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# SAMVAAD

# NEWSLETTER

COMPENDIUM OF THE SAMVAAD-RESEARCH TALK SERIES AT IIIT BANGALORE



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## A note from Dean (R&D):

Samvaad is an initiative started in January 2018, to create a platform and enable a dialogue among the different research initiatives going on at IIIT Bangalore. Although IIIT Bangalore as a whole is a small institution, it boasts of a rich diversity of research expertise. All faculty members, regardless of the nature of courses they offer, have a PhD at the minimum, and pursue an active agenda.

Samvaad features a public talk by one faculty member every week, introducing the ideas and questions that they are pursuing as part of their research. This edition of the newsletter features abstracts and links to Samvaad talks that were presented in the Spring semester of 2018.

The objective of Samvaad is to enable cross-fertilization of ideas, and develop strategic research collaborations between members of the faculty, as well as with interested external partners.

We hope that you will find the talk details interesting, and our hope is that they will potentially enable new path-breaking research directions as well as social impact.

**Prof. Srinath Srinivasa, Dean (R&D)**

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## January 8, 2018: “Inclusion and Technology Designs: Reflecting on ICT & Development (ICTD) Efforts in India

Prof. Amit Prakash, IIIT Bangalore, Ashish Kumar Srivastava, M.Sc. (Digital Society), 2nd year, IIIT Bangalore, Rajesh Hanbal, PhD candidate in the ITS area, IIIT Bangalore, Supriya Dey and Vidhya Y, Co-Founders, Vision Empower Trust (incubating at IIIT Bangalore Innovation Centre)

**Abstract:** In this session, we will touch upon two key aspects of the Indian state's response to the issues currently plaguing [most of] its citizens: 'inclusion' and 'ICTs/digital technologies'. Inclusion has been used quite often in the last few years in guiding our aspirations as a nation - the 12th (and, the last) Five-Year Plan had a focus on faster, sustainable and more inclusive growth while the present Union Government has adopted sabka saath, sabka vikas (collective efforts, inclusive growth) as its governance mantra. Similarly, flagship programmes such as Digital India (and, the earlier National E-Governance Plan), look up to ICTs as critical in transforming the country's development landscape.

We draw upon ongoing and completed research projects at IIIT Bangalore's Centre for IT and Public Policy (CITAPP) and E-Health Research Centre (EHRC) in the broad area of ICT and Development (ICTD) and concerning the sectors of health & nutrition, education, livelihoods and food security to provide a commentary on existing technology design approaches and their implications for inclusion of a diverse range of people and social groups. Our findings and conclusions point towards a need for greater inclusion in the technology design process if the chances of ICTs contributing to inclusive growth have to improve.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=amit-prakash](https://www.iiitb.ac.in/faculty_page.php?name=amit-prakash)

### For video:

<https://www.youtube.com/watch?v=NOwMuNt5dU8>



## January 15, 2018 “Geometry, Topology and Computing”

Prof. Amit Chattopadhyay

**Abstract:** In this samvaad session, I will introduce three of my current research topics: (i) Certified Geometric Computing - A newly emerging branch of computing science where the main goal is not only numerical accuracy, but above all the geometric and topological correctness of the output, (ii) Topological Data Analysis - Developing/Applying tools in/from computational topology for scientific data analysis and (iii) Fiber Surfaces - Generalising isosurfaces for bivariate data. We'll highlight some of the important research challenges and applications in this area.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=amitchattopadhyay](https://www.iiitb.ac.in/faculty_page.php?name=amitchattopadhyay)

### For video:

<https://www.youtube.com/watch?v=1n7mSE6Aha0>



## January 22, 2018: “The World of Secure Multi-Party Computation (SMPC)”

Prof. Ashish Choudhury

**Abstract:** Computing on Private Data (a.k.a secure multi-party computation) is the Holy Grail problem in secure distributed computing. Informally, it allows a set of mutually distrusting parties with private inputs to carry out any joint computation of their inputs, by keeping their inputs as private as possible. In a nut-shell, an SMPC protocol guarantees that whatever can be securely computed in the presence of a trusted third party, the same can be done in a distributed fashion, even in the absence of any trusted entity. Due to its central importance and powerful abstraction, this problem is unarguably one of the widely studied problems, both in the cryptographic community as well as in the distributed computing community. The aim of this lecture is to give an informal introduction to this area and high level overview of some of my recent works in this area.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=ashish-choudhury](https://www.iiitb.ac.in/faculty_page.php?name=ashish-choudhury)

### For video:

[https://www.youtube.com/watch?v=KtU00k\\_bfes](https://www.youtube.com/watch?v=KtU00k_bfes)



## January 29, 2018: “Investigations to Enhance on Linux Kernel's Deterministic Behavior”

Prof. B. Thangaraju

**Abstract:** The Linux kernel works on everything from wristwatches and mobile phones to mainframes along with all the peripherals imaginable for each platform. There has been a considerable interest to do research on Linux kernel from both academic institutions and companies. The reason for this could be the open source code, support for a great number of processor architectures, a rich set of developed device drivers and the existence of billions of applications and open source tools like open stack, docker, chef etc., running on it.

An operating system is an environment that enables users to execute their programs on the system hardware. A Kernel is a core part of an operating system and its main subsystems are process management, file management, memory management and network management. A kernel that groups all these subsystems together in a single file is called a monolithic kernel. Most GPOSs like Linux and Windows are based on this type of kernel and are designed to maximize throughput and provide fair share of system resources in a multi-user and multi-process environment.

The default time-sharing kernel in GPOS is not appropriate for real time systems. For example a 'Hard Real Time Fatal' system like car Anti-lock Braking System (ABS), a flight control system, or a nuclear power plant control system needs to complete the execution of critical tasks within a specific time period. If the system misses the deadline, the results will be catastrophic. The kernel should be predictable and should have deterministic behavior. A system is deterministic if, for each possible state and each set of inputs, a unique set of outputs and the next state of the system can be determined. The sources of non-determinism in Linux kernel are monolithic kernel design, scheduling mechanism, virtual memory management, system V IPC and ISR design.

We can achieve the deterministic behavior of Linux kernel with the help of dynamic resource allocation, efficient design to achieve required interrupt latency, smaller kernel footprint with less overhead, appropriate synchronization mechanisms, efficient usage of RT scheduling mechanism, RT signals, HRT, strip to keep smaller executables, memory locking and light weight IPC. Also, Linux kernel can be highly configurable and many kernel features like KML, LTT, PREEMPT\_RT, RTAI are available outside the mainline kernel.

The core objective of the research works is to enhance deterministic behavior of Linux kernel which will help the flexibility and support for development and testing of applications in Embedded and Real time Systems.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=thangaraju](https://www.iiitb.ac.in/faculty_page.php?name=thangaraju)

### For video:

<https://www.youtube.com/watch?v=im0fQBWuKM4>



## February 5, 2018: “Quantum Computing - An Introduction from a novice in the field”

Prof. K. V. Dinesha

**Abstract:** The emerging field of quantum computing presents a few unique technical and business challenges. This talk is presented as a software engineer's view of quantum computing and its business potential. We shall look at the underlying philosophy, principles, current status and broad future scope of the field. Interestingly, one of the paradoxes in physics, suggested by Einstein - EPR paradox is foundation for quantum computing!

This talk presents a gentle introduction to the field of Quantum Computing and tries to answer the question as to why companies like IBM, HP, Google, Accenture, Intel, Huawei, Hitachi, Honeywell, Microsoft Research, etc. are making significant investments in Quantum Computing.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=kvdinesha](https://www.iiitb.ac.in/faculty_page.php?name=kvdinesha)





February 12, 2018:  
“Dynamics & soft matter:  
from bubble oscillators to  
living systems”

Prof. B. Ashok

**Abstract:** In this talk, we will briefly review some problems in soft matter physics and nonlinear dynamics that have been the focus of some of our recent work. We will restrict ourselves to a more detailed discussion of one or two topics in the micrometer & nanometer length scales, starting with the problem of predicting the behaviour of a charged gas bubble undergoing radial, nonlinear oscillations under ultrasonic acoustic forcing, in a liquid. We find this system to exhibit a period-doubling route to chaos and the presence of charge has the effect of advancing these bifurcations. Charge and pressure thresholds are found, and the bubble's ambient radius influences thresholds and dynamics, as does the driving frequency.

We will additionally touch upon some other research problems we have been working on in recent years (e.g., explaining the dynamics of nanotubule formation by mechanical manipulation of vesicles -- this has practical implications in making nanofluid devices and drug-delivery systems). We will also mention our work on other diverse living systems which are underway).

**About the Speaker:**

[https://www.iitb.ac.in/faculty\\_page.php?name=balakrishnanashok](https://www.iitb.ac.in/faculty_page.php?name=balakrishnanashok)

**For video:**

<https://www.youtube.com/watch?v=0qxs5Jr7XUQ>



February 19, 2018:  
“Technology, Politics and  
Practice”

Prof. Bidisha Chaudhuri

**Abstract:** Is Aadhaar a technology of surveillance? Are information communication technologies inherently more democratic? Are data merely tools for better decision-making or our identities now reduced to the sum total of the data we generate? These are questions that are equally debated in popular press and academic circles. These questions lead us to ask what is the relationship between technology and politics and how may we analyse this relationship?

In 1980, in his seminal essay, “Do Artifacts have Politics”, political theorist Langdon Winner argued that technical things, at least in modern material culture, embody politics. This means technologies either allude to a certain forms of power or they inherently represent specific power arrangements. It is this relationship between technology and politics that I will explore in my talk. In doing so, I will look at technologies as enacted in situated practices - what do people do with technological artefacts in their everyday lives and to what extent are their practices determined by the technical and functional structures of the artifact/system? To elaborate on this point, I will present cases from my research that range from weather information system for farmers in West Bengal to Aadhaar related practices in Common Services Centres in Rajasthan. I examine how technological artifacts and politics shape each other in these cases.

**About the Speaker:**

[https://www.iitb.ac.in/faculty\\_page.php?name=bidishachaudhuri](https://www.iitb.ac.in/faculty_page.php?name=bidishachaudhuri)

**For video:**

[https://www.youtube.com/watch?v=J7ch9e9tA\\_0](https://www.youtube.com/watch?v=J7ch9e9tA_0)



## February 26, 2018: “Weak Interactions Between Molecules”

Prof. Brijesh Kumar Mishra

**Abstract:** Weak interactions between molecules (such as hydrogen bonds, stacking interactions, cation- $\pi$  interactions, CH- $\pi$  interactions etc.) are ubiquitous in nature. We know that a water molecule forms two to three hydrogen bonds at room temperature. These weak interactions play an important role in the packing of crystals containing aromatic moieties, the stabilisation of large three-dimensional helical structures of DNA and RNA, and in molecular recognition processes. The nature and origin of these interactions in various chemical systems will be presented.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=brijeshkumarmishra](https://www.iiitb.ac.in/faculty_page.php?name=brijeshkumarmishra)



## March 12, 2018: “Information Convergence – Need, Applications, and Strategies”

Prof. Chandrashekar  
Ramanathan

**Abstract:** The revolution of mobile phones made media convergence possible. Today we don't need separate devices for talking on the phone, listening to music, watching videos, surfing the internet, reading/sending emails. These devices are not just lumped together (“passive convergence”) into a single device but they actually form a cohesive integrated unit (“active convergence”). Information convergence is a similar concept that is focused on interoperability of information scattered across multiple dimensions and multiple sources and destinations. What do we mean by interoperability? Interoperability could be defined in terms of meeting the information needs of various software applications across the software ecosystem. The ecosystem could be comprised of large enterprises, the government, and so on. A specific example of information convergence at the consumer end is the ability to access the bank account information for the purpose of filing tax returns. Another example in the government could be the ability of healthcare department to have visibility to those who are below the poverty line (BPL), which is maintained by the welfare department. A third example in the context of a large enterprise is to find out how the organization's annual earnings information typically stored in highly guarded Excel spreadsheets is shared with the public in the corporate portal?

Challenges in Information convergence span across across a wide range of technologies and research areas including information modeling, data integration, natural language computing, image processing, and so on. In this talk, I will discuss the notion of active and passive convergence in the context of information management and present a whole range of strategies and their limitations for overcoming the challenges in this ever-relevant field.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=chandrashekarramanathan](https://www.iiitb.ac.in/faculty_page.php?name=chandrashekarramanathan)

### For video:

<https://www.youtube.com/watch?v=whfV5urZvOo>





**March 19, 2018:**  
“A calibration technique for current-steering digital-to-analog converters” and “The difficulty of knowing what is ethical”

Prof. Chetan Parikh

**Abstract:** As a deep research talk on electronic circuits will ensure that almost no one will turn up (and those who do will fall asleep!), my presentation will very quickly outline an electronics research paper, and then will have a longer discussion on an aspect of Ethics (on which I teach a course)

1. Digital-to-analog converters (DACs) are used in a large number of electronic systems (including smartphones, set-top boxes, biomedical instrumentation systems, communication systems, and so on). Making them faster and more accurate is a continuing quest and challenge. As they are made more accurate, errors due to variations in temperature, during actual operation of the DAC, need to be controlled in real-time. This is achieved by 'calibration' of the circuit. The talk will describe a novel method of calibrating a current-steering DAC, and is based on work that won the Best Paper award at VDAT-2017.

2. Ethics has undergone a significant transition since the 18th century Age of Reason in Europe, which overthrew many previously held notions and principles of determining what is ethical, and replaced them with new ones. In this discussion, we will look at some principles of ethics of Aristotle, Thomas Aquinas and Immanuel Kant, and then look at a controversial and perhaps disturbing view of Alasdair MacIntyre on ethics (or the lack thereof) in the modern world.

**About the Speaker:**

[https://www.iitb.ac.in/faculty\\_page.php?name=chetan-parikh](https://www.iitb.ac.in/faculty_page.php?name=chetan-parikh)

**For video:**

<https://www.youtube.com/watch?v=LZUKHhwtpFU>



**March 26, 2018:** “Power Saving in Next Generation Base Station and Network Slicing in 5G”

Prof. Debabrata Das

**Abstract:** There are acute shortage of power in India and many parts of the world. In India we have around 800,000 base stations, 70% of it does not get 12 hours of conventional power (rest of the time run by diesel generator). The talk presents ‘Proposed Power Saving Medium Access Control Protocol for LTE-Advanced Base Station’. The talk will also present on ‘Possible challenges and solution for Access of Massive IoT devices in present base station’.

The present Internet (optical backbone) and last mile (wireless 4G-Advanced and beyond networks) have multiple challenges to support 5G requirements. This talk will cover the present bottleneck in existing Internet and one of the strong candidatures to support 5G, i.e., Network Slicing. It will cover the concept of Software Defined Network (SDN) and Network Function Virtualization (NFV) leading to Network slicing.

**About the Speaker:**

[https://www.iitb.ac.in/faculty\\_page.php?name=debabrata-das](https://www.iitb.ac.in/faculty_page.php?name=debabrata-das)

**For video:**

<https://www.youtube.com/watch?v=7lwxiDnAPXU>



## April 9, 2018: "Large Scale Railway Systems", "Decimal FP ALU" and "Robotics"

Prof. G N Srinivasa Prasanna

**Abstract:** The Indian Railway system is the world's largest system, if the complexity of the services, and total load, is taken into account. This project aims at various optimization problems on timetabling for Indian Railways. As such the task involved includes a large amount of big data handling, and large scale mixed integer-continuous optimization. Since the complete problem is gigantic, a sample route between two stations was given to IIIT-B to analyse the existing timetable, and schedule new trains. Our results based on mixed integer linear programming formulations, have been able to double throughput, while not increasing delay significantly. Our methods are able to analyze the global correctness of a schedule, over global correlated variations in arrival times, without making assumptions of probability distributions of time delays. The data representation used in this work couples information theory, optimization, and the relational algebra of database systems.

We are designing a decimal floating point ALU operating directly on decimal numbers. Financial transaction processing is one of the major uses of computers. Typically, these transactions involve many decimal multiplications, such as multiplying the cost per minute or the tax rate per charge. These decimal calculations must be rounded to a decimal radix point. Decimal calculations cannot be directly implemented with binary floating point because fractions such as 0.1 cannot be represented exactly. Hence rounding error becomes a bottleneck in the design of such financial systems. Thus this further helps the banking systems to greatly reduce the precision and round off errors to a great extent, paving a way for them to prevent incurring huge losses due to the aforementioned problems. Extensions of this work include novel architectures for machine learning. We have made some advances in electromechanical actuators for robotics, by introducing a magnetic potential energy function in various configurations of a mechanism. A simple example of our ideas is the game of magnetic carrom (Magrom). It enhances the standard carrom game, with magnetism, making pieces attract/repel each other, and swinging by or getting trapped at different places on the board. This creates a delightful game, with new and unsolved problems in electromagnetics, generalizations of the Ratnakara-Vedanta-Desikar-Hamilton Journey (also called the TSP), machine learning, ...

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=gnsrinivasaprasanna](https://www.iiitb.ac.in/faculty_page.php?name=gnsrinivasaprasanna)

### For video:

<https://www.youtube.com/watch?v=P9A7vQK5hPY>



## April 16, 2018: "Research@Multimodal Perception Lab"

by Prof. Dinesh Babu Jayagopi

**Abstract:** In this talk, we will give an overview of applications of interest to us, and detail two pieces of specific works.

### 1. Automatic skill assessment and feedback e.g. communication skill, dancing skill and skill in sports.

While action recognition and pose recognition are mature vision problems, assessing the skill-level or expertise of a performer and quantifying their quality of actions is an emerging problem. We will showcase mainly our work on assessing communication skill in face-to-face interviews, asynchronous interviews (no interviewer), along with written interviews and essays.

### 2. Visual Recognition, Tracking, Surveillance

For skill assessment and other systems we want to build, an important component is the visual recognition and tracking module, that can detect people and objects, track them, estimate body joint locations, estimate face pose, facial action units, quantify actions and activity, and detect abnormal activities. We will show an overview and talk about activity recognition.

### 3. Traffic Analytics, Human Robot Interaction, Augmented Reality

We will show our progress so far and discuss some challenges. Traffic Analytics: Vehicle counting, Number Plate Recognition, Rash driving Human Robot Interaction: Towards language learning in the wild Augmented Reality: Jewel Augmentation.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=dineshbajayagopi](https://www.iiitb.ac.in/faculty_page.php?name=dineshbajayagopi)

### For video:

<https://www.youtube.com/watch?v=SbxTjVeSKtQ>





## April 23, 2018: “Seeing Invisibility”

by Prof. Janaki Srinivasan

**Abstract:** Technology for development has a long history, from railroads to mobile phones. And if there is one thing we can learn from this history, much depends on the framing of the problem. How a technology is used, whether it is used, who uses it, what impacts it has, all these hinge on that first step. In this talk, I will discuss how the framing of problems has gone on to shape implications in several ICTD initiatives. Specifically, the focus on certain actors and assumed behaviours has ensured that others stay invisible in the framing process. I will use diverse examples from my work, and that of my students, on financial inclusion, identity systems and e-waste management, to trace the implications of this invisibility.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=janakisrinivasan](https://www.iiitb.ac.in/faculty_page.php?name=janakisrinivasan)

### For video:

<https://youtu.be/D2IVrADqrxQ>



## April 30, 2018: “Using Spatial Locality for Visual Analytics”

by Prof. Jaya Sreevalsan Nair

**Abstract:** Data visualization is a way of finding the unknown in new datasets. In recent times, visualization has given way to visual analytics, where it becomes one of the several methods used in data science workflows for making sense of data. Visualization has its physical/structural limitations in terms of screen space, human abilities, and computational capabilities. Given this, the research community focuses on making sense of data by adopting appropriate paradigms, e.g. levels of detail, visual info-seeking mantra, etc. and innovating on new methodologies for challenging scenarios. At the Graphics-Visualization-Computing Lab, we have occasionally seen the need for going beyond the visualization of the data in its raw form. In this talk, I will talk of how we exploit spatial locality for our works on analysis of LiDAR point clouds and small world networks. The information from spatial locality allows us to refine our analysis of complex/rich datasets. We have chosen to use tensorial (specifically, second-order tensors) and matrix representation to encapsulate the spatial locality information. The talk will focus on the challenges and some solutions we have proposed towards this goal.

### About the Speaker:

[https://www.iiitb.ac.in/faculty\\_page.php?name=jayasreevalsannair](https://www.iiitb.ac.in/faculty_page.php?name=jayasreevalsannair)

### For video:

<https://www.youtube.com/watch?v=LRXm5e7VQak>

