IEEE New Zealand Central Section Report
February 2025

PART A - SECTION SUMMARY

A.1 Executive Summary – (Please follow the format given below)

- Section Executive Committee Member List
  - Chair: Yi Mei
  - Vice Chair: Bach Nguyen, Alex Doronin
  - Secretary: Fangfang Zhang
  - Treasurer: Duncan Hall
  - Membership Development: Qi Chen
  - Webmaster: Jordan MacLachlan, Yuan Tian, Jesse Wood
  - (Joint) Education Coordinator: Nurul Sarkar
  - Professional Activities Coordinator: Alex Doronin
  - Industry Coordinator: Fanglue Zhang
  - Young Professionals: Alex Doronin, Fangfang Zhang
  - Women in Engineering: Bing Xue, Qi Chen, Fangfang Zhang
  - Life Member Coordinator: Murray Milner
  - Victoria Student Branch Chair: Kun Huang
  - Massey Student Branch Chair: Chen Zhang
  - Student Counsellor: Mengjie Zhang
  - Central CIS Chapter Chair: Mengjie Zhang
  - Central Power and Energy Chapter Chair: Daniel Burmester
  - NZ Joint SP/IT Chapter Chair: Yusuke Hioka
  - NZ Joint Communications Chapter Chair: Andrew Austin
  - NZ Joint I&M Chapter Chair: Andrew Taberner
  - NZ Joint Robotics and Automation Chapter Chair: Ho Seok Ahn
  - Other Committee Members: Xiang Gui

- Section Highlights
  - Organized a successful Postgraduate Symposium in August 2024, attracting around 40 participants
  - Sponsored the IVCNZ 2024 conference, strengthening our presence in the academic and research community.
  - Hosted several IEEE Fellows and Distinguished Lecturers from around the world, offering members valuable insights and keeping them engaged with the latest research in their fields.Major Events (International, National)
- Major Chapter Activities
  - IEEE NZ Central Computational Intelligence Society Chapter
    - 17/01/2024: Prof Joanna Weng delivered seminar on “Research in AI for Safety Critical Systems at the ZHAW School of Engineering”. The ZHAW IAMP (Institute of Applied Mathematics and Physics) Safety-Critical Systems Research Lab (SCS) promotes technological progress in various fields like hazard and risk analysis, functional safety of complex sociotechnical systems (e.g. automotive, nuclear and railway), RAMS and certification and verification methods. In this talk, a selection of current applied research projects at the SKS are presented, focusing on the project CertAInty: The increasing adoption of Artificial Intelligence (AI) systems necessitates the certification of their trustworthiness, emphasizing aspects like reliability and transparency. As regulatory standards emerge, it becomes vital to provide clear, actionable guidelines for both developers and certifying bodies to assure the trustworthiness of AI technologies. The project is centered around creating a robust AI certification scheme. A certification scheme is a framework for assessing the trustworthiness of AI systems and encompasses a set of specific requirements and criteria, along with corresponding methods and metrics to fulfill the criteria. Importantly, the scheme makes an explicit link between such requirements and

validated techniques for assessing the compliance of AI systems, resulting in the implementation of a concrete workflow to support AI certification.

- 17/01/2024: Frank-Peter Schilling delivered a seminar on “Research at ZHAW’s Centre for AI & Mitigation of Motion Artifacts in Cone-beam CT with Deep Learning”. The Centre for AI (CAI) at Zurich University of Applied Sciences (ZHAW) in Winterthur, Switzerland, conducts both methods oriented and applied research in AI, Machine Learning and Deep Learning in the focus areas of Autonomous Learning Systems, Computer Vision – Perception - Recognition, Natural Language Processing, Trustworthy AI and MLOps. In this talk, current research at the CAI is showcased using an applied research project in the context of medical imaging for cancer treatment: Cone-beam computed tomography (CBCT) is often employed on radiation therapy treatment devices used in image-guided radiation therapy (IGRT). Reconstructed CBCT images often suffer from artifacts, particularly those induced by patient motion. In a recently completed project, ZHAW partnered with Varian Medical Systems to apply AI and deep learning to significantly improve CBCT image quality. It could be shown that deep neural networks applied as pre- and/or post-processing steps during CBCT reconstruction are able to reduce motion artifacts. The results were confirmed by a clinical evaluation and can help to improve radiation therapy for cancer patients.
- 19/01/2024: A seminar on “Balancing Information Protection and Information Access” was delivered by Prof. Doug Oard. Current search engines are designed to find things, but there are many cases in which we actually don't want some things to be found. In particular, we can't yet make many potentially valuable collections available to be searched because they contain some intermixed sensitive content that requires protection, but for which reliable sensitivity labels are not available. Some prominent examples include government transparency regimes such as New Zealandâ€TMs Official Information Act, the rapidly growing backlog of national security information in the United States that is awaiting declassification review, and the vast troves of email that are now accumulating in both government archives and personal collections. The scale of many of these problems is such that asking people to mark all the sensitive content in a collection would simply be impractical. If we are ever to be able to find that which is not actually sensitive, we will thus need to build systems --- systems involving both people and automation that are able to recognize and protect that which requires protection. We formulate this as a multi-objective optimization problem in which the goal is to balance information access with information protection. I'll describe two implementations of this broad idea. In the first, designed for high-stakes tasks such as topic-focused declassification review, the search is performed on behalf of the end user by a trusted intermediary (e.g., an archivist), and the system's goal is to focus that intermediary's limited time in a way that balances the risk of missing relevant content with the risk of revealing sensitive content. In the second, designed for higher-volume but lower-stakes cases such as searching archived through email, we seek to support end-user search by using a risk-averse search engine to surface some relevant content, thus allowing searchers to explore collections to find some immediately useful content, with the beneficial side effect that their final refined queries might also be used to flag the more difficult decisions for (future) human review. Both of these techniques require automated sensitivity classifiers, so I will also briefly describe three lines of work on that problem: one for email, a second for government transparency, and a third for national security information. This is joint work with Jason Baron, Mahmoud Sayed, Nate Rollings, Fabrizio Sebastiani and Jyothi Vinjumur.
- 04/02/2024: Prof. Hisao Ishibuchi delivered a seminar on “Greedy, Local Search and Evolutionary Algorithms for Subset Selection”
- 07/02/2024: Prof. Hisao Ishibuchi delivered a seminar on “Algorithm Design and Algorithm Evaluation for Evolutionary Multi-Objective Optimization”. Evolutionary multi-objective optimization (EMO) has been a very active research area in the last three decades in the field of evolutionary computation. Every year, a number of new EMO algorithms are proposed. When a new EMO algorithm is proposed, computational experiments are conducted in order to compare its performance with existing algorithms. Then, experimental results are summarized and reported as a number of tables together with statistical significance test results. Those results

usually show higher performance of the new algorithm than the other examined algorithms. However, fair performance comparison of different EMO algorithms is not easy since the evaluated performance of each algorithm usually strongly depends on experimental settings. In this seminar, first, difficulties of fair performance comparison of EMO algorithms is explained. More specifically, it is clearly explained that totally different performance comparison results can be obtained from the following four settings: (i) termination condition specification, (ii) population size specification, (iii) performance indicator choice, and (iv) test problem choice. Next, based on the discussions on performance comparison, two new ideas for EMO algorithm design are explained. One is the use of an unbounded external archive where the final solution set is not the final population but the selected solution from all the examined solutions during the execution of an EMO algorithm. Since the final population is not necessarily the best subset of all the examined solutions, it is intuitively clear that a better solution set than the final population can be selected from the unbounded external archive. Another idea is to use an inverse model from the objective space to the decision space. The input to the inverse model is a preference vector, which shows the decision maker's preference as a point in the objective space. The corresponding output from the inverse model is a solution (i.e., a point in the decision space). Two scenarios for the training of the inverse model are explained."

- 09/02/2024: Prof. Thomas Bensky delivered a seminar on "Use of a Genetic Algorithm for class scheduling in a large Physics Department". In this talk, work in implementing a Genetic Algorithm (GA) to create teaching schedules for ~50 professors into ~200 classes in a university physics department is discussed. This will include how a scheduling "fitness function" was developed, followed by a look at interpretability and performance of the algorithm. Emphasis will be placed on how the GA is very natural in assigning, assessing, and adapting class placement as it optimizes the overall fitness. This helps to demonstrate transparency and fairness in the highly visible result, which is very important when scheduling people. This will be followed by a short discussion on how the Prolog language is used to further refine the resulting schedule. Lastly, I'll discuss how a "physics professor" came to be interested in AI and visiting with your group.
- 13/03/2024: Prof. Guenther Raidl delivered a seminar on "Learning to Guide Heuristic Search in Combinatorial Optimization". The machine learning boom of the last years also led to interesting new developments in the area of heuristic (and exact) methods for approaching hard combinatorial optimization problems. Classical methods are frequently based on construction heuristics, local search but also tree search, sometimes in combination with (mixed integer) linear programming or constraint programming principles. While end-to-end machine learning approaches are still far from replacing these established techniques in combinatorial optimization, it has been recognized that the latter may benefit from incorporating learning for certain purposes. One may say the aim is to ``learn how to better optimize". This talk will give an overview on a selection of developments in this direction. For example, in beam search, guidance heuristics may be learned that yield better results than leading manually crafted heuristics. Large neighborhood search approaches were proposed in which the construction of the neighborhoods to be applied is learned. For dynamic and stochastic transportation problems, efficient surrogate objective functions are learned that can effectively replace time-consuming sampling-based approaches. Some of these methods rely on imitation or supervised learning where labeled training data or some powerful other method to learn from need to be available. More versatile may be methods based on reinforcement learning principles, on which we will also have a look at.
- 07/06/2024: Dr. Qi Chen gave a seminar on "How to do experiments, and What results to present". This seminar presents a set of skills for performing experiments for evolutionary computation (and neural networks). This includes experiment setup such as choice of datasets, selection of benchmark methods, performance evaluation, and presentation of the results with analyses. This also includes comparisons between different methods, statistical significance tests.
- 12/07/2024: Prof. Yanan Sun delivered seminar on "My notes for submitting paper to top-tier AI conferences". This seminar presents skills for preparing a paper for those

top AI conferences, including IJCAI, AAAI, ICML, NIPS, ICCV, and CVPR. Preparing a paper for a top AI/CI journal such as IEEE Transactions on Evolutionary Computation is quite different from that for a top AI conference. Prof Yanan Sun used his experience and examples to discuss the essential skills for preparing a paper for top AI conferences.

- 02/08/2024: Prof. Alberto Tonda delivered a seminar on "An Overview of Fundamental and Applied Research Topics in the MIA-PS lab". Alberto Tonda, senior permanent researcher at the Applied Mathematics and Computer Science lab of Université Paris-Saclay (MIA-PS), is going to present a few ongoing research topics related to machine learning and evolutionary computation. The focus will be on (i) approaches to estimate uncertainty for machine learning models; (ii) program synthesis using Genetic Programming and the ARC challenge; (iii) analysis of machine learning algorithms in behavioral spaces.
- 02/10/2024: Prof. Yaochu Jin delivered a seminar on "Graph Neural Networks and Diffusion Models for Data-Driven Combinatorial Optimization". Deep learning models such as graph neural networks and diffusion models have been found successful in solving combinatorial optimization problems. This talk presents a few recently developed algorithms that employ graph neural networks for combinatorial optimization. We start with a reinforcement learning approach to train timetable rescheduling, where a graph neural network is adopted for automatic extraction of most informative states. Then, we discuss how graph neural networks can be employed to solve combinatorial problems such as travelling salesman problems, graph coloring problems and facility selection problems. Finally, we introduce our preliminary work on using diffusion models for solving multi-objective optimization problems. We conclude the talk with a summary and discussion of future work.
- 04/10/2024: Prof. Sven Hartmann delivered a seminar on "Functional dependency, cardinality constraints, and Armstrong tables". Database dependencies are rules used to ensure the consistency and integrity of data in databases. These rules restrict the data that can be inserted or modified, enforcing specific requirements that maintain high data quality. Clean and consistent data are important for feature engineering to prevent poor model performance. Algorithmic methods are in demand for managing dependencies eCectively. Several research questions arise in this context: the implication problem (determining whether a dependency is implied by a given set of dependencies), the discovery problem (mining which dependencies hold in a given database instance), and the representation problem (constructing a database instance that precisely reflects a set of dependencies). In this talk, we focus on two types of dependencies: embedded functional dependencies and the interaction between cardinality constraints and functional dependencies, and survey some recent results.
- 28/11/2024: Prof. Weineng Chen delivered a seminar on "Distributed Evolutionary Computation for Optimization in Multi-Agent Systems". Swarm intelligence is an important direction in the development of next-generation artificial intelligence. Evolutionary computation and swarm intelligence optimization are critical branches within this field. With the rapid advancements in technologies like the Internet of Things (IoT) and edge-cloud computing, the interconnection of everything has given rise to numerous distributed optimization problems involving multi-agent collaboration. Traditional gradient descent-based multi-agent distributed optimization methods face bottlenecks when dealing with non-convex or black-box problems. In contrast, swarm intelligence and evolutionary computation methods not only handle complex problems effectively but also possess inherent characteristics suitable for distributed execution, offering promising new avenues for solving such problems. This presentation will explore multi-agent distributed swarm-intelligence-based evolutionary optimization. To address conflicts in distributed optimization objectives, it will introduce distributed co-evolutionary methods aimed at achieving global consistency. For data-driven distributed optimization problems, it will present edge-cloud collaborative surrogate model-driven evolutionary algorithms.
- 29/11/2024: Prof. Jacek Mańdziuk delivered a seminar on "Evolutionary Methods for Wildlife Conservation and Public Safety". Security Games (SGs) is a rapidly growing research field devoted to modeling threats to public safety, natural resources, and social good, such as international terrorism, mass poaching or logging, or weapons or drug smuggling, in the form of games played between security forces and organized

criminals. I will start with an introduction to SGs and a brief summary of the mainstream solution methods that are based on Mixed Integer-Linear Programing (MILP), followed by a presentation of several evolutionary approaches developed by our research group at Warsaw University of Technology. The last part of the talk will be devoted to a case study – poaching prevention in one of the national parks in Africa, based on our joint research with the Teamcore group at Harvard University.

- 18/12/2024: Prof. Thilo Stadelmann delivered a seminar on "Artificial Intelligence: A Tale of Two Meanings". Artificial intelligence is increasingly influencing our lives. Corresponding products and services provide benefits and create added value. At the same time, the media is talking about existential risks or a life in the matrix. Does artificial intelligence enable both - concrete benefits now, with catastrophic side effects? The talk traces the two essential but disjointed meanings of the term AI: As a scientific discipline on the one hand, producing amazing solutions with great potential and manageable risks (for this we take a look at the state and future of technology and applications). On the other hand, however, as an empty phrase that serves certain schools of thought to make the narratives of extreme world views appear plausible - from Transhumanism to Effective Altruism and others (we look at the beliefs that are particularly widespread in the tech industry, which are known as the 'TESCREAL' package). The real opportunities and challenges of technology for our society can thus be separated from statements that are philosophically controversial.

- IEEE New Zealand Central Power and Energy Society Chapter
  - 08/05/2024: The chapter collaborated with Engineering New Zealand and the Institution of Engineering and Technology (IET UK) hosted a presentation by James Araci, the Lead Adviser for Science and Innovation at the British High Commission in Wellington. The event focused on opportunities for collaboration between New Zealand and United Kingdom businesses, particularly in science, technology, and engineering. James provided insights into his role at the British High Commission, the impact of the UK-New Zealand Free Trade Agreement and the 2022 UK-New Zealand Research, Science & Innovation Arrangement, and the benefits of the Horizon Europe Programme. He also shared experiences from his career, including his work with businesses across three continents in leveraging scientific and technological advancements. The event was held both in person at Engineering New Zealand's Wellington offices and online, starting at 5:30 PM, with light refreshments available from 5:00 PM. Following the presentation, James engaged with attendees in a Q&A session.
  - 21/05/2024: Geoff Bertram, an economist and senior associate at the Institute of Policy Studies at Victoria University of Wellington, delivered a seminar on "Energy for homes in Aotearoa – past and present"
  - 23/05/2024: Michael Johnston discussed his business, Overlay. "Overlay creates a compute layer , with the ability to distribute logic, over a ultimately scalable network, An ecosystem controlled in real time, where loads are moved flexibly and efficiently."
  - A series of 5 seminars on the New Zealand Power industry.
- IEEE Joint NZ Communications Society Chapter
  - 20/02/2024: STEM Outreach @AUT where Professor Nurul Sarkar spoke to new students on the orientation day (21st Feb 2024) at Auckland University of Technology (AUT). The lecture began with a short presentation highlighting the importance of STEM education and student learning opportunity at AUT. The scope and the various study options within the Bachelor of Computer and Information Sciences (BCIS) programmes were discussed. In the second half, Prof Sarkar talked about external engagement opportunity including Women in Technology, IEEE Women in Engineering, and IEEE student branch on campus. The IEEE STEM resources for students were highlighted. About 400 students attended the lecture and the positive outcomes indicated that the event was successful.
  - 24/08/2024: AUT Open Day is one of the largest and most significant pre-Uni outreach programmes was held at Auckland University of Technology (Auckland, New Zealand) on 24 August 2024. Prof Nurul Sarkar (IEEE STEM Champion) was volunteered for the day. We met and greeted about 300+ pre-University students and their parents on campus. We had opportunity to talk to numerous pre-University students and their parents regarding study plans and career opportunities in ICT/computer Science,

Engineering, network and cybersecurity. Data science, Software development and Digital services.

- 08/09/2024: Multiethnic Youth STEM Networking --- Professor Nurul Sarkar was invited to a Pathway and Careers Day- Multiethnic Youth event (AUT South Campus, Manukau) attended by some 200+ year thirteen students accompanied by their teachers on Monday 9 September 2024. It was one of the most significant career events the Ministry of Education organised this year. By attending the STEM networking session, Prof Nurul Sarkar had an opportunity to talk to various pre-University students (mostly refugee/migrant and Pacifica) about our AUT BCIS programmes and answer their queries. Many students have expressed their interest in coming to AUT for Computer Science and Engineering study.

- IEEE Joint NZ Signal Process / Information Theory Society Chapter
  - 17/11/2024: Dr. Kouei Yamaoka delivered a seminar on "Optimization Algorithms for Signal Enhancement and Time Delay Estimation Efficiently Using Spatial Information". Sound is a vital medium that carries a variety of information. In our daily lives, we use sound, for example, to communicate through speech, enjoy music, and perceive various situations around us. Microphone array signal processing is a framework aimed at enhancing human hearing functionalities and implementing them on computers. It enables a wide range of audio applications by utilizing the spatial information from sounds captured by multiple microphones. In general, the performance of microphone array signal processing heavily depends on the number of microphones used and that of sound sources. This presentation includes the following two techniques that aim to improve their performance by fully leveraging available data observed by the microphones. 1) Switching Beamformer: A method for distortionless signal enhancement designed specifically for scenarios with a limited number of microphones, namely, an underdetermined system with fewer microphones than sound sources. 2) Auxiliary-Function-Based Time Delay Estimation: A technique that achieves subsample-level time delay estimation, particularly effective when using a large number of microphones. This talk also briefly introduces the concept of distributed microphone arrays, which form the background of these techniques and represent one of the future directions for microphone array signal processing.
- IEEE Joint NZ Robotics and Automation Society Chapter
  - 01/03/2024: Prof Inho Han delivered a seminar on "Robots in hospital"
  - 05/04/2024: Jong Yoon Lim delivered a seminar on "LLM for robots"
  - 10/05/2024: Joey Back delivered a seminar on "Chatbot using DialogFlow"
  - 14/06/2024: Prof Inho Han delivered a seminar on "Medical robotics"
  - 16/08/2024: Isaac Lee delivered a seminar on "Facial emotion expression"
- IEEE Joint NZ Geo-Remote Sensing Society Chapter
  - 14/03/2024: Prof Marwan Younis delivered a seminar on "The Golden Age of Satellite Imaging Radar - Trends in SAR Instrument Development and Missions". The success story of remote sensing with synthetic aperture radar (SAR) is fascinating and would not have been possible without a strong radar community and international cooperation between scientist and engineers. The presentation tells this story from the perspective of Germany's contribution through its SAR missions. After a short introduction to remote sensing and radar, the principle of synthetic aperture radar is explained and supported by examples of airborne and spaceborne SAR missions, while focusing on the instruments. A radar image from an operational radar satellite acquiring data is the result of a long preparation and requires overcoming many constraints. The talk highlights some of these steps including mission design, technology development, principal SAR constraints, and operation. Last but not least, current and future trends of multi-channel SAR with digital beamforming techniques are mentioned giving an outlook of what to expect in the next years is given.
  - 04/09/2024: New Zealand SAR Hackathon a collaborative event, is open to undergraduate or postgraduate students interested in improving their radar technology expertise through mission design. The goal is to propose a mission/instrument concept that advances the state of the art in radar remote sensing. With the objective of enhancing the participant's understanding of mission design, demonstrate radar system synergy, and foster innovative solutions in radar remote sensing relevant to New Zealand. Attendees will receive the necessary learning experience in remote sensing, sensor design, and development to successfully complete the hackathon. They will be

introduced to: Integrated mission design and requirements flow. Demonstrate the synergy and complementarity between different SAR missions. Students will be guided to develop a mission/instrument concept that advances the state of the art in radar remote sensing. Identify observable gaps in existing missions/systems and propose solutions to address these gaps.

- Major Student and Affinity Group Activities:
  - 26/08/2024: The Victoria University of Wellington Student Branch and Massey University Student Branch organised the IEEE Postgraduate Symposium 2024, which was held at Victoria University of Wellington in Kelburn, Wellington. This event involved presentations from over 30 PhD students from Victoria University of Wellington and Massey University (Palmerston North) to present their research work. There were approximately 40 attendees who enjoyed the presentations. The three best presentations were recognised and awarded with prizes.

A.2 Financial Report – (Please follow the format given below)

Westpac Account 03-0502-0585328-00		
Opening Balance	NZ$ 10,118.55	NZ$ 10,118.55
Receipts	$ 10,173.42	
Less 2023 payments	-$ 8,060.61	
Closing Balance (as at 27/11/2022)	**NZ$ 12,231.36**	**NZ$ 12,231.36**
Receipts:		
Interest	$ 114.93	
IEEE Section Rebate	$ 7,368.10	
Share of IVCNZ Conference	$ 2,470.39	
AGM Dinner	$ 220.00	
Total	NZ$ 10,173.42	
Payments:		
Bank charges	$ 15.38	
Student member grants (26)	$ 1,211.58	
Meeting costs	$ 5,146.85	
Student activities costs	$ 986.80	
PG Symposium Awards	$ 700.00	
Total	NZ$ 9,424.21	
NEXTGEN Banking	**(**$US)	
Opening balance (1/1/2024)	$ 13,684.65	
(Converted to NZ$ @ 1.58101)		NZ$ 21,635.57
R10 Fund to NZ LMAG, IEEE Day joint event	$ 500.00	
Interest received	$ 548.38	
Closing balance (31/12/2024)	**US$ 14,733.03**	
(Converted to NZ$ @ 1.78675)		**NZ$ 26,324.24**
Overall position		
Current position 31/12/2024	NZ$ 38,555.60	
Position at 1/1/2024	NZ$ 31,754.12	
Net profit (year to date)	**NZ$ 6,801.48**	
(includes exchange rate gain of NZ$3,031.17)		

PART B - ORGANIZATIONAL ACTIVITIES

B.1 Membership Development Activities

- Total number of active members in the past 3 years.

- 2022: 276
- 2023: 268
- 2024: 312

- Summary and evidence of work done to improve the value of membership, which leads to retention and growth of members
  - In 2024, we have emailed to remind members within the Section who are late to renew their membership for the new year about the benefit of being IEEE member and continue to be a part of the group.
  - We have had an active program of section activities, particularly focused on Chapter activities to encourage more participation by members with specialist interests.
  - We have had a strong program within Victoria University of Wellington and Massey University associated with the section, particularly with postgraduate students. This is reflected in the strong participation with the joint Postgraduate Symposium, which is a whole day event.

B.2 Chapter Activities

- Total number of Chapters in the Section: 6 (Six)
  - Chapter of the Computational Intelligence Society
  - Chapter of the Power and Energy Society
  - Joint Chapter of the IEEE Communications Society (joint with NZ North and NZ South)
  - Joint Chapter of the IEEE Instrumentation and Measurement Society (joint with NZ North and NZ South)
  - Joint Chapter of the Signal Processing and Information Technology Societies (joint with NZ North and NZ South)
  - Joint Chapter of the IEEE Geoscience and Remote Sensing Society Chapter (joint with NZ North and NZ South)
- Number of Chapters formed in the current year: 0 (Zero)
- Number of active Chapters (Chapters who have reported required number of meetings during the year)
  - 6 (Six)
- Summary of Chapter activities (Chapter wise with attachment table/information)
  - See above

B.3 Professional and Continuing Education Activities

We have a NZ nationwide Education Coordinator (Nurul Sarkar from AUT) nominated by NZ Central Section, who is also an IEEE STEM Ambassador. Our Education Coordinator has organised a number of education activities as follows:

- 21/02/2024: STEM Outreach --- Professor Nurul Sarkar spoke to new students on the orientation day (21st Feb 2024) at Auckland University of Technology (AUT). The lecture began with a short presentation highlighting the importance of STEM education and student learning opportunity at AUT. The scope and the various study options within the Bachelor of Computer and Information Sciences (BCIS) programmes were discussed. In the second half, Prof Sarkar talked about external engagement opportunity including Women in Technology, IEEE Women in Engineering, and IEEE student branch on campus. The IEEE STEM resources for students were highlighted. About 400 students attended the lecture and the positive outcomes indicated that the event was successful.
- 23/08/2024: AUT Open Day --- AUT Live (Open day) is one of the largest and most significant pre-Uni outreach programmes was held at Auckland University of Technology (Auckland, New Zealand) on 24 August 2024. Prof Nurul Sarkar (IEEE STEM Champion) was volunteered for the day. We met and greeted about 300+ pre-University students and their parents on campus. We had opportunity to talk to numerous pre-University students and their parents regarding study plans and career opportunities in ICT/computer Science, Engineering, network and cybersecurity. Data science, Software development and Digital services.
- 08/09/2024: Multiethnic Youth STEM Networking --- Professor Nurul Sarkar was invited to a Pathway and Careers Day- Multiethnic Youth event (AUT South Campus, Manukau) attended by some 200+ year thirteen students accompanied by their teachers on Monday 9 September 2024. It was one of the most significant career events the Ministry of Education organised this year. By attending the STEM networking session, Prof Nurul Sarkar had an opportunity to talk to various pre-University students (mostly refugee/migrant and Pacifica) about our AUT BCIS programmes and answer their queries. Many students have expressed their interest in coming to AUT for Computer Science and Engineering study.

B.4 Students Activities

- Total number of Student Branches in the Section
    - Two – Massey University and Victoria University of Wellington
- Number of new Student Branches formed in the current year
    - None
- Section level student activities (student congress, paper and other contests, awards etc)
    - 26/08/2024: The Victoria University of Wellington Student Branch and Massey University Student Branch organised the IEEE Postgraduate Symposium 2024, which was held at Victoria University of Wellington in Kelburn, Wellington. This event involved presentations from over 30 PhD students from Victoria University of Wellington and Massey University (Palmerston North) to present their research work. There were approximately 40 attendees who enjoyed the presentations. The three best presentations were recognised and awarded with prizes.
- Number of active Student Branches (Student Branches who have reported required number of meetings during the year)
    - Two
- Summary of Student Branch activities (Student Branch wise with attachment table/information)
    - As per above.

B.5 Affinity Group Activities

- Young Professional (YP): During 2024, the YP Affinity Group organised 4 seminars:
    - 23/02/2024: Skin optics: the connection between intrinsic properties of skin and the appearance of skin --- Prof. Steven L. Jacques from the University of Washington, Seattle discussed Skin optics where optical images and spectroscopy of skin can characterize the appearance of skin... the sheen, the glow, the smoothness, the pigmentation. Such parameters are worthwhile to assess, and of practical use to people managing their skin's appearance. Such observed parameters are connected to the intrinsic properties of skin: blood content, oxygen saturation of hemoglobin in blood, water content, melanin content, scattering properties, as well as the architecture of skin (depth of the blood, multiple layers: epidermis, papillary dermis, vascular plexus, reticular dermis, fat, muscle). The geometry of observation (delivery and collection of light from the skin) influences how intrinsic properties map to observed parameters. This talk will discuss how light transports in/through/out of skin based on skin properties and architecture, and yields the observed appearance of skin.
    - 02/10/2024: The Young Professional Affinity Group hosted a panel discussion on "Research life and experiences related to career progression". We invited junior faculty, postdocs, and PhD students to discuss about multiple aspects of research life and experiences related to career progression, while keeping the floor open for questions.
    - The Group participated in the IEEE Postgraduate Symposium.
- Women In Engineering (WIE):
    - 02/10/2024: The Women in Engineering Affinity Group hosted a panel discussion on "Empowering Women in Engineering: Challenges, Experiences and Opportunities". This panel discussion brings together a diverse group of women in engineering, representing various stages of the career journey - from students to early-career professionals to seasoned experts. The hour-long session will explore the unique experiences, challenges, and opportunities faced by women in the engineering field. Panellists share personal insights, discuss strategies for success, and address current issues affecting women in Engineering. Topics include mentorship, work-life balance, overcoming barriers, and fostering inclusivity in the workplace. This engaging dialogue aims to inspire, inform, and empower current and future women engineers, while also highlighting the importance of diversity in driving innovation and progress in the field.
    - The WIE group participated in the two events: IEEE Postgraduate Symposium and the Seminar - Skin optics: the connection between intrinsic properties of skin and the appearance of skin.
- Life Member (LM)
    - 02/10/2024: The LM group organized on a workshop on “What is Resilience and Why is it so elusive in New Zealand?” There were four speakers: Professor Bob Hodgson, Life Member IEEE, Distinguished Fellow ENZ Kieran Devine, Life Member IEEE, Fellow ENZ Dr Murray Milner, Life Member IEEE, Distinguished Fellow ENZ Duncan Hall, Life Member IEEE, Distinguished Fellow ENZ. The negative impacts of recent weather events have led to many

questions being raised about the resilience of the critical infrastructure and services upon which we all rely. Subsequent speakers will consider the resilience of electrical power supplies, communication systems and the software that underpins much of modern life. This introductory presentation will provide an overview of the key concepts and definitions necessary to a discussion of resilience, including reliability, risk and exposure to rare but potentially devastating events. The second speaker will consider the Resilience of the Fuel Supply for New Zealand's Electricity Generation System. With the transition of the New Zealand electricity generation system to renewables, away from carbon rich fuels, the question needs to be asked is the renewables "fuel tank" adequate to keep the lights ON, during major long term (3 months and longer), system wide events, i.e.: droughts, DC Link failures, dam failures, etc? The third speaker will address issues related to the resiliency of the telecommunications capability in New Zealand and whether it is adequate to meet public expectations for critical life, safety and wellbeing outcomes in the face of severe disruptive events. What are the lessons we can learn from lack of resiliency that has been demonstrated during recent disruptive weather events? Are there cost effective ways to ensure that a minimum capability is maintained during any adverse condition event? Continuing with the resilience theme the forth speaker will address the issues related to resiliency in regard to the software that we all rely on in our daily lives. Should we expect systems and technology which depend on the use of software for their satisfactory operation to be capable of operation under severe adverse conditions? Is software inherently resilient or what can we do to make it more resilient? After the presentations, there will be ample time for the audience to ask questions of the presenters either from the floor or via the chat function.

    - The group also organized monthly meetings to discuss the plan for upcoming months.

B.6 Awards & Recognition Activities

- Award constituted by the Section
    - The key awards constituted by the Section are those in support of the Postgraduate Symposium. These awards for best presentation are presented each year at the Symposium.
- Please list all Awards and Recognitions received by the Section, and members in the Section, from R 10 and IEEE HQ during the year
    - None

B.7 Communication Activities (Newsletter, Home Page, E-mail etc.)

- Newsletter (name and number of issues in the year: N/A
- Home Page of the Section (give the URL and how often it is updated?
    - The Section website is updated regularly with activity information, both as announcements of upcoming events, and reports on the events as they happen. The URL is https://r10.ieee.org/nzc/.
    - The website is kept regularly up to date by our very active webmasters Jordan MacLachlan, Yuan Tian, Jesse Wood. They ensure that all activities involving the Section are recorded on the website in a timely manner and frequently chase committee members to ensure that reports on recent events are recorded quickly, with photos where possible.
- Other means of contacts with Section members including social media
    - Members are notified of upcoming events through e-Notices.

B.8 Industry Relations

- Membership growth and retention:
    - 11/04/2024: Our Industry Coordinator, Fanglue Zhang, organized IEEE New Zealand Central Section Industry in collaboration with the Computational Visual Media Conference (CVM2024) is proud to present a cutting-edge workshop. This workshop will feature four key speakers who will provide comprehensive insights into "Building a high-quality performance capture pipeline", "AI-Based 3D Visual Computing", "User Experience as a Driver for System Development", and "Light Transport in Turbid Media: Modern Applications and Synergy with Machine Learning". Don't miss this unique opportunity to learn from leading experts in the field.

- Activities for/with industrial members: Our Central Power and Energy Chapter Chair, Daniel Burmester, organized the following presentation series with power companies in NZ to talk about their experience in the power industry and the problems we have faced, and will face in the future.
    - 02/08/2024: Mathew Cooper from Electra: Data and insights in Distribution Company
    - 09/08/2024: Nabil Adam from Transpower: Assessing Grid Investment in System Planning
    - 16/08/2024: Patrick Berry: Condition based asset risk assessment
    - 06/09/2024: Ramu Naidoo from Transpower: NZ Electricity Market
    - 13/09/2024: Vong Nyuk from Transpower, System Operations

B.9 Humanitarian Technology Activities

- Humanitarian Technology related activities supported by the Section including collaboration with other OUs.
    - None
- SIGHT Activities
    - None

B.10 Community Activities

- IEEE Social activities (Family day, IEEE day, Engineers Week)"
    - 02/10/2024: New Zealand Central Section IEEE Day --- The IEEE Day organised by the New Zealand Central Section will be a combination of the Life Members, Young Professional, and Women in Engineering Affinity Group events. The **New Zealand Joint Life Members Affinity Group** will host a seminar on "What is Resilience and Why is it so elusive in New Zealand?" We will invite four very senior speakers to give a short presentation each, followed by a Q/A session. Professor Bob Hodgson (Life Member IEEE, Distinguished Fellow ENZ) will consider the resilience of electrical power supplies, communication systems and the software that underpins much of modern life, and given an introductory presentation to provide an overview of the key concepts and definitions necessary to a discussion of resilience, including reliability, risk and exposure to rare but potentially devastating events. Kieran Devine (Life Member IEEE, Fellow ENZ) will consider the Resilience of the Fuel Supply for New Zealand's Electricity Generation System. With the transition of the New Zealand electricity generation system to renewables, away from carbon rich fuels, the question needs to be asked is the renewables "fuel tank" adequate to keep the lights ON, during major long term (3 months and longer), system wide events, i.e.: droughts, DC Link failures, dam failures, etc? Dr Murray Milner (Life Member IEEE, Distinguished Fellow ENZ) will address issues related to the resiliency of the telecommunications capability in New Zealand and whether it is adequate to meet public expectations for critical life, safety and wellbeing outcomes in the face of severe disruptive events. What are the lessons we can learn from lack of resiliency that has been demonstrated during recent disruptive weather events? Are there cost effective ways to ensure that a minimum capability is maintained during any adverse condition event? Duncan Hall (Life Member IEEE, Fellow ENZ) will address the issues related to resiliency in regard to the software that we all rely on in our daily lives. Should we expect systems and technology which depend on the use of software for their satisfactory operation to be capable of operation under severe adverse conditions? Is software inherently resilient or what can we do to make it more resilient? **The Young Professional Affinity Group** will host a panel discussion on "Research life and experiences related to career progression". We will invite junior faculty, postdocs, and PhD students to discuss about multiple aspects of research life and experiences related to career progression, while keeping the floor open for questions. The **Women in Engineering Affinity Group** will host a panel discussion on "Empowering Women in Engineering: Challenges, Experiences and Opportunities". This panel discussion brings together a diverse group of women in engineering, representing various stages of the career journey - from students to early-career professionals to seasoned experts. The hour-long session will explore the unique experiences, challenges, and opportunities faced by women in the engineering field. Panellists will share personal insights, discuss strategies for success, and address current issues affecting women in Engineering. Topics will include mentorship, work-life balance, overcoming barriers, and fostering inclusivity in the workplace. This engaging dialogue aims to inspire, inform, and

empower current and future women engineers, while also highlighting the importance of diversity in driving innovation and progress in the field.

PART C - OTHERS

C.1 Special Events

- None

C.2 Relationship with National and International Societies and Non-Government Organizations (NGO)

- Nature of relationship and details of any formal agreement signed
  - **Engineering New Zealand (ENZ):** A Collaboration Agreement was signed several years ago and requires renewal. Initial discussions with ENZ began in 2020, but progress has been slow due to administrative restructuring within ENZ and shifting organizational priorities. We will continue to follow up in the coming year. Joint events are held annually. There is a significant overlap in membership.
  - **Institute of Engineering and Technology** (IET): A Collaboration Agreement was signed several years ago and is due for renewal. Communication with IET has been positive, with agreement in principle for renewal and a shared interest in strengthening collaboration, particularly in Young Professionals (YP) initiatives. However, internal leadership changes and scheduling constraints have delayed progress. We will work towards finalizing the agreement and expanding collaboration in the new year. The IEEE NZCS LM Chair is also a member of the IET Wellington Network Committee. Significant membership overlap. Several joint events are held annually.
- Details of joint activities
  - Other events held on a collaborative basis as appropriate.

- Benefit to IEEE members (for example discounts, access to technical information etc.)
  - IEEE members gain access to technical seminars and events that would otherwise require multiple memberships.
- Benefit to Section (for example help in membership development, venue facilities, cost saving etc.):
  - Expanded range of activities for members with reduced organizational effort.
  - Enhanced collaboration by leveraging the resources and reach of all three organizations.
  - Minimizes competition for members and fosters stronger partnerships among IEEE, ENZ, and IET.

C3. Collaboration with other IEEE Sections

- Support extended to neighboring Sections
  - Many activities are undertaken collaboratively with the New Zealand North and South Sections
  - Several Chapters are Joint with the North and/or South Sections in order to ensure scale and scope of activities.
- Joint activities with any other Section
  - We mainly have joint activities with other New Zealand Sections through the activities organised by our Joint Chapters, as listed above.

C.4 Support extended to Sub-sections & Society Chapters within the Section

- Support extended for organizing technical, educational and professional activities
  - There are no sub-sections within the New Zealand Central Section
  - The NZCS always works to support Society Chapters in a collaborative manner with funding as required.

- All Chairs of Chapters and Joint Chapters are invited to participate in monthly Section Committee meetings.

- Joint activities for membership development
  - Society Chapter Chairs are involved in all membership development activities undertaken by the Section.
- Support extended for the formation of a Sub-section or transition of a Sub-section into a full Section
  - Not applicable

C.5 Best Practices of your Section (which you would like to share with other Sections for the benefits of members)

- Maintaining regular (monthly) committee meetings.
- We have defined a "Portfolio responsibilities" document, which outlines the roles and responsibilities for the various portfolios on the executive committee.
- Close coordination of activities with those of affiliated groups such as Engineering New Zealand and Institute of Engineering and Technology.
- The New Zealand Central Section always organizes the annual Postgraduate Symposium which involves participation across the two postgraduate universities within the NZ Central Region and typically has 30-40 presentations. Prizes are awarded for the best presentations, but the greatest value is derived from the sharing of research activities from across the region. We also provide 1-year free IEEE student membership grant to the presenters to increase our membership retention and visibility of IEEE and our Section in NZ.

C.6 Problems anticipated and suggestions for solutions, if any

- Like many countries, New Zealand has a national engineering institution—Engineering New Zealand (ENZ). As engineering gains recognition as a critical field for delivering safe, modern infrastructure, engineers face increasing requirements for Continuous Professional Development (CPD) and competency maintenance. These requirements have become a matter of Regulatory Compliance, typically tied to membership and competency evaluations through ENZ. The challenge for IEEE is that engineers are often required to join their national institution for regulatory reasons, making it financially difficult to maintain memberships in other organizations like IEEE. This growing trend presents a competitive challenge for IEEE and IET in New Zealand.

- A joint membership model with ENZ and IEEE at a reduced rate is likely necessary in the future. Our LM Affinity Group Chair, Murray Milner, is a Distinguished Fellow of ENZ, while our Chair, Bach Nguyen, CIS Chapter Chair and Student Counselor Mengjie Zhang, and WIE Coordinator Bing Xue are Fellows of ENZ. We will continue to seek ENZ Fellowships for IEEE Committee members to strengthen our influence on ENZ's decisions and strategic planning.

- Maintaining active student branches remains a challenge due to high student turnover. To sustain engagement, we must focus on attracting and retaining members across our two student branches.

PART D - GOALS AND PLANS

D.1 Continuation of project/activity in progress and their implementation plans

- Maintain our highly successful Joint Institutions Breakfast Meeting, providing a valuable networking opportunity for industry professionals.
- Continue hosting the Postgraduate Presentation Event, supporting knowledge sharing and academic engagement.
- Invite Distinguished Lecturers to deliver insightful presentations for our members.
- Send personalized welcome letters to all new members in the Central Region to enhance engagement and retention.

D.2 Goals and Future Plans

- Goals:
    - Expand membership across all engineering disciplines.
    - Encourage professional growth by supporting members in advancing their membership levels.
    - Strengthen engagement with all members in the Central Region.
    - Promote Young Professionals (YP) and Women in Engineering (WIE) initiatives.
    - Develop future leaders by sponsoring their participation in the R10 Meeting and IEEE Sections Congress.
- Future Plans:
    - Require all coordinators to submit an annual plan and budget at the first committee meeting of the year.
    - Enhance visibility by establishing Section social media platforms (e.g., Facebook, Twitter).
    - Introduce new awards to recognize contributions and encourage event organization.
    - Increase industry representation by inviting more committee members from the sector.

D.3 Any innovative ideas to make IEEE more creative and value added for sustaining the membership retention and recruitment goals.

- As highlighted in Section C6, strengthening collaboration with Engineering New Zealand (ENZ) is becoming increasingly important to ease the financial burden of dual memberships. Our approach will focus on two key areas:
    - Enhancing engagement with ENZ activities, particularly through Young Professionals (YP) events, to build a stronger relationship.
    - Increasing our influence within ENZ by securing more Fellowships for IEEE Section members.

  Once we establish a stronger presence, we will explore proposing an ENZ-IEEE joint membership program in discussions with the ENZ leadership team.
- We will continue to increase our local visibility through our website, social media, and organized events to attract and retain more members

D.4 Business Plan for Sustainable Growth and Financial Stability.

- Business Planning for 2025: New Zealand's summer holidays span December and January, so Business Planning for the New Year will begin in February 2025. As a result, the 2024 Business Plan is still in its early development stage.
- Planned Focus Areas for 2025:
    - Support Chapter seminars and events, with a strong emphasis on Distinguished Lectures.
    - Host the annual Combined Institutions Industry Breakfast, a key networking event.
    - Organize the Postgraduate Presentation Symposium, in collaboration with Student Branches.
    - Enhance visibility through the Section website, social media, and various activities.
    - Prioritize membership development and retention, addressing challenges noted in Section C6.
    - Strengthen Affinity Groups, ensuring continuity and growth of: Young Professionals (YP), Women in Engineering (WIE), and the newly established NZ-wide Life Member Affinity Group
    - Increase engagement with Engineering New Zealand (ENZ) by:
        - Applying for more ENZ Fellowships to strengthen IEEE's influence.
        - Exploring opportunities for deeper collaboration, including potential joint membership initiatives.
    - Introduce special funds and awards to incentivize event organization and provide financial support, aiming to boost the Section's visibility and influence.