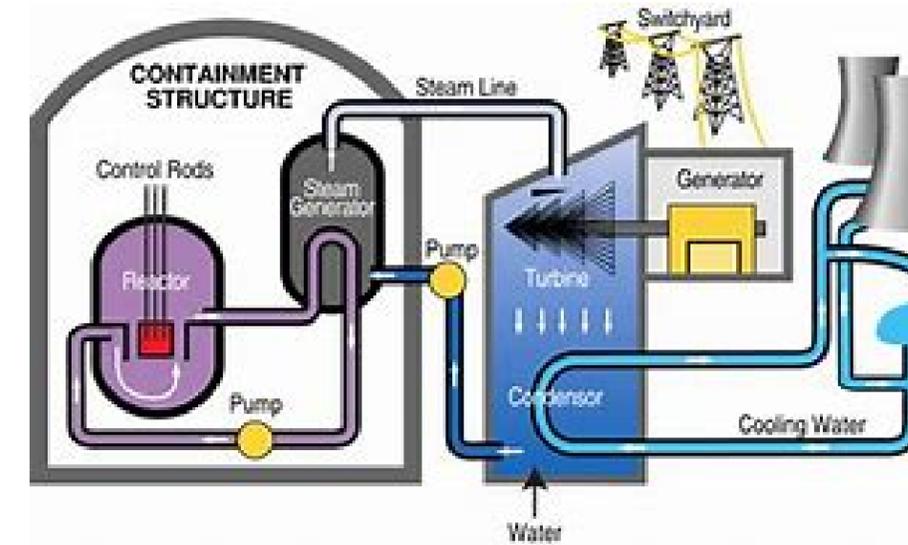


Fig.1: Nuclear Power Plant

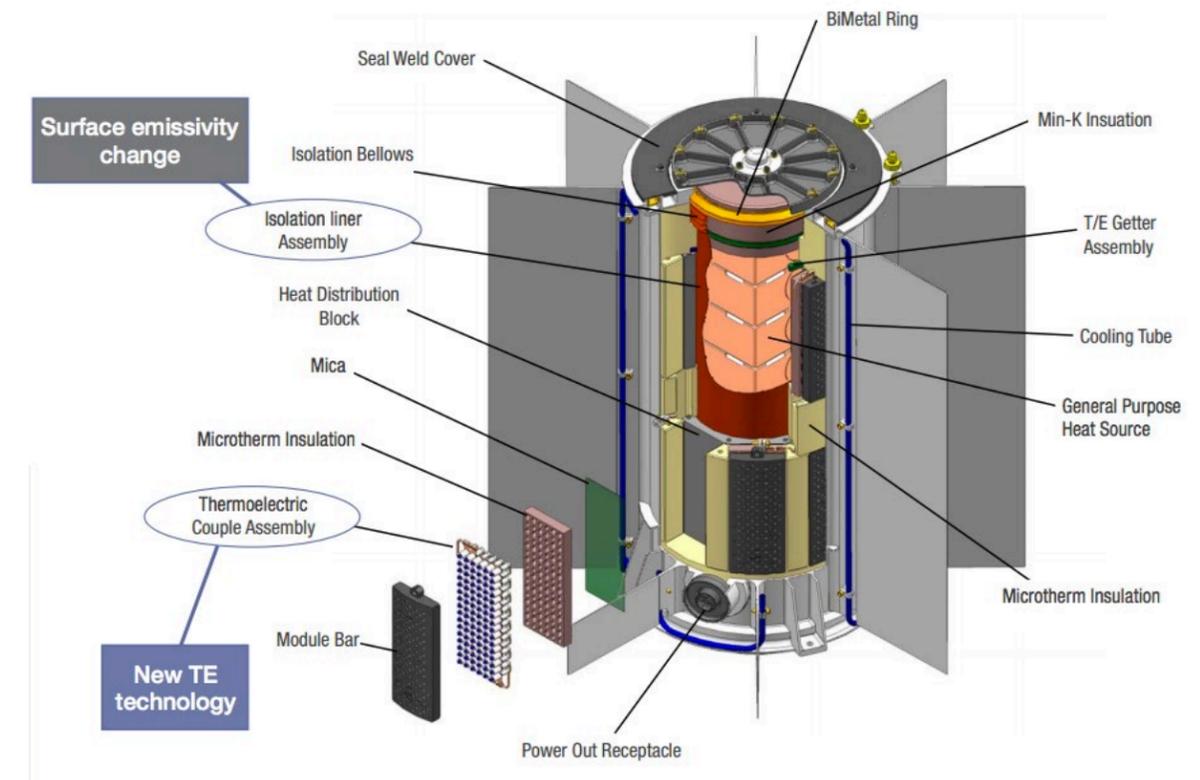


Fig.1: Cross section of Nuclear Battery

Introduction

The performance of nuclear batteries is a function of the radioisotope(s), radiation transport properties and energy conversion transducers. The energy conversion mechanisms vary significantly between different types of nuclear battery, where the radioisotope thermoelectric generator, or RTG, is typically considered a performance standard for all types of nuclear battery. Radioactive Thermoelectric Generator uses heat generated spontaneously from radioactive substances. The technology requires a large space to capture escaping heat inside semiconductors effectively. The shortcomings of RTG technology are its poor efficiency of 6%, its low power density, and its large size. Betavoltaic cells also known as betavoltaic devices utilize beta-decay of isotopes such as tritium. Tritium is a by-product of nuclear power plants, so manufacturing betavoltaic cells with tritium is an excellent way to turn nuclear wastes into useful goods [1]. The work carried out by Baek Hyun Kim and Jae Won Kwon at University of Missouri proposed the possibility next generation nuclear battery technology [2]. Water based nuclear battery, which is alternatively known as aqueous nuclear battery uses the radiolysis technology of liquid medium. In this case the kinetic energy of beta particles is absorbed and lost in betavoltaic cells. Usage of aqueous solution for radiolytic energy conversion results in higher energy level and lower temperature compared to that when used with a solid state material. A high efficiency of 53.88% was reached at a potential of 0.9 volts as per the design of Kim and Kwon where they had used nano porous titanium dioxide semiconductor coated in platinum [3].

The energy conversion efficiency of non-thermal-type nuclear batteries requires that the two governing scale lengths of the system, the range of ionizing radiation and the size of the transducer, be well-matched.

Power density is also a critical performance factor and is determined by the interface of the radioisotope to the transducer. Solid radioisotopes are typically coated on the transducer, forcing the cell power density to scale with the surface area (limiting power density). Methods which embed isotopes within the transducer allow the power density to scale with cell volume (maximizing power density). Other issues that are examined include the limitations of shelf-life due to radiation damage in the transducers and the supply of radioisotopes to sustain a commercial enterprise. The physics imply that nuclear batteries will be of moderate size and limited power density. The supply of radioisotopes is limited and cannot support large scale commercialization. Quite a bit. In power systems of the future, it's not just that smaller is better, smaller is essential. Big centralized systems like power stations with vast physical grids for transmission are inefficient. Barely a third of the primary energy content in most sources is converted to useable energy. Solar and Wind are limited by physics. But in Fossil Fuels and Nuclear, most of the loss happens because we use the energy for a single purpose, such as producing electricity or thrust, rejecting the remaining two-thirds as waste heat. A centralized power system must account for the highest potential demand anywhere and anytime in the system, so only 40-50% of the grid's capacity is used to power our system. The rest is in reserve for short periods of high summer or winter demand. This results in significant underused capacity and unamortized debt. Intermittency in generation only exacerbates the problem.

Basic Principle and structure of Nuclear Battery

Nuclear batteries can be classified by energy conversion technology into two main groups: (a) *thermal converters* and (b) *non-thermal converters*. The thermal types convert some of the heat generated by the nuclear decay into

electricity. The most notable example is the radioisotope thermoelectric generator (RTG), often used in spacecraft. The non-thermal converters extract energy directly from the emitted radiation, before it is degraded into heat. They are easier to miniaturize and do not require a thermal gradient to operate, so they are suitable for use in small-scale applications. The most suitable example of this type of nuclear battery is betavoltaic cell. Nuclear batteries use radioisotopes that produce low energy beta particles or sometimes alpha particles of varying energies. Low energy beta particles are needed to prevent the production of high energy penetrating Bremsstrahlung radiation that would require heavy shielding. Radioisotopes such as tritium, nickel-63, promethium-147 and technetium-99 have been tested. Plutonium-238, Curium-242, Curium-244 and Strontium-90 have been used so far. They have an extremely long life and high energy density compared to chemical batteries. Although nuclear batteries generate electricity from atomic energy like nuclear reactors, they don't use a chain reaction, instead using the emissions from a radioactive isotope to generate electricity. So there's no risk of the battery in a pacemaker suffering a meltdown. As per Kwon, the battery can be thinner than the thickness of human hair.

Applications towards Industry

Implantable medical devices (IMDs) utilize the unique characteristics of nuclear batteries. Similar to its use in spacecraft, nuclear batteries used to power IMDs must function reliably over a long period of time without being accessed for recharge or maintenance. Unlike in spacecraft, however, batteries used in IMDs must be limited in size and radioactivity. Hence, a different nuclear battery technology called betavoltaic cell is used in IMDs. Although the technology was invented and widely used for patients in the 1970s, the potential risk of radiation convinced the medical industry to shift to lithium ion batteries in the 1980s.

Conclusions

The manufacturing industry of nuclear battery depends on the nuclear power plant because the radioactive waste produced from nuclear power plant is the main ingredient of nuclear battery. Nuclear batteries remain impractically expensive and slow to power consumer products. However, new technologies that allow for smaller, safer, more efficient, and longer-lasting nuclear batteries suggest a bright future for nuclear battery products in future markets. When the cost of manufacturing nuclear batteries decreases, low-power internet-of-things devices could also be powered cord-free for thousands of years with a single charge using this revolutionary technology one day.

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4 Feature articles

Article-4

Heart Sound Classification and Feature Selection Using Support Vector Machine

Tanmay Sinha Roy & Joyanta Kumar Roy

HUMAN being heart makes sounds. The sounds come from the bicuspid/mitral valves, the tricuspid valves, and the aortic valves. As these valves contract and relax, allowing blood flow to and from the heart, they produce the heartbeat sound.

Feature Extraction [1, 27] and Classification proves to be very effective when it comes to PCG signal analysis. Although many advances have been made towards automated heart sound segmentation and heart pathology detection and classification, an efficient method for noise handling would come as a major aid for further development in this field, especially when it comes to working with PCGs collected in realistic environments such as hospitals and clinics. The feature extraction has been gone through different levels of PCG recorded signals using transformation techniques. Analyzing PCG signals with calculating parameters such as Energy, Average Power, Root Mean Square Error (RMSE), THD (Total Harmonic Distortion), Zero Crossing Rate (ZCR), Standard

deviation, Variance, Kurtosis and Skewness values of human heart signal which were extracted from Phonocardiogram were calculated, and then a classification made based on different Machine Learning algorithms as explained in Fig 1.

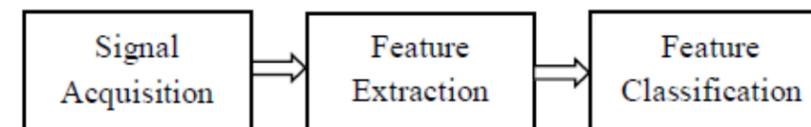


Fig 1: Various steps Involved in PCG Analysis [2]

Literature Review

The entire work is focused on the detection, diagnosis of cardiac sound, and its analysis using different feature extraction techniques and classification methods using Machine Learning algorithms with the help of MAT LAB and PYTHON software. A healthy heartbeat in a continual rhythm. There are varieties of abnormal heart sounds, some of which are harmless, while others can indicate serious heart problems. Heart sounds [3, 21] are the noises generated by the beating heart and the resultant flow of blood through it. Specifically, the sounds reflect the turbulence created when the heart valves snap shut. In cardiac auscultation, an examiner may use a stethoscope to listen for these unique and distinct sounds that provide important auditory data regarding the condition of the heart. To start with, we should discuss a few words about the physiology of heart sounds, which includes the cause of generation, characteristics, etc. The Relationship of heart sound with the cardiovascular system is given below in Figure 2, and in Figure 3, different types of Murmurs associated with Cardiovascular System have been shown.

One thousand samples of heart sounds have been collected in wav format using MAT LAB, and then after the application of AI Modelling, the classified waveforms of different diseases have been diagnosed.

For our analysis, mainly five different kinds of heart sounds have been considered. They are Normal Sound, Aortic Stenosis, Aortic Regurgitation Mitral Stenosis, and Mitral Regurgitation as given in Fig 4.

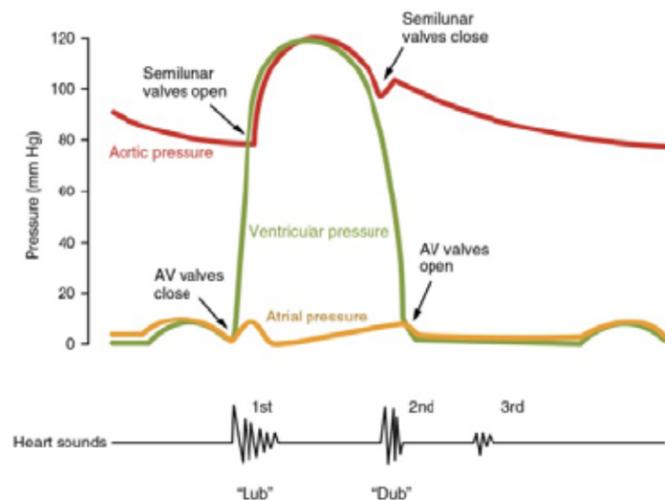


Fig.2. Relationship of heart sound with the cardiovascular system

SCHEMATIC DIAGRAM OF EXPERIMENTAL-SETUP

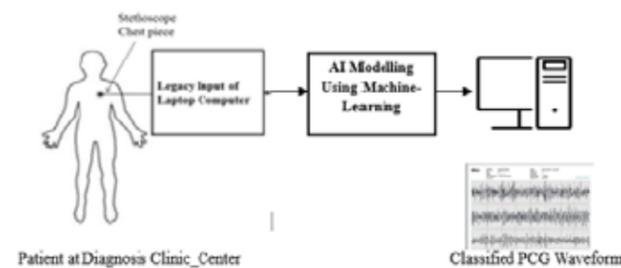


Fig 3: Experimental Set-Up

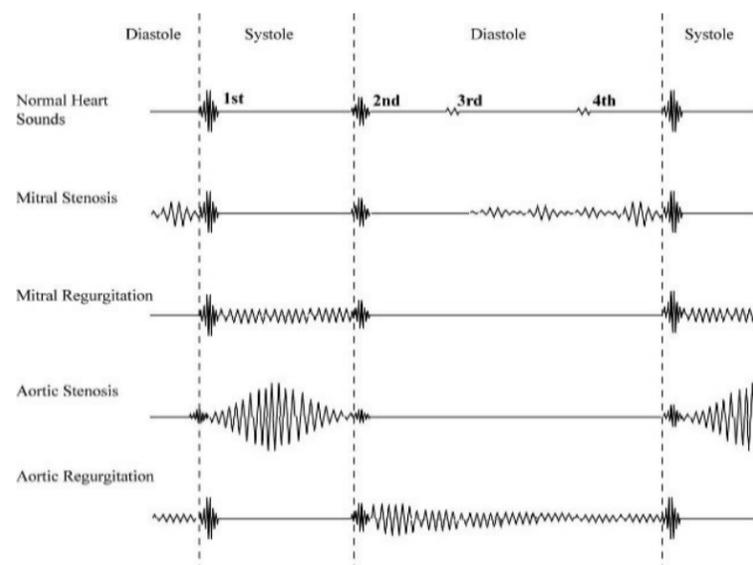


Fig 4: Different types of Heart Sounds

In healthy adults, there is two normal heart sounds often described as:

1. *Lub* 2. *Dub* (or *dup*)

[4, 44] LUB and DUB occur in sequence with each heartbeat. These are the **first heart sound (S1)** and **second heart sound (S2)**, produced by the closing of the AV valves and semilunar valves, respectively. In addition to these normal sounds, a variety of other sounds may be present in the abnormal heart, which is:

Cardiac murmurs: Heart murmurs [5, 22, 30] are generated by the turbulent flow of blood, which may occur inside or outside the heart. Murmurs may be physiological (benign) or pathological (abnormal). Abnormal murmurs can be caused by stenosis restricting the opening of a heart valve, resulting in turbulence as blood flows through it. Abnormal murmurs may also occur with valvular insufficiency (regurgitation), which allows the backflow of blood when then competent valve closes with only partial effectiveness. Different murmurs [6, 8] are audible in different parts of the cardiac cycle, depending on the cause of the murmur. **A Third Heart Sound (S3)** is sometimes heard, especially in young adults. This sound, which occurs from 0.1 to 0.2 sec, after the second heart sound, is attributed to the rush of blood from the atria into the ventricles, which causes turbulence and some vibrations of the ventricular walls.

The fourth heart sound (S4) is a late diastolic sound [7, 9, 32] that corresponds to late ventricular filling through an active atrial contraction. It is a low-intensity sound heard best with the bell of the stethoscope.

S1 30 to 45 hertz S2 has a frequency range of 50 to 70-hertz third heart sound is an extremely weak vibration ranges below 30 Hz, as shown in Fig 5.

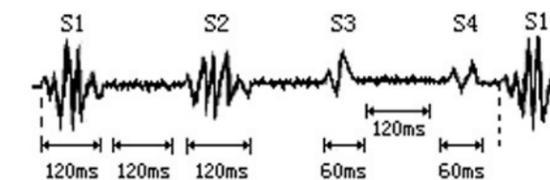


Fig.5: Different segments of heart sound

Feature Extraction

Root Mean Square (RMS)

The RMS [8, 20] can be computed in the time domain as given below

$$\text{RMS}\{x(n)\} = \left(\frac{1}{N} \sum |x(n)|^2 \right)^{1/2}$$

The RMS can be computed in the frequency domain, using Parseval's Theorem.

$$\sum x^2(n) = \frac{1}{N} \sum |x(m)|^2$$

Where, $x(m) = \text{FFT}\{x(n)\}$

$$\text{RMS}\{x(n)\} = \left(\frac{1}{N} \sum |x(n)|^2 \right)^{1/2}$$

$$= \left(\sum |x(m)|^2 / N \right)^{1/2}$$

Average Power of a signal $x(n)$ can be expressed in terms of RMS value as

$$\text{Average-Power} = (\text{RMS}\{x(n)\})^2$$

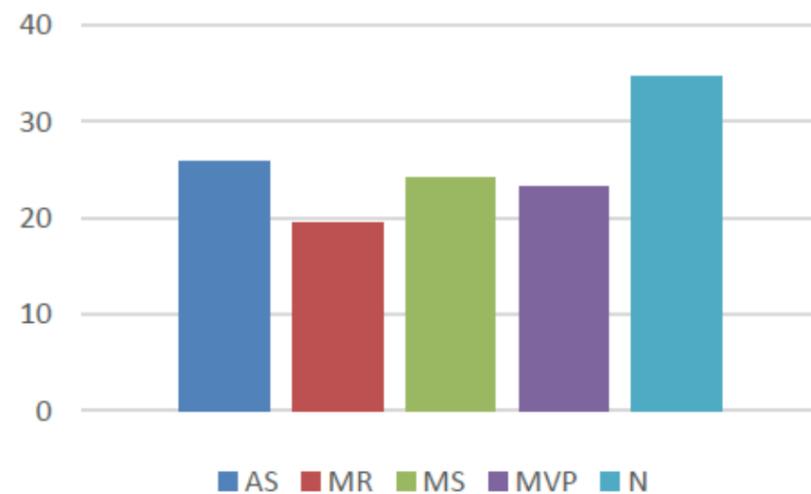


Fig 6: Comparison of RMS Value of Different Heart Sound

From the Comparative study of 1000 odd samples of different kind of heart sounds (Normal, Aortic Stenosis, Mitral Regurgitation, Mitral Stenosis and Mitral Valve Prolapse), it can be concluded that Normal heart sound can easily be identified and distinguished. As RMS Value of Normal Heart sound is the highest given in Fig 6.

Signal Energy and Power

Average Energy and Average Power for continuous-time signals

The terms [9, 31] signal energy, and the signal power is used to characterize a signal. They are not actually measures of energy and power. The definition of signal energy and power refers to any signal $x(t)$, including signals that take on Complex values.

The signal energy in the signal $x(t)$ is given by $E = \int_{-\infty}^{+\infty} |x(t)|^2 dt$

The signal Average- Power in the signal $x(t)$ is given by

$$P = \lim_{T \rightarrow \infty} \frac{1}{2T} \int_{-T}^{+T} |x(t)|^2 dt$$

If $0 < E < \infty$, then the signal $x(t)$ is called an energy signal. However, there are signals where this condition is not satisfied. For such signals, we consider power.

If $0 < P < \infty$, then the signal is called a power signal. Note that the power for an energy signal is zero ($P = 0$) and that the energy for a power signal is infinite ($E = \infty$). Some signals are neither energy nor power signals.

Energy and power for discrete-time signals

The definition of signal energy and power for discrete signals parallel similar definitions for continuous signals. A discrete-time energy signal is defined as one for which $0 < E < \infty$ and a discrete-time power signal is defined as one for which $0 < P < \infty$. It is possible for a discrete-time signal to be neither an energy signal nor a power signal

The signal energy in the discrete-time signal $x(n)$ is

$$E = \sum |x(n)|^2$$

where n starts from $-\infty$ to $+\infty$

The Signal Average power in the signal $x(n)$ is

$$P = \lim_{N \rightarrow \infty} \frac{1}{N} \sum |x(n)|^2$$

Where n starts from $-N$ to $+N$

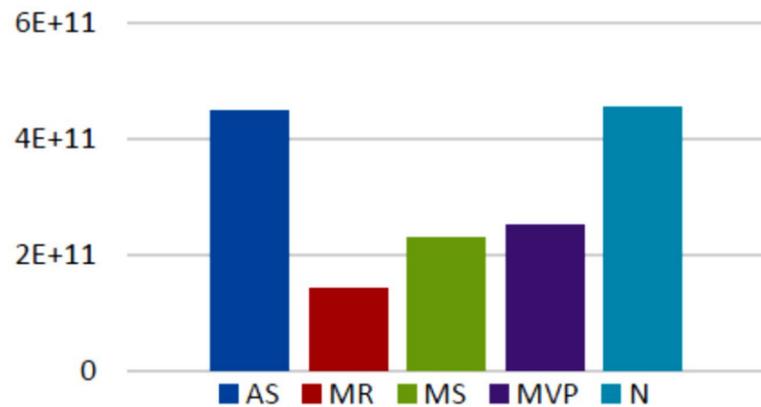


Fig 7: Comparison of Average Energy of Different Heart Sound

From the Comparative study of 1000 odd samples of different kind of heart sounds (Normal, Aortic Stenosis, Mitral Regurgitation, Mitral Stenosis, and Mitral Valve Prolapse), it can be concluded that Normal heart sound can easily be identified and distinguished. As Avg Energy of Normal Heart sound is the highest given in Fig 7.

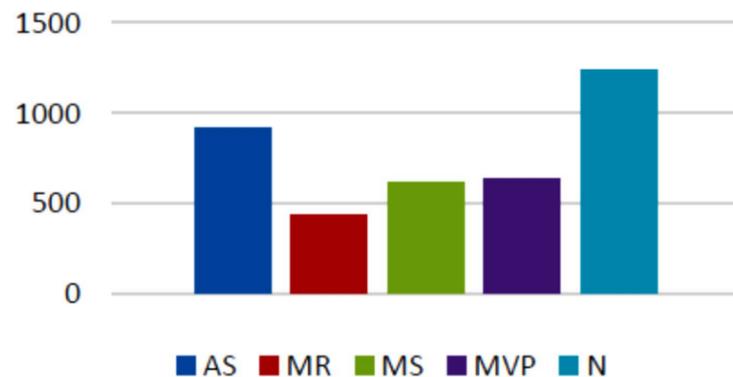


Fig 8: Comparison of Average Power of Different Heart Sound

From the Comparative study for 1000 odd samples of different kind of heart sounds (N, AS, MR, MS, MVP), it can be concluded that Normal heart sound can easily be identified and distinguished. As Avg. Power for Normal Heart sound is the highest, as given in Fig 8.

The [10, 29] zero-crossing rate (ZCR) is the rate of sign-changes along with a signal, i.e., the rate at which the signal changes from positive to negative or back. This feature has been used heavily in both [speech recognition](#), and [music information retrieval](#) is a key feature to classify percussive sounds. In some cases, only the "positive-going" or "negative-going" crossings are counted, rather than all the crossings. Since, logically, between a pair of adjacent positive zero-crossings, there must be one and only one negative zero-crossing.

From the Comparative study for 1000 odd samples of different kind of heart sounds (N, AS, MR, MS, MVP), it can be concluded that Normal heart sound can easily be identified and distinguished as ZCR for Mitral Stenosis is the lowest given in Fig 9.

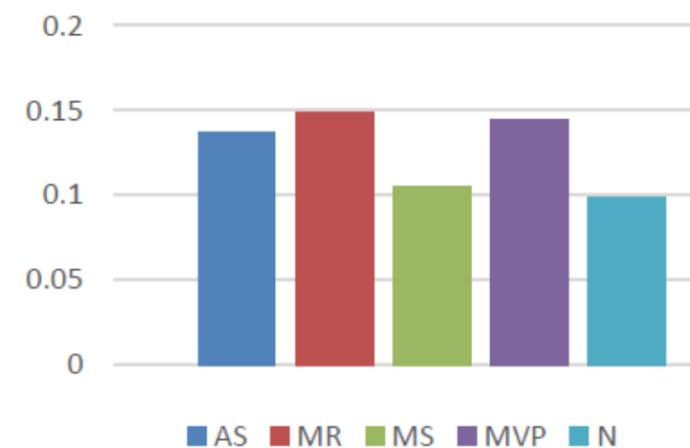


Fig 9: Comparison of ZCR of Heart Sounds

1. Total Harmonic Distortion (THD)

The THD [11, 17] function computes the Total Harmonic Distortion (THD) of a periodic distorted signal. The signal can be a measured voltage or current.

The THD is defined as the root mean square (RMS) value of the total harmonics of the signal, divided by the RMS value of its fundamental signal. For example, for currents, the THD is defined as

$$\text{Total Harmonic Distortion (THD)} = I_H / I_F$$

$$I_H = \sqrt{I_2^2 + I_3^2 + \dots + I_n^2}$$

$$I_F = I_1$$

Total Harmonic Distortion (THD)=IH/IF

$I_H = \sqrt{I_2^2 + I_3^2 + \dots + I_n^2}$

$I_F = \text{RMS value of the fundamental Harmonic}$

$I_F = \sqrt{I_1^2}$

IF: RMS value of the fundamental Harmonic

The THD has a null value for a pure sinusoidal voltage or current.

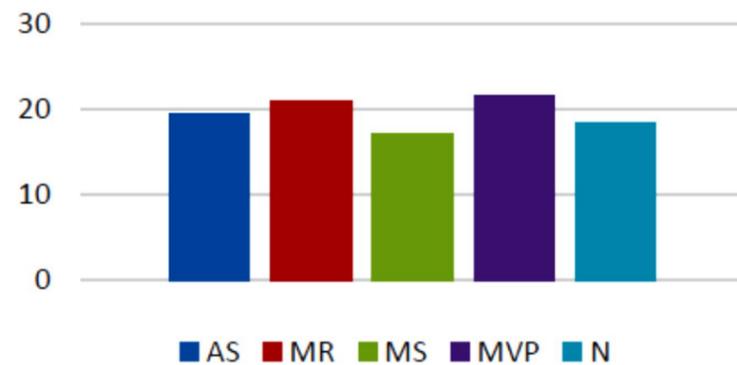


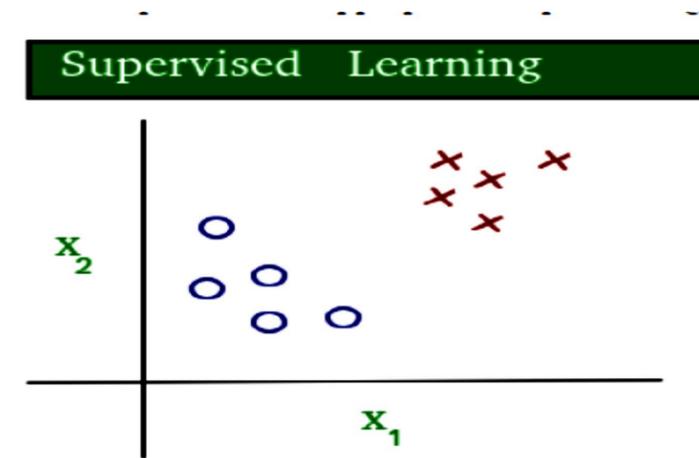
Fig 10: Comparison of THD of Different Heart Sound

I. Feature Selection Using Machine Learning

Machine Learning [12, 28] is the field of study that gives computers the capability to learn without being explicitly programmed. ML is one of the most exciting technologies that one would have ever come across. As it is evident from the name, it gives the computer what makes it more similar to humans: *The ability to learn*. Machine learning is actively being used today, perhaps in many more places than one would expect.

Supervised Machine Learning

A supervised machine learning algorithm (as opposed to an unsupervised machine learning algorithm) is one that relies on labeled input data to learn a function that produces an appropriate output when given new unlabeled data.



As you can see clearly, the

data in supervised learning is labeled.

SVM Algorithm

[13, 23] Support Vector Machine (SVM) is a supervised [machine learning algorithm](#) that can be used for both classification and regression challenges. However, it is mostly used in classification problems. In this algorithm, we plot each data item as a point in n-dimensional space (where n is the number of features you have) with the value of each feature being the value of a particular co-ordinate. Then, we perform classification by finding the hyper-plane that differentiates the two classes very well.

Support Vectors are simply the coordinates of individual observation. Support Vector Machine is a frontier that best segregates the two classes.

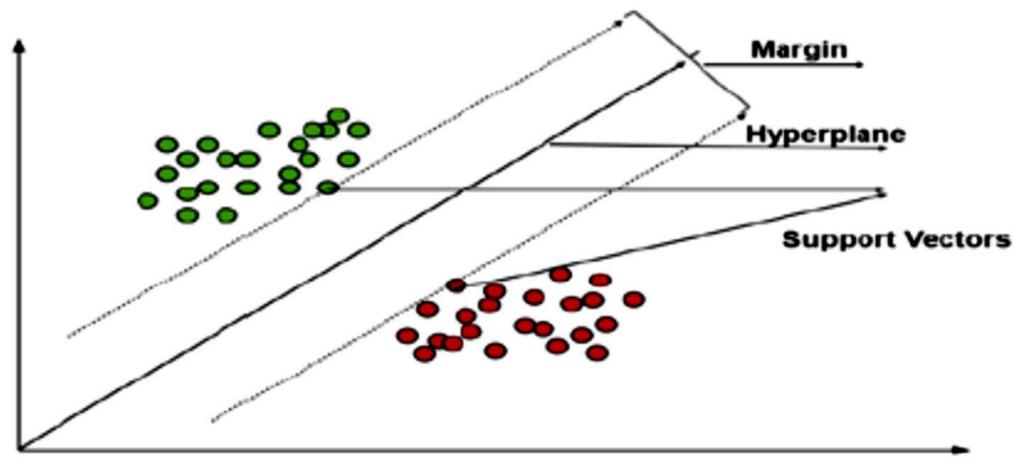


Fig 12: SVM Block Diagram

We have considered 1000 heart sounds of 5 different kinds (N, AS, MR, MS, MVP), each having 200 heart sounds. With the help of Machine learning (20% Test data and 80% Training data), we used Classification methods like SVM and got results given below.

Different features [14, 25] like Avg Energy, MS, THD, ZCR, and Avg Power have been considered for classification, but out of all these features, only RMS value and Avg Energy gives the best result. Below given figures explain the Normalized Spread with Dataset for every considered feature.

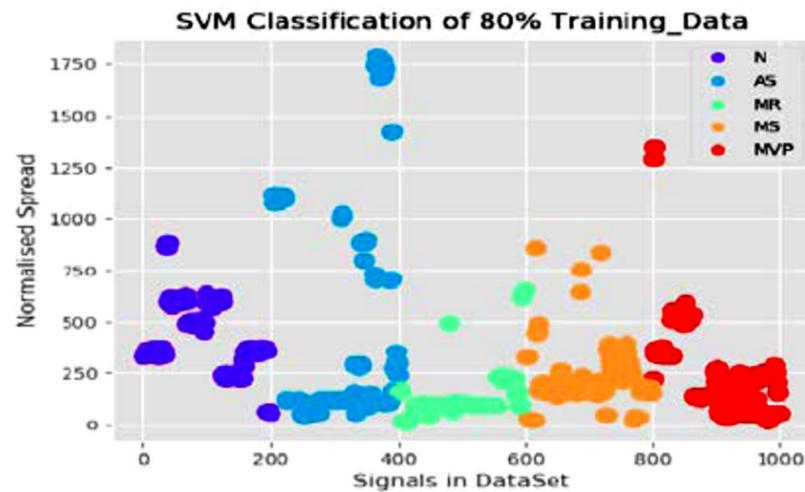


Fig 13: SVM Classification of 80% Training Data and 20% Test data

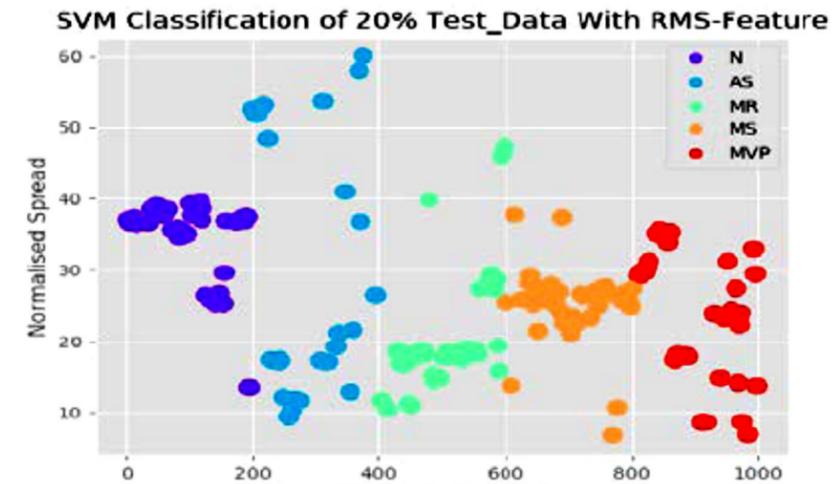


Fig 14: SVM Classification of Test data with RMS

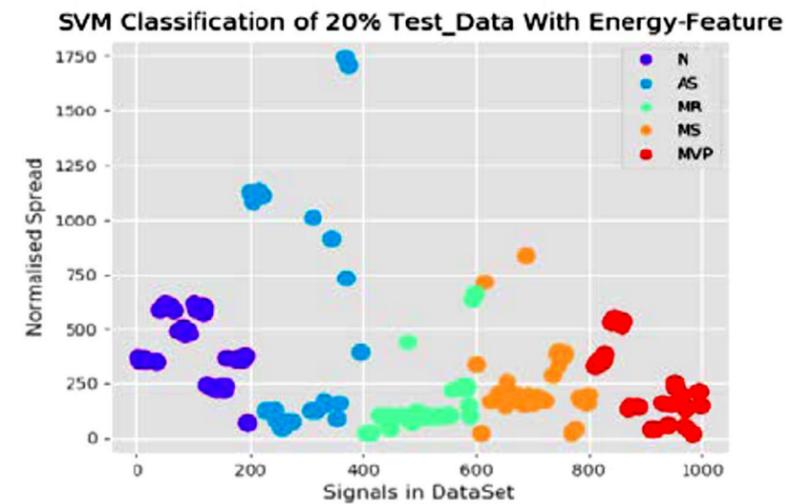


Fig 15: SVM Classification of Test data with Avg Energy

From the above figures 14, 15, it can be said that five different classes of heart sounds are very well separated from each other. In other words, Classification goes very well in terms of features like RMS and Avg Energy. Whereas in below figures 16, 17, 18 Classification goes to a slightly lesser extent in terms of features like THD, Avg Power, and ZCR.

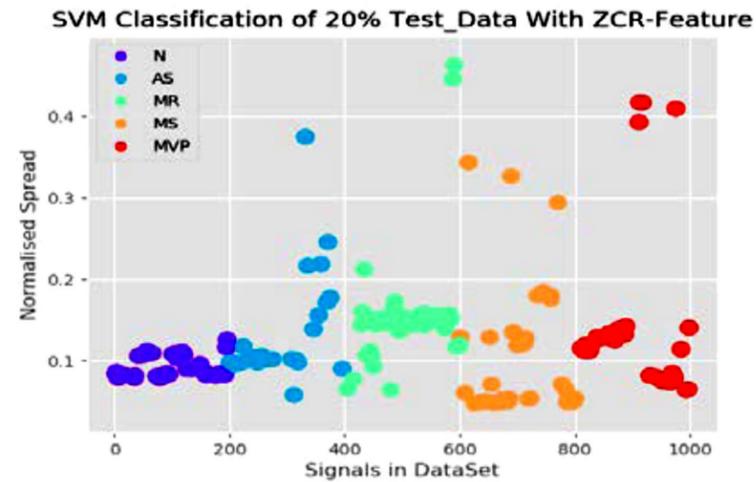


Fig 16: SVM Classification of Test data with ZCR

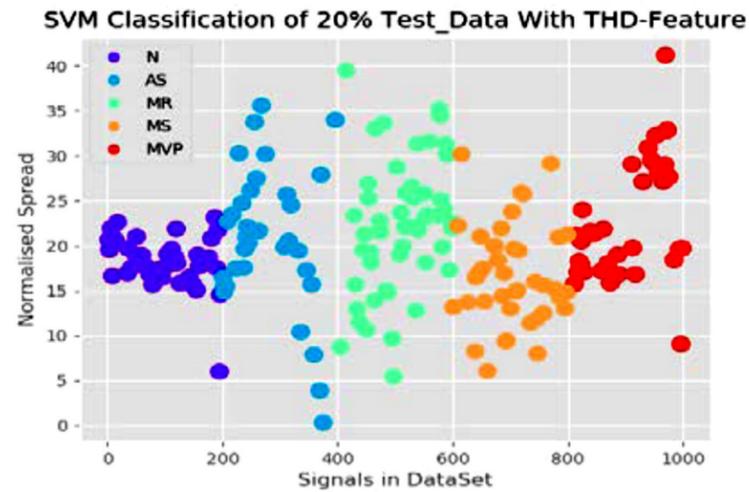


Fig 17: SVM Classification of Test data with THD

SVM Classification of 20% Test_Data With Average Power-Featu

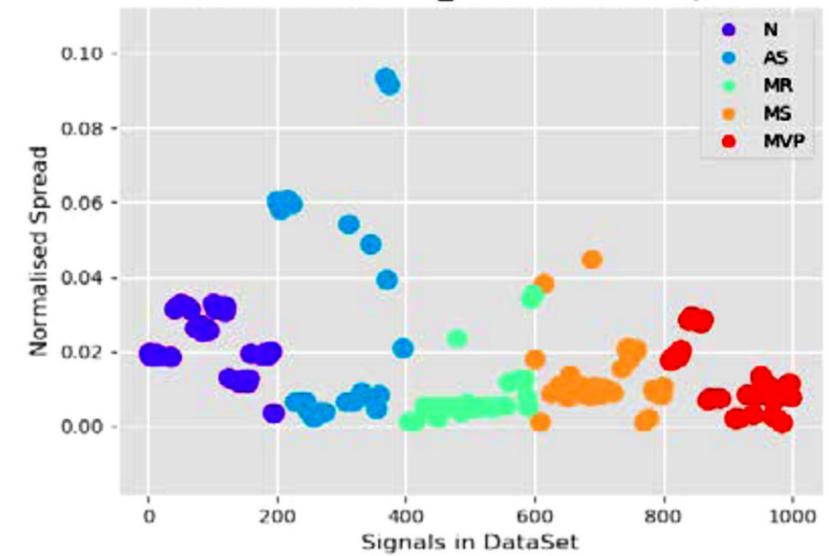


Fig 18: SVM Classification of Test data with Avg Power

V. Results and Discussions

	Predicted Class		
		Class=Yes	Class=No
Actual class	Class=Yes	True Positive	False Negative
	Class=No	False Positive	True Negative

Table 1: Block Diagram of the Confusion Matrix

True Positives (TP) - These are the correctly predicted positive values, which means that the value of the actual class is yes, and the value of the predicted class is also yes. E.g., if actual class value indicates that this passenger survived and predicted class tells you the same thing.

True Negatives (TN) - These are the correctly predicted negative values, which means that the value of the actual class is no, and value of the predicted class is also no. E.g., if the actual class says this passenger did not survive and predicted class tells you the same thing.

False positives and false negatives, these values occur when your actual class contradicts with the predicted class.

False Positives (FP) – When the actual class is no, and the predicted class is yes. E.g., if the actual class says this passenger did not survive, but predicted class tells you that this passenger will survive.

False Negatives (FN) –When actual class is yes but predicted class in no. E.g., if actual class value indicates that this passenger survived and predicted class tells you that passenger will die.

Metrics Used for evaluating different Machine Learning Algorithms.

Accuracy - Accuracy is the most intuitive performance measure, and it is simply a ratio of correctly predicted observation to the total observations. One may think that if we have high accuracy, then our model is best. Yes, accuracy is a great measure, but only when you have symmetric datasets where values of false positive and false negatives are almost the same. Therefore, you have to look at other parameters to evaluate the performance of your model. For our model, we have got 0.803, which means our model is approx. 80% accurate.

$$\text{Accuracy} = \frac{TP+TN}{TP+FP+FN+TN}$$

Precision - Precision is the ratio of correctly predicted positive observations of the total predicted positive observations. The question that this metric answer is of all passengers that labeled as survived, how many actually survived? High precision relates to the low false positive rate. We have got 0.788 precision, which is pretty good.

$$\text{Precision} = \frac{TP}{TP+FP}$$

Recall (Sensitivity) - Recall is the ratio of correctly predicted positive observations to all observations in actual class - yes. The question recall answers are: Of all the passengers that truly survived, how many did we label? We have got a recall of 0.631, which is good for this model as it's above 0.5.

$$\text{Recall} = \frac{TP}{TP+FN}$$

F1 score - F1 Score is the weighted average of Precision and Recall. Therefore, this score takes both false positives and false negatives into account. Intuitively it is not as easy to understand as accuracy, but F1 is usually more useful than accuracy, especially if you have an uneven class distribution. Accuracy works best if false positives and false negatives have a similar cost. If the cost of false positives and false negatives are very different, it's better to look at both Precision and Recall. In our case, F1 score is 0.701.

$$\text{F1 Score} = \frac{2 * (\text{Recall} * \text{Precision})}{(\text{Recall} + \text{Precision})}$$

Features	Accuracy	Precision	Recall	F1-Score
Energy	1.00	1.00	1.00	1.00
THD	0.98	0.98	0.98	0.98
RMS	1.00	1.00	1.00	1.00
ZCR	0.995	1.00	0.99	0.99
Power	0.995	1.00	0.99	0.99

Table 2: Comparison of Different Features

In our experiment, we classified different heart sounds (N, AS, MS, MR, and MVP) using different features. It is observed that RMS Value and Avg Energy gives the best Feature Selection result obtained in terms of accuracy and precision.

Normally in our research work, 1000 heart sounds of different types have been taken for classification purposes. Out of which, 80 percent of samples (800) have been used for training the algorithm, and 20 percent of them (200) have been used for testing the algorithm. Below is the Confusion Matrix of SVM Classifier Algorithms applied on Test data only.

Predicted Value with Respect to True value has been plotted in terms of a Confusion Matrix shown below.

		PREDICTED VALUE				
		N	AS	MR	MS	MVP
TRUE VALUE	N	40	1	0	0	0
	AS	0	33	0	0	0
	MR	0	0	50	0	0
	MS	0	0	1	39	0
	MVP	0	0	0	0	36

Correctly Identified Classes

N= 40 out of 41

AS= 33 out of 33

MR= 50 out of 50

MS= 39 out of 40

MVP=36 out of 36

Fig 19: Confusion Matrix of SVM

VI. Conclusion

Recently PCG signal analysis has been an emerging research area where researchers are trying to design different techniques of PCG signal analysis using machine learning, which can provide more accurate measurements to the user and at the same time, can help in the diagnosis of a diseased heart. From this Comparative study of PCG Signal Analysis for 1000 odd samples of different kinds of heart sounds (N, AS, MR, MS, MVP), it can be concluded that different heart sounds can easily be identified and distinguished. Feature Extraction and Selection can be used to detect normal heart sounds and abnormal heart sounds. Thus it can also be used to diagnose between a normal and abnormal heart sound properly.

The preliminary idea about PCG Signal analysis has been provided, and along with the basic idea of various algorithms of signal processing, Machine Learning used in PCG Signal analysis have been discussed. The prototype developed with a concept of direct data acquisition using legacy input of the sound card of a Laptop PC and use of Mat lab and Python computational power. The initial approach is successful, and the research will continue for further development of the hardware and software based on the outcome of the project.

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4 Feature articles

Article-5

A Step-By-Step Approach to Analysis of Covid- 19 Data Using R

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ABSTRACT

This article aims at describing a step-by-step approach to analyzing COVID-19 data using R on publicly available datasets available on World Wide Web. The first step of data analysis involves acquisition of relevant data from reliable sources. For that purpose the current work incorporates data from John Hopkins University, Center for Systems Science and Engineering (JHUCSSE), as it is highly reliable and easily accessible. The next step is preprocessing of data that prepares and organizes data for the analysis task at hand, and curates it for the next step. This step involves removing inconsistency, incompleteness and missing data from the set, that further helps removing errors at later stages. Then comes the central task of analysing the data for a given purpose. This stage is governed by the need at hand. For the current purpose, the data has been first descriptively analysed for extracting Country Wide Infection Count at a given moment of time. Then Country Wide Aggregate of Total Infection Count is

studied and analysed next. The analytical studies are depicted visually by creating Graphical Representations of Data. A trend analysis of COVID-19 spread across the globe is presented next. This article is expected to pave way for COVID-19 data analysis by youngsters and novice data science programmers who are starting their journey into the world of data science.

Introduction

Since its discovery in December 2019, at Wuhan, China, COVID-19 pandemic has caused havoc all over the world. Termed Corona Virus Disease 2019, COVID-19 has brought the world to a standstill. Nations after nations, lives after lives, have been affected by this tiny virus called SARS-COV-2, which is found to be a genetic modification of flu virus SARS-COV. All around the world, people in all capacities are fighting this pandemic disease, in whatever way they can. Data Scientists have done an exceptional job in analyzing the huge amount of data that are coming out of reports from all around the world, both medical and non-medical, to understand the trend of spread of this deadly virus, and help Govt. and non-Govt. agencies, medics and people in general, to devise protocols to handle this pandemic. The objective of this article is to showcase a step-by-step methodology, that has evolved as a standard procedure to analyse COVID-19 related data, available from open sources, and provide a trend analysis for the same to understand the spread of this pandemic disease all around the world.

With the help of path shown in this article, readers are expected to get an idea of data analysis and its application in analysing data related to COVID-19. Interested readers can initiate exploratory analysis of worldwide COVID-19 data to enhance understanding of this pandemic, and contribute to the worldwide fight in their own capacities.

Steps involved in COVID-19 Data Analysis

a) Data Acquisition

Data relevant to COVID-19 pandemic are organized and maintained in a well documented manner in several online repositories. One such repository is GitHub. GitHub repository of *John Hopkins University Center for System Science and Engineering* (JHUCSSE) is one such repository. It is highly reliable and easily accessible. This repository can be accessed using a published URL, through which the latest data on worldwide spread of COVID-19 can be downloaded. The R code corresponding to this part is given herein as Code 2.a. **Code 2.a**

```
install.packages("data.table", dependencies=TRUE)
library(data.table)
df <-
fread("https://raw.githubusercontent.com/CSSEGISandData/COVID-19/master/csse_covid_19_data/csse_covid_19_time_series/time_series_covid19_confirmed_global.csv")
df <- data.frame(df, header=TRUE, stringsAsFactors=FALSE)
```

a) Data Preprocessing

Preprocessing of the acquired data is an essential part of data analysis. This step is needed to clean the data and prepare for further analysis. This step removes inadvertent errors, missing and incomplete data elements, from the collection. Proper processing helps to organize the data efficiently and reduce the chances of error in the later stages. Preprocessing also makes the data complete by filling in missing values by means of *imputing*, *interpolating* or *averaging*, or removing altogether the missing parts of data from the collection.

In the current exercise, the noisy data with NA values and blank fields are searched out. It has been found that there are some blank values in the *Province. State* field, which are to be filled with *Country. Region* values. As it is a huge dataset, analysis of some selective countries will be demonstrated here such as *China*, *India*, *Pakistan* and *Iran*. The code snippet is shown in Code 2.b.

Code 2.b

```
install.packages("dplyr", dependencies=TRUE)library(dplyr)
df$Province.State <- sub("A$", NA, df$Province.State)
df <- transform(df, Province.State = ifelse (Province.State==" "
| is.na(Province.State), Country.Region, Province.State))#Replace all fields with 0 if
the value is NA
df <- df %>% replace(=="NA", 0)
df <- df [with(df, Country.Region %in% c("China", "India", "Pakistan", "Iran")),]
```

C) Analysis

Country-wise Infection Count: the JHUCSSE data set contains state-wise, date-wise infection count of some countries. To get the country-wise infection count on each date, the state-wise data has to be aggregated within the countries. This can be done by using *aggregate()* function of R, that performs group wise summation of data. The code snippet is given in Code 2.c.

Code 2.c

```
dfCountryGroupWise <- aggregate(df[,c(5:ncol(df))], by=list
(Category=df$Country.Region), FUN=sum)
head(dfCountryGroupWise [dfCountryGroupWise$Category == "China"
,c(1:5)])
Output:
Category X1.22.20 X1.23.20 X1.24.20 X1.25.20 37 China 548
643 920 1406
```

```
dfCountryGroupWise[dfCountryGroupWise$Category == "China" |
dfCountryGroupWise$Category == "India", c(1:10)]
head(dfCountryGroupWise[dfCountryGroupWise$Category %in% c("China",
"India"), c(1:5)])
Output:
Category X1.22.20 X1.23.20 X1.24.20 X1.25.20 X1.26.20 X1.27.20 X1.28.20
X1.29.20 X1.30.20
37 China 548 643 920 1406 2075 2877 5509 6087 8141
80 India 0 0 0 0 0 0 0 0 1
```

The aggregated result is stored in a data frame variable *df Country-GroupWise*, and displayed with data frame indexing and logical filter-ing.

Aggregate of total infection count of each country

To get the aggregate of infection in a given country, date wise infection count is needed to be added up for that country. This can be implemented in R by the function *apply()* and the function *sum()*, that is mapped to each row from second column to the last column in the data- frame variable, as given under

Code 2.d

```
dfCountryGroupWise$Total <- apply(dfCountryGroupWise [,
c(2:ncol(dfCountryGroupWise))],1,sum, na.omit=T)
head (dfCountryGroupWise[with(dfCountryGroupWise, Category
%in% c("China", "India")), c(1, ncol(dfCountryGroupWise))])
```

Output:

```
Category      Total 37   China 24237314
80 India 647496901
```

Graphical Representation

In order to intuitively appreciate the outcome of analysis, it is desirable to depict the analytical outcomes by means of graphs and visualizations. With the help of the following code, the Exploratory Data Analysis (EDA) results can be displayed in the form of Histograms in order to provide a comparative visual study of the data spread.

Code 2.e

```
names(dfCountryGroupWise)[1]<-c("Country")
TotConfirmedCase <- dfCountryGroupWise[,c(1,ncol(dfCountryGroupWise))]
View(TotConfirmedCase)
p<-ggplot (TotConfirmedCase, aes (x=Country, y=log(TotCase))) +geom_bar
(stat="identity")
p
```

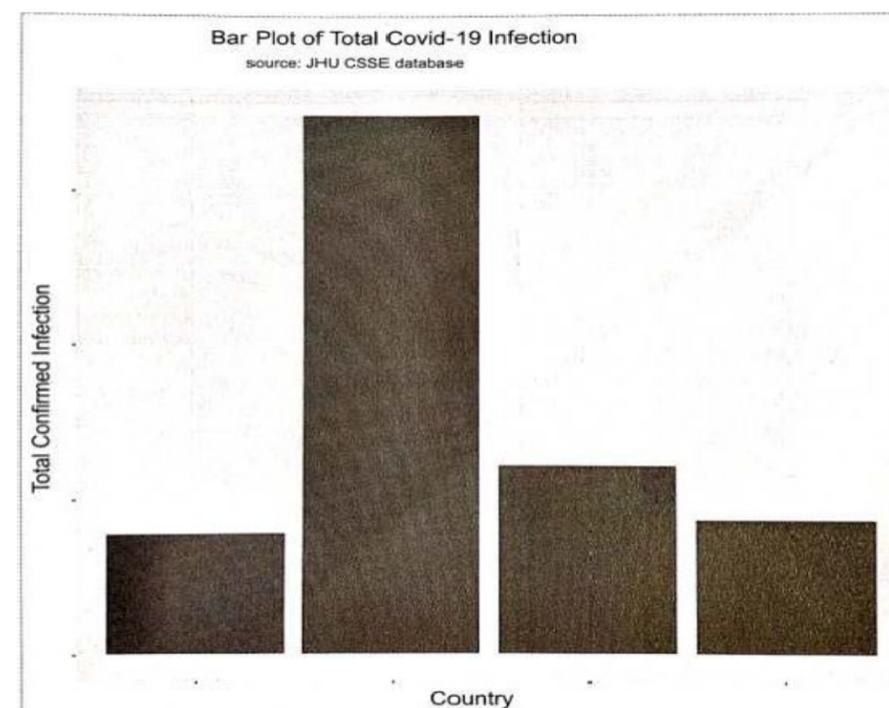


Figure 1. Bar Plot to show country-wise total infection count

Trend Analysis

For future projections from the current data, trend analysis is important. As the acquired data contains sufficient amount of reliable information covering day-wise count of confirmed infection cases, a trend analysis can be performed using a *time series*. For simplicity, *the Time Series Analysis* has been demonstrated on some selected records only, as shown in the following code

Code 2.f

```
daterange <- colnames (df[,c(5:ncol(df))])
countrynames <- df$Country.Region
tdf <- data.frame(t(df), stringsAsFactors=FALSE)
Eliminate Province.State tdf <- tdf[c(-1),]
rownames (tdf) <- daterange
colnames (tdf) <- countrynames
tdf$date <- as.Date (seq(as.Date("2020/1/22"), by = "day",
length.out=nrow(tdf)), format = "%d/%b/%Y -%u")
class(tdf$date)
tstdf <- ts(tdf$China, frequen-
cy=365,start=as.POSIXct(as.Date("2020/1/22")))
plot.ts(tstdf, xlab="Country", ylab="Count", main="Time
Series graph")
tstdf <- ts(tdf$India, frequen-
cy=365,start=as.POSIXct(as.Date("2020/1/22")))
plot.ts(tstdf, xlab="Country", ylab="Count", main="Time
Series graph")
```

Figure 2 shows the Trend Analysis of COVID-19 infections in China and India.

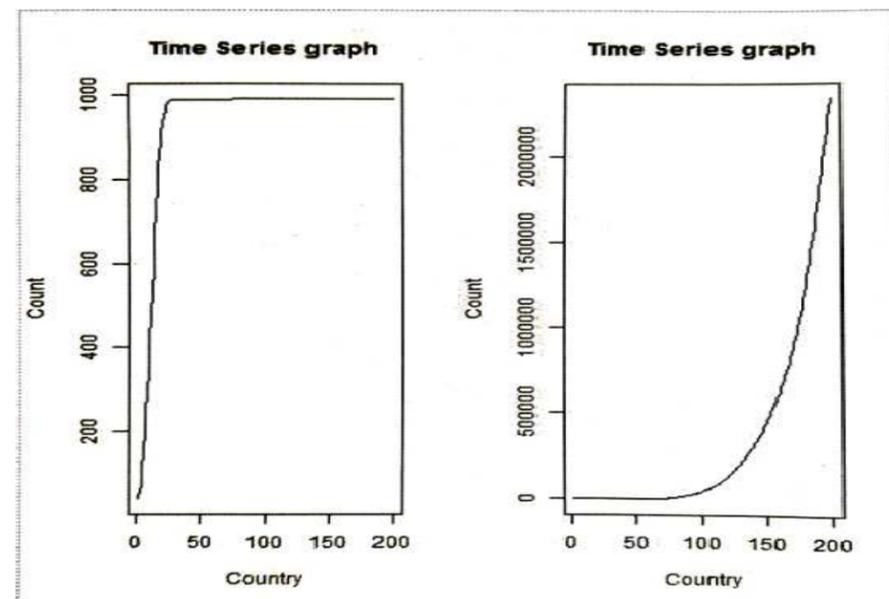


Figure 2. Trend analysis of COVID-19 spread in China and India

g) Density Distribution Plot

To visualize the distribution of total infection for each country, a Histogram and Density Plot are good tools for visualization, and that can be shown in R with the help of *ggplot()* function. The two sub- functions *geom_histogram()* and *geomdensity()* of the *ggplot* package are handy in achieving the two discrete and continuous visualizations respectively. The following code shows the example usage of the concept:

Code 2.g

```
dfCountryGroupsum <- aggregate(df[c5:ncol(df)],
by=list(Category=df$Country.Region), FUN=sum)
dfCountryGroupsum$Total <- apply(dfCountryGroupSum
[,c(2:ncol(dfCountryGroupSum))],1,sum,na.omit=T)
names(dfCountryGroupSum)[1]<- c("Country")
TotConfirmedCase <-
dfCountryGroupSum[,c(1,ncol(dfCountryGroupSum))]
names(TotConfirmedCase)[2]<-c("TotCase")
p<-ggplot(TotConfirmedCase, aes(x=log(Totcase))) +
geom_histogram(aes(y=..density..), colour="black", fill="white") +
geom_density(alpha=.2, fill="#FF6666") +
geom_vline(aes (xintercept=mean(log(TotCase))), Color-"blue", Tine-
type="dashed", size=1) + xlab( "Country wise total Number of Cases")
p
```

Figure 3 shows the Density Plot of global total cases.

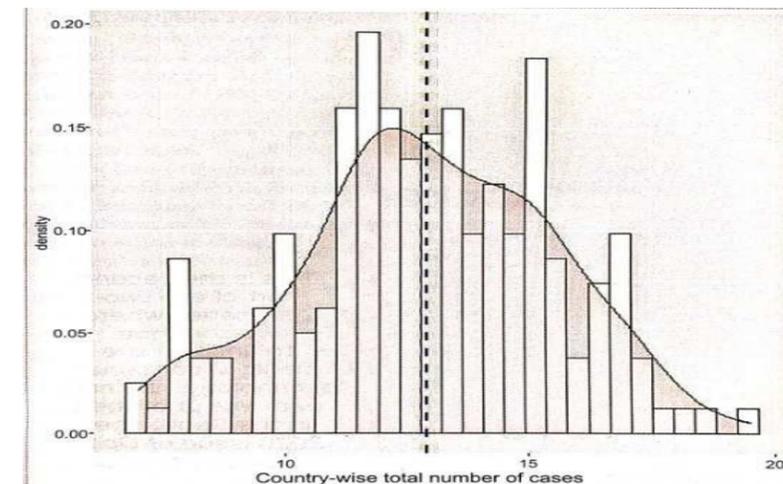


Figure 3. Density plot of global total cases

3. Conclusion

The COVID-19 pandemic has opened up new ways of different types of activities. Highly reliable structured data pertaining to COVID-19 spread, treatment, drug design & trials, economics, etc. are readily available in the Web. The current article took an effort to sensitize the new entrants to the field of healthcare data science, to take up more innovative approaches of analyzing the COVID-19 data and contribute to the worldwide war against the virus. Different communities all over the world are using this data to study the virus dynamics and invent new solutions to conquer it. This article attempts to show fundamental pathway to analyze the worldwide COVID-19 data and motivate the readers to contribute from their fields of interest in the war against this global pandemic.

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