IEEE CIS Flagship summer school during 16.9.2021 to 18.9.2021 organized by IEEE CIS Kolkata Chapter and hosted online by the Department of Computer and System Sciences, Institute of Science, Visva Bharati University, India

General Chair:

- **Dr. Paramartha Dutta** (Professor, Department of Computer and System Sciences, Visva-Bharati University, India)

Organizing Committee Members:

- **Dr. Tandra Pal (**Professor, Department of Computer Science and Engineering, NIT Durgapur, India (Chair, IEEE Computational Intelligence Society, Kolkata Chapter (R 10))
- **Dr. Kakali Datta (**Assistant Professor, Department of Computer and System Sciences, Visva-Bharati University, India)
- **Dr. Debaditya Barman (**Assistant Professor, Department of Computer and System Sciences, Visva-Bharati University, India)

Attendance: 39 (Registered) + 6 (Invited)

Brief Profile of the Speakers

Prof. Chia-Feng Juang

Time Schedule: 13.00 - 15.00 IST (15.30 – 17.30 CST) on **16.9.2021**

Meeting Link: meet.google.com/nzs-thdf-zgm

Title: Multiobjective Evolutionary Fuzzy Systems: Techniques and Applications

Abstract:

This lecture will introduce the technique of multiobjective evolutionary fuzzy systems (EFSs) that learn fuzzy systems (FSs) through multiobjective evolutionary computation algorithms and its application to learning control of a mobile robot. FSs show the advantage of interpretability in their fuzzy inference rules. In this speech, I will first introduce the basic concept and learning of interpretable FSs, including structure and parameter learning. Because of the tradeoffs between different learning objectives such as high system interpretability and high system accuracy, learning of FSs can be formulated a multiobjective optimization problem. The basic concepts of multiobjective optimization problems and their solutions found through multiobjective evolutionary computation such as ant colony optimization will then be introduced. Next, multiobjective EFSs will be introduced together with its application to learning control of a wall-following mobile robot. The learning technique aims to find a set of non-dominated FSs showing tradeoffs between different objectives. To boost learning efficiency in the robot learning control application, the basic concept of surrogate-assisted evolutionary computation will be introduced. The technique of reinforcement neural fuzzy surrogate-assisted evolutionary computation proposed to improve robot learning efficiency will then be given. Finally, I will introduce the application of the learned wall-following behavior to navigate a real robot in unknown environments.

Bio-sketch:

Chia-Feng Juang received the B.S. and Ph.D. degrees in Control Engineering from the National Chiao Tung University, Hsinchu, Taiwan, in 1993 and 1997, respectively. Since 2001, he has been with the Department of Electrical Engineering, National Chung Hsing University, Taichung, Taiwan, where he has been a Distinguished Professor since 2009. He served as the Chapter Chair of IEEE Computational Intelligence, Taipei Chapter, in 2017-2018, during which the chapter won the Outstanding Chapter Award from IEEE Taipei Session. Dr. Juang has authored or coauthored over 100 journal papers (including over 60 IEEE journal papers), over 10 book chapters, and over 120 conference papers. Five of his highly cited papers have collected over 3300 citations in Google Scholar and 2100 citations in WOS. His current research interests include computational intelligence, intelligent control, computer vision, and evolutionary robots. Dr. Juang received the Outstanding Automatic Control Engineering Award from Chinese Automatic Control Society (CACS), Taiwan, in 2014; the Outstanding Electrical Engineering Professor Award from Chinese Institute of Electrical Engineering, Taiwan, in 2019; and the Outstanding Research Award from Ministry of Science and Technology, Taiwan, in 2021. He was elevated to CACS Fellow in 2016 and IEEE Fellow in 2019. He is a Distinguished Lecture of IEEE Computational Intelligence Society. He was an Associate Editor of the IEEE TRANSACTIONS ON FUZZY SYSTEMS and is the Associate Editor of the IEEE TRANSACTIONS ON CYBERNETICS, the Asian Journal of Control, and the Journal of Information Science and Engineering and an Area Editor of the International Journal of Fuzzy Systems.

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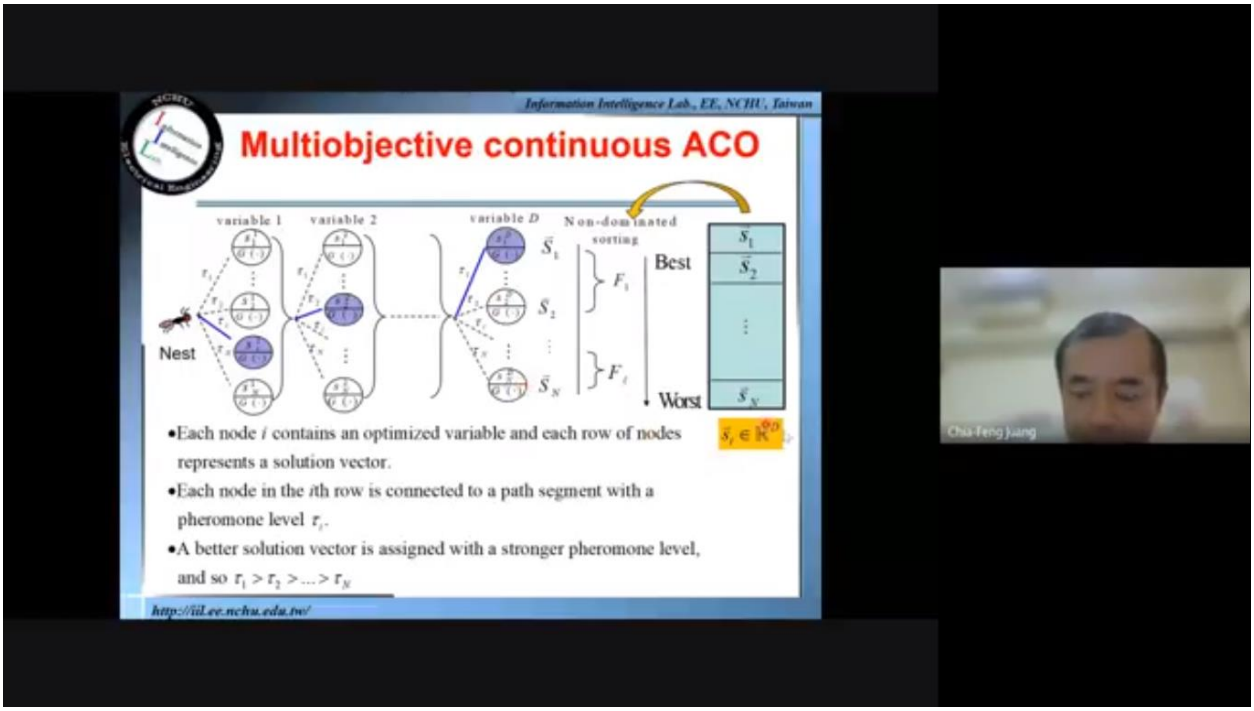

Prof. Kalyanmoy Deb

Time Schedule: 18.30 - 21.30 IST (09.00 – 12.00 EDT) on **16.9.2021**

Meeting Link: meet.google.com/ndq-vran-ghj

Title: Evolution's Niche in Solving Search and Optimization Problems

Abstract:
Most search and optimization problems in practice involve various complexities -- discontinuity, non-differentiability, large dimensions, highly constrained spaces, dynamically changing problems, multiple conflicting objectives, etc. -- which make classical point-based algorithms inadequate. In this lecture, we shall first discuss the scope of search and optimization problems in practice. Then, we shall briefly introduce a few popular classical point-based methods and then introduce population-based evolutionary optimization methods. Thereafter, we shall highlight the niche of latter methods through a number of practical case studies. The need for using customized and hybrid optimization methods for practical problems will also be highlighted.

Bio-sketch:
Kalyanmoy Deb is Koenig Endowed Chair Professor at Department of Electrical and Computer Engineering in Michigan State University, USA. Prof. Deb's research interests are in evolutionary optimization and their application in multi-criterion optimization, modeling, and machine learning. He has been a visiting professor at various universities across the world including University of Skövde in Sweden, Aalto University in Finland, Nanyang Technological University in Singapore, and IITs in India. He was awarded IEEE Evolutionary Computation Pioneer Award for his sustained work in EMO, Infosys Prize, TWAS Prize in Engineering Sciences, CajAstur Mamdani Prize, Distinguished Alumni Award from IIT Kharagpur, Edgeworth-Pareto award, Bhatnagar Prize in Engineering Sciences, and Bessel Research award from Germany. He is Fellow of IEEE, ASME, and three Indian science and engineering academies. He has published over 560 research papers with Google Scholar citation of over 165,000 with h-index 126. He is in the editorial board on 18 major international journals. More information about his research contribution can be found from https://www.coin-lab.org

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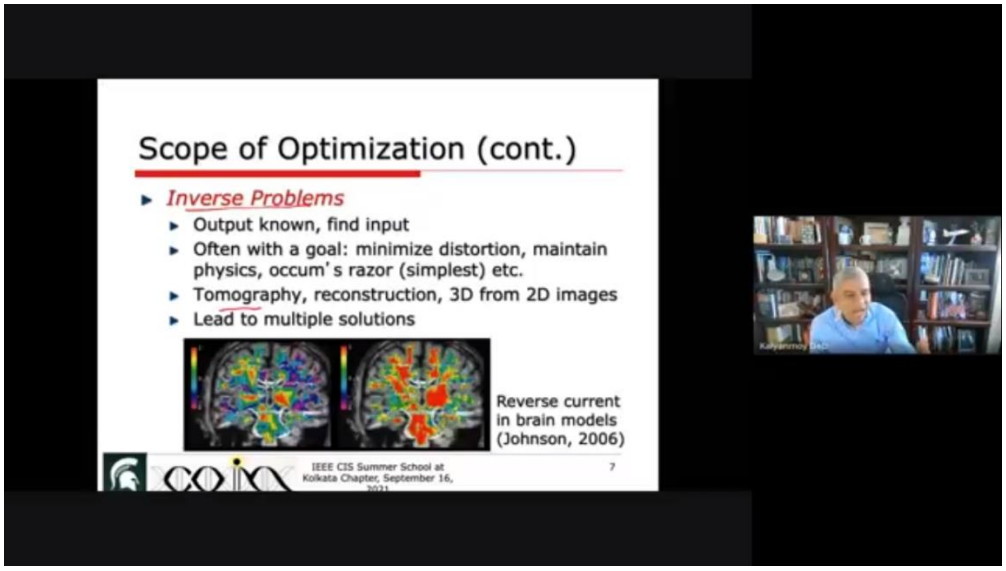

Prof. Sanaz Mostaghim

Time Schedule: 13.00 - 16.00 IST (09.30 – 12.30 CEST) on **17.9.2021**

Meeting Link: meet.google.com/dhp-xzou-tdi

Title: Evolutionary Multi-Objective Optimization and Decision-Making for Autonomous Systems

Abstract:

This talk is about the recent advances in multi-objective optimization and decision-making techniques for autonomous systems. Decision-making is usually required when we are confronted with conflicting objectives and is in fact a very challenging task even for human decision-makers, since we first need to find all the possible optimal alternatives and then select the right choice using a decision policy. In this talk, we replace the human decision-maker with an autonomous system and provide novel methodologies for multi-criteria decision-making on a range of scenarios in which the autonomous systems are confronted with conflicting objectives during the mission. Enabling such systems to autonomously decide can contribute to their applicability in critical missions such as rescue robotics where the intervention of a human-controller is not always possible. The challenge is not only in finding and selecting the best alternative, but also in acting in a limited timeframe during the mission. One more focus of the talk is on the individual vs. collective decision-making algorithms. We will show that collective learning of a decision policy can help both the individual and the collective to act in an efficient way.

Bio-sketch:

Sanaz Mostaghim is a full professor of computer science at the chair of Computational Intelligence and the founder and head of SwarmLab at the Faculty of Computer Science, Otto von Guericke University Magdeburg, Germany. She holds a PhD degree (2004) in electrical engineering from the University of Paderborn, Germany. Sanaz has worked as a postdoctoral fellow at ETH Zurich in Switzerland and as a lecturer at Karlsruhe Institute of Technology (KIT), Germany, where she received her habilitation degree in applied computer science. Her research interests are in the area of multi-criteria decision-making, collective learning and decision-making, and their applications in robotics and science. Sanaz is the deputy chair of the Informatics Germany and a member of the advisory board on Digitalization at the ministry of Economy, Science and Digitalization, State Saxony-Anhalt, Germany. She is the vice president of the IEEE Computational Intelligence Society (CIS) and is associate editor of IEEE Transactions on AI, IEEE Transaction on Evolutionary Computation and member of the editorial board of several international journals on Robotics and AI. Since 2020, she is appointed as a distinguished lecturer at IEEE CIS.

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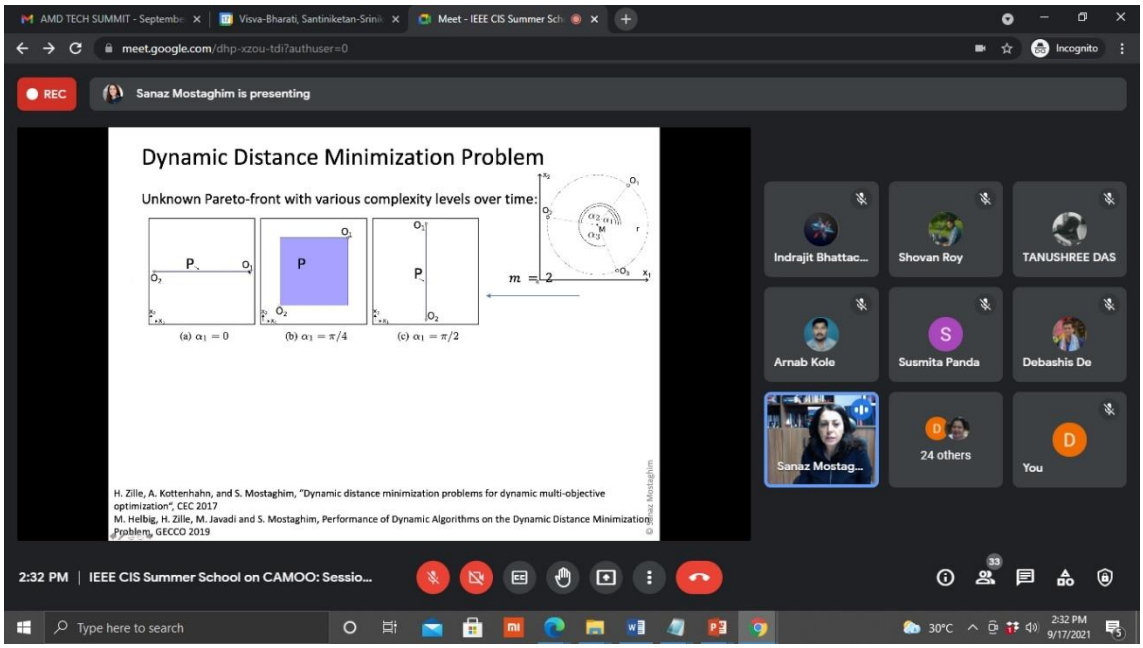

Prof. Alice Smith

Time Schedule: 19.00 - 22.00 IST (08.30 – 11.30 CDT) on **17.9.2021**

Meeting Link: meet.google.com/rkx-tzyv-vnp

Title: Bi-Objective Evolutionary Strategies for Design Optimization

Abstract:
This presentation will put forth three straightforward, but successful implementations of natural systems inspired optimization for the design of complex systems in continuous (or real) valued spaces with two objectives. These nature-based paradigms range in fidelity with their natural systems origins but seek to leverage the structures and operations of nature doing what it does best –system optimization, adaptability to dynamic environments, robustness, and flexibility. More specifically, the well-known, but often misunderstood and misused, natural system computational paradigm of evolutionary strategies will be considered. The three diverse applications are (1) the design of an airfoil for a flying drone considering drag and lift, (2) the design of heterogeneous communications networks considering traffic efficiency and network resilience, and (3) the location of semi-obnoxious facilities in municipalities considering transport costs and social costs.

Bio-sketch:
ALICE E. SMITH is the Joe W. Forehand/Accenture Distinguished Professor of the Industrial and Systems Engineering Department at Auburn University, where she served as Department Chair from 1999-2011. She also has a joint appointment with the Department of Computer Science and Software Engineering. Previously, she was on the faculty of the Department of Industrial Engineering at the University of Pittsburgh from 1991-99, which she joined after industrial experience with Southwestern Bell Corporation. Dr. Smith has degrees from Rice University, Saint Louis University, and Missouri University of Science

and Technology. Dr. Smith's research focus is analysis, modeling, and optimization of complex systems with emphasis on computation inspired by natural systems. She holds one U.S. patent and several international patents and has authored more than 200 publications which have garnered over 13,000 citations and an H Index of 47 (Google Scholar) and nearly 5,000 citations and an H Index of 29 (Web of Science). She is the editor of the recent book Women in Industrial and Systems Engineering: Key Advances and Perspectives on Emerging Topics (https://www.springer.com/us/book/9783030118655#aboutBook). Several of her papers are among the most highly cited in their respective journals including the most cited paper of Reliability Engineering & System Safety and the 3rd most cited paper of IEEE Transactions on Reliability. She won the E. L. Grant Best Paper Awards in 1999 and in 2006, and the William A. J. Golomski Best Paper Award in 2002. Dr. Smith is the Editor in Chief of INFORMS Journal on Computing and an Area Editor of Computers & Operations Research. Dr. Smith has been a principal investigator on over $10 million of sponsored research with funding by NASA, U.S. Department of Defense, Missile Defense Agency, National Security Agency, NIST, U.S. Department of Transportation, Lockheed Martin, Adtranz (now Bombardier Transportation), the Ben Franklin Technology Center of Western Pennsylvania, and U.S. National Science Foundation, from which she has been awarded 18 distinct grants including a CAREER grant in 1995 and an ADVANCE Leadership grant in 2001. Her industrial partners on sponsored research projects have included DaimlerChrysler Electronics, Toyota, Eljer, Frontier Technology Inc., Extrude Hone, Ford Motor, and Crucible Compaction Metals. International research collaborations have been sponsored by Germany, Mexico, Japan, Turkey, United Kingdom, The Netherlands, Egypt, South Korea, Iraq, China, Colombia, Chile, Algeria, and the U.S., and by the Institute of International Education. In 2013 she was a Fulbright Senior Scholar at Bilkent University in Ankara, Turkey, in 2016 a Fulbright Specialist at EAFIT in Medellin, Colombia, in 2017 a Senior Fulbright Fellow at Pontifical Catholic University of Valparaíso, Chile, and in 2020, a Fulbright Specialist at University La Sabana in Bogota, Colombia. For accomplishments in research, education, and service she was named the Joe W. Forehand/Accenture Distinguished Professor in 2015. Previously, she was the H. Allen and Martha Reed Professor. In 2017, she received the inaugural Auburn University 100 Women Strong Leadership in Diversity Faculty Award. Dr. Smith was awarded the Wellington Award in 2016, the IIE Albert G. Holzman Distinguished Educator Award in 2012, and the INFORMS WORMS Award for the Advancement of Women in OR/MS in 2009. Dr. Smith was named the Philpott- WestPoint Stevens Professor in 2001, received the Senior Research Award of the College of Engineering at Auburn University in 2001, and the University of Pittsburgh School of Engineering Board of Visitors Faculty Award for Research and Scholarly Activity in 1996. Dr. Smith is a fellow of the Institute for Operations Research and Management Science (INFORMS), the Institute of Industrial and Systems Engineers (IISE), and the Institute of Electrical and Electronics Engineers (IEEE), a senior member of the Society of Women Engineers, a member of Tau Beta Pi and the Institute for Operations Research and Management Science (INFORMS), and a Registered Professional Engineer in Alabama and Pennsylvania. She was elected to serve on the Administrative Committee of the IEEE Computational Intelligence Society from 2013-18 and 2020-22 and as IISE Senior Vice President – Publications from 2014-17. She served as associate editor for two IEEE journals and is currently an IEEE Computational Intelligence Society Distinguished Lecturer and an INFORMS Official Speaker. She has served as Chair of the Council of Industrial Engineering Academic Department Heads and as President of the INFORMS Association of Chairs of Operations Research Departments. She was a keynote speaker at the International INFORMS Conference (2019) and at the IEEE World Congress on Computational Intelligence (2018). She was named a 2020 Yellowhammer Women of Impact (20 women are honored each year in the State of Alabama https://alabamawomen.org/#2020) and was named an INFORMS Diversity, Equity, and Inclusion Ambassador in 2021. During her tenure as Chair, the Industrial and Systems Engineering Department at Auburn University witnessed unprecedented growth in student enrollments (+200%), research funding (+500%) and private donations (+400%). Facilities expanded

significantly and the department became a leader of three federally funded research centers. Interdisciplinary educational programs were developed, and diversity of student body and faculty flourished. Ranking (U.S. News) significantly surpassed all other Auburn University engineering departments.

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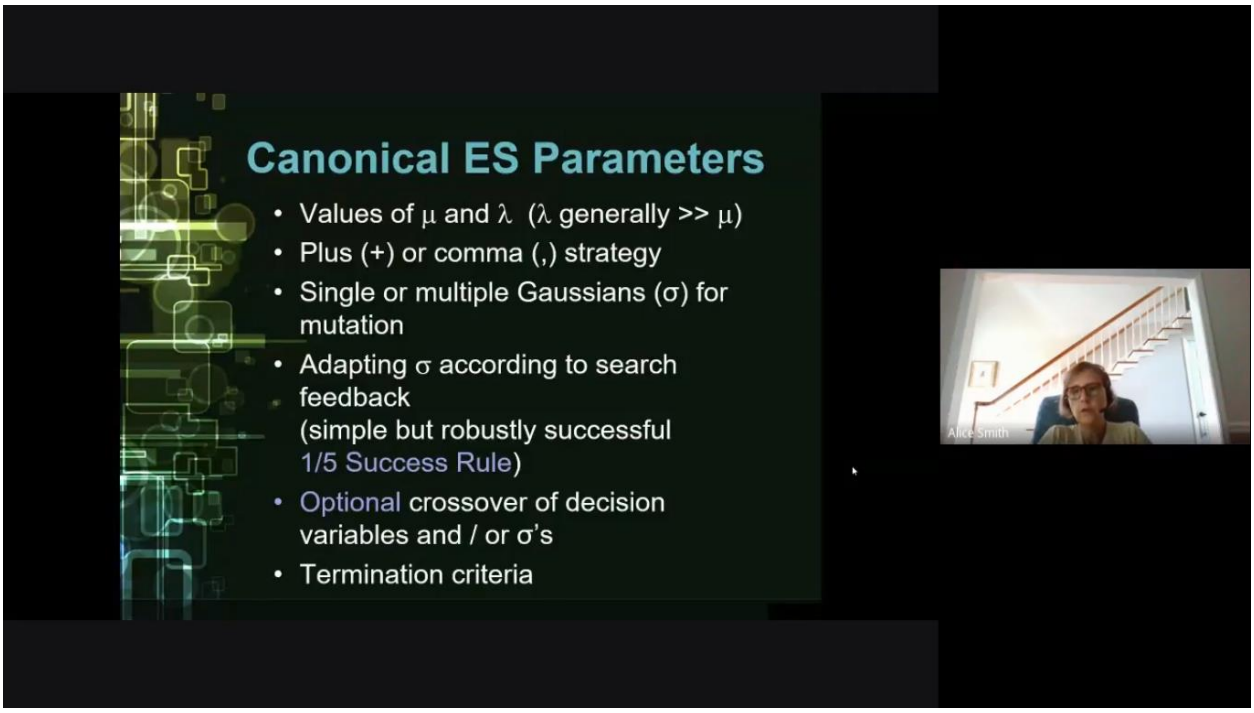

Prof. Tapabrata Ray

Time Schedule: 13.00 - 16.00 IST (17.30 – 20.30 AEST) on **18.9.2021**

Meeting Link: meet.google.com/xur-uicu-kyv

Title: Surrogate assisted optimization for practical design optimization problems

Abstract:

Optimization is an indispensable tool that has been a catalyst for many scientific breakthroughs and technological innovations spanning several decades. In the context of multidisciplinary design, there is an ever increasing need to solve multiple-objective, constrained optimization problems involving computationally expensive analysis. While, population based stochastic algorithms are typically used to deal with such nonlinear problems, their native use demands evaluation of numerous solutions prior to convergence. Since every analysis in design is computationally expensive, such optimization algorithms need to be embedded with some form of approximation/surrogates. The presentation will cover the challenges and approaches to deal with such classes of problems. The presentation will also highlight some open problems and areas that require further development.

Bio-sketch:

Tapabrata Ray is a Professor with the School of Engineering and Information Technology at the University of New South Wales (UNSW), Canberra. He obtained his B. Tech (Hons.), M. Tech and Ph.D from Indian Institute of Technology, Kharagpur, India. Between 1996 and 2004, he held a number of research positions in Singapore (Information Technology Institute, Institute for High Performance Computing, Temasek Laboratories at National University of Singapore). In 2005, he joined UNSW Canberra and established the Multidisciplinary Design Optimization Group (www.mdlolab.net). He currently leads the group. In 2012, he was awarded the Future Fellowship by the Australian Research Council and between 2017-2019, he served as a Member of College of Experts of the Australian Research Council. His research focusses on development of optimization methods to deal with computationally expensive optimization problems.

Further details can be obtained from http://www.mdolab.net/Ray/index.html

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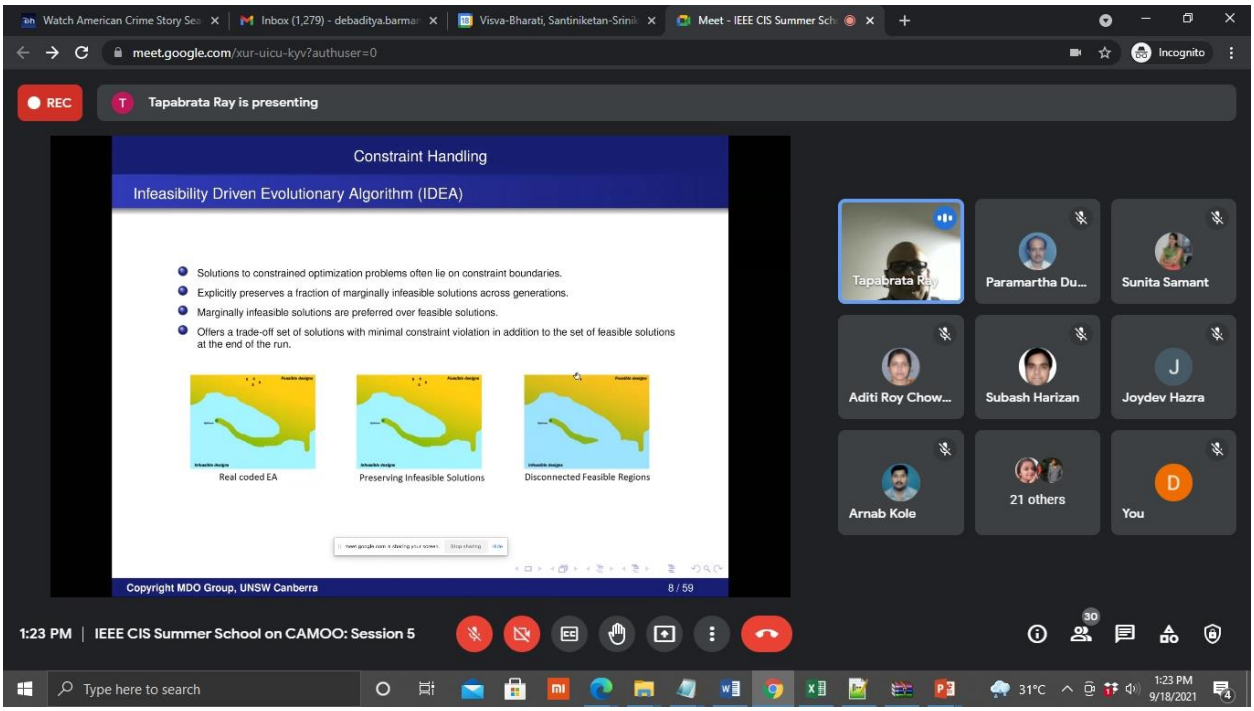

Prof. Carlos. A. CoelloCoello

Time Schedule: 19.30 - 22.30 IST (09.00 – 12.00 CDT) on **18.9.2021**

Meeting Link: meet.google.com/djb-jvsk-awf

Title: An Overview of Evolutionary Multi-Objective Optimization

Abstract:
Multi-objective optimization refers to solving problems having two or more (often conflicting) objectives at the same time. Such problems are ill-defined and their solution is not a single solution but instead, a set of them, which represent the best possible trade-offs among the objectives. Evolutionary algorithms are particularly suitable for solving multi-objective problems because they are population-based, and require little domain-specific information to conduct the search. Due to these advantages, the development of the so-called multi-objective evolutionary algorithms (MOEAs) has significantly increased in the last 15 years. In this talk, we will provide a general overview of the field, including the main algorithms in current use as well as some of the many applications of them.

Bio-sketch:
Carlos Artemio Coello Coello received a PhD in Computer Science from Tulane University (USA) in 1996. His research has mainly focused on the design of new multi-objective optimization algorithms based on bio-inspired metaheuristics (e.g., evolutionary algorithms), which is an area in which he has made pioneering contributions. He currently has more than 500 publications, including more than 160 journal papers and 50 book chapters. He has published a monographic book and has edited 3 more books with publishers such as World Scientific and Springer. He has supervised 22 PhD theses (including 3 in Argentina) and 48 Masters thesis (including one in France). Several of the PhD theses that he has supervised, have received awards in national competitions. He has also received (with his students) several "best paper awards" at different international conferences. He is also the only Latin American who has been awarded (twice) the "outstanding paper award" of the IEEE Transactions on Evolutionary Computation. His publications currently report 58,146 citations in Google Scholar. According to Scopus, Dr. Coello has 22,725 citations, excluding self-citations and citations from all his co-authors. His h-index is 95, according to Google Scholar, 67 according to Scopus and 63 according to the ISI Web of Science. In the Shanghai Ranking's Global Ranking of Academic Subjects 2016 developed by Elsevier, he appears as one of the 300 most highly cited scientists in the world in "Computer Science", occupying the first place in Mexico. He has received several awards, including the National Research Award (in 2007) from the Mexican Academy of Science (in the area of exact sciences), the 2009 Medal to the Scientific Merit from Mexico City's congress, the Ciudad Capital: Heberto Castillo 2011 Award for scientists under the age of 45, in Basic Science, the 2012 Scopus Award (Mexico's edition) for being the most highly cited scientist in engineering in the 5 years previous to the award and the 2012 National Medal of Science in Physics, Mathematics and Natural Sciences from Mexico's presidency (this is the most important award that a scientist can receive in Mexico). He also received the Luis Elizondo Award from the Tecnológico de Monterrey in 2019. Additionally, he is the recipient of the 2013 IEEE Kiyo Tomiyasu Award, "for pioneering contributions to single- and multiobjective optimization techniques using bioinspired metaheuristics", of the 2016 The World Academy of Sciences (TWAS) Award in "Engineering Sciences", and of the 2021 IEEE Computational Intelligence Society Evolutionary Computation Pioneer Award. Since January 2011, he is an IEEE Fellow. He is currently the Editor-in-Chief of

the IEEE Transactions on Evolutionary Computation. He is Full Professor with distinction (Investigador Cinvestav 3F) at the Computer Science Department of CINVESTAV-IPN in Mexico City, Mexico.

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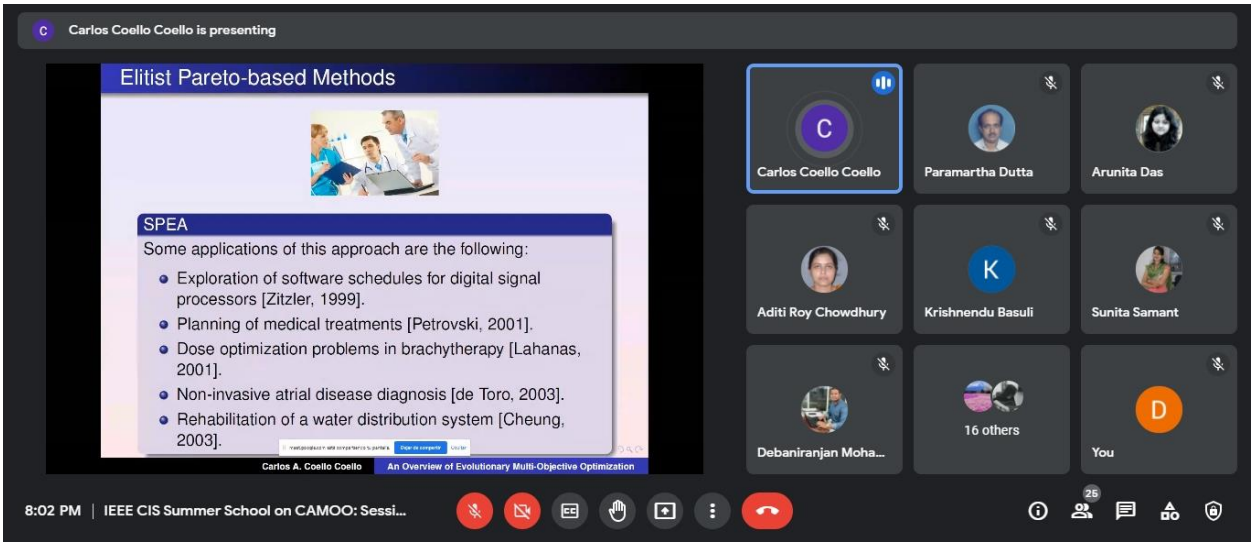
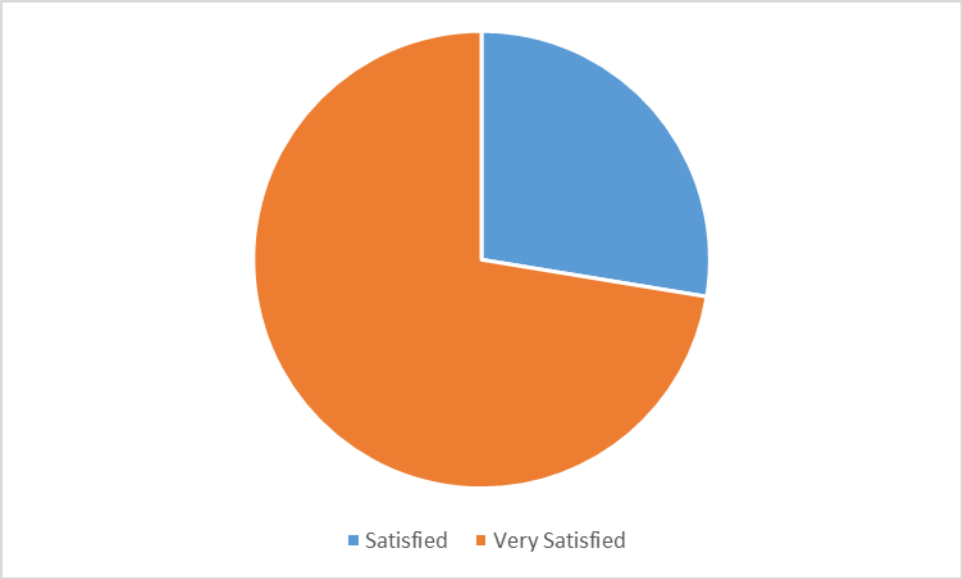
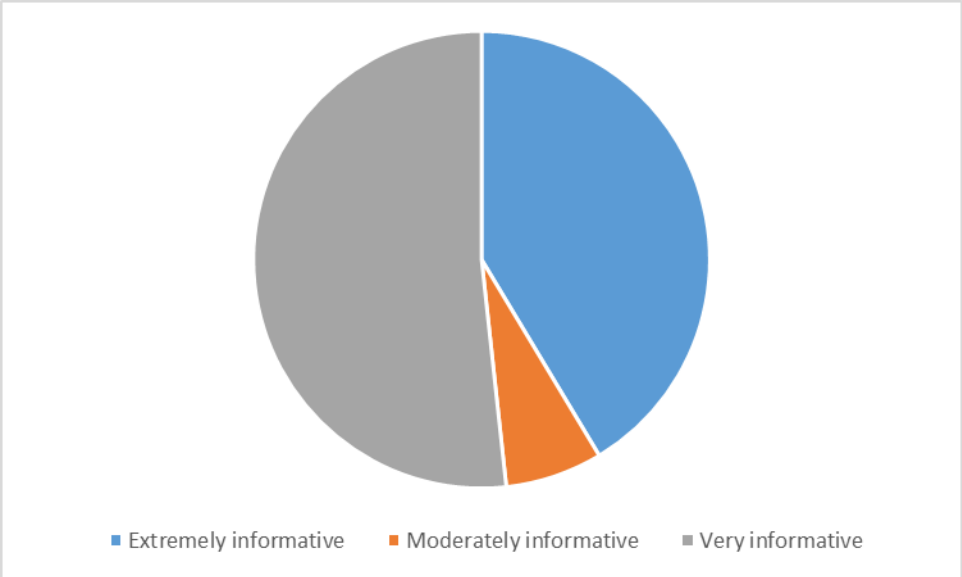


Feedback received from the participants

1. Overall how satisfied were you with this event?



2. How informative did you find the event?



3. How likely is it that you would recommend this event to a friend or colleague (in five scale)?