The Institution of Electronics and Telecommunication Engineers

BENGALURU CENTRE

# IETE Bengaluru Magazine

VOLUME 5 JUNE 2019 - AUGUST 2019

## From the Predident IETE

I am very glad IETE Bengaluru Centre is bringing out the 5th edition of its quarterly magazine "IETE Bengaluru Magazine". I am very happy to also note that the first issue of this magazine was brought out last year at the Engineers Day Program on 15th Sept 2018 and this is the first anniversary issue. I congratulate IETE Bengaluru, Executive Committee and the editorial team for their sustained and continued efforts in bringing out this magazine and to disseminate knowledge through interesting and state-of-art technical articles and share information about the IETE Bengaluru activities. IETE Bengaluru is a very active centre involved in organizing many programs and this magazine helps in showcasing its multi-layered activities.

I wish the IETE Bengaluru Centre and this Magazine all the success. IETE HQ has always encouraged and supported all initiatives by its Centres in attaining technical excellence and spreading knowledge.

**Dr K. T. V. Reddy**
President IETE
IETE HQ, New Delhi

## From the Chairman

Dear IETE Members,

We are glad to present you the fifth issue of the IETE Bangalore Magazine, which also happens to be the first anniversary issue. We started the first issue on 15th Sept 2018 and we are issuing the fifth issue on 15th Sept 2019! We are glad we are able to continue with efforts and serve the IETE Bengaluru fraternity. The positive and encouraging response to the first four issues has encouraged us to bring this fifth issue. IETE Bengaluru Magazine is trying to provide informative technical information and also highlight IETE Bangalore's achievements.

Details of some of the technical activities conducted during the last quarter are given in this magazine. IETE Bangalore organized many technical activities, conferences, seminars and workshops in the last quarter. Some of the activities include: World Telecom & Information Day, SUSIEC 2019 Valedictory Function, IETE Bengaluru AGM 2019, Embedded Systems & Design short term course, various technical talks on AI, 5G, Robotics, several ISF programs in association with affiliated Engineering Institutes. IETE Bangalore is always interested in collaborating with Technical Institutions and Organizations in organizing courses, workshops, seminars. Please take advantage of this.

I am also glad to inform the IETE Bengalru has established a new IoT Lab in collaboration with C-DAC. Many technical activities will be organized using this facility. IETE Bengaluru has also acquired a new Maruti Eeco Van for providing 'Mobile Lab' facility for educating and empowering rural women and children.

In order to successfully continue this magazine, we need your support, help, contributions and suggestions for the success of IETE Bengaluru Magazine. Please help us with your active support and response.

With warm regards,
**HS Bhatia**
Chairman, IETE Bangalore

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IETE BENGALURU

## From the Hon. Secretary

On Engineers' Day last year, we launched our Magazine and ever since, we have religiously brought out the quarterly editions. It has been of immense satisfaction to us that during this one year we could apprise you of details of our activities and share our dreams for the future. This issue contains highlights of the happenings of the last three months including a report on the Summer School in Electronics & Computers (SUSIEC 2019). IETE Bangalore has planned many important events in the coming months all of which will find a place in the next edition.

Once again, I appeal to you to go through every edition critically and send us your feedback.

**C. Satyanandan**
Hon. Secretary
IETE Bengaluru

## FROM THE EDITOR'S DESK


Welcome to Fourth Issue of *iete Bengaluru Magazine!*

Please note this is also the First Anniversary Issue as we started the first issue exactly a year back on 15th Sept 2018! We are very happy and proud that we could continue and sustain this activity and successfully bring four issues in time and the fifth issue now. This was possible only due to your continued support and encouragement. This issue also covers all the regular features like 'Know Your Distinguished Persons from Bengaluru' – respecting all the past Chairmen of IETE Bangalore Centre, 'Eventful Quarter' – listing all activities organized by IETE Bangalore, 'Forthcoming Events', 'Laurels', 'Technical Articles', 'Tech Trends'.

IETE Bengaluru is always in pursuit of technical excellence and strive to provide best and state-of-art technical knowledge and experience. In this effort IETE Bengaluru has established an 'IOT Lab' in collaboration with C-DAC. Many technical activities are planned using this new lab. IoT Lab will be inaugurated on 15th Sept 2019 and a one-day Workshop is organized on IoT Applications. Detailed report on these programs will be provided in the next issue of the Magazine.

We would like to thank Mr Kesheorey for his technical article on Speech Processing. Our thanks are always due to Dr K T V Reddy, President IETE, Prof J W Bakal, President Elect, Prof B S Sonde & Mr H Ramakrishna for their constant support & blessings.

Thanks for your support and encouragement. Your contributions in any technical domain are always welcome. Please send your views, suggestions and also be part of the magazine by contributing articles, news clips etc. Your Magazine is now one year old, it may need some modifications, change, improvements! Please provide inputs, it will be invaluable!!

Thank You

**Dr M H Kori**

On behalf of *iete Bengaluru Magazine* Editorial Board

## KNOW YOUR DISTINGUISHED PERSONS FROM IETE BANGALORE

IETE Bangalore has produced a large number of very distinguished eminent persons who have held high responsible positions who have made significant contributions to IETE, industry, research, academics, administration & public policy and in many technical domains.

In this feature ***"KNOW YOUR DISTINGUISHED PERSONS FROM IETE BANGALORE"***, we are attempting to recognize all these eminent people.

In this issue we are listing all the eminent people who have held position of Chairperson of Bangalore IETE and have led from the front to make IETE Bangalore as one of the best IETE Centres.

### CHAIRPERSONS OF IETE BANGALORE CENTRE FROM 1960 TO 2020

| | |
|---|---|
| *1960 - 61* | *Prof. S V C Aiya* |
| *1961 - 62* | *Sri. S K Kanjilal* |
| *1962 - 63* | *Sri. N V Shenoi* |
| *1963 - 65* | *Sri. Uma Shankar* |
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| *1966 - 67* | *Brig. B J Shahaney / Sri. G U Menon* |
| *1967 - 68* | *Col. D Swaroop* |
| *1968 - 70* | *Brig. S K Malhotra* |
| *1970 - 72* | *Brig. B Bhasin* |
| *1972 - 74* | *Sri. D K Sachdev* |
| *1974 - 76* | *Brig. N Dayal* |
| *1976 - 78* | *Prof. B S Sonde* |
| *1978 - 79* | *Sri. U V Nayak* |
| *1979 - 80* | *Sri. U V Nayak / Prof. B S Sonde* |
| *1980 - 81* | *Brig. R C Dhingra* |
| *1981 - 82* | *Brig. R C Dhingra / Dr. R P Shenoy* |
| *1982 - 83* | *Dr. R P Shenoy* |
| *1983 - 84* | *Sri. K Swaminathan / Dr. R P Shenoy* |
| *1984 - 86* | *Dr. S Srikantan* |
| *1986 - 87* | *Sri. G T Narayan / Sri. R Somasundaram / Prof. A Kumar* |
| *1987 - 89* | *Prof. A Kumar* |
| *1989 - 91* | *Wg. Cdr. C P K Menon* |
| *1991 - 93* | *Sri. Avinash Kumar Srivastav* |
| *1993 - 94* | *Sri. Desikamani* |
| *1994 -96* | *Sri. M G Chandrasekhar* |
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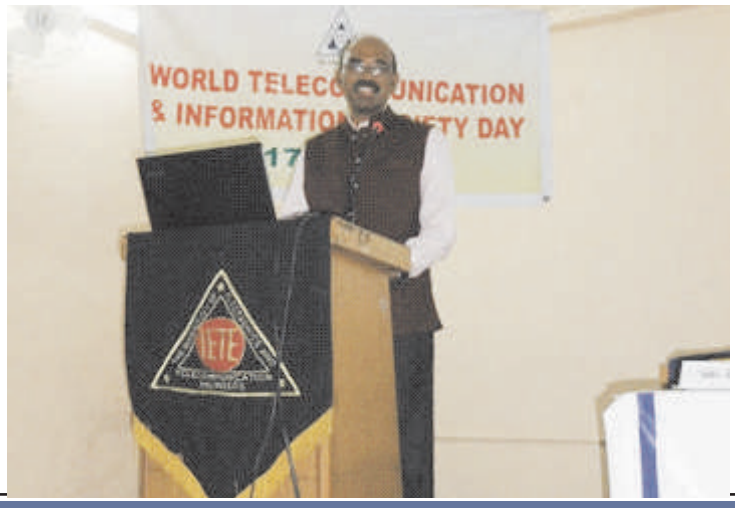
| *2006 - 08* | *Sri. G R Joshi* |
| *2008 - 10* | *Sri. R Lakshminarayana Rao* |
| *2010 - 12* | *Wg. Cdr. HR Parthasarathy* |
| *2012 - 14* | *Sri. Rajagopal D* |
| *2014 - 16* | *Dr. D C Pande* |
| *2016 - 18* | *Sri. G Ramesh* |
| *2018 - 20* | *Prof. H S Bhatia* |

*We deeply appreciate and recognize your leadership & contributions!*

## AN EVENTFUL QUARTER

1. **17-05-2019:** World Telecommunications & Information Society Day was celebrated at IETE Bangalore on 17th May 2019. Sri. N Janardhana Rao ITS, Principal General Manager Bangalore Telecom Dist. BSNL was the Chief Guest. Dr. MH Kori, Past Chairman IETE Bangalore delivered the Theme Lecture on 'Bridging the Standardisation Gap'.




The program commenced with a welcome address by Sri. C Satyanandan, Hon. Secretary who also introduced the Chief Guest. Sri. CP Dwivedi, Vice Charman read out the messages from Secretary General ITU and President IETE. Prof. HS Bhatia Chairman presided and Sri. KS Ravi Executive Committee Member proposed the Vote of Thanks.


The IETE Bengaluru Magazine 4th edition was released on the occasion by the Chief Guest.

2. **19-05-2019**: The Valedictory Function of "SUSIEC 2019"and Dr. S Srikantan Memorial Awards was held at 1600 hrs. (Report in this issue)

3. **30-05-2019:** Annual General Body Meeting of IETE Bengaluru Centre was held on Sunday 30th June 2019.

AGM commenced at 10.15 am with Vande Matharam and observance of silence in memory of veterans who passed away during the year. Prof. HS Bhatia, Chairman welcomed the members and put up the Minutes of the last AGM, which was adopted by the General Body. Shri.C Satyanandan Hon.Secretary presented the Annual Report, which was followed by the Audited Statement of Accounts presented by the Hon. Treasurer Shri. Jagannatha Rao.

The General Body reassembled after a break for the NS Nagaraja Memorial Lecture. Shri. A Chockalingam, Professor, ECE, Indian Institute of Science Bangalore delivered a talk on '5G and beyond'. The program concluded with Vote of Thanks proposed by Shri. KS Ravi EC member, followed by National Anthem.

4. **23-07-2019:** National Institute of Electronics & Information Technology (NIELIT) officials- Shri Jaideep Kumar Mishra, Jt.Secy, MeitY, Dr MP Pillai, ED, NIELIT Calicut and Shri. Pratap Kumar S Scientist/Engineer "E", NIELIT Calicut- visited IETE Bengaluru Centre to discuss possible collaboration between NIELIT and IETE Bangalore.

5. **15- 08-2019:** Independence Day 2019 was celebrated at IETE Bangalore. Sri. GR Srinivasan, Joint Managing Director, Bionexgen Innovation Pvt. Ltd. was the Chief Guest and hoisted the flag. After Flag Hoisting members assembled over breakfast and exchanged Independence Day greetings.

6. **02-08-2019**: Embedded Systems & Design short term course started by Sri. Malhar Deshpande at IETE Bangalore .

7. **04-08-2019**: Prof. H S Bhatia, Chairman, IETE Bangalore inaugurated IETE Students Forum at New Horizon College of Engineering, Bangalore. Prof. C Murali was the guest of honor and delivered the technical talk on Latest trends on 5G. Dr. Sanjeev Sharma, Head of the department proposed vote of thanks.

8. **11-08-2019**: Ms. Ashika Naidu, CAIR, DRDO, Bangalore deliver a technical talk on Artificial Intelligence (AI) at Bangalore Institute of Technology, Bangalore

9. **28-08-2019:** Sri. Malhar Deshpande conducted one day hands on workshop on Embedded Systems & Design at Reva University for the benefits of students community and faculty members.

10. **30-08-2019:** Prof. C Murali delivered a technical talk on Intelligent Connectivity - The fusion of 5G, AI and IoT at Sairam Engineering College, Anekal.

11. **01-09-2019:** Short Term Course 'Advanced FPGA Design' was started by Sri. Anilkumar T S.

## A Report on Summer School in Electronics & Computers 2019 (SUSIEC 19)

SUSIEC is conducted every year at IETE Bangalore during the Summer Vacation for students of classes VIII, IX and X. This year marks the 40th year of birth of the Summer School.

The inaugural programme was held on Sunday, 28th April 2018 at 1100 Hrs.at IETE Bengaluru Centre. It was inaugurated by Shri. P Radhakrishnan Outstanding Scientist & Associated Director, LRDE (DRDO) Bangalore, the Chief Guest. Shri. Rabindra Srikantan MD, ASM Technologies Ltd. was the Guest of Honour.

After the welcome address by Shri. Satyanandan, Hon. Secretary, Dr. CV Ravishankar, Course Director, SUSIEC'19 introduced the Chief Guest who spoke on Electronics and its applications. Shri. Rabindra Srikantan distributed tool kits to the students. Prof. HS Bhatia, Chairman presided and Shri. Jagannatha Rao Hon. Treasurer proposed the Vote of Thanks. About 60 students registered for the programme. Students and their parents attended the inaugural function.


Course Details (by Course Director Dr. Ravishankar)

1. Around 56 students from 32 prestigious schools participated in this year's Course:
2. Full-fledged theory and lab sessions were planned. Theory sessions were held from morning 9am to 11am and from 11.30 to 1.30 pm project sessions were conducted.
3. Senior faculty members from various engineering colleges such as Sambhram Institute of Technology, MSRIT and Global Academy of Engineering took classes in Electrical, Electronics and Computer Science areas.
4. This year several new programs and methods were introduced:
5. Forming students' batches to do general electronic circuit experiments
6. Supporting individual innovative projects
7. Allowing students to take home their project components to work on it.
8. Encouraging individual students to do experiment
9. Providing two project components to get more knowledge about connections and theory.
10. Complete list of experiments and related information as Lab Manual
11. SUSIEC 2019 Handbook containing complete notes and theory details by experienced authors.
12. Arrangement of Industrial visits for students to enhance their practical knowledge
13. Almost 3 to 4 full days given for hands on experience on electronic circuits and preparing for the project competition.

14. Conducted small quiz, tests etc.. by the subject faculty
15. Almost all faculty classes were conducted using Power point presentation.
16. Special sessions by eminent personalities for motivation and humanity related issues.
17. Theory tests were conducted- 50 marks, 50 questions in 1hr 45 min. No negative marking.
18. Internal assessment done for every student for 20 marks from day one about punctuality, behavior, team work etc. and performance.
19. The theory final test for the participants was conducted. A Project competition among student teams was conducted on 19-05-2019.
20. First Prize Rs 8000 each for 3 students, Second Prize Rs.7000 each for 3 students, Third prize Rs.6000 each for 3 students and consolation prize Rs.3000 each for 43 students were awarded. Certificates were given at the Valedictory function.

The Valedictory Function of "SUSIEC 2019"and Dr. S Srikantan Memorial Awards was held on Sunday 19th May 2019 at 1600 hrs. Prof. BS Sonde was the Chief Guest. Shri. Rabindra Srikantan Managing Director ASM Technologies Ltd. Bangalore and Dr. MVKV Prasad, Director ADE were the Guests of Honour.

Shri. C Satyanandan, Hon. Secretary welcomed the Chief Guest and Guests of Honour as well as the gathering of students, parents and other invitees and anchored the program. Shri. CP Dwivedi, Vice Chairman introduced the Chief Guest and the two Guests of Honour.

Prof. BS Sonde reminisced about the early days of IETE Bangalore which became a full-fledged Centre in 1969. He recalled the services rendered by such stalwarts as Prof. SVC Aiya and Prof. K Srinivasan and how the first major activity, namely, an exhibition on transistors and their applications was held in 1972 in collaboration with the Institution of Engineers (India) in their premises on Vidhana Veedhi which attracted enthusiastic school children. Thus was born, he said, the idea of SUSIE. In 1974, the 100th year of Marconi's invention of the Radio, a major national level program was conducted at IETE at which the foundation stone of the present building was laid, and the construction was completed in 1985 with the efforts of late Dr. S Srikantan and Dr. RP Shenoy.

Prof. Sonde congratulated the students, parents and the Faculty involved for the smooth conduct of the Course. He also complemented the Course Director, Executive Committee and staff of IETE Bangalore and the Patron Dr. Rabindra Sikantan, MD of ASM Technologies Ltd.

Dr. Rabindra Sikantan in his brief speech expressed his happiness at the way the course was conducted and thanked IETE Bangalore for associating him and ASM Technologies.

Dr. MVKV Prasad congratulated the students and their parents for their active participation. He appreciated the efforts of IETE Bangalore and ASM Technologies. He gave a few words of advice to the young students based on his own experience as an engineering student.

Dr. CV Ravishankar, Course Director read out the names of the Prize winners and names of all those who participated in making SUSIEC 19 a success. Certificates were distributed to them by the Chief Guest and Guests of Honour. Prof. HS Bhatia, Chairman then delivered the Presidential Address. Shri. Jagannatha Rao, Hon. Treasurer proposed the Vote of Thanks and the function ended with National Anthem.


## Honours

Dr. GK Venkatesh, EC Member, IETE Bangalore received his Doctorate from Dr. K Sivan, Chairman ISRO, at Jain University, Bangalore.

**Donations**

| Date | Donor | Amount |
|---|---|---|
| 29-06-2017 | Dr. MH Kori DFIETE | 10,000 |
| 20-12-2018 | Dr. MH Kori DFIETE | 10,000 |
| 08-07-2018 | Shri. Keshava Reddy | 5,000 |
| 08-07-2018 | Alumni AP | 10,000 |
| 31-08-2018 | Shri. G Ramesh FIETE | 2,000 |
| 19-09-2018 | Prof. C Murali FIETE | 50,001 |
| 29-06-2019 | Dr. MH Kori DFIETE | 10,000 |
| 12-01-2019 | Dr. MH Kori DFIETE | 10,000 |

IETE Bangalore gratefully acknowledges the kind gesture of the Members

*Members/ Well-wishers may send their donations for the development of the Centre by cheque in favour of IETE Bengaluru Centre or on-line to the following account:
Account no.: 520101256326973
IFSC Code: CORP0002021
MICR Code: 560017034
Corporation Bank, Branch: Ganganagar, Bangalore

## A Proud Possession

IETE Bangalore has become the proud owner of the first van to be supplied to an IETE Centre to facilitate implementation of its initiative 'iete at your doorstep'. We intend to take digital education to the villages and underprivileged.


*IETE Bangalore congratulates* **Prof J W Bakal,** *current Vice President of IETE, on being elected as the* **PRESIDENT of IETE for 2019-2020.**
*IETE Bangalore congratulates* **Sri G Ramesh,** *past Chairman of IETE Bangalore, on being elected as the* **IETE Governing Council Member for 2019-2022.**
*We wish both of them great success.*

# Speech Processing - An Overview

M R Kesheorey

This paper is written in three parts. The first part is a brief about the philosophy of human speech and developments till the present age. Its purpose is to make the reader revisit consciously the development of humans from the speech researcher's point of view and innovate using speech processing techniques. The second part briefly contains speech processing techniques giving the idea behind it. The third part briefly deals with applications of speech processing.

Human communication is dominated by speech (and hearing). Animals also employ different modes of communication, by body postures or basic tones and sounds. Maybe, it was similar for the early cave man. However, when his hands became busy, he had a need to communicate at night or communicate when not in the line of sight. Speech evolved. Man used the organs which are used for his sustenance, that is, for breathing and eating. Speech communication is so important that it has been found in every community that has been discovered. As the human race progressed, the other method by which complex information was transferred (or stored) was by writing. Writing has the advantage that the other party can receive the information at a later time or at another place. However this communication was not in real time and also was bereft of the emotional component that speech communication provides. The difficulties of speech communication in real time at a distance were overcome by invention of telephony. This was a major breakthrough which led to a resurgence of the domination of speech in human communication. In telephony the acoustic signal is converted into electrical signal by microphone and this electrical signal reconverted into acoustic wave by speaker. This conversion of acoustic signal to electrical signal has opened all the possibilities of speech manipulations and processing of present age speech gadgets. Manipulation or processing of speech signal in analog form has its own limitations, mainly, addition of noise at each processing stage and thereby distortion of the original signal. When digitized, the speech signal opens up many frontiers of usage, limited only to the imagination of modern human, seed to which lies in speech processing,

**Speech Digitization**

The process of analog to digital (A to D) conversion is the production of a set of discrete data points which represent the continuous speech waveform with sufficient accuracy. The reverse process is called digital to analog (D to A) conversation. There are two parameters in this conversion process. The frequency at which the speech waveform to be sampled and the accuracy (the number of bits) to which each of this sample is to be represented. Nyquist sampling fixes the sampling frequency at least twice the highest frequency. Usually speech range is 20 to 20 Khz. However, as most of the energy of speech lies below 5 Khz. Normal telephone quality speech lies below 3.4 Khz. Thus after using anti aliasing filter speech is sampled at 8 to 10 KHz rate. The second parameter which is considered in A to D conversion is the accuracy with which this sample is to be represented. Speech signal span a range of 70 dB. Hence 12 bits are sufficient to cover the whole range. For normal digital communication of speech this is the simplest coding also known as **PCM coding**. As the resulting bit rate is multiplication of sampling rate and number of bits per sample, PCM coding results in 96 to 128 Kbps rate, a price to be paid in terms of the communication channel bandwidth!

With the intention to reduce the bit rate speech samples were looked closely. The speech samples are highly close from neighboring samples. In mathematical terms, they are highly correlated. Then why to represent each sample by full dynamic range of 70 dB? This led to speech coding technique called **DPCM**, Differential pulse code modulation. The difference in adjacent samples is coded by fewer bits resulting in a bit rate around 64 Kbps, certainly lesser than that of PCM. Variants of DPCM where the number of bits were adapted by looking into speech samples more closely (more than one sample) resulted in coding scheme known as **ADPCM**. The resulting bit rates for acceptable speech quality by ADPCM was around 32 Kbps.

When the sample to sample correlation at Nyquist sampling gave positive results, it was thought that a higher sampling rate should result in higher correlation between sample to sample and a binary indication by a single bit should be sufficient to know whether the speech waveform is increasing or decreasing! This resulted in coding technique known as **DM**, Delta Modulation. Bit rates achieved by DM and its variants **ADM** Adaptive Delta Modulation are around 16 to 32 Kbps. It is seen that the bit rate reduction of speech coders which results more speech channels for the available bandwidth is at a cost of pre-processing of speech samples at the sender (transmit end) and post-processing at the receiver (receive end). Any further processing of speech waveform didn't result in saving of bits for acceptable speech quality. All these techniques which try to preserve speech

waveform are as a group come under **waveform coding of speech.**

Instead of preserving the waveform of speech representing acoustic pressure in the air medium, another group of speech researchers focused into the speech production model for further reduction in speech bit rate and got excellent results. This work based on speech production model has come to be known as **Parametric coding of speech**. Before taking these coders, it is necessary to know how speech is produced, how it can be modeled. The Figure 1 shows articulators for the production of speech sounds.

Speech is produced by inhaling, expanding the rib cage and lowering the diaphragm, so that air is drawn into the lungs, the pressure in the lungs is increased by contracting the rib cage and raising the diaphragm. This results in air flow up the trachea (wind pipe). At the top of trachea it passes through larynx, a bony structure covered by skin containing a slit like orifice, the glottis also popularly known as vocal cords.

The flow of air through glottis causes a local drop in pressure, closes the glottis, interrupting the airflow. The pressure builds up again and the process repeats causing puffs of air through glottis, resulting in a train of pulses. Source of excitation to the vocal tract (mouth cavity and nasal connection) which acts as a filter. The acoustic wave so produced radiates from the lips. Different shape of mouth produces different frequency response which when excited by glottal signal produces different sounds.

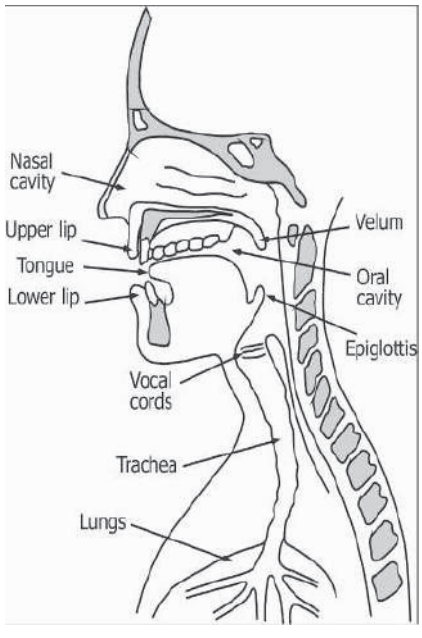



Figure 1: Articulators for the production of speech sound.

In short the speech production is simplified as outcome of a **source – filter** model where source is air pressure from glottis and vocal tract is filter. When the vocal tract is excited by a periodic train of pulses, the acoustic outcome is a periodic waveform, with a period of glottal pulses. The periodic glottal pulses are known as pitch pulses, their period as **Pitch Period** and the sound thus produced is voiced sound. When there is constriction in the vocal cords and a turbulence of air gushes through vocal cords, the vocal tract is excited by a noise like signal. The sound thus produced is called **unvoiced sound**. The velum connects the nasal tract for producing nasal sounds.

Voiced sounds are characterized by periodicity (known as pitch period), high energy, most of the energy in lower frequencies, high sample to sample correlation and low zero crossing rate. On the contrary, unvoiced sounds have no periodic structure, low sample to sample correlation, have low energy and high zero crossing. It looks like a very simple model to start with. But the problem is speech is a continuous activity, often difficult to distinguish between the exact beginning of voicing, tracking the pitch, encountering the pitch doubling and as consequence pitch halving also!

Unlike waveform coding technique where one works on speech sample to sample basis, parameteric coding technique works on a frame of speech sample trying to preserve the spectrum. Normally 10 to 40 msec speech frame is analyzed. A suitable window (Hamming or Hanning) is applied to speech samples to minimize aliasing. The task is to model the vocal tract filter, and the source of excitation.

For excitation, a three way decision is taken, whether the frame under consideration is voiced, or unvoiced or is silent. AMDF (Average Magnitude Difference Function) method of pitch estimation computes magnitude of difference between speech samples for different lags. The frame in which lag for which AMDF gives minima below a set threshold is taken as voiced frame and the position of minima as pitch.

**Auto correlation** technique of pitch and voiced/unvoiced decision looks at the peak in auto correlation of speech samples. Presence of the peak above the threshold declares the frame as voiced and the peak position gives the pitch value. Peak clipping of speech signal before auto-correlation gives sharper peak.

**CEPSTRUM** technique computes the spectrum, by performing Fourier Transform on speech frame, thereby multiplying the spectrum of the source (glottal pulse) and the filter (vocal tract). The log operation on this converts the multiplication into addition, resulting in superposition of spectra of the source and filter. Inverse Fourier Transform separates outs the slow

varying filter near the origin and fast varying pitch away from the origin. Presence or absence of peak above the threshold declares the frame as voiced or unvoiced. The position of peak away from origin gives the pitch period. CEPSTRUM method is computation intensive, but in addition to pitch info, gives vocal tract information also.

The resonant peaks of the vocal tract are called **FORMANT frequencies.** Normally knowledge about 3 formants is sufficient to crudely describe the shape of vocal tract. Vocoders based on the formant position, their energy and bandwidth result in machine like speech and have only historical relevance. Same is the case with **Channel vocoders** where the vocal tract spectrum is represented by a bank of filters. Bandwidth of filters is low at lower frequencies (around first two formants) and higher at higher frequencies.

**Linear Predictive Coding (LPC)** models the vocal tract as a series of sections of different cross section areas. Thereby the glottal excitation, while passing through these cross sections produces forward going and backward going waves. In time domain, the present speech sample is supposed to be a linear combination of past n samples. Over a frame, these linear weights are optimized to minimize the overall error. Normally, a tenth order predictor is used to minimize the error. This method has been researched extensively. However, the pitch problem still remained and though LPC remains best method for vocal tract modeling, vocoders based on LPC method employing separate pitch estimation methods lacked natural quality speech.

**Code book exited LPC (CELP)** takes the recourse to the fact that if all the prediction due to vocal tract is available in LPC parameters, why not do inverse filtering on speech frame using those parameters? The result must be the pure excitation! Now is the frame is voiced, it must show some periodicity due to pitch pulses. That it is the voiced frame must have some predictable component in the inverse filter output. On the inverse filter output of 40 msec frame, first order prediction is performed which when used as inverse filtering, leaves residue as entirely un-predictable component which can be used as a code book foe excitation. There are again variants of CELP coders like spectral shaping of noise vector to give better perceptual results.

With speech processing separating out the source and filter, voice coding did not remain in the domain of communication systems alone. Bit rates achievable for good to excellent quality speech is right from 2.4 Kbps to 16 Kbps. We take few examples of other than the well established voice response systems, key word spotting, speech synthesis, speaker verification, speaker recognition, Speech to text, text to speech List will keep growing and the limit is human imagination!

Two of the speech processing systems which deal with hearing impairment deal in a novel way to make quality of life better for such individuals. The idea is speech is a feedback and learning process. In most of the cases the due to defect in the hearing mechanism, person is not able to speak, though the organs (vocal tract and glottis) for speaking are good. A visual running spectrum called sonagram of basic most often words can be used as a clinical therapy to hearing impaired individuals. They can be taught by speech experts to speak essential vocabulary.

The second one is directly giving the electrical stimulus to cochlea by cochlea implant. The implant sends the Short Term Fourier Transform (STFT) signals to brain nerves.

# TECH TRENDS

## Method to automatically estimate rooftop solar potential

Computer scientists use machine learning technique to speed process

The progress of rooftop solar installations is often slowed by a shortage of trained professionals who must use expensive tools to conduct labor-intensive structure assessments one by one, say scientists. Now researchers are proposing a new, data-driven approach that uses machine learning techniques and widely available satellite images to identify roofs that have the most potential to produce cost-effective solar power.

Industry figures show the global rate of solar energy installations grew by 30 percent in one recent year, and the average cost of installing solar has fallen from $7 per watt to $2.8 per watt, making rooftop solar attractive to many more homeowners. But the progress of rooftop installations is often slowed by a shortage of trained professionals who must use expensive tools to conduct labor-intensive structure assessments one by one, say scientists at the University of Massachusetts Amherst.

To automate the process at present requires expensive three-dimensional aerial maps using LIDAR technology not available for many areas. Now a new, data-driven approach uses machine learning techniques and widely

available satellite images to identify roofs that have the most potential to produce cost-effective solar power.

Solar potential estimation of a roof can substantially benefit homeowners deciding to adopt solar, but current automated tools work only for cities and towns where LIDAR data is available, thereby limiting their reach to just a few places in the world. The new data-driven DeepRoof approach takes advantage of recent advances in computer vision techniques and uses satellite imagery to accurately determine roof geometry, nearby structures and trees that affect the solar potential of the roof. DeepRoof estimates can be used to identify ideal locations on the roof for installing solar panels. Results show that DeepRoof can identify the solar potential of roofs with 91 percent accuracy. Further, the tool can be scaled to automatically analyze satellite images of an entire city to identify all building roofs with the most solar potential.

## Optical neural network could lead to intelligent cameras

Engineers have made major improvements on their design of an optical neural network -- a device inspired by how the human brain works -- that can identify objects or process information at the speed of light.

UCLA engineers have made major improvements on their design of an optical neural network -a device inspired by how the human brain works -- that can identify objects or process information at the speed of light.

The development could lead to intelligent camera systems that figure out what they are seeing simply by the patterns of light that run through a 3D engineered material structure. Their new design takes advantage of the parallelization and scalability of optical-based computational systems.

For example, such systems could be incorporated into self-driving cars or robots, helping them make near-instantaneous decisions faster and using less power than computer-based systems that need additional time to identify an object after it's been seen.

The technology was first introduced by the UCLA group in 2018. The system uses a series of 3D-printed wafers or layers with uneven surfaces that transmit or reflect incoming light -- they're reminiscent in look and effect to frosted glass. These layers have tens of thousands of pixel points -- essentially these are artificial neurons that form an engineered volume of material that computes all-optically. Each object will have a unique light pathway through the 3D fabricated layers.

Behind those layers are several light detectors, each previously assigned in a computer to deduce what the input object is by where the most light ends up after traveling through the layers.

For example, if it's trained to figure out handwritten digits, then the detector programmed to identify a "5" will see the most of the light hit that detector after the image of a "5" has traveled through the layers.

## Seeing how computers 'think' helps humans stump machines and reveals AI weaknesses

Researchers have figured out how to reliably create questions that challenge computers and reflect the complexity of human language through a human-computer collaboration, developing a dataset of more than 1,200 questions that, while easy for people to answer, stump the best computer answering systems today. The system that learns to master these questions will have a better understanding of language than any system currently in existence.

One of the ultimate goals of artificial intelligence is a machine that truly understands human language and interprets meaning from complex, nuanced passages. When IBM's Watson computer beat famed "Jeopardy!" champion Ken Jennings in 2011, it seemed as if that milestone had been met. However, anyone who has tried to have a conversation with virtual assistant Siri knows that computers have a long way to go to truly understand human language. To get better at understanding language, computer systems must train using questions that challenge them and reflect the full complexity of human language.

Researchers from the University of Maryland have figured out how to reliably create such questions through a human-computer collaboration, developing a dataset of more than 1,200 questions that, while easy for people to answer, stump the best computer answering systems today. The system that learns to master these questions will have a better understanding of language than any system currently in existence. The work is described in an article published in the 2019 issue of the journal Transactions of the Association for Computational Linguistics.

"Most question-answering computer systems don't explain why they answer the way they do, but our work

helps us see what computers actually understand," said Jordan Boyd-Graber, associate professor of computer science at UMD and senior author of the paper. "In addition, we have produced a dataset to test on computers that will reveal if a computer language system is actually reading and doing the same sorts of processing that humans are able to do."

Most current work to improve question-answering programs uses either human authors or computers to generate questions. The inherent challenge in these approaches is that when humans write questions, they don't know what specific elements of their question are confusing to the computer. When computers write the questions, they either write formulaic, fill-in-the blank questions or make mistakes, sometimes generating nonsense. To develop their novel approach of humans and computers working together to generate questions, Boyd-Graber and his team created a computer interface that reveals what a computer is "thinking" as a human writer types a question. The writer can then edit his or her question to exploit the computer's weaknesses. In the new interface, a human author types a question while the computer's guesses appear in ranked order on the screen, and the words that led the computer to make its guesses are highlighted.

## Newfound superconductor material could be the 'silicon of quantum computers'

Possible 'topological superconductor' could overcome industry's problem of quantum decoherence

Newly discovered properties in the compound uranium ditelluride show that it could prove highly resistant to one of the nemeses of quantum computer development -- the difficulty with making such a computer's memory storage switches, called qubits, function long enough to finish a computation before losing the delicate physical relationship that allows them to operate as a group. This relationship, called quantum coherence, is hard to maintain because of disturbances from the surrounding world.

A potentially useful material for building quantum computers has been unearthed at the National Institute of Standards and Technology (NIST), whose scientists have found a superconductor that could sidestep one of the primary obstacles standing in the way of effective quantum logic circuits.

Newly discovered properties in the compound uranium ditelluride, or UTe2, show that it could prove highly resistant to one of the nemeses of quantum computer development -- the difficulty with making such a computer's memory storage switches, called qubits, function long enough to finish a computation before losing the delicate physical relationship that allows them to operate as a group. This relationship, called quantum coherence, is hard to maintain because of disturbances from the surrounding world.

The compound's unusual and strong resistance to magnetic fields makes it a rare bird among superconducting (SC) materials, which offer distinct advantages for qubit design, chiefly their resistance to the errors that can easily creep into quantum computation. UTe2's exceptional behaviors could make it attractive to the nascent quantum computer industry.

## The World's Top 10 Telecommunications Communications Companies:

1) China Mobile Ltd.
2) Verizon Communications Inc.
3) AT&T Inc.
4) Vodafone Group Plc
5) Nippon Teleg. Telephone Corp.
6) Softbank Group Corp.
7) Deutsche Telekom AG
8) Telefonica S.A.
9) America Movil
10) China Telecom

## The World's Top 10 Semiconductor Companies:

1) Intel
2) Samsung
3) Taiwan Semiconductor
4) Qualcomm
5) Broadcom
6) SK Hynix
7) Micron Technology
8) Texas Instruments
9) Toshiba
10) NXP

Compiled by Dr M H Kori

# IETE INTERNATIONAL CONFERENCE INDIA-2020 (IICI-2020)
# ON
# AI & ML DRIVING 5G & BEYOND
## APRIL 30 - MAY 2, 2020
## J N TATA AUDITORIUM (IISC), BENGALURU, INDIA
## ANNOUNCEMENT & CALL FOR PAPERS

IETE is organizing The Second 'IETE International Conference India -2020' **(iici-18)**, on **"AI & ML DRIVING 5G & BEYOND" from April 30 to May 2, 2020 in Bengaluru.** This conference attempts to highlight the technological developments in 5G with emphasis on the critical role of Artificial Intelligence and Machine Learning in efficient design of 5G Networks.

**5G is set to power billions of connections and be the network infrastructure for the Internet of everything. It promises to reinvent the business world, solve problems we haven't yet encountered and have a major impact on every aspect of our digital lives. Economists estimate the global economic impact of 5G in new goods and services will reach $12 trillion by 2035 as 5G moves mobile technology from connecting people to people and information, towards connecting people to everything. The economic impact of 5G is estimated to be over one trillion dollars for India, which is aggressively positioning itself to be at the forefront of this new age technology.**

Advances in technology will usher in the age of fifth generation, or 5G, telecommunications. Think about a world in which not just people but all things are connected: cars to the roads they are on; doctors to the personal medical devices of their patients; augmented reality available to help people shop and learn and explore wherever they are. This requires a massive increase in the level of connectivity. 5G is the technological answer, making possible billions of new connections, and making those connections secure and instantaneous. 5G will impact every industry – autos, healthcare, manufacturing and distribution, emergency services, just to name a few. And 5G is purposely designed so that these industries can take advantage of cellular connectivity in ways that wouldn't have been possible before, and to scale upwards as use of 5G expands. 5G has three basic objectives – Enhanced Mobile Broadband (eMBB) to provide extreme high data rate to meet the insatiable demand, Massive Machine Type Communication (mMTC) catering to massive IOT applications & Ultra Reliable and Low Latency applications (uRLC) for critical low latency requirements like autonomous driving and robotic surgery.

### AI & ML DRIVING BEYOND 5G

A fully operative and efficient 5G network cannot be complete without the inclusion of artificial intelligence (AI) routines. Existing networks with all-IP (Internet Protocol) broadband connectivity are based on a reactive conception, leading to a poorly efficiency of the spectrum. AI and its subcategories like machine learning and deep learning have been evolving as a discipline, to the point that nowadays this mechanism allows fifth-generation (5G) wireless networks to be predictive and proactive, which is essential in making the 5G vision conceivable. Machine intelligence, which encompasses the fields of artificial intelligence (AI) and machine learning, offers the best opportunity to achieve the high levels of automation necessary to manage the complexity and optimize system performance.

### IICI-2020

iici-2020 creates a platform for experts in these domains to come together and exchange their research and developments. It also provides opportunities for industries and startups to exhibit and announce their new and innovative products, ideas and concepts at this conference. Leading renowned experts will be participating in the conference sharing their expertise in their domains in the pre-conference Tutorials and also in the Keynote / Invited Talks.

### Tutorial:

Leading experts in the domain of 5G / AI / ML will be conducting a pre-conference Tutorial on 8th April 2020 covering in-depth finer aspects of these technologies.

### Exhibition:

A technical exhibition will be organized during the conference. It gives a great opportunity for the technology companies to exhibit their products and services. Please contact the organizers for the details.

### Call for Papers:

All researchers working in domain of Wireless Communications, AI & ML are requested to submit their contributions in these broad areas for presentation in IICI-2020.

Some suggested topics (but not limited to only these): All aspects of 5G – particularly related to: 5G network, NR, Massive MIMO, Beam Forming, mmwave, Waveforms, Numerology, eMBB, mMTC, uRLC, NB-IoT, Edge & Fog Computing, AI, ML, Deep Learning, Network Slicing / SDN / Network Virtualization etc

Selected accepted papers will be published in peer reviewed journal.

**Please contact: Dr M H Kori, iici-20 coordinator, at mhkori@gmail.com, iici20@gmail.com**

# 12th International Radar Symposium India 2019 (IRSI-19)

**10-14 Dec 2019 | Venue : NIMHANS Convention Centre, Bangalore INDIA**

**irsi@radarindia.com ww.radarindia.com**

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## Welcome to 12th International Radar Symposium India 2019 (IRSI-19) 10-14 Dec 2019

The International Radar Symposium India 2019 (IRSI-19 the 12th in the series, being jointly organized by IEEE Bangalore Section, IET Bangalore Network, IETE Bangalore Centre and Society of Electronic Engineers (SEE), co-sponsored by Bharat Electronics (BEL), Defence Research & Development Organisation (DRDO), Hindustan Aeronautics Ltd (HAL) and Indian Space Research Organisation (ISRO) is scheduled for 10-14 Dec 2019. First IRSI was conducted in 1983 and was revived in 1999 as a biennial series.

The response and success of the previous events, which set several benchmarks, are remembered by all participants. IRSI has grown from strength to strength over the years and the current edition is poised to scale new heights with enhanced international participation. The large scale Radar India Exhibitions with provision for more than 100 exhibition stalls will be an added attraction. Live Demos are also being organised.

## IRSI-19 Call for Papers:

Original contributions, based on theoretical /experimental work, are solicited from Scientists / Engineers / Academicians / Users working in radar and related broad areas such as:-

- Radar Systems
- Weather and Atmospheric Radars
- SAR/ISAR Imaging Radars
- Radar Receivers / MICs / MMICs
- Guidance and Navigational Aids
- RCS/Stealth / Anti-Stealth Technologies
- Tracking and Instrumentation Radar
- Antenna Arrays, Active / Passive
- Thermal Management & Packaging Issues
- Ground Penetration Radar techniques
- Foliage Penetration Radar Techniques etc
- MEMS & Nano Technology in Radar Applications
- Target Recognition
- Antenna Elements
- Ultrawideb and Techniques
- RDP and Data Fusion
- Terahertz Technologies
- Millimetric Radars
- Digital Array Radars
- Radar Signal Processing
- Radar Displays
- Radar ECM/ECCM
- New Materials in Radar
- Radar Transmitters and MPMs

## IMPORTANT DATES

| | |
|---|---|
| Last Date to submit Abstract | 30th April 2019 |
| Last Date for Full Paper Submission | 30th August 2019 |
| Final Acceptance Notification | 30th Sept 2019 |
| Presenting Author Registration | 30th October 2019 |
| Last Date to receive advertisements | 20th Nov 2019 |
| Tutorials | 10- 11th Dec 2019 |
| Symposium | 12-14 Dec 2019 |

## Radar India Exhibition-2019

**For Stall layout Plan and availability :-**
**Visit www.radarindia.com &**
**Mail query to irsi@radarindia.com**

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