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ANNUAL RESEARCH EXPO

FACULTY OF COMPUTER SCIENCE

APRIL 12, 2024

9:00 A.M. – 4:00 P.M. | WU CENTRE

UNB

UNB EST. 1785 UNIVERSITY OF NEW BRUNSWICK | Computer Science

WELCOME FROM THE DEAN

The 2024 Faculty of Computer Science Annual Research Exposition showcases the excellent research, new developments, and experience related to the area of information and communication technology. This year we have a wide range of interesting researcher and industry speakers and forty-seven posters in the poster sessions. The coverage of the research contributions is very wide while remaining inherently discipline-related, which is one of the features that distinguishes our Research Exposition from other events that focus on more specific areas.

I hope that you enjoy the Expo's program and find the experience of meeting and sharing thoughts and ideas with our students, researchers, and each other to be an interesting and inspiring day.

Many people contributed to the success of this Exposition. I am also profoundly grateful to the students and professors whose work is on display, and to all participants for devoting time to being here with us. It is your participation that makes it all worthwhile.

Luigi Benedicenti, *Dean and Professor, Faculty of Computer Science*

Xueling Zhao, Minghui Wang, Zhuliang Jia, Shundong Li - *Privacy-Preserving Any-hop Cover Shortest Distance Queries on Encrypted Graphs*

Yoonjib Kim, Saqib Hakak, Ali Ghorbani - *Detecting Distributed Denial-of-Service (DDoS) Attacks that Generate False Authentications on Electric Vehicle (EV) Charging Infrastructure*

Zeming Zhou, Jinkun Gui, Rongxing Lu, Mohammad Mamun - *An Efficient Secure Logistic Regression for IoT Devices in Aging in Place Systems*

Zeynab Anbiaee, fatemeh Nejati - *A Review on Advanced Persistent Threat Detection*

Thank you for being part of our 2024 Research Expo!

S M Mozammal Hossain, Kenneth B. Kent, Phil Munz, James Stewart - *Exploring Explainability Opportunities for Trustworthy AI*

Sanya Sahni, Daniel Rea - *Impact of Robot Noise on Human Perception and Cognition*

Shabnam Saderi, Nethmi Hettiarachchi, Kalikinkar Mandal - *GridLock: Defending the Digital Frontiers in Energy Security*

Shermin Khosravi, David Bremner - *Efficient Compact Linear Programs from Algorithms*

Shima Majidilavasani , Bahar Ataeyan - *Security of file sharing in P2P networks*

Shriram Tallam Puranam Raghu, Dawn MacIsaac, Erik Scheme- *Leveraging Self-Supervised Learning for EMG Pattern Recognition*

Simin Shehbaz, Ravali Santi, Kenneth. B. Kent - *Optimizing Household Energy Simulation with Weather - Based Insights*

Subhabrata Rana, Kenneth B. Kent, Brett Kelly - *CephVault: A Secure Key Management System for Ceph*

Toushal Sewruttun (UNB HCI Lab), Daniel J. Rea (UNB Computer Science, Assist. Professor), Jeff Mundee (Spandrel Interactive) - *Motion Capture: Enhancing Animation Using Computer Vision & Artificial Intelligence*

Toushal Sewruttun, Daniel J. Rea - *"Help Me If You Can, I'm Feeling Down!" - Using Neurotic Robot Behaviour to Promote Maintenance*

Truong Thanh Hung Nguyen, Hung Cao - *LangXAI Everywhere: Integrating Large Vision Models for Generating Textual Explanations to Enhance Transparency of Black-box Systems*

WELCOME FROM THE ASSOCIATE DEAN, RESEARCH & GRADUATE STUDIES

Welcome to the Faculty of Computer Science 2024 Research Expo! The Expo is our annual showcase of research in computing, bringing together academic research with current innovations from industry. It's our opportunity to see what people are doing, to see what's been accomplished, and to engage with a wide range of innovative ideas in computer science. This year, we'll hear from some of our established researchers in diverse areas, as well as newer faculty members and PhD students. We'll also hear from several companies about their innovations. During the breaks, students will be presenting their work on posters in the foyer.

Of course, our program and our posters do not encompass everything being done in industry or in our faculty. We are growing and building: new people, new ventures, and new advances from our ongoing research. This year, we have a new Institute, RIDSAI, and a new Centre, SPECTRAL, whose founding research will close out this year's Expo. There's far too much to fit into one day, and this momentum will continue, making these expos interesting and engaging year after year.

Much thanks to our participants: our speakers from faculty and industry; our students for their posters; our staff for their support and organization; and all attendees for coming and making our Expo a celebration of ideas and achievements in technology. A special thanks to Kalikinkar Mandal, Sonya Hull, Brenda Stennick, Shelley Zimmerman, and John Peterson for their work in the organization and support of this Research Expo.

Patricia Evans, *Associate Dean (Research and Graduate Studies) and Professor, Faculty of Computer Science*

AGENDA

8:30 – 9:00am	**Registration**
9:00 – 9:10am	**Welcome and Opening Remarks** **Luigi Benedicenti**, Dean of the Faculty of Computer Science
9:10 – 9:35am	**Kalikinkar Mandal,** Faculty of Computer Science *"Cybersecurity and Privacy Considerations in the Smart Grid: A Cryptographic View"*
9:35 – 10:05am	**Mark McAllister -** CEO, Verosource Solutions *"MyHealthNB: AI components with real-time dashboards, and citizen engagement research"*
10:05 – 10:45am	**Break & Poster Session I**
10:45 – 11:10am	**Tristan Rutter -** CEO, Populus Global Solutions *"Our Translational Science Platform - supporting research teams from Houston Methodist to Atlantic Cancer Consortium"*
11:10 – 11:35am	**Suprio Ray**, Faculty of Computer Science *"Scalable and Explainable Data Science"*
11:35 – 12:00pm	**Windhya Rankothge,** Faculty of Computer Science - Research Associate, Canadian Institute of Cybersecurity (CIC) *"Towards Cyber Resilience: Role of Cyber Security Standards and Frameworks"*

Jinkun Gui, Yantao Yu, Zeming Zhou, Rongxing Lu, and Mohammad Mamun - *An Efficient Multicast Authenticated Encryption Scheme for Smart Elderly Care Systems*

Jonas R. Schoenauer, David Bremner, Kenneth B. Kent, Julian Wang - *Impact of Garbage Collection Policies on Load Stalls on AArch64 in Eclipse OpenJ9*

Krishno Dey, Hung Cao, Francis Palma - *Semantic Analysis of REST and GraphQL APIs to Assess Linguistic Design Quality*

Lili Sun; Rongxing Lu - *Towards privacy-preserving LBSNs-based and category-aware POI recommendation in Cloud*

Mahjabin Muntaha, Wei Song - *Learning-Based Collaborative Task Allocation in Mobile Crowdsensing*

Matthew de la Torre, Daniel Rea - *"Shoryuken? Sure, you can!" - Tutorial Design and Improved Learning in Teleoperations*

Md. Arid Hasan, Hung Cao, Francis Palma - *Do Developer Sentiment and Emotions Affect Software Quality? An Exploratory Study*

Minh Nguyen, Daniel J. Rea - *"Yes, your robot has anxiety" - Perception and social effects of robot with anxious behavior*

Muhammad Zubair, Saqib Hakak - *Look Beyond the pixels*

Navid Jafarof, Kenneth B. Kent - *Advancing VTR Flow: Integrating ABC9 via Yosys for Enhanced Technology Mapping and Optimization*

Prakhar Singh Dhaila, Tushar, Sarthak Gautam - *A survey: Lightweight cryptography in Industrial IoT*

Chenghao Xu, Wei Song - *Multi-Agent Deep Reinforcement Learning for Mobile Crowd Sensing*

Cole Campbell, Scott Bateman - *Mixed Reality Medical Task Trainer*

Colin Brett, Scott Bateman, Ernst Kruijff - *Reading Spaces: Exploring Reading Experience in MR*

David Mohren, Kenneth B. Kent, Brett Kelly - *Encrypting Data in Distributed Cloud Systems*

Ellen Z. Zhang, Yunguo Guan, Yantao Yu, Rongxing Lu, Harry Zhang - *An Efficient Range Sum Query Scheme under Local Differential Privacy*

Hao Hu, Kenneth B. Kent, Joran Siu, Michael Dawson - *Node.js Energy Awareness on Asymmetric Multi-Processing Systems*

Hassan S. A. Arafat, David Bremner, Kenneth B. Kent, Julian Wang - *Object-Oriented Access Predictor*

Hung Nguyen, Hung Cao - *Prototyping a Multimodal XAI Toolbox to Enhance Transparency of Black-box Systems*

Hung Nguyen, Rene Richard, Monica Wachowicz, Hung Cao - *Deciphering the Heartbeat: Towards an Explainable AI approach using ECG signals for Exploring Aging-in-Place Intelligence*

Ian Smith, Erik Scheme, Scott Bateman - *Designing Sport Training Games for Improving Skill*

Jeswin Switzer, Dr. Mohammad Mamun, Dr. Rongxing Lu - *Privacy-Preserving Edge Computing for IoT based Healthcare monitoring*

12:00 – 1:00pm	**Lunch & Poster Session II**
1:00 – 1:25pm	**Kumaran Thillainadarajah -** CTO, SmartSkin Technologies *"Optimizing operations, reducing wastage and enabling large scale carbon footprint reduction projects"*
1:25 – 1:50pm	**Wei Song**, Faculty of Computer Science *"Deep Reinforcement Learning for Graph Problems in Mobile Crowd Sensing"*
1:50 – 2:05pm	**Dakota Staples,** PhD student, Faculty of Computer Science *"Beyond the Surface: Exploring Security Challenges in Large Language Models (LLMs)"*
2:05 – 2:30pm	**Denish Bhavsar -** Director Global Data Governance, McCain Foods **Samantha Juman -** Global Data & Analytics Manager, McCain Foods *"Digital & Data Analytics @ McCain Foods"*
2:30 – 3:00pm	**Break & Poster Session III**
3:00 – 3:25pm	**Daniel Rea,** Faculty of Computer Science **Alexander LeBlanc and Samridhi Pargal,** Spandrel Interactive *"Dance XR: Augmented Reality for Remote Dance Collaboration"*
3:25 – 3:50pm	**Scott Bateman,** Faculty of Computer Science *"The Research that Created the SPECTRAL Spatial Computing Research Centre"*
3:50 – 4:00pm	**Wrap Up**

OUR RESEARCH CHAIRS, INSTITUTES, AND CENTRES

The Faculty of Computer Science is proud of our distinguished Research Chairs, Institutes, and Centres all focusing on leading-edge areas of computer science, technology, innovation, and entrepreneurship.

RESEARCH CHAIRS

- **Dr. Ali Ghorbani** - Tier 1 Canada Research Chair in Cybersecurity
- **Dr. Ken Kent** – Barrett Chair in Entrepreneurship for Digital Transformation
- **Dr. Rongxing Lu** – Mastercard Cybersecurity Research Chair in IoT security
- **Dr. Kalikinkar Mandal** - NB Power Cybersecurity Research Chair - Smart Grid Security and Privacy

INSTITUTES AND CENTRES

Canadian Institute of Cybersecurity (CIC)

The Canadian Institute for Cybersecurity (CIC), a founding member of the National Cybersecurity Consortium (NCC), is a comprehensive multidisciplinary training, research and development, and entrepreneurial unit that draws on the expertise of researchers in the social sciences, business, computer science, engineering, law, and science. The Institute is the first of its kind to bring together researchers and practitioners from across the academic spectrum to share innovative ideas, create disruptive technology and carry out groundbreaking research into the most pressing cybersecurity challenges of our time.

POSTERS

A big thank you to our forty-seven poster participants!

Abdelrahman Elba, Saqib Hakak - *MultiLFocus: Cross-Lingual Fake News Detection in English and Arabic*

Akolgo Samuel Akanzoe, Jerehiah Amankwah - *Peer to Peer Network Security*

Alireza Rahimi, Daiyan Khan, Varun Sundaram, Matthew Laskey, Hung Cao - *Online Fall Prediction with TinyML*

Alireza Azadi, Kenneth B. Kent - *Algorithms to Silicon: HLS Verification*

Amir Arjomand, Kenneth B. Kent, Amin Boudesh, Farnoush Bayat, Arash Mohammadi - *TransfoRhythm I: Accurate Blood Pressure Estimation Via Transformer Architecture and Solo PPG Signal Capturing*

Amir Hassanpour Zarghani, Milad Kameli, Seyed Jafar Mazareei - *Hybrid approaches in key encapsulation mechanism*

Amirhossein Azimyzadeh, Fahimeh Tolouee, Taylor Short, Colin Brett, Ian Smith, Ethan Eddy, Jeff Mundee, Scott Bateman - *Designing Mixed Reality Toolbars*

Arash Kariznovi, Kalikinkar Mandal - *Secure and Private AMI*

Arya Parvizi, Daniel Rea - *The Effects of Empathy on Teleoperation*

Bhavani Sai Prasad Addala, Mohammad Mehabadi, Kenneth B. Kent - *Power Grid Demand and Production Simulation Framework*

Samantha Juman - Global Data & Analytics Manager, McCain Foods

Over the last four years at McCain Foods, Samantha has spent her time on revenue management and global data analytics. She has focused on pioneering advanced analytics and AI initiatives through use-case identification and project management while fostering a culture of upskilling and data-driven decision making. Samantha graduated in 2022 from Esade, Barcelona with MSc in Data Analytics and is currently pursuing CMA designation.

Research Institute in Data Science and Artificial Intelligence (RIDSAI)

UNB's newest Institute will be a focal point for fundamental and applied research in all areas of data science and AI, from developing new algorithms to leveraging their strengths for social good to ensuring their ethical and respectful use. By bringing together researchers across many domains, the RIDSAI enables multidisciplinary, comprehensive, outcome-focused insights and solutions for community and industry partners in the Atlantic region and beyond.

SPECTRAL Spatial Computing Research Centre

SPECTRAL's mission is to be the leading touch point for spatial computing technology in Atlantic Canada, providing access to cutting-edge applied research and pioneering technological leadership. It is committed to empowering the effective implementation and maximization of Extended Reality technologies (Virtual, Mixed, Augmented, and other 3D and spatial technologies) and fostering robust partnerships with industry, academia, and government. SPECTRAL seeks to catalyze innovation and drive transformative progress across sectors through spatial computing technology, which has already transformed how people can and will work with technology.

IBM Centre for Advanced Studies - Atlantic (CAS-A)

CAS-Atlantic is an IBM-research-based institution dedicated to promoting and cultivating collaborative research between IBM and UNB. The Centre conducts research aimed at advancing the performance and concurrency of software executing on multicore systems. Computer science researchers and students explore innovations in the context of real-world applications through our industry partnerships.

FACULTY OF COMPUTER SCIENCE SPEAKERS

Thank you to our presenting faculty member researchers, partners, and students.

Scott Bateman is an Associate Professor in the Faculty of Computer Science, director of the SPECTRAL Spatial Computing Research Centre, and Co-Director of the Human-Computer Interaction Lab. His research in Human-Computer Interaction explores the use of mixed reality and spatial computing technology (including virtual reality and augmented reality) to allow people to work, learn, and play together in new ways. This work has been applied in many areas, from health to construction to entertainment.

Kalikinkar Mandal is an Associate Professor in the Faculty of Computer Science. He holds the New Brunswick Power Cybersecurity Research Chair for smart grid security and privacy and is a member of the Canadian Institute for Cybersecurity. Dr. Mandal received a Ph.D. in Electrical and Computer Engineering from the University of Waterloo and an MTech degree in Computer Science from Indian Statistical Institute, Kolkata. He joined the University of Washington in Seattle as a Research Associate before accepting a Postdoctoral Fellowship at the University of Waterloo in Ontario. He was a Research Assistant Professor in the Department of Electrical and Computer Engineering at the University of Waterloo before joining UNB.

Kumaran Thillainadarajah - Co-founder and CTO, SmartSkin Technologies

SmartSkin developed the initial concept in 2008 and then made several strategic pivots until they found the right market. Today SmartSkin provides IIoT based productivity solutions globally to the food, beverage, and pharmaceutical sectors. In 2015, SmartSkin was listed on Deloitte Fast 50™ 2015 Companies-to-Watch and won 1st place at the World Beverage Innovation Awards in Germany in 2016. Kumaran was listed in RBC Top 25 Canadian Immigrants across the country in 2016. In 2020 SmartSkin won best innovation in manufacturing at Pharmapack in Paris. In 2021 the company raised $10M in a venture round led by BDC.

Denish Bhavsar - Director of Global Data Governance, McCain Foods

Denish has over 15 years of business transformation experience, including standing up an enterprise data & analytics function. Currently at McCain Foods for little over 2 years, he is responsible for rolling out McCains' global data governance practice. He is driven by innovation, fueled by curiosity, and a true #DataGeek at heart.

INDUSTRY SPEAKERS

Thank you to our valued industry partners for coming to share their time, knowledge, and interesting stories with us.

Mark McAllister - Co-founder and CEO, VeroSource Solutions

VeroSource is a NB-based software and data company providing digital health solutions for jurisdictions across Canada. Mark is passionate about using technology to improve healthcare. He provides strategic leadership and vision in growing VeroSource and has been instrumental in building the company's product suite, which focuses on securely moving and analyzing health data to empower citizens and improve healthcare delivery efficiency. In 2023, VeroSource was named one of Canada's Top SME Employers. Mark has a BCS from UNB and is a member of the Wallace McCain Institute. Mark was named one of the Top 50 CEOs in Atlantic Canada by Atlantic Business Magazine in 2022 and 2023.

Tristan Rutter - Co-founder and CEO, Populus Global Solutions

Tristan is a health data specialist with broad experience in the health technology start-up industry including ideation, strategy, and operations. Populus' newest business, nonte.io, is a SAAS platform to improve data collection accuracy, and enable collaborate on clinical trials, innovation, and translational research in leading institutions here at home and as far away as Houston Methodist. Populus is proud to be a long-term partner with UNB's Computer Science Co-op Program.

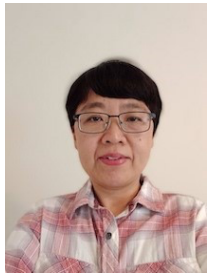
Suprio Ray is an Associate Professor in the Faculty of Computer Science. He obtained his Ph.D. in Computer Science from the University of Toronto and an M.Sc. from the University of British Columbia. Prior to his academic career, he worked in the software industry. His research interests include Big Data and database systems, query processing on modern hardware, scalable data science and advanced analytics, data privacy and security, and Blockchain data management.

Daniel Rea is an Assistant Professor in the Faculty of Computer Science and a collaborator at Kyoto University. He earned his M.Sc. and Ph.D. at the University of Manitoba in 2015 and 2020. Daniel focuses on user-centered design to improve the performance and experience of people remotely controlling robots. His research also includes game design and applying game design to robotics and other fields, social human-robot interaction, and interaction design.

Co-presenters: Alexander LeBlanc and Samridhi Pargal

Alexander is a Research Technician who works with Mixed Reality applications. He has a MCS from UNB, where he completed research focused on Game Design and Development. On the DanceXR project, he has made contributions to both user flow and network communication to allow for collaboration within the software.

Samridhi has a Master's degree from UNB and specializes in mixed reality and application development. With a keen focus on designing interfaces and interactions, she has made valuable contributions to the success of DanceXR and brings a user-centric approach to her work, ensuring the seamless integration of technology and user experience.



Wei Song is a Professor in the Faculty of Computer Science. Wei received a Ph.D. degree in Electrical and Computer Engineering from the University of Waterloo in 2007 and joined UNB's Faculty of Computer Science in 2009. Her current research interests include Internet of Things, mobile edge computing, edge intelligence and cooperative intelligence for networking. She received the Best Paper Award from the 2018 IEEE ICC, the 2014 UNB Merit Award, and the Best Student Paper Award from the 2013 IEEE CCNC. She has been the Chair of the Joint Computer and Communications Chapter of IEEE New Brunswick Section from 2014 to 2020. She co-chaired tracks/symposiums for IEEE GLOBECOM 2011, IWCMC 2011, IEEE ICC 2014, and IEEE VTC Fall 2010/2016/2017/2023.

Dakota Staples is a PhD student at the Faculty of Computer Science. He obtained his BCS from UNB with a specialization in cyber security and his MCS also from UNB. He has received multiple awards including the Magee Third Century Postgraduate Merit Award and the NBIF Graduate Merit Award. Prior to UNB, he worked as a security operation center analyst at Bulletproof Solutions. His past research has been on phishing detection and detecting fake news spreaders. His current research interests pertain to the security of large language models including how they produce confidently incorrect content, how they can divulge private information, and how they can be guided to ignore their training instructions and safety guidelines.

Windhya Rankothge is a Research Associate at UNB's Canadian Institute for Cybersecurity (CIC). She is leading the ADGA research project, focusing on cyber risk management of critical operations. Prior to joining CIC, she was an Assistant Professor at the Faculty of Computing, Sri Lanka Institute of Information Technology. Windhya received her PhD in Information Technology and Communication in 2017 from University of Pompeu Fabra, Barcelona and was a visiting researcher at the IBM International Technology Alliance, and Imperial College London in 2016 and 2017. Her research interests are Risk Management, Network Security, Cybersecurity and Software Defined Networks. She is an IEEE Senior member and has served for international research communities as a reviewer, advisor and an executive committee member. Currently she is Vice Chair of IEEE Women in Engineering Region 7 and Secretary of IEEE New Brunswick Section.