A Note from Dean (R&D):

Welcome to the fourth edition of the Samvaad newsletter. This edition presents the last set of talks that concluded the first series of Samvaad. This edition featured 9 talks by: Profs. G. Srinivasaraghavan, S. Rajagopalan, Preeti Mudliar, Vittal Prabhu, Srinivas Vivek, Priyanka Das, Vinod Reddy, Shrisha Rao and Aarti Yardi.

The subject of these talks span across the following research domains: Computer Science, Data Science, Networking & Communication, and Information Technology & Society. This edition of the newsletter exposes abstracts and video links to all the nine talks of the last leg of initial series of Samvaad.

These talks presents a wide range of topics including homomorphis encryption, scheduling algorithms, machine learning, antenna design, multi-agent systems and application case studies. The Research Samvaad initiative started in January 2018, continues to bring together researchers across domains in the institution as well as from outside the institution. We continue to hear about new collaborations and joint project proposals coming out of the participation in Samvaad.

Samvaad talks have already elicited interest from several quarters outside the institute. The next Samvaad series will begin from the new academic year starting from August 2019. This series will feature several changes and enhancements in the underlying model, and presents the talk series organised into a set of thematic areas. We hope to keep this momentum going and enable cross-fertilization of ideas and develop strategic research collaborations.

We hope that you will find the talk details interesting, and our

expectations are that they will potentially enable new path-breaking research directions as well as the social impact.

"Frontiers in Machine Learning Today"
by Professor G Srinivasaraghavan on January 7, 2019

Abstract:

The talk will be a broad sweep --- a survey of sorts --- of some of my pet topics at the frontiers of Machine Learning today, interspersed with overviews of my own related work with my students. The talk will start with a quick overview of some of the central contemporary open issues in ML followed by a deeper dive into three specific topics that I am particularly interested in:

- Is intelligence essentially Bayesian -- some arguments and experiments along with recent results
- Frontiers in Reinforcement Learning --- Bayesian Reinforcement Learning, Multi-Agent Reinforcement Learning, and Safety in Reinforcement Learning

Speaker Bio:

Prof. Raghavan's current research focus is in Machine Learning and AI --- both the applications and the theory. He is particularly interested in the theoretical underpinnings of machine learning including computational learning theory. His interests cut across a range of subdomains within Machine Learning - Deep Learning, Bayesian Methods in Machine Learning, Optimization methods for Machine Learning, Reinforcement Learning, Explainable AI and so on. He earlier had an extended stint in the software industry --- at TISL (the earlier avatar of IBM India), Infosys Technologies, Bangalore, a startup Peritus Software and Aztecsoft Ltd. where he was the CTO. He was engaged in independent consulting for a few years after his stint at Aztecsoft.

- Knowledge vs Learning --- attempts to integrate existing 'knowledge' with learning something new, leading to forays into transfer learning and multitask learning.

Prof. Raghavan has been associated with IIIT-B from 2012.

He has a B.Tech (Mech) from IIT, Madras and a PhD (CS) from IIT Kanpur and later did a Post-Doc stint at the Institute of Mathematical Sciences (Matscience), Chennai before moving into industry.

Professor S Rajagopalan gave a Samvaad Talk on January 21, 2019

Abstract:

In this talk, we present research on public transportation in Bangalore, with a focus on the public bus transport run by BMTC.

For over two decades, BMTC has provided services to urban, suburban, and some rural parts of Bangalore. It was created as an independent corporation on 15th August, 1997, after its separation from Karnataka State Road Transport Corporation (KSRTC). Since then, it has expanded, with a fleet strength of close to 7,000 buses now operated through ten

Speaker Bio:

Dr. S. Rajagopalan received his B.Tech degree from IIT Delhi , PGDM from IIM Bangalore and Ph.D from IIT Kanpur.

He was the Chief Executive Officer of the Karnataka State Council for Science and Technology from 1982 to 1993 and was involved in managing innovations that addressed the problems of Karnataka.
In 1993, he along with a few colleagues founded Technology Informatics Design Endeavour (TIDE) a not for profit development society which focused on

'Traffic and Transit Management Centers' (TTMCs). BMTC has an average ridership of around 4.5 million people every day, which is almost equivalent to the population of Norway.

It is evident that given the scale and the complexity of operations, BMTC faces significant challenges to ensure their services are affordable, accessible, and more efficient. Their challenges are compounded by ever-increasing demand, as Bangalore's population continues to grow rapidly. These challenges are immediate, and they must be responded to now. Our research, therefore, has to necessarily be applicable in practice. It is with this focus and understanding that we present research on different themes that tackle critical challenges faced by BMTC, including congestion, bus-bunching and estimation of arrival times. The research reported here were done by post graduate and doctoral programme students of IIITB mostly on a pro bono basis. We place on record our deepest appreciation of the work done.

developing and disseminating technologies that are economically attractive, environmentally sustainable and socially acceptable in rural areas of Karnataka. He was its Chairman till 2007. For his work in TIDE, he was awarded the Ashoka Fellow (1994), Fellow of the Salzburg Seminar (1999), one of the four finalists of Social Entrepreneur of India award (2006) and one of the 50 pioneers of India chosen by India Today Magazine (2008). TIDE was awarded the International Green Oscar, the Ashden Award in 2008.

Dr Rajagopalan has been working in the area of Geographical Information Systems since 1989 and founded a Company Spatial Data Private Limited in 1999. This Company was pioneer in developing user-friendly digital maps of Indian Cities under the Brand Name Mapcue. Dr. Rajagopalan areas of interest includes innovation dissemination, economics of innovations, Geographical Information systems , and Economics of Information Technologies. He also heads the IIITB Innovation Centre, which aims at incubating and promoting innovations in the area of Information and Communication Technologies.

Find the Video here:
https://youtu.be/KohRhRe57Q8

"WiFi in the Wild – Learnings from non-users of an infrastructure"
by Prof. Preeti Mudliar on January 28, 2019

Abstract:

In telecom policy imaginations that seek to bridge India's digital divide, public WiFi hotspots are a particular favourite to ensure last mile Internet connectivity in rural areas. As infrastructure, WiFi networks are thought to privilege democratic notions of freedom and connectivity by rendering space salient networked areas, that only require users to have a WiFi-enabled device to get online. However, the kind of spaces that WiFi networks occupy are not always accessible by women even though they are ostensibly public in nature. Social norms that restrict and confine women's mobilities to certain sanctioned areas do not allow their Internet and digital literacies to be visible in the same way as men who are easily recognized as active and often default users of technology and the Internet. The invisibility of women thus struggles to create a presence as desirable subjects of the Internet and related infrastructure deployments. Drawing on researcher reflexivity, observations, and interviews around WiFi access and use in a rural

Speakers' Bio:

Preeti Mudliar's research interests centre around using ethnographic methods and analyses to study social contexts around technology access and use. She is particularly interested in the ways in which gender constitutes the lived experiences of people and finds herself researching and writing about gender both intentionally and serendipitously. Her work has been published in human-computer interaction (HCI) venues such as CHI and CSCW. She holds a Bachelor's and a Master's degrees in Commerce and Communication Studies from the University of Pune and a PhD in Communication Studies from the University of Texas, Austin. Currently, she is assistant professor at IIIT Bangalore.

Find the Video here:

https://youtu.be/uWlzd6pIvMo

community in Rajasthan, this talk will reflect on how recognizing subjectivities of use and non-use can contribute towards more inclusive user design.

"Modeling and Analysis of Distributed Control Algorithms A Science-Base for Smart Manufacturing & Service Systems" by Prof. Vittal Prabhu on February 4, 2019

Abstract:

This presentation will provide an overview of a methodology for controlling discrete-event systems by formulating these problems as continuous variable feedback control problems resulting in a unified mathematical and computational framework. The science-base of this work includes theories of discontinuous differential equations, Lyapunov stability, adaptive control, and nonlinear control theory, which can be used to prove convergence properties and to characterize emergent behavior of the resulting control systems. This has resulted in scalable parallel/distributed algorithms for a variety of applications including Just-in-Time

Speakers' Bio:

Vittal Prabhu obtained his BE in Instrumention Technology from Bangalore University, MS degrees in Manufacturing Engineering and Mechanical engineering, and PhD in Mechanical engineering from University of Wisconsin-Madison. He is a Professor in Marcus department of industrial and manufacturing engineering at Penn State University.

At Penn State, he also serves as the Director of Service Enterprise Engineering Initiative SEE360, and Chair of Consortium for Digital Enterprises.

He is a Fellow of IISE, and currently in

production scheduling, maintenance scheduling, batch sequencing, inventory control, transportation, and distributed supply chains. Computational complexity of these control theoretic algorithms typically increases linearly with the number of events to be controlled, and worst case is of the order $O(n^2)$.

We will discuss some of the salient features of this approach along with applications. In the manufacturing context, we will discuss how the approach can be used for simultaneously controlling production, capacity, maintenance, and energy. In the context of services, we will discuss how the approach can be used for just-in-time delivery for green fleets as well as crowdsourced delivery services. In the later part of this presentation we will present some of our recent and ongoing efforts addressing ways to smarten service systems using techniques from operations research in our SEE 360 initiative at Penn State. The presentation will conclude with some thoughts on integrating OR and AI techniques with this feedback control problem as well integrating IIoT sensors for improving fidelity.

"Fixed-Point Arithmetic in Somewhat Homomorphic Encryption Schemes"
by Prof. Srinivas Vivek on February 11, 2019

India on a sabbatical as a Fulbright-Nehru Fellow.

Find the Video here:
https://youtu.be/kPUb_WpFJ1k

Abstract:

Homomorphic encryption schemes allow users to meaningfully manipulate ciphertexts "without revealing" any information about the underlying plaintexts. In this talk, we investigate issues related to performing fixed-point arithmetic homomorphically using existing fully/somewhat homomorphic encryption (FHE/SHE) schemes. We analyse and compare encoding schemes to encode fractional numbers in the native algebraic plaintext space of an SHE scheme and derive bounds on the parameters to be used by an SHE scheme. We will see how a particular choice of encoding can significantly affect the practical performance. As an application of these bounds, we investigate homomorphic image processing and also perform an implementation using the HElib homomorphic encryption library.

Speakers' Bio:

Dr. Srinivas Vivek is currently an Assistant Professor at IIIT Bangalore. Previously, he was a postdoctoral researcher in the Cryptography group at the University of Bristol, UK. He has obtained his Doctoral, Masters, and Bachelor's degrees from the University of Luxembourg (Luxembourg), IISc, Bangalore, and NITK, Surathkal, respectively. His research interests are in the design, analysis and implementation of (1) countermeasures against side-channel attacks, and (2) homomorphic encryption schemes.

Find the Video here:

https://youtu.be/fHCuMRrlWds

"Impact of Channel State Information Uncertainty on the Performance of Cooperative Cognitive Radio Networks"
by Prof. Priyanka Das on February 18, 2019

Abstract:

Frequency spectrum is always scarce for wireless communications. However, the fact is that frequency spectrum is always underutilized by conventional spectrum management approaches. As the cognitive radio (CR) enables the unlicensed secondary users (SUs) to use the licensed frequency bands of the primary users (PUs) without causing harmful interference, it is widely considered as one of the promising solutions to improve spectrum utilization. In the underlay mode of CR, a SU can simultaneously transmit on the same frequency band as a higher priority PU so long as the interference it causes to the PU must be constrained. These interference constraints severely limit the performance of the SUs.

Cooperative relaying combined with selection exploits spatial diversity technique and helpsto improve the performance of interference-constrained SUs. In it, one among the available relays is selected for every instantaneous channel

Speakers' Bio:

Priyanka Das received her B.Sc. degree in Physics from the University of Burdwan, West Bengal in 2006. Thereafter, she obtained the B.Tech. degree in Radio Physics and Electronics from the University of Calcutta, West Bengal in 2009, and M.Tech. degree in Digital Signal Processing from the Indian Institute of Technology, Guwahati in 2011. She obtained her Ph.D. degree from the Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore in 2018. From 2011 to 2012, she was with the Dell Research and Development Center, Bangalore, and as an intern in Nokia Siemens Networks, Bangalore, in 2015. She joined IIITB as an assistant professor in October 2018. Her research interests are primarily in the areas of design and performance analysis of the next generation wireless communication systems.

Find the Video here:

power gains of the various links that include the secondary communication links as well as the interference links between the secondary transmitters and the primary receiver. The mapping between the channel power gains and the selected relay is determined by the relay selection rule employed by the secondary network.

To satisfy the interference constraint, secondary transmitters need to know the instantaneous channel power gains of the interference links. The estimated channel gains can be noisy or outdated due to channel estimation error or feedback delay. This leads tosub-optimal relay selection rule and also causes harmful interference to the primary receiver, which is not acceptable. Moreover, as the number of primary receivers increases, obtaining these channel information in a timely and scalable manner is challenging. We, therefore, proposed a practically-motivated channel state information (CSI) model for an underlay CR network with multiple primary receivers and analyzed its impact, which will be discussed in detail in the talk.

https://www.youtube.com/watch?v=IN3oVDvBFWk

"Beyond RADAR design limits"
by Prof. Vinod Reddy on Monday, February 25, 2019

Abstract:

Radar has been a buzzword for over a century now. What makes this topic so important even today? To answer this question, the talk starts with some applications and working principle of Radar. We then look at some Radar design limits and the existing trade-offs. We discuss some cases where these trade-offs are smartly circumvented. One other design limit that bothers research community, is the space debris tracking problem. This case study will be presented in the talk with a discussion on existing techniques and their limitations.

Speakers' Bio:

Vinod received his Ph.D. degree from Nanyang Technological University (NTU), Singapore, in 2013. His research interests include signal processing for acoustic, biomedical, wireless and RADAR applications. Prior to joining IIITB in October 2018, Vinod worked with Samsung Research Institute and GE Global Research as Signal Processing Engineer on biomedical Ultrasound and Oil & Gas applications for 3.5 years. He worked as a post- doctoral Research Fellow at Infinitus Center, NTU, on phased-array RADAR from 2014 to 2015. Prior to his Ph.D., he worked with Accord Software and Systems Pvt. Ltd. developing signal processing algorithms for navigation receivers from 2003-2007.

Find the Video here:

https://youtu.be/2ePWIvPQ3w0

"Agent-Based Models and Energy Efficiency Studies"
by Prof. Shrisha Rao on March 18, 2019

Abstract:

Agent-based modeling is a technique that allows for the study of emergent properties arising from diverse interactive behaviors in complex social groups. We look at three different uses of agent-based models:

(i) to study taxpayer behavior and related matters in the face of varying tax rates under standard economic theory, wherein the existence of the Laffer curve is verified;

(ii) to gain a better understanding of the effects of egocentric bias on social interactions and individual outcomes, by enriching agents to incorporate the same; and

(iii) to observe the nature of panicked evacuations of crowds of people during fire emergencies.

Energy efficiency is a major issue in computing systems as well as in general, as energy costs are a sizable fragment of

Speakers' Bio:

Shrisha Rao received his Ph.D. in computer science from the University of Iowa, and before that his M.S. in logic and computation from Carnegie Mellon University.

His research interests are in artificial intelligence, agent-based modeling, distributed computing particularly for resource management in complex systems, and bioinformatics and computational biology. He also has interests in energy efficiency, computational sustainability, renewable energy and its use, applied mathematics, and intelligent transportation systems.

Dr. Rao has been a reviewer for many journals/transactions of the IEEE and ACM, and has served as a program committee member and keynote speaker for several international conferences. He is also a regular reviewer, with over 80 published reviews, for the ACM Computing Reviews journal (computingreviews.com), which

the lifetime costs of most systems (including computing systems). Energy efficiency is also desirable on account of the untoward effects of energy use on the environment. We look at two aspects of energy efficiency:

(i) a classification of certain types of energy-efficient scheduling problems on simplified general machines as being tractable (solvable in polynomial time) or NP-hard, with approximation algorithms given for some of the intractable ones; and

(ii) using results from optimal control theory, specifically Pontryagin's Minimum Principle, for deriving a feasible time-varying processor speed law in computing systems, which can be used to solve the problem of minimizing energy expenditure given applicable constraints (such as battery discharge or temperature rise).

reviews a sample of the latest publications related to the computing sciences.

Dr. Rao is a contributing member of the LITD 14 "Software and System Engineering" sectional committee (a national mirror committee of the ISO sub-committees IEC/JTC 1/SC 7 Software and System Engineering, and JTC 1/SC 38 Cloud Computing) of the Bureau of Indian Standards (BIS). He is also a member of the Intelligent Transport Systems Sectional Committee, TED 28, of the BIS.

Dr. Rao is an ACM Distinguished Speaker and a Senior Member of the IEEE. He is also a life member of the American Mathematical Society and the Computer Society of India.

Atharva Anant Deshpande (IMT2015011) and Juhi Singh (IMT2015019) are students in the integrated-MTech program at IIIT Bangalore.

Nanda Kishore Sreenivas, a graduate of NIT Trichy, is a full-stack developer at Oracle in Bangalore.

Dr Sachit Rao obtained his Master's and Ph.D. degrees in Mechanical Engineering from the Ohio State University. His specialization is in the area of Control Systems and Theory with an emphasis on Sliding Mode Control.

He has over 3 years of post-doctoral experience working in the areas of control of electric machines, swarms of dynamic agents, and guidance laws for tactical interceptors. He also has 3 years of industrial experience working for an Indian robotics company. Prior to joining IIIT-B,

he was a faculty in the Aerospace Engineering department of Jain University for a year.

His interests lie in the design and implementation of controllers for robotic manipulators and unmanned systems. He is also interested in using tools from Computer Science in widening the areas of applicability of automatic control.

Find the Video here:

https://www.youtube.com/watch?v=l-b1OXNvWlY

"Problems in classical and modern channel coding theory"
by Dr. Arti D Yardi on March 25, 2019

Abstract:

Channel codes are widely used in satellite communication, wireless mobile communication, internet data packets, and data storage to have a reliable communication over noisy channel. Since the discovery of the very first type of channel codes in 1950's, till today a variety

Speaker Bio:

Dr. Arti D. Yardi is a DST-INSPIRE faculty fellow at IIIT Bangalore since January 2019. She received her M.Tech & PhD degrees from the Department of Electrical Engineering, IIT Bombay in January 2017. She was a post-doctoral researcher in

of channel codes have been designed that are optimal for a given application.

In this talk, I shall begin with a brief introduction to the theory of channel codes along with a discussion of historical development of channel codes from 1950's till today. I shall summarize some basics of cyclic codes, low-density parity-check (LDPC) codes, Turbo codes, and recently designed spatially-coupled codes. I shall then talk about two problems in the classical and modern coding theory; blind reconstruction of classical channel codes and estimating the maximum a posteriori threshold (MAP) threshold for families of LDPC and Turbo codes. In the problem of blind reconstruction of channel codes, the receiver does not have the knowledge of the channel code used at the transmitter and the aim is to identify this unknown code from the received data. Blind reconstruction of channel codes is an important problem in military surveillance applications to identify the channel code used by an adversary. In the second problem, the aim is to estimate the MAP threshold associated tothe given code ensemble. For a given family of code, MAP threshold provides the fundamental limit below which reliable communication is possible. This problem has important applications for designing spatially-coupled codes, which an important class of capacity achieving codes.

Informatics Research Institute of Toulouse, France from May 2017 to January 2019. She was a recipient of the CIMI postdoctoral fellowship given by the University of Toulouse, France. She has also worked as a software and hardware design engineer at Larsen and Toubro, Mumbai from July 2007 to July 2009.

Find the Video here:

https://www.youtube.com/watch?v=1tPMs18LvCw