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# CISphere@UoJ

*Igniting Intelligent Connections*

## NEWSLETTER

IEEE Computational Intelligence Society  
Student Branch Chapter of the University of Jaffna



Workshops  
& Tech Talks



Awards



Outreach  
Activities



Summer School

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## IEEE CIS Student Branch Chapter



University of Jaffna Student Branch Chapter

Welcome to the IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna (IEEE CIS-SBC-UoJ), Sri Lanka. As the first CIS Student Branch Chapter in the country, we take pride in pioneering a platform that inspires innovation, collaboration, and excellence in the field of computational intelligence.

The chapter was officially established in March 2022, following a successful petition submitted in February 2022 under the guidance of Prof. M. Siyamalan, the then Counsellor of the IEEE Student Branch at the University of Jaffna, with Dr. (Ms.) R. Nirthika serving as the Interim Chair. The Inaugural General Meeting of the chapter was held on 14 March 2022, marking the beginning of a journey dedicated to advancing knowledge and fostering a strong community of technology enthusiasts. The chapter commenced its activities under the advisorship of Dr. K. Sarveswaran and the leadership of Mr. S. P. D. Anuraj, supported by a founding executive committee.

During 2023-2026, the chapter strengthened its presence through diverse academic, outreach, and capacity-building initiatives, while actively promoting STEM education in Artificial Intelligence (AI) and the Internet of Things (IoT). Notable achievements include hosting the 2023 IEEE CIS Summer School on Computational Intelligence and conducting a series of IEEE CIS High School Outreach Programmes. The chapter's excellence was recognized through the IEEE Sri Lanka Section Awards (2023 & 2025), receiving the Emerging Chapter Award in both years, while Prof. A. Ramanan, who served as the advisor during this period, was honored with the Outstanding Student Branch Chapter Advisor Award (2025).

Building upon this strong foundation, CIS-SBC-UoJ continues to cultivate an environment that promotes intellectual growth, interdisciplinary collaboration, and professional development among students, researchers, and industry professionals.

Beyond its core academic initiatives, the chapter actively contributes to school-level STEM education through hands-on training programmes and Training of Trainers (ToT) initiatives for teachers and administrative staff, enhancing their capacity to deliver technology-driven education.

Through a wide range of workshops, seminars, competitions, and industry collaborations, the chapter empowers its members to explore their interests, strengthen their expertise, and transform innovative ideas into impactful solutions.

CIS-SBC-UoJ warmly welcomes students from all disciplines who share a passion for computational intelligence. Together, we aim to shape a future where innovation meets collaboration and knowledge drives meaningful change.

Join us as we continue to grow, lead, and redefine possibilities through IEEE CIS-SBC-UoJ.



### Newsletter Designer

Mr. Nageswaran Thileepan  
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## Behind the Editors' Desk

We are delighted to present the inaugural volume of "CISphere@UoJ", the newsletter of the IEEE Computational Intelligence Society Student Branch Chapter at the University of Jaffna. This publication reflects our journey, our achievements, and the continued growth of our award-winning chapter.

Over the past years, we have had the privilege of organizing a diverse range of initiatives, including research-focused activities, hands-on technical workshops, and knowledge-sharing sessions. These efforts have strengthened our student community while expanding our outreach, raising awareness of AI, IoT, and emerging technologies among school students and working professionals. The impact of these initiatives is clearly reflected in our alumni, many of whom are now making meaningful contributions to the AI and software industries. Their achievements continue to inspire us and reaffirm the purpose of our work.

This edition also highlights our ongoing awareness sessions and technical talks on computational intelligence and emerging technologies, conducted in collaboration with leading technology companies in Sri Lanka, as well as local and international experts. Such engagements provide our members with practical skills, global exposure, and valuable networking opportunities, preparing them to thrive in this rapidly evolving AI landscape.

We extend our heartfelt gratitude to our past and present IEEE Student Branch Counselors, Chapter Advisors, university lecturers, IEEE volunteers, and the non-academic staff of the Department of Computer Science. Their unwavering support, guidance, and encouragement have been instrumental in shaping the success of our chapter. Through inspiring member success stories and snapshots of our activities, we hope this newsletter motivates every reader to explore opportunities, pursue excellence, and actively contribute to both the local and global IEEE CIS community.

We would also like to express our sincere appreciation to Dr. S. Mahesan (Visiting Lecturer, DCS, UoJ), Dr. K. Sarveswaran (Senior Lecturer, DCS, UoJ), and Dr. S. Shriparen (Senior Lecturer, DCS, UoJ) for generously dedicating their time to review the articles and for providing timely and valuable feedback. Our special thanks go to Mr. N. Thileepan, Management Assistant, DCS, for his creative efforts in designing this newsletter.

A sincere thank you to everyone who contributed to making this inaugural volume possible. We hope it informs, inspires, and strengthens the bonds within our community.

**Editorial Team/ IEEE CIS Student Branch Chapter - University of Jaffna**

## Dean's Message



**Prof. P. Ravirajan**  
Senior Professor of Physics and Dean  
Faculty of Science, University of Jaffna

It is with great pleasure that I extend my warm greetings to the editorial team, staff, and students of the IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna on the publication of this newsletter. The IEEE CIS-SBC-UoJ has, within a relatively short span since its establishment in 2022, demonstrated remarkable commitment to academic excellence, innovation, and community engagement. As the first IEEE CIS Student Branch Chapter in Sri Lanka, your initiative has set a commendable benchmark, reflecting both vision and dedication.

I am particularly pleased to note the breadth of activities highlighted in this publication, from foundational explorations in artificial intelligence and computational intelligence to discussions on responsible AI, cybersecurity, and emerging technologies. These efforts clearly illustrate the chapter's commitment to staying at the forefront of rapidly evolving technological landscapes while fostering critical thinking and ethical responsibility among its members.

The Faculty of Science takes immense pride in the achievements of our students, whose enthusiasm and curiosity continue to drive such impactful initiatives. Equally, I wish to appreciate the guidance and mentorship provided by the academic staff and advisors. Their dedication has been instrumental in nurturing a culture of innovation, collaboration, and professional growth.

It is also commendable that the chapter actively engages with the broader community through STEM outreach programmes, teacher training initiatives, and knowledge-sharing platforms. Such efforts not only strengthen the link between academia and society but also inspire the next generation of scientists and engineers.

I congratulate the editorial team for compiling this comprehensive and insightful magazine, which stands as a testament to the collective efforts and accomplishments of the IEEE CIS-SBC-UoJ. I am confident that this publication will serve as both a source of inspiration and a record of excellence for years to come.

I wish the chapter continued success in all its future endeavors and encourage you to persist in your pursuit of knowledge, innovation, and service to society.

## Chairperson's Message IEEE CIS Sri Lanka Chapter



**Dr. Sidath Weerasinghe**  
Chairperson  
IEEE CIS Sri Lanka Chapter  
Associate Architect - Axiata Digital Labs

"A connected student is an empowered student. Moreover, an empowered student becomes the researcher, the engineer, the leader that the world is waiting for."

It is with great enthusiasm and pride that I extend my greetings to the vibrant community of the IEEE CIS Student Branch Chapter at the University of Jaffna. Your continued commitment to advancing knowledge and fostering innovation within the field of Computational Intelligence is both commendable and inspiring. As we navigate an era defined by rapid technological evolution, Computational Intelligence (CI) stands at the forefront of transformative change. From machine learning and neural networks to evolutionary computation and fuzzy systems, CI is not merely an academic discipline; it is a catalyst shaping industries, economies, and societies. The role you play as students and emerging professionals in this domain is therefore both significant and impactful.

The IEEE Computational Intelligence Society (CIS) Sri Lanka Chapter remains dedicated to supporting student branches such as yours through knowledge-sharing platforms, technical workshops, collaborative research opportunities, and industry engagement initiatives. Your chapter has consistently demonstrated strong potential through its activities, and I encourage you to continue pushing boundaries, organizing events, participating in global competitions, and contributing to research that addresses real-world challenges.

University of Jaffna holds a unique and important position within Sri Lanka's academic landscape. By leveraging your strengths, embracing interdisciplinary collaboration, and staying connected with the broader IEEE CIS network, you can position yourselves as leaders in innovation not only locally but globally.

I would also like to emphasize the importance of community. Beyond technical excellence, the relationships you build within your chapter and across institutions will shape your professional journey. Engage actively, support one another, and cultivate a culture of curiosity and inclusivity.

As Chairperson of the IEEE CIS Sri Lanka Chapter, I reaffirm our commitment to empowering your journey. We look forward to working closely with your student branch and witnessing your continued growth and achievements.

Let us move forward together innovating, collaborating, and leading the future of intelligent systems.

## Counsellor's Message IEEE Student Branch, UoJ [2024-2026]



**Dr. E. Y. A Charles**  
Counsellor (2024-2026)  
IEEE Student Branch of the University of Jaffna

Congratulations to the IEEE Computational Intelligence Society (CIS) Student Branch Chapter at the University of Jaffna on the launch of this newsletter. As the former Counsellor for the IEEE Student Branch, it has been a privilege to witness your evolution from Sri Lanka's first CIS chapter into a vibrant hub of innovation. This milestone is a testament to the collective dedication of the Executive Committees, advisors, and committee chairs dating back to 2022.

Beyond the technical milestones, I am particularly proud of the diverse skills you have cultivated through this journey. The experience gained in organising high-level summer School, workshops, authoring insightful articles, and designing creative outreach materials has provided a practical edge that goes well beyond the classroom. Most importantly, the fellowships and lifelong friendships forged while working late on projects or coordinating seminars are your most valuable assets. These bonds of collaboration will serve as a permanent foundation for your professional lives, ensuring that as you move forward to tackle global challenges, you do so with a network of peers that will support your greatest achievements for years to come.

## Counsellor's Message IEEE Student Branch, UoJ [2026-2027]



**Dr. S. Shriparen**  
Counsellor (2026-2027)  
IEEE Student Branch of the University of Jaffna

It is with great pleasure that I extend my warmest greetings to the IEEE Computational Intelligence Society, Student Branch Chapter of the University of Jaffna (IEEE CIS-SBC-UoJ) on the publication of this newsletter. As the first CIS Student Branch Chapter in Sri Lanka, you continue to set an inspiring example in promoting innovation and excellence in computational intelligence.

IEEE, as the world's largest technical professional organization, is dedicated to advancing technology for the benefit of humanity. In line with this vision, IEEE CIS-SBC-UoJ has created a dynamic platform for students to explore artificial intelligence and related fields while developing their technical and professional skills.

This newsletter highlights a distinguished record of achievements and a wide range of impactful initiatives. From technical talks and workshops to the IEEE CIS Summer School and STEM outreach programs, your efforts demonstrate a strong commitment to knowledge sharing and community engagement. Your focus on human-centred and responsible AI further reflects your forward-thinking approach.

I would like to commend the unwavering dedication of all members and the editorial team for producing this excellent publication. I encourage you to continue demonstrating innovation and making impactful contributions to the field and the wider community. Wishing you continued success.

## Interim Chair's Message



**Dr. (Ms.) Nirthika Rajendran**  
Interim Chair, 2022  
IEEE-CIS-SBC-UoJ

It is with great pride that I reflect on the establishment of the IEEE Computational Intelligence Society (CIS) Student Branch Chapter at the University of Jaffna, for which I had the privilege of serving as the Interim Chair from February to March 2022.

During this period, I initiated and submitted the petition to the IEEE Member and Geographic Activities Department, transitioning from an IEEE Student Branch to a formally recognized CIS Student Branch Chapter, under the valuable guidance of Prof. M. Siyamalan, the then Counselor. I am pleased to note that the Chapter was officially established with effect from 15 February 2022, marking a significant milestone in promoting computational intelligence within our academic community.

I extend my sincere appreciation to all Executive Committee members from inception to the present for their dedication in strengthening the Chapter. I wish the current and future committees continued success in achieving greater milestones.

## Advisor's Message [2022-2023]



**Dr. K. Sarveswaran**  
Advisor (2022-2023)  
IEEE-CIS-SBC-UoJ

It is with great pleasure that I extend my best wishes on the publication of the inaugural newsletter of the IEEE Computational Intelligence Society (CIS) Student Chapter of the University of Jaffna.

The establishment of this Chapter marks a significant milestone in our journey. The IEEE Computational Intelligence Society Student Branch Chapter was inaugurated on 14th March 2022. Notably, this became the first IEEE CIS Student Branch Chapter in Sri Lanka—an achievement that underscores the vision and initiative of our students and staff.

In today's world, Computational Intelligence stands at the forefront of technological advancement, driving innovations in artificial intelligence, data science, and intelligent systems. For a university such as ours, located in a region with unique linguistic and societal contexts, the relevance of CIS is particularly profound. It provides an essential platform to develop locally relevant yet globally impactful solutions, especially in areas such as low-resource language technologies and inclusive AI. I encourage our students to make full use of this platform—to explore, innovate, and collaborate—and to contribute meaningfully both to the global scientific community and to the development of our region.

I commend all those who contributed to establishing this Chapter and to the publication of this inaugural newsletter. I wish the Chapter continued success in the years ahead.

## Advisor's Message [2023-2026]



**Prof. A. Ramanan**  
Advisor (2023-2026)  
IEEE-CIS-SBC-UoJ

It is my pleasure to share this message as the Immediate Past Advisor of the IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna, on the occasion of its inaugural newsletter, CISphere@UoJ. This milestone publication reflects the chapter's dynamic journey, impactful initiatives, and notable accomplishments.

Covering the period from 2023 to 2026, this phase marks a transformative era during which I served as the Advisor. When I assumed the role in 2023, the chapter was still in its infancy. Over the next three years, it achieved remarkable growth, securing two competitive IEEE CIS grants totaling approximately USD 7,000, earning three national-level awards from the IEEE Sri Lanka Section, and organising Sri Lanka's first-ever summer school on computational intelligence in 2023.

Between January 2023 and January 2026, the chapter implemented a diverse portfolio of activities, including 22 technical talks, 06 workshops, 06 career development sessions, a summer school, 09 full-day outreach programmes, and a talent show. These outreach efforts had significant societal impact, providing training to administrative officers of the Government Agent's office, school teachers, and high school students in emerging fields such as IoT and Generative AI. Notably, nearly 800 participants benefited from these programmes in 2025 alone.

The chapter's consistent engagement led to major recognition, including the Emerging Chapter Award (SB Category) at the IEEE Sri Lanka Section Awards in 2023 and 2025. I was also honoured to receive the IEEE Sri Lanka Section Outstanding Student Branch Chapter Advisor Award in 2025.

Inclusivity has been a defining feature of the chapter's initiatives. Most events were open to students across Sri Lanka, with the inaugural summer school attracting around 111 participants from leading universities and higher education institutions. Collaborations with software industry partners and Google Research further strengthened the quality and impact of these activities.

These achievements were made possible by the dedication of IEEE student volunteers and successive Executive Committees. I extend my sincere appreciation to all IEEE student volunteers of the University of Jaffna, as well as to those contributing to IEEE Sri Lanka Section initiatives.

I also express my gratitude to the chapter chairpersons, Mr. Nipun Weerasinghe, Miss Sankavi Mohan, and Miss Vinuki Samaraweera, for their leadership. I further acknowledge the Heads of the Department, Mr. S. Suthakar and Dr. (Mrs.) B. Mayurathan, along with the academic and non academic staff, whose continuous support was instrumental in the success of these initiatives.

I wish the CIS Chapter of the University of Jaffna continued success and growth, with many more impactful initiatives and achievements in the years ahead.

## Advisor's Message [2026-2027]



**Dr. (Mrs.) B. Mayurathan**  
Advisor (2026-2027)  
IEEE-CIS-SBC-UoJ

It is my pleasure to extend warm greetings on the release of the inaugural newsletter, "CISphere@UoJ," of the IEEE Computational Intelligence Society Student Branch Chapter at the University of Jaffna.

As the first IEEE CIS Student Branch Chapter in Sri Lanka, it has established a vibrant platform for innovation, collaboration, and academic excellence since its inception in March 2022, demonstrating remarkable growth through the dedication of its members.

During the period (2023-2026) under the advisorship of Prof. A. Ramanan, the chapter organized workshops, technical talks, outreach activities and knowledge-sharing initiatives, fostering intellectual growth, interdisciplinary collaboration, and professional development among students. It also promoted STEM education through hands-on training in IoT and AI, and conducted Training of Trainers (ToT) programmes for teachers and administrative staff to enhance their effectiveness.

Many key milestones were achieved during this period, including the successful organization of the 2023 IEEE Summer School on Computational Intelligence: Theory and Applications, supported by an IEEE CIS grant, which provided both theoretical and practical exposure in AI, Deep Learning, Natural Language Processing, IoT, and Robotics.

The chapter further secured the IEEE CIS High School Outreach Programme Grant for 2024/2025, valued at approximately USD 3,000, reflecting its commitment to extending its impact by promoting STEM education among school students.

Its excellence has been recognized through the IEEE Sri Lanka Section Awards in 2023 and 2025, receiving the Emerging Chapter Award in both years. In addition, Prof. A. Ramanan was honoured with the Outstanding Student Branch Chapter Advisor Award in 2025, highlighting strong leadership and collective effort during this period.

This newsletter represents a significant milestone, showcasing the creativity, research, and achievements of students while promoting knowledge sharing and innovation. I commend the editorial team and contributors for their dedication in bringing out this inaugural volume.

I encourage members to continue engaging in such initiatives and striving for excellence in academic and professional pursuits. I hope this newsletter grows as a source of inspiration reflecting the outstanding work of IEEE-CIS-SBC-UoJ.

I extend my sincere appreciation to all contributors and wish the chapter continued success in its future endeavors.

## Chairperson's Message [2022-2023]



**Mr. S. P. D. Anuraj**  
Chairperson (2022-2023)  
IEEE-CIS-SBC-UoJ

Dear Members, Friends, and Fellow Enthusiasts of the IEEE CIS Student Branch Chapter of the University of Jaffna,

When I look back at the inception of this chapter, I am reminded of a fundamental concept in computational intelligence, a single node, on its own, has limited capacity. But when you connect multiple nodes, feed them a shared purpose, and allow them to learn and adapt together, they become a network capable of solving incredibly complex problems.

When I first had the idea to establish an IEEE Student Branch at the University of Jaffna back in 2018, I quickly realized I was just one node. I am immensely proud to say that I received tremendous support from the lecturers and all the members of the Department of Computer Science (DCS). Forming those building blocks was not easy. Often, people do not notice the significant outcomes of laying a foundation until several years have passed.

After that initial foundation was set, we looked toward the next evolution. With the great vision of Prof. A. Ramanan and the invaluable support of Dr. K. Sarveswaran as our first advisor, we started the IEEE CIS chapter in 2022.

The early days were our "training phase". My journey taught me that the true value of an organization lies in the environment we cultivate for the future. Today, I am so happy to witness how the committees that came after my term put a massive effort into making the IEEE-CIS-SBC-UoJ truly shine under the IEEE umbrella.

Marking this remarkable journey, this chapter conducted the first-ever summer school in the IEEE Sri Lanka Section, providing a brand-new experience to students across the entire country. I am so incredibly proud of the past chairs and executive committees who made that and so much more possible.

This newsletter you are reading right now stands as proof and a witness to the journey of the IEEE-CIS-SBC-UoJ. It is a testament to all the dedicated volunteers who understand the true meaning of volunteering, who support the CIS chapter to shine without expecting anything in return.

Last, I want to leave you with one very important message. Volunteering is, above all else, a journey of discovering who you are, discovering your true capacities, and learning how you treat others. That self-discovery is the real prize. But never forget one thing, everything you do with a pure vision will eventually come back to you with great gifts.

Thank you for letting me be a part of your foundation. Keep questioning, keep collaborating, and I cannot wait to see what you all build next.

## Chairperson's Message [2023-2024]



**Mr. Nipun Sadeepa Weerasinghe**  
Chairperson (2023-2024)  
IEEE-CIS-SBC-UoJ

It was a great privilege to serve as the Chairperson of the IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna. My experience in this role helped me grow as a leader while contributing to student engagement in Artificial Intelligence and emerging technologies.

During my tenure, we focused on strengthening the chapter and creating meaningful learning opportunities through workshops and TechTalks on AI, IoT, and related fields. We also expanded membership through active engagement, awareness activities, and maintaining a strong online presence, helping to build a more connected student community.

A key milestone was organizing Sri Lanka's first IEEE CIS Summer School, where I served as the Program Chair. This experience enhanced my skills in large-scale event coordination, teamwork, and leadership under pressure. Our collective efforts also led to the Emerging Student Branch Chapter Award, highlighting the importance of collaboration, consistency, and shared commitment.

Alongside leadership activities, I worked on strengthening my technical skills by moving beyond classroom learning and exploring advanced areas such as AI systems and Retrieval-Augmented Generation (RAG). Through continuous learning and hands-on projects, I was able to bridge academic knowledge with industry requirements, which eventually led to an engineering internship and my current role as a Full-Stack Software Engineer at H2O.ai.

I am deeply grateful to Prof. A. Ramanan for his guidance and to all members and volunteers for their support. I remain confident that the IEEE CIS Student Branch Chapter at the University of Jaffna will continue to grow and inspire more students in computational intelligence.

## Chairperson's Message [2025-2026]



**Ms. Vinuki Samaraweera**  
Chairperson (2025-2026)  
IEEE-CIS-SBC-UoJ

Serving as the Chairperson of the IEEE Computational Intelligence Society Student Branch Chapter has been a truly rewarding experience. Over the past year, our chapter carried out numerous initiatives, including high school outreach programs, workshops, and tech talks, creating a meaningful impact within the university and beyond.

I am happy to share that our efforts were recognized with the Emerging Chapter Award - Student Branch Category under the Sri Lanka Section. It is also a great honor that our Advisor received the Section Outstanding Student Branch Chapter Advisor Award.

I extend my sincere gratitude to my team for their dedication and commitment. As I step down, I am confident that the new committee will continue this momentum and reach even greater heights.

## Chairperson's Message [2024-2025]



**Ms. Sankavi Mohan**  
Chairperson (2024-2025)  
IEEE-CIS-SBC-UoJ

It was a great privilege to serve as the Chairperson of the IEEE Computational Intelligence Society Student Branch Chapter at the University of Jaffna in 2024. This year was focused on strengthening our chapter's presence while creating meaningful learning opportunities for students.

Throughout the year, we organized a range of workshops and TechTalks covering areas such as Artificial Intelligence, IoT, and emerging technologies. At the same time, we worked on growing our membership through active engagement, awareness campaigns, and maintaining a strong online presence through our website and social media platforms. These efforts helped us build a more connected and active community within the university.

A key highlight of our journey was securing the IEEE CIS outreach grant, which enabled us to carry out the High School Outreach Programme. Through this initiative, we reached over 400 students and teachers from 61 schools across Jaffna, introducing them to practical applications of technology and encouraging interest in STEM fields. This was a significant step in extending our impact beyond the university.

I am proud of the consistency and teamwork demonstrated by our members throughout the year. These efforts were later recognized with the Best Emerging Chapter Award at the IEEE Sri Lanka Section Awards 2025.

I would like to express my sincere gratitude to our advisor, Prof. A. Ramanan, for his continuous support and guidance. I am confident that the chapter will continue to grow and inspire more students to explore the field of computational intelligence.

## Chairperson's Message [2026-2027]



**Ms. Miruba Gunaseelan**  
Chairperson (2026-2027)  
IEEE-CIS-SBC-UoJ

Stepping into the role of Chairperson of the IEEE Computational Intelligence Society Student Branch Chapter at the University of Jaffna for 2026 is not just a responsibility for me, it is a journey I take with gratitude and hope. Looking back at the efforts of the past years, I feel deeply inspired by the passion, unity, and impact created by our members. From reaching students beyond our university to building a strong and connected community within, these moments remind us that what we do is not just about technology, but about people.

As we begin this journey, I want to hear from you. Your ideas are the fuel for our innovation, and I invite every member to help shape our roadmap for 2026. In an era where AI is rapidly transforming the world, our chapter will focus on "Intelligence with Heart" ensuring that the algorithms we study and the systems we build truly serve people and solve real-world challenges in our community. Together, let us build a chapter that not only learns and achieves, but also uplifts, inspires, and creates meaningful impact. Because the true power of intelligence is not measured by how advanced it becomes but by how deeply it cares, how widely it reaches, and how many lives it transforms.

### Leading the Chapter:

## Executive Committee 2022



**Dr. K. Sarveswaran**  
Advisor



**Mr. S. P. D. Anuraj**  
Chairperson



**Ms. S. Sobia Chaine**  
Secretary



**Ms. S. N. S. C. Sapugoda**  
Vice Chairperson



**Mr. P. N. Nipun Sandeepa Weerasinghe**  
Treasurer



**Ms. R. A. M. P. Manohari**  
Assistant Secretary



**Ms. K. Nishanthini**  
Webmaster



University of Jaffna Student Branch Chapter

### Continuing the Legacy:

## Executive Committee 2023



**Prof. A. Ramanan**  
Advisor



**Mr. Nipun Weerasinghe**  
Chairperson



**Ms. Mohan Sankavi**  
Secretary



**Mr. Lakshan Rasogha**  
Vice Chairperson



**Mr. Isuru Lakmal**  
Treasurer



**Ms. Vinuki Samaraweera**  
Assistant Secretary



**Mr. Asantha Herath**  
Designer



University of Jaffna Student Branch Chapter

### Driving Innovation:

## Executive Committee 2024



**Prof. A. Ramanan**  
Advisor



**Ms. Mohan Sankavi**  
Chairperson



**Ms. Vinuki Samaraweera**  
Secretary



**Mr. Tharusha Randima**  
Vice Chairperson



**Mr. Pamuda Goonatilake**  
Treasurer



**Ms. Mevanya Grero**  
Assistant Secretary



**Mr. Kanistan Kanesalingam**  
Webmaster



**Ms. Thusani Vimalenthiran**  
Designer



University of Jaffna Student Branch Chapter

### Shaping the Future:

## Executive Committee 2025



**Prof. A. Ramanan**  
Advisor



**Ms. Vinuki Samaraweera**  
Chairperson



**Ms. Mevanya Grero**  
Secretary



**Mr. Avidu Witharana**  
Vice Chairperson



**Ms. Kanchana Harshamali**  
Treasurer



**Mr. Mathurshan Jeyamohan**  
Assistant Secretary



**Mr. Pasindu Waligama**  
Webmaster



**Mr. Vishwa Janith**  
Designer



University of Jaffna Student Branch Chapter

# Artificial Intelligence: From Laboratories to Everyday Life

Dr. S. Mahesan  
Visiting Lecturer  
Department of Computer Science  
University of Jaffna

For nearly seven decades, Artificial Intelligence (AI) remained largely within research laboratories and university departments. Today, however, AI has become a part of everyday conversation. It appears in news reports, social media discussions, and even government policy announcements. The reason is simple: AI-based tools and applications are no longer confined to research—they are now being used by ordinary people in their daily lives.

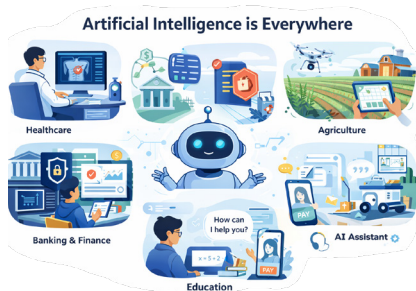


Figure 1: Artificial Intelligence is now integrated into everyday life across multiple sectors such as healthcare, agriculture, finance, education, and personal assistance.

AI first drew global attention in 1997 when IBM's supercomputer Deep Blue defeated world chess champion Garry Kasparov. Later, in 2011, IBM's Watson competed in the popular American quiz show Jeopardy! and defeated long-standing champions Brad Rutter and Ken Jennings. These milestones demonstrated that machines could perform tasks previously thought to require uniquely human intelligence.

Yet AI's progress began much earlier. During the 1960s, 70s, and 80s, specialised expert systems were developed to assist professionals in fields such as medicine, chemistry, geology, and computing. Systems like MYCIN, DENDRAL, and PROSPECTOR helped specialists analyse complex data, while systems such as XCON, developed for Digital Equipment Corporation, automated computer configuration and saved companies significant resources. Though these systems were not widely known outside research circles, they laid the foundations for modern AI.

The conceptual roots of AI go back to the early 1950s. British mathematician and computer scientist Alan Turing proposed that machines might someday display intelligent behaviour. Turing also

played a major role in breaking German wartime encryption, contributing significantly to shortening World War II. In 1955, American scientist John McCarthy introduced the term Artificial Intelligence and later developed the programming language LISP, which became central to early AI research.

Turing also proposed what is now known as the Turing Test, in which a human judge converses with both a machine and another human and attempts to distinguish between them. If the machine cannot be reliably identified, it may be considered intelligent. While researchers debate whether this test truly measures intelligence, modern conversational systems often produce responses that appear convincingly human in short exchanges.

In simple terms, AI refers to computer systems capable of performing tasks that normally require human intelligence. These tasks include learning from data, recognising patterns, understanding language, and making decisions.

Modern AI systems are often described as rational agents—systems that perceive their environment through sensors and act in ways that best achieve their goals. A humorous illustration makes the idea clear: if a heavy object is falling toward someone's head, an intelligent response is not to calculate precise physics but to shout a warning. Practical action matters more than theoretical perfection.

Today, AI influences nearly every sector of society. In healthcare, AI helps analyse medical images and predict health risks. In agriculture, satellite and drone imagery assist farmers in monitoring crops and planning irrigation. Financial institutions use AI to detect fraud and guide investment decisions. Businesses rely on recommendation systems to suggest products and manage inventory. Factories employ AI-driven robots and quality-control systems. Educational tools adapt learning materials to individual students, while customer-service systems answer questions automatically. Transportation systems use AI to optimise traffic flow and support autonomous driving research. Cybersecurity tools monitor networks and analyse surveillance feeds to improve safety.

Behind these applications lie several key technologies: natural language processing, knowledge representation, automated reasoning, machine learning, computer vision, and speech recognition. Among these, machine learning plays a dominant role, allowing systems to learn patterns from data rather than being explicitly programmed for every task.

Machine learning itself includes several approaches. In supervised learning, systems learn from labelled examples. In unsupervised learning, they discover hidden patterns in unlabelled data. Self-supervised learning allows systems to learn structure from large amounts of raw data, while reinforcement learning enables systems to improve through trial and error using rewards and penalties.

Developing such systems requires strong foundations in mathematics, statistics, and logical problem-solving. At the same time, ethical considerations are crucial. Since AI systems learn from data, biased or poorly handled data can lead to harmful outcomes. Personal information relating to health, finance, or private life must be protected, and AI must be used responsibly.

In recent years, generative AI tools capable of producing text, images, music, computer programs, and even videos have become widely accessible to the public. Systems built using large-scale machine learning models now assist people in writing, coding, designing, and learning. These developments show how decades of research have finally reached everyday users, transforming how people work and create. As these tools become more powerful, responsible and ethical use becomes even more important.

At the same time, some people worry that AI will eliminate human jobs. Such fears are not new. When calculators appeared, people feared losing the ability to calculate mentally. Earlier generations relied on slide rules, which are now largely forgotten. Technological change is constant, and society adapts. Today, people are similarly astonished—or worried—by powerful AI systems, yet history suggests that humans will continue to adapt, finding new ways to work alongside emerging technologies.

# Augmented Collective Intelligence: How Humans and AI Elevate Each Other

Ms. Vithusha, B.

Undergraduate Student

Department of Information and Communication Technology  
Faculty of Technological Studies, University of Vavuniya

## The Future of Intelligence Is Collaborative

Every generation witnesses a technological shift that changes how humanity moves forward. Steam engines powered the industry. Electricity lit cities. The internet connected the world. Today, we stand at the edge of another transformation.

Artificial intelligence systems developed by organisations such as OpenAI and Google DeepMind, Meta, and NVIDIA are no longer futuristic ideas. They assist doctors, guide researchers, optimise supply chains, and even help students learn more efficiently. Artificial intelligence is everywhere. But the real revolution is not artificial intelligence alone. Rather, it is how we choose to work with it. Are we building machines to compete with us or to collaborate with us?

For years, artificial intelligence was framed as a replacement technology.

- Will machines take jobs?
- Will algorithms outperform experts?
- Will automation eliminate human roles?

What happens when human intelligence and artificial intelligence do not compete but collaborate?

Human intelligence brings empathy, ethics, creativity, contextual understanding, moral responsibility. Artificial intelligence brings speed, scalability, pattern detection, data-driven precision, tireless computation. When these strengths intersect, something extraordinary happens. This is the vision of Augmented Collective Intelligence. It proposes that when humans and intelligent systems work together, they can achieve outcomes neither could reach alone. This collaboration is not about dependency. It is about amplification, and this idea is not theoretical but a direction for the future.



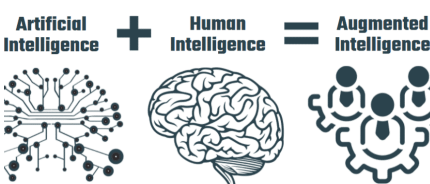
## What Is Augmented Collective Intelligence?

Collective Intelligence emerges when groups collaborate effectively. It is a future where humans and intelligent systems do not compete, but collaborate. Augmented Collective Intelligence happens when intelligent systems support groups of people in thinking better, deciding faster, and solving more complex problems.

We are facing many problems that are too complex for individuals to solve alone. Climate instability, public health challenges, mental health crises, cybersecurity threats, and sustainable energy transitions are some examples of such problems. No single expert can process global-scale data in real time. And no artificial intelligence system fully understands human context, ethics, and emotion.

Research from the MIT Center for Collective Intelligence shows that teams supported by intelligent decision systems often outperform teams without them. The machine processes possibilities. Humans interpret meaning.

## How Humans and AI Elevate Each Other



### 1. Machines find patterns. Humans find meaning

Artificial intelligence systems can scan millions of data points in seconds. They detect correlations invisible to the human eye. But they do not understand cultural nuance. They do not feel responsibility. They do not carry moral judgment. Humans do.

In healthcare, for example, intelligent diagnostic systems may highlight suspicious patterns in scans. Yet trained doctors interpret those findings within patient history and ethical responsibility. The technology supports but does not replace the professional. That is augmentation.

### 2. Creativity is not replaced; it is expanded

There is a fear that artificial intelligence threatens creativity. In reality, it can accelerate it.

*Designers use intelligent tools to generate prototypes. Researchers use models to simulate experiments. Engineers test thousands of design variations virtually before building one physical model. The machine suggests. The human chooses. It becomes a feedback loop of inspiration and refinement.*

### 3. Teams become smarter with support

Consider a disaster management team responding to floods. Artificial intelligence models predict water spread patterns. Emergency coordinators plan evacuation routes. Medical teams prepare response units. The system processes data. The humans act with judgment. Together, response times improve, and lives are saved.

This is augmented collective intelligence in action.

## The Ethical Considerations

With greater capability comes greater responsibility. As Dr. Thomas Malone, Director of the MIT Center for Collective Intelligence, has observed,

*"The future of work is not about Artificial Intelligence replacing humans, but about new ways for humans and computers to work together."*

However, collaboration must be ethical. We must ensure:

- Transparency in model decisions
- Accountability for outcomes
- Fairness in data usage
- Protection of privacy

If artificial intelligence is to elevate humanity, it must be designed with humanity at its core.

The next generation of breakthroughs will not come from artificial intelligence operating in isolation. They will emerge from collaboration between:

# Computational Intelligence in Action: A Student's Perspective on a Transformative Technology

**Ms. Poojah Y.**  
Undergraduate Student  
Department of Computer Engineering  
University of Jaffna

In today's technology-driven world, Computational Intelligence is more than a buzzword; it is a catalyst for smarter, adaptable, and more human-like systems. As a student passionate about real-world problem-solving, I have come to appreciate how Computational Intelligence enables systems to learn from experience, adapt to new inputs, and make intelligent decisions.

Unlike conventional artificial intelligence, which follows fixed logic, Computational Intelligence embraces uncertainty, complexity, and approximation. It is rooted in biologically inspired methods such as:

- ▣ **Artificial Neural Networks (ANNs)** for learning patterns
- ▣ **Fuzzy Logic** for handling imprecision
- ▣ **Evolutionary Algorithms** for optimisation

These tools allow systems to deal with ambiguity in the same way humans do—gracefully and efficiently.

## Practical Applications That Inspire Me

### 1. Voice and Audio Classification

In one of my recent MATLAB projects, I implemented MFCC (Mel-Frequency Cepstral Coefficients) and Euclidean distance to classify audio signals. This real-world use of Computational Intelligence in signal processing taught me the value of feature extraction and similarity metrics in building intelligent systems.

### 2. Smart Infrastructure

From adaptive traffic systems to energy-saving smart homes, Computational Intelligence is used to predict and respond to human behaviour—minimising waste and maximising comfort.

### 3. Healthcare Diagnostics

Deep learning models are already outperforming traditional methods in medical imaging, detecting anomalies earlier than the human eye. Computational Intelligence here does not just assist—it can save lives.

### A Word on Ethics and Responsibility

With power comes responsibility. While Computational Intelligence has enormous potential, its explainability, fairness, and bias need constant monitoring. As students and future developers, we must commit to building transparent and ethical models—especially in sensitive areas like finance, education, and justice.

### To Fellow Students: Your Journey Starts Now!

Computational Intelligence isn't just for researchers or professionals in Silicon Valley. With resources like scikit-learn, TensorFlow, MATLAB, and Python, we can build and experiment even during our undergraduate years. I encourage my peers to take that first step -- try a classifier, build a small model, participate in a competition, or write an article like this one.

*"It's not about being perfect. It's about being passionate."*

Let's explore, experiment, and evolve—because the future of Computational Intelligence belongs to us too.

## Did You Know?

### Swarm Intelligence in Nature

Some of the most intelligent systems in the world do not come from powerful computers—but from nature. Swarm Intelligence is inspired by the collective behaviour of animals such as ants, bees, and birds.

For example, ants can find the shortest path to food sources without any central control. Similarly, birds in a flock move in perfect coordination, avoiding collisions while responding instantly to changes.

These natural behaviours have inspired algorithms used in optimization problems, robotics, and network routing. By mimicking simple interactions among individuals, complex and efficient solutions can emerge—showing that intelligence does not always require a central brain.



**Swarm Intelligence in Nature**

# Technical Talks: Industry Insights & Global Perspectives (2023)

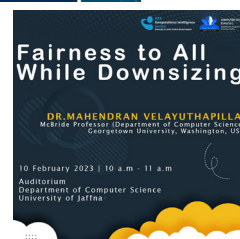
1

"Data Science and its Applications" by Dr. Alma Rahat (Senior Lecturer in Data Science, Swansea University, UK) held on 31st of January 2023 from 01.30 p.m. to 2.30 p.m. in hybrid mode at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the IEEE Student Branch of the University of Jaffna.



2

"Fairness to all while downsizing" by Dr. Mahendran Velayuthapillai (McBride Professor, Department of Computer Science, Georgetown University, USA) held on 10th of February 2023 from 10.00 a.m. to 11.00 a.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the Computer Society (CompSoc) of the University of Jaffna.



3

"Multi-Modal Sensor Data Processing for Autonomous Vehicles" by Professor Thia Kirubarajan, (Department of Electrical & Computer Engineering, McMaster University, Canada) held on 23rd of March 2023 from 09.30 a.m. to 10.30 a.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the IEEE Student Branch of the University of Jaffna.



4

"Building Resources: Language Comparison and Analysis" by Professor Miriam Butt (Department of Linguistics, University of Konstanz, Germany) held on 28th of March 2023 from 09.30 a.m. to 10.15 a.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the IEEE Student Branch of the University of Jaffna.



5

"Google Workspace for Education" by Ms. Shihara Mohamed (Asst. Vice President SMB, EDU and Gov. Business - Sri Lanka and Maldives) held on 26th of June 2023 from 2.00 p.m. to 3.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna.



6

Workshop on "Coding Practice for Competitions" held on 22nd of August 2023 from 1.00 p.m. to 3.00 p.m. at the Laboratory of the Department of Computer Science, University of Jaffna. Dr. E.Y.A. Charles (Senior Lecturer in Computer Science, University of Jaffna) served as the resource person.



7

"Dynamics of TechOps in the IT Industry" by Mr. Ishanka Thilakaratne (Senior Manager Operations, Sysco LABS), Mr. Roslan Halaldeen (Associate Site Reliability Engineering Lead, Sysco LABS), and Mr. Dasun Peiris (Senior Site Reliability Engineer, Sysco LABS) held on 29th of August 2023 from 1.00 p.m. to 3.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the Sysco LABS.



## IEEE Sri Lanka Section Awards 2023

The IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna was honoured at the IEEE Sri Lanka Section Awards 2023, held on 04 November 2023. The IEEE CIS Student Branch Chapter of the University of Jaffna received the Emerging Chapter Award (Student Branch Category) in recognition of its outstanding performance and impactful activities.



## IEEE CIS Competitive Grant Award for 2023 IEEE Summer School on Computational Intelligence

The IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna (IEEE CIS SBC UoJ) was awarded a competitive grant of USD 3,900 (approximately LKR 1.2 million) by the IEEE Computational Intelligence Society to organize the 2023 IEEE Summer School on Computational Intelligence: Theory and Applications. The grant supported the successful conduct of the summer school held from 12-14 July 2023 at the Department of Computer Science, University of Jaffna.

This achievement is particularly significant as only nine proposals worldwide were selected for IEEE CIS Summer Schools, and this event marked the first-ever summer school on Computational Intelligence organized by a higher education institution in Sri Lanka. The initiative was guided by Prof. A. Ramanan, Advisor of the IEEE-CIS-SBC-UoJ, who played a key role in preparing and submitting the grant proposal to IEEE and also served as the General Chair of the programme.

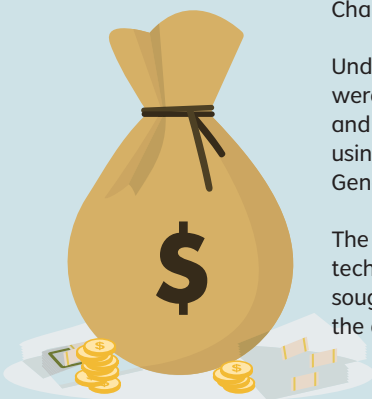


## IEEE CIS Student Chapter Secures Grant for High School Outreach Programme 2025

The IEEE Computational Intelligence Society (CIS) Student Branch Chapter at the University of Jaffna has secured a competitive grant of USD 2,900 (approximately LKR 900,000) from IEEE CIS, USA, to conduct the IEEE CIS High School Outreach Programme for 2024-2025. The grant proposal was jointly prepared by Ms. Mohan Sankavi, 2024-2025 Chair of the IEEE-CIS Student Branch Chapter, and Prof. A. Ramanan, Chapter Advisor, and was submitted in September 2024.

Under this initiative, a series of outreach workshops themed "Explore the Future of Technology" were conducted from March to June 2025. The programme targeted G.C.E. (A/L) students and ICT school teachers, introducing them to the fundamentals of the Internet of Things (IoT) using Arduino through hands-on activities, along with the emerging impact and challenges of Generative Artificial Intelligence in education.

The programme aimed to bridge the gap between classroom learning and real-world technological applications, particularly in regions with limited access to such opportunities. It also sought to inspire students to pursue higher education and careers in STEM fields, contributing to the development of a skilled and empowered community.



# 2023 IEEE Summer School on Computational Intelligence: Theory and Applications

The IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna (IEEE-CIS-SBC-UoJ) successfully organized the IEEE Summer School on Computational Intelligence: Theory and Applications from 12-14 July 2023 at the Department of Computer Science, University of Jaffna. This landmark event represents a significant milestone, as it is the first summer school on Computational Intelligence hosted by any higher education institution in Sri Lanka and the inaugural summer school organized by the University of Jaffna. The IEEE-CIS-SBC-UoJ also holds the distinction of being the only IEEE Computational Intelligence Society Student Branch Chapter in Sri Lanka.

The programme was funded by a competitive IEEE CIS grant of USD 3,900 (≈ LKR 1.2 million), awarded as part of a highly selective global call in which only nine proposals were chosen worldwide to host CIS Summer Schools in 2023. Prof. A. Ramanan, Advisor of the IEEE-CIS-SBC-UoJ, led the grant proposal preparation and served as the General Chair, providing overall academic leadership.

The three-day Summer School was carefully structured to provide a balanced blend of theoretical knowledge and hands-on experience across key areas of computational intelligence. Day 1 focused on Artificial Intelligence, Machine Learning, and Deep Learning, featuring keynote talks, technical sessions, and extensive practical training on developing ML/DL models, along with discussions on AI applications in finance and the future of work. Day 2 was dedicated to Natural Language Processing, covering topics such as language resource development, NLP fundamentals, and hands-on sessions on building language models and working with large language model platforms, complemented by an expert talk on AI privacy and security. Day 3 explored Internet of Things (IoT) and Robotics, including sessions on emerging trends, practical IoT training, industrial applications in sectors such as healthcare and agriculture, and an introduction to robotics. The programme also included interactive elements such as networking opportunities and a banquet dinner, enriching the overall learning experience.

The event brought together an exceptional panel of speakers from globally reputed institutions, including the University of Melbourne (Australia), Imperial College London (UK), and the University of Southampton (UK). In addition, distinguished academics from Sri Lankan state universities such as the University of Moratuwa and the University of Peradeniya contributed their expertise. Six faculty members from the University of Jaffna also shared their knowledge and research insights. Furthermore, industry experts from leading organizations including 99x, H2O.ai, and SenzAgro Solutions conducted hands-on training sessions in the Department of Computer Science laboratories.

The summer school attracted 81 students from multiple higher education institutions, including SLIIT, the University of Peradeniya, the Eastern University Sri Lanka, the University of Ruhuna, the University of Vavuniya, the University College of Jaffna, and the University of Jaffna. Faculty members from the Department of Computer Science and the Faculty of Engineering also actively participated in the teaching-learning process. In total, the programme engaged 104 participants.

The opening ceremony was graced by the Vice Chancellor, Prof. S. Srisatkunarajah, and the Dean of the Faculty of Science, Senior Prof. P. Ravirajan, whose presence and support were instrumental in the success of the event. Beyond the technical sessions, participants also enjoyed vibrant social and networking activities organized by student volunteers, including a banquet dinner held at Valampuri Hotel on the second day, which fostered informal interactions and collaboration.







## IEEE CIS and the Establishment of the IEEE CIS Sri Lanka Chapter

The IEEE Computational Intelligence Society (CIS) began as the IEEE Neural Networks Council in 1990, later became the IEEE Neural Network Society, and was renamed IEEE CIS in 2004 to reflect a broader scope covering neural networks, fuzzy systems, evolutionary computation, and other areas of computational intelligence. Initially, CIS had only a few technical chapters and limited global presence, mainly in North America. Over time, it has expanded significantly, with many technical chapters and Student Branch activities worldwide, supporting collaboration, research, conferences, and education in computational intelligence. Prof. Yaochu Jin (Westlake University, China) served as CIS President for the 2024-2025 term, leading initiatives and society activities globally, while Luis Magdalena (Technical University of Madrid, Spain) is the President for the 2026-2027 term, guiding the society's programs and strategic plans. IEEE CIS continues to grow through its technical chapters, student branches, conferences, and publications, fostering innovation, collaboration, and excellence in computational intelligence research and applications worldwide.

The IEEE CIS Sri Lanka Section Chapter, established in October 2025 with its Inaugural General Meeting held in January 2026, serves as a dedicated platform for researchers, professionals, and enthusiasts in neural networks, fuzzy systems, and evolutionary computation. Dr. Sidath Weerasinghe, founding member, highlights that this initiative marks a significant milestone for the local technology community, aiming to bridge the gap between academic research and industry while promoting innovation, knowledge sharing, and global collaboration in computational intelligence.

# If AI Writes the Code, What Defines the Engineer?

Ms. Sankavi, M

Graduand

Department of Computer Science

University of Jaffna

In contemporary software development environments, a notable transformation is underway. Developers are increasingly working alongside AI-powered assistants, using them to generate code, diagnose errors, and accelerate development workflows. Rather than writing every line manually, engineers now guide, refine, and validate machine-generated outputs.

This emerging paradigm—often referred to as “vibe coding”—reflects a broader cultural and technological shift in software engineering. It emphasizes speed, intuition, and rapid experimentation, enabled by advances in artificial intelligence.

For undergraduate students observing this transition, an important question arises:

## If AI can write code, what remains the role of the engineer?

More specifically, are traditional educational practices becoming obsolete, or do they still serve a critical purpose?

## What Is Actually Changing?

Despite rapid technological advancements, the core principles of software engineering remain unchanged. What has evolved is the workflow. Modern development practices increasingly incorporate:

- ▣ AI-assisted code generation
- ▣ Automated testing frameworks
- ▣ Intelligent debugging tools
- ▣ Rapid prototyping and iterative development

These tools significantly enhance productivity and reduce development time. However, while AI accelerates execution, it does not replace understanding. The responsibility for correctness, efficiency, and robustness continues to lie with the engineer.

## Is Manual Coding Becoming Obsolete?

At a superficial level, the growing capabilities of AI tools may suggest that manual coding is becoming less relevant. If code can be generated instantly, the need to memorize syntax or implement algorithms manually may appear diminished.

However, the purpose of manual coding in

higher education extends beyond syntax. It is fundamentally about developing mental models of computation. Through hands-on implementation, students gain insight into:

- ▣ Algorithmic behavior and complexity
- ▣ Data structures and memory usage
- ▣ System constraints and trade-offs

This foundational understanding becomes essential when evaluating AI-generated solutions, which may be inefficient, insecure, or poorly structured.

## Why Fundamentals Matter More—Not Less

Paradoxically, the rise of AI-assisted development increases the importance of foundational knowledge.

When AI generates an asynchronous function, the engineer must still recognize potential race conditions.

*When a database query is produced, its performance implications must be evaluated.*

*When architectural patterns are suggested, their scalability and fault tolerance must be assessed.*

Without a solid grounding in areas such as concurrency, database systems, networking, and system design, developers cannot effectively validate AI-generated outputs. Increasingly, software engineering is shifting from:

*“Can you write this?” “Can you evaluate this?”*

AI can propose solutions, but engineers must exercise judgment. This requires conceptual clarity, debugging intuition, and system-level thinking—core competencies cultivated through traditional education.

## The Risk of Blind Dependency

While AI-assisted development enables rapid progress, it also introduces risks. Code that appears functional may conceal inefficiencies, security vulnerabilities, or architectural flaws.

Over-reliance on AI tools can lead to a superficial understanding of systems, where developers become dependent on generated outputs without critically assessing them. This raises a fundamental concern: the potential

shift from *engineers to mere prompt operators*.

The software industry, however, continues to value individuals who can think critically, design robust systems, and solve complex problems—capabilities that extend beyond tool usage.

## Foundation First, Acceleration Next

Engineering has continuously evolved through abstraction. From compilers to frameworks to cloud computing, each advancement has simplified development while increasing the importance of underlying knowledge.

AI represents the next layer of abstraction.

The future-ready engineer is not defined by resistance to AI, nor by complete dependence on it. Instead, such an engineer:

- ▣ Masters core principles
- ▣ Develops deep conceptual understanding
- ▣ Understands systems at multiple levels
- ▣ Leverages AI as a tool for acceleration

AI functions as a multiplier. However, its effectiveness depends on the strength of the underlying knowledge it amplifies.

## What Defines the Engineer in the Age of AI?

If AI is capable of generating code, the defining qualities of an engineer are no longer limited to syntax proficiency or implementation speed. Instead, they include:

- ▣ The ability to evaluate and validate solutions
- ▣ The capacity to design scalable and reliable systems
- ▣ The judgment to identify limitations and risks
- ▣ The insight to extend beyond generated outputs

Engineering education, therefore, should not be viewed as a choice between manual coding and AI-assisted development. Rather, it should aim to produce professionals who can operate effectively both with and without AI.

Such individuals can stand independently on strong fundamentals—and move faster with intelligent tools.

# AI Meets Satellites: A New Era in Earth Monitoring

Ms. Nirupa, A.

Department of Computer Science  
University of Jaffna

**A**rtificial Intelligence (AI) and satellite technology are combining to transform how we monitor and understand our planet. Satellites have long been essential for collecting data about the Earth, including weather, oceans, forests, ice sheets, land use, and urban growth. However, satellites generate enormous amounts of data every day, and analysis methods are often too slow or insufficiently accurate. This is where AI becomes highly valuable.

AI, particularly techniques such as machine learning and deep learning, can quickly identify patterns, detect anomalies, classify land types, and generate predictions. For example, research shows that AI can enhance satellite imagery analysis using neural networks, enabling more accurate detection of changes in land use and natural disasters compared to traditional methods. This demonstrates how AI can make satellite data more useful for environmental studies, disaster management, and land-use planning.

Beyond research, AI is already being applied in practical settings. Scientists have developed AI-based weather forecasting systems that use satellite data to predict heavy rainfall and storms more quickly and accurately than traditional methods. Some AI models can even predict the path and

intensity of cyclones up to a week in advance by analysing historical data and satellite imagery, helping to protect vulnerable populations. This shows that AI can significantly improve disaster preparedness and help save lives.

Researchers are also developing technical solutions to improve satellite data processing. For instance, AI can process multispectral images, detect hotspots such as wildfires and volcanoes, and even operate directly on satellites to reduce delays in data transmission. Other studies combine satellite imagery with environmental data to map habitats and support biodiversity protection.

Many research studies highlight how AI is helping with land classification, object detection, climate monitoring, and disaster management. In practice, AI and satellite technologies are being used by companies and organisations to monitor pollution and greenhouse gas emissions. This helps make environmental information more accessible and encourages accountability. AI is also being used to improve satellite image quality, making it easier to study agriculture, climate, and natural resources. These applications show how research is being transformed into practical tools that help people and governments make better decisions.

Combining AI with satellite data has many advantages. Satellites can cover large areas of the Earth repeatedly, and AI can analyse the resulting data rapidly. This allows real-time insights for early warning systems, precision agriculture, sustainable land management, climate monitoring, and urban planning.

However, challenges remain. High-quality AI models require powerful computing infrastructure and skilled experts. Satellite data can sometimes be incomplete or of low quality. There are also privacy concerns when high-resolution images are used, and excessive reliance on AI could reduce human oversight.

Despite these challenges, AI and satellite technology together offer a powerful way to study the Earth and respond to global challenges. In conclusion, the combination of AI and satellites is creating a new era in Earth monitoring. AI makes satellite data faster, more accurate, and easier to use, while satellites provide a global perspective of our planet. Together, they support disaster prediction, monitor the environment, plan cities, and manage natural resources. With continued research and responsible use, AI and satellite technology will play a key role in protecting our planet and making better decisions for a sustainable future.

## Did You Know?

### Mental Health Matters!

- ✦ Mental health is just as important as physical health.
- ✦ Many young people today face stress due to social media, studies, and daily pressures.
- ✦ Being open about feelings helps reduce the stigma around mental health.
- ✦ Simple self-care activities like meditation, exercise, and taking breaks can improve mental well-being.
- ✦ Schools and workplaces now offer counseling and support systems for mental health.
- ✦ Many people still hesitate to seek help due to fear or lack of resources.
- ✦ Ignoring mental health can lead to serious emotional and physical problems.

Remember: Talking, sharing, and supporting each other can create a healthier and happier society!

# The Quantum Leap in Computing

Ms. Preethy, S.  
Department of Computer Science  
University of Jaffna

When we think about computers, we usually imagine them processing information as ones and zeros. This has been the foundation of computing since the beginning. But there's a new type of computer being developed that works completely differently, and it's called quantum computing. Instead of using regular bits, these computers use qubits, which can be both 0 and 1 at the same time. This might sound strange, but it's based on quantum physics, and it could change everything about how we solve complex problems.

The main difference between regular computers and quantum computers is how they process information. A normal computer has to check each possibility one at a time. If you are trying to solve a really complicated problem with millions of possible answers, it takes forever. Quantum computers can look at many possibilities all at once because of something called superposition. Think of it like this -- if you had to find the right key for a lock from a keyring with 100 keys, you'd have to try them one by one. A quantum computer could somehow try all 100 keys simultaneously. This means problems that would take regular computers thousands of years could potentially be solved in hours or even minutes.

So where would we actually use quantum computers? One major area is in medicine and drug development. Right now, testing how different molecules interact with each other is extremely time-

consuming and expensive. Scientists have to run countless experiments in labs. Quantum computers could simulate these molecular interactions much faster, which means new medicines could be developed more quickly. Another important use is in security and encryption. Many of the passwords and encryption methods we use today could be broken by quantum computers, which sounds scary, but it also means we can develop new, stronger security systems. Financial companies are also interested because quantum computers could help them analyze huge amounts of market data and make better predictions.

However, building quantum computers is incredibly difficult. The main problem is that qubits are extremely sensitive to their environment. They need to be kept at temperatures close to absolute zero, which is colder than outer space. Even tiny vibrations or electromagnetic interference can mess them up. This is called decoherence, and it happens within microseconds. Because of this, quantum computers need to be kept in special laboratories with extensive cooling systems and shielding. They are also massive and expensive - not something you would ever have on your desk at home. Error correction is another huge challenge because quantum operations are so delicate that mistakes happen frequently, and fixing these errors requires using many qubits just to create one reliable qubit.

Right now, companies like IBM and Google have built quantum computers

that can perform certain tasks better than regular computers. Google even claimed to achieve what they called quantum supremacy, where their quantum computer solved a specific problem that would be practically impossible for classical computers. But we are still in the early stages. Most experts think quantum computers will not replace our regular computers but will work alongside them. Your laptop or phone will still be better for everyday tasks like browsing the internet or writing documents. Quantum computers will be used more like specialized tools for specific problems that regular computers struggle with.

Looking ahead, quantum computing is one of the most exciting developments in computer science. We're seeing progress every year, with more stable qubits and better error correction methods. Universities are starting to offer courses in quantum programming, and more companies are investing in the technology. While we probably won't see quantum computers in homes anytime soon, they'll likely become an important tool in research labs, hospitals, and tech companies. The problems we can't solve today might become routine in the future. What makes quantum computing really fascinating is that it is not just about making computers faster - it is about approaching computation in a fundamentally new way that opens up possibilities we haven't even imagined yet.

## Did You Know?

### Code your dreams into reality.

- 💡 Every great developer was once a beginner.
- 💡 Bugs are proof that you are trying.
- 💡 Think logically, create creatively.
- 💡 Practice coding daily—success will compile.
- 💡 Debug your code, not your confidence.
- 💡 The future belongs to those who understand technology.
- 💡 Small lines of code can change the world.
- 💡 Keep learning—technology never stops evolving.
- 💡 Don't fear errors, they are your best teachers.

# Technical Talks: Emerging Perspectives & Global Innovations (2024)

1

"Realising Your Potential in Early Stage and Achieving Success" by Dr. S. Sabesan (Founder and President at PervasID & Fellow at Girton College, University of Cambridge) held on 04 January 2024 from 3.00 p.m. to 4.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organized in collaboration with Google Research and the University of Melbourne, Australia.



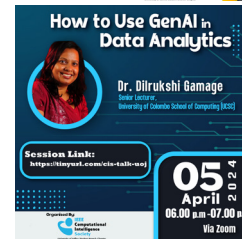
2

"Introduction to Generative AI" by Dr. Damayanthi Herath (Senior Lecturer, Department of Computer Engineering, University of Peradeniya) held in hybrid mode on 13th of February 2024 from 2.00 p.m. to 3.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna.



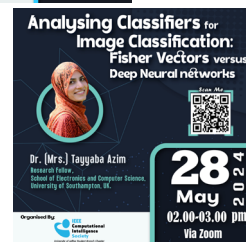
3

"How to Use GenAI in Data Analytics" by Dr. (Ms.) Dilrukshi Gamage (Senior Lecturer, University of Colombo School of Computing) held on 05th of April 2024 from 6.00 p.m. to 7.00 p.m. via Zoom.



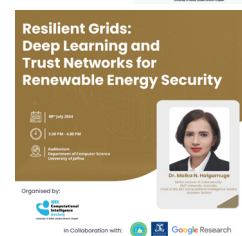
4

"Analysing Classifiers for Image Classification: Fisher Vectors versus Deep Neural Networks" by Dr. (Ms.) Tayyaba Azim (Research Fellow, School of Electronics and Computer Science, University of Southampton, UK) held on 28th of May 2024 from 2.00 p.m. to 3.00 p.m. via Zoom.



5

"Resilient Grids: Deep Learning and Trust Networks for Renewable Energy Security" by Dr. (Mrs.) Malka N. Halgamuge (Senior Lecturer in Cybersecurity, RMIT University, Australia; Chairperson, IEEE Computational Intelligence Society, Victorian Section, Australia) held on 8th of July 2024 from 3.00 p.m. to 4.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the University of Melbourne, Australia and the Google Research.



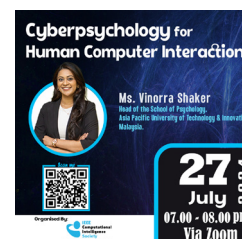
6

"The New Turing Age: AI Manifesto for the Modern Society" by Mrs. Melissa Lee Blanchard (Artificial Intelligence Analyst, Melise Services, Florida, USA) held on 9th of July 2024 from 1.00 p.m. to 2.00 p.m. in hybrid mode at the Auditorium of the Department of Computer Science, University of Jaffna.



7

"Cyberpsychology for Human Computer Interaction" by Ms. Vinorra Shaker (Head of the School of Psychology, Asia Pacific University of Technology & Innovation, Malaysia) held on 27th of July 2024 from 7.00 p.m. to 8.00 p.m. via Zoom.



8

"Creating Engaging Learning and Teaching Experiences via Digital Technologies" by Professor Angela Carbone (Associate Deputy Vice-Chancellor, Learning, Teaching, and Quality, STEM College, RMIT University), Professor James Harland (Director, STEM Center for Digital Innovation and Professor in Computational Logic, RMIT University), Professor Michelle Spencer (Deputy Director, STEM Centre for Digital Innovation and Professor of Chemistry, RMIT University), Dr. Charu Rana (Team Lead, Learning, Teaching, and Quality Portfolio, STEM College, RMIT University), and Mr. Keith Hibbert (Virtual Experience Designer, STEM College, RMIT University) held on 30th of July 2024 from 1.30 p.m. to 2.30 p.m. in hybrid mode at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the University of Melbourne, Australia and the Google Research.



9

"The Rise of Large Language Models: Transforming AI and Beyond" by Dr. T. Uthayasanker (Head, Department of Computer Science and Engineering, University of Moratuwa) held on 29th of August 2024 from 3.00 p.m. to 4.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This session was organised in collaboration with the University of Melbourne, Australia and the Google Research.

10

"From Good to Great: Tips for Personality Growth" by Ms. Rasanjalie Dedunu Kularathne (Lecturer Department of Human Resource Management, Rajarata University of Sri Lanka) held on 30th August 2024 from 09:30 a.m. to 12:30 p.m. at the CSL 3&4 of the Department of Computer Science, University of Jaffna.



11

Workshop on "Kickoff your Salesforce Journey" held on 3rd of September 2024 from 1.00 p.m. to 3.00 p.m. at the Department of Computer Science, University of Jaffna. The workshop was conducted by Mr. S. Thiriyambaga Sarma Sothinathan (Salesforce MVP, 8x Salesforce Certified Principal Consultant) and Mr. Anuran Rajasekaran (Salesforce Certified Developer).

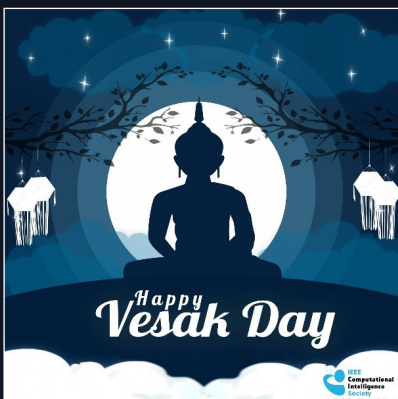
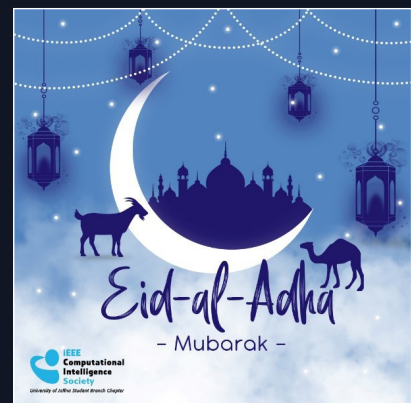


12

Workshop on "Cloud Computing" held on 31st of December 2024, at the Computer Laboratory of the Department of Computer Science, University of Jaffna. Dr. Elankayer Sithirasanen from Southern Cross University, Australia, served as the resource person.



# Festival Celebrations



# Real-Time English-to-Sinhala Dubbing: Bridging the Language Divide in Digital Content

Kusalya De Zoysa, Visitha Wickramasinghe, Fathima Hana, Haritha Mihimal, and Uthayasanker Thayasivam  
Department of Computer Science and Engineering  
University of Moratuwa

In an increasingly digital world, video content has become a powerful medium for education, communication, and entertainment. Yet, language remains a significant barrier to access, especially in countries like Sri Lanka where a majority of the population consists of native Sinhala speakers. A large portion of this content, ranging from technical tutorials and academic lectures to international news is available only in English, limiting its reach and impact.

While subtitles offer some relief, they often assume a high level of literacy, reading speed, and focused attention. This approach is not always suitable for younger audiences, elderly users, or individuals with visual impairments.

A more natural and inclusive alternative is language dubbing, where spoken content is translated and voiced in the listener's native language. Traditionally, this process has been manual and time consuming. However, with recent advancements in artificial intelligence (AI), there is increasing interest in the development of automated real-time dubbing systems. A real-time dubbing system can be understood as a pipeline of interconnected components:

**Audio extraction → Speech Recognition → Translation → Speech Synthesis + Voice cloning → Synchronization → Output**

In simple terms, the system first converts spoken English into text using speech recognition. This text is then translated into Sinhala while preserving its meaning and context. Next, text-to-speech technology generates Sinhala audio, and finally, the system synchronizes this audio with the original video so that the output feels natural and seamless.

However, building such a system is not easy. One of the biggest challenges is maintaining translation quality while preserving cultural nuance and meaning. Synchronizing audio with video timing is also complex, and generating natural-sounding Sinhala speech remains difficult due to limited resources and datasets. On top of that, real-time systems must operate with very low delays, which adds another layer of complexity.

While global platforms like Netflix and YouTube have shown how powerful dubbing can be, they mainly focus on widely used languages. Sinhala support is still limited, and many systems do not fully address real-time processing or speaker identity preservation. This opens up an exciting opportunity to develop AI-driven solutions specifically designed for Sinhala users.

As digital content continues to grow, ensuring that it is accessible to everyone becomes increasingly important. Real-time Sinhala dubbing is not just a technical advancement—it is a step toward making information more inclusive and easier to engage with for a wider audience. By breaking language barriers, it opens the door for more people to connect with global knowledge in a meaningful way. Underrepresented in global language technology research. Building robust datasets, refining pronunciation models, and incorporating cultural sensitivity are all critical to ensuring the success of such systems.

## Did You Know?

### Brain-Computer Interfaces (BCI)

Imagine controlling a computer using only your thoughts. This is the goal of Brain-Computer Interfaces (BCIs) – a rapidly advancing field that connects the human brain directly to machines.

BCIs work by capturing brain signals and translating them into commands. This technology is already helping individuals with disabilities to control prosthetic limbs, type messages, and interact with digital systems.

Researchers are exploring how BCIs could be used in areas such as rehabilitation, gaming, and even communication. While still evolving, this field represents a powerful intersection between neuroscience and computational intelligence.



# When AI Forgets - Managing Context in Long Conversations

Mr. R. N. Viththagan  
Software Engineer  
WSO2



## Feeling Ignored

Interacting with AI agents can feel a lot like trying to talk to someone who never replies. You explain things carefully, provide clear examples, and map out exactly what you want. You feel confident, expecting the agent to understand the vision. Then comes the next message.

- ▣ "Can you continue from what we did earlier?"
- ▣ And the agent responds as if it has no idea what you are talking about.
- ▣ "Sorry, can you remind me what you mean?"
- ▣ It's frustrating. You put in the effort, but each new interaction feels disconnected and one-sided, like pouring your heart out only to hear silence in return.

## Why Simple Instructions Aren't Enough

Writing careful instructions works well for short, one-off tasks. But for longer, multi-step interactions, it falls short. Even though modern agents possess memory, lengthy conversations can grow so large that context drift begins to occur.

Important initial instructions are often pushed out of the focus area as the conversation progresses. Furthermore, if you switch topics within the same thread, the new prompt can conflict with the earlier context, creating confusion and confusing outputs.

This is the digital equivalent of talking to someone who seems to understand in the moment but quickly forgets the foundation of the conversation—or worse, mixes it up with something entirely unrelated.

## Remembering Matters: The Role of Context Engineering

Context engineering is the solution to this "amnesia." It provides a framework for agents to carry information forward accurately and keep essential details in focus. In simple terms, context engineering means helping AI remember what matters during long conversations.

Effective context management involves:

- ▣ Summarizing: Periodically condensing previous interactions to save space while retaining meaning.
- ▣ Highlighting: Identifying and pinning essential decisions

or "ground truths" for the project.

- ▣ Flow Management: Carefully directing the stream of information between different sub-tasks.

Some modern coding agents attempt to handle aspects of this automatically. They analyze the conversation and occasionally "clean up" older messages to reduce clutter while preserving core data. You can implement similar strategies manually by archiving old logs and explicitly re-including high-priority instructions in new prompts.

With disciplined context management, agents can reference earlier decisions, maintain consistency, and handle complex, multi-step tasks without losing the plot.

## A Simple Example: Refactoring

Imagine asking an agent to refactor a function without managing context. It may ignore past architectural decisions or blend the request with unrelated snippets from earlier in the chat. The result is generic code that often requires significant rework.

## A Better Approach:

If you provide a project history, specific coding standards, and a summary of previous changes, the agent produces consistent results across multiple steps. It's like talking to someone who actually listens and remembers.

**The Lesson:** Instead of relying solely on repetitive prompting, build a system that actively tracks context.

## Actionable Steps for Better AI Memory:

- ▣ **Maintain a Memory Log:** Keep a separate document of key decisions.
- ▣ **Summarize Often:** Every 5 -- 10 messages, ask the AI to summarize the current state of the project.
- ▣ **Clean the Slate:** Archive information that is no longer relevant to the current task to prevent "noise."

## Conclusion

Interacting with AI isn't about writing the "perfect" prompt every single time. It's about managing context so that long conversations stay coherent and connected. That's what turns disconnected, one-sided exchanges into interactions that actually make sense.

## References

- ★ Cognition AI – Don't Build Multi-Agents (<https://cognition.ai/blog/dont-build-multi-agents>)
- ★ Viththagan R. N. – Smart Sub-Agents for File and Context Searching in Coding AI Agents (<https://medium.com/@viththagan.rn/smart-sub-agents-for-file-and-context-searching-in-coding-ai-agents-b78d9b0ee662>)

# Beyond Accuracy: Engineering Accountability in AI Decisions

Ms. Laksana, S

Graduated in 2026

Department of Computer Science  
University of Jaffna

Not long ago, critical decisions were made across desks, in meeting rooms, and through human deliberation. Today, many of those same decisions are quietly influenced by software systems running behind screens. They recommend who advances in a recruitment process, assist doctors in identifying diseases, evaluate financial risk, filter information we consume, and support vehicles as they navigate through complex roads. These systems do not simply automate routine tasks. They shape opportunities, access, safety, and trust.

Because their influence is so widespread, performance numbers often become the primary measure of success. A model that reports impressive results in testing environments is quickly labelled reliable. Accuracy percentages, precision scores, and benchmark rankings create a sense of confidence. Yet the real world is rarely as tidy as a test dataset. Conditions change, data shifts, and human behaviour introduces uncertainty that cannot be fully captured in controlled experiments.

When failures surface, they can be deeply consequential. A qualified candidate may be filtered out of a hiring process. A medical condition may be overlooked or misinterpreted. A financial assessment may unfairly disadvantage certain groups. In safety-critical contexts, even small misjudgements can escalate into serious harm. These breakdowns are rarely caused by a single flawed prediction. More often, they stem from earlier design choices, limitations in training data, assumptions embedded in objectives, and pressures during deployment.

The uncomfortable truth is that a system can perform exceptionally well on paper and still act irresponsibly in practice. Accuracy measures how often outputs match expected labels, but it does not reveal whose data was excluded, which edge cases were ignored, or how uncertainty is communicated to end users. It does not explain how trade-offs were made between speed and fairness, cost and safety, innovation and oversight.

As intelligent systems become decision makers in environments that affect real lives, engineering responsibility must stand alongside performance. The conversation must move beyond how well a system predicts and toward how carefully it has been designed, evaluated, and governed. Accountability is not an optional feature. It is a fundamental requirement for systems

that hold power over meaningful outcomes. This raises an important question for engineers, developers, and organizations:

## When a system makes a wrong decision, who is accountable?

This article examines the technical, ethical, and organizational layers of responsibility in modern systems. From automated vehicles to hiring tools and medical support systems, it explores why accountability must go beyond performance metrics and become a core part of every stage of development.

Accuracy is often treated as the ultimate measure of success in intelligent decision systems, yet performance metrics alone do not guarantee responsible outcomes. A system may perform exceptionally well in controlled testing environments while still producing harmful results in real-world contexts. This gap emerges because laboratory validation cannot fully capture unpredictable scenarios, social complexity, or rare edge cases. When a system operates at a large scale, its decisions can shape people's jobs, safety, and chances in life. That is why accountability cannot just be about hitting the right numbers – it needs to be part of every step from the moment you start building to the moment you deploy. Responsibility begins at the stage of problem definition. If the objective is framed poorly or narrowly, the resulting system will reflect those limitations. Data collection is equally critical. Historical records may contain patterns of exclusion or imbalance, and when these patterns are learned without scrutiny, they become encoded into automated decisions. During model development, design choices such as feature selection, threshold settings, and optimization goals influence outcomes in ways that are not always visible to end users. Validation and testing must therefore go beyond accuracy and examine fairness and real-world reliability.

These risks become far more tangible in areas like hiring and healthcare, where decisions directly shape people's lives. In recruitment, a system trained on past employment records can unintentionally carry forward old patterns of exclusion, quietly favouring certain groups simply because the data reflects historical imbalances. The process may appear efficient and objective, yet fairness can slowly erode if no one critically examines what the data contains and what it leaves out. In healthcare, the consequences feel even more immediate. An incorrect output is not just a technical flaw but

a missed diagnosis, an unnecessary treatment, or added stress for a patient and their family. As professionals grow accustomed to relying on these systems, trust can gradually replace careful scrutiny, especially when the reasoning behind a recommendation is unclear. Without transparency and thoughtful oversight, small hidden weaknesses can turn into real harm.

Accountability does not rest on a single individual. Engineers design and implement the system, data teams curate and preprocess information, managers approve deployment, and organizations determine acceptable levels of risk. Regulatory bodies may provide oversight, but internal governance often shapes day-to-day decisions. When responsibility is distributed across multiple actors, there is a danger that it becomes diluted. Clear documentation, audit trails, and continuous monitoring are essential to ensure that responsibility remains traceable. Designing for accountability requires intentional effort. Systems should include mechanisms for explaining decisions, logging outcomes, and incorporating feedback after deployment. Monitoring must be ongoing rather than occasional, since real-world environments evolve over time. When failures occur, there should be structured processes for investigation and correction. Accountability is not a final checkpoint before release; it is a continuous commitment throughout the lifecycle of the system.

In the end, strong performance numbers are important, but they are only part of the story. The systems we design now influence very real parts of people's lives, their careers, their health, their financial stability, and their sense of security. That kind of impact demands more than technical excellence. It calls for care. Responsibility cannot be treated as a final checklist item added before release. It has to be woven into every stage, from how data is gathered to how results are explained and monitored. It means being honest about what a system can and cannot do, acknowledging uncertainty, and ensuring that human judgment remains present rather than replaced. These systems do not carry values on their own. They reflect the choices, priorities, and trade-offs of the people who create and deploy them. When something fails, accountability does not belong to the code. It belongs to us. Real progress is not just about building systems that perform well, but about building ones that respect people, uphold fairness, and earn the trust placed in them.

# Explainable AI: Making Medical Image Decisions Transparent

Ms. Ushantha, B.,  
Instructor  
Department of Computer Science,  
University of Jaffna

**A**rtificial Intelligence (AI) has become an integral component of modern healthcare, particularly in medical image classification tasks such as disease detection from X-rays, computed tomography (CT) scans, and magnetic resonance imaging (MRI). Deep learning models have demonstrated high accuracy in identifying abnormalities and supporting clinical diagnosis. Despite these advances, limited transparency remains a major barrier to real-world clinical adoption. Understanding why a model produces a specific prediction is essential in safety-critical domains such as medicine.

Deep learning systems learn hierarchical feature representations directly from data rather than relying on explicitly defined rules. While this data-driven learning enables strong performance, it also results in complex internal representations that are difficult to interpret. Consequently, even highly accurate predictions may be viewed with scepticism if the underlying reasoning cannot be explained. In clinical practice, trust, accountability, and interpretability are as important as performance, as automated decisions directly influence patient outcomes.

Explainable artificial intelligence addresses this challenge by enhancing the transparency of model predictions. Instead of functioning as opaque decision-makers, explainable models provide insight into the features or image regions that influence their outputs. In medical image classification, this is commonly achieved through visual explanations that highlight diagnostically relevant regions. For example, when a model detects pathology in a chest X-ray, interpretability methods can indicate whether the prediction is based on lung tissue abnormalities rather than irrelevant background patterns.

Heatmap-based visualizations are among the most widely adopted explanation techniques. These methods assign importance scores to different regions of an image and overlay them using color intensity, allowing clinicians to visually assess the basis of a prediction. Such explanations are particularly

effective because they align with the visual reasoning processes already used by medical professionals, reducing the cognitive gap between human interpretation and algorithmic output.

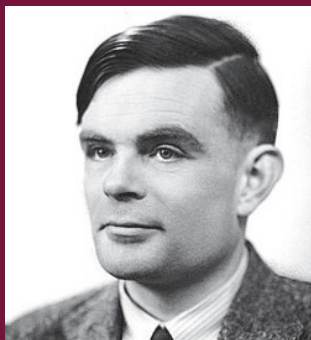
Beyond visual explanations, other interpretability techniques analyse how individual image regions contribute positively or negatively to a prediction. These approaches support deeper understanding of model behaviour, facilitate error analysis, and help identify biases or unintended correlations learned during training. From a development perspective, explainability aids model refinement and validation, improving robustness and reliability.

The role of explainability extends beyond technical insight to clinical collaboration. Rather than replacing healthcare professionals, AI systems function as decision-support tools that augment human expertise. By providing interpretable evidence alongside predictions, these systems enable clinicians to make informed decisions while retaining responsibility and ethical judgment.

Although interpretability methods are still evolving and may yield varying explanations, they represent a significant improvement over fully opaque system (black box). Continued research is refining these techniques to better align explanations with clinical reasoning and real-world diagnostic workflows.

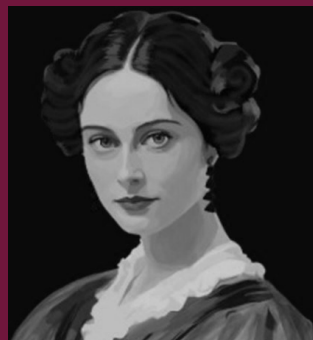
In conclusion, explainable artificial intelligence is a critical enabler for the safe and ethical deployment of deep learning models in medical image classification. By making automated decisions more transparent and interpretable, it enhances trust, supports clinical validation, and promotes responsible integration of AI into healthcare systems. This paradigm not only advances technical performance but also reinforces the human-centered nature of medical decision-making.

## Pioneers of Computer Science!



**Alan Turing** [1912 - 1954]

Father of theoretical computer science and artificial intelligence. Introduced the Turing Machine, forming the basis of modern computation. Played a crucial role in breaking WWII codes



**Ada Lovelace** [1815 - 1852]

The world's first programmer. She wrote the first algorithm for a machine, envisioning how computers could go beyond calculations.



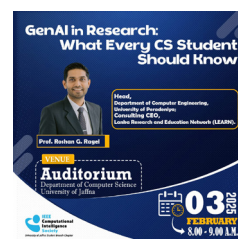
**Tim Berners-Lee** [1955 to Present]

Inventor of the World Wide Web, enabling global information sharing. Created HTML, HTTP, and the first web browser.

# Technical Talks: Leadership, AI & Professional Growth (2025)

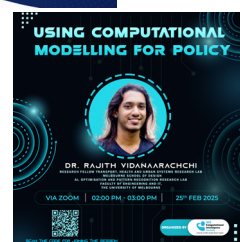
1

"GenAI in Research: What Every CS Student Should Know" by Prof. Roshan G. Ragel (Head, Department of Computer Engineering, University of Peradeniya; Consulting CEO, LEARN) held on 3rd of February 2025 from 8.00 a.m. to 9.00 a.m. at the Auditorium of the Department of Computer Science, University of Jaffna.



2

"Using Computational Modelling for Policy" by Dr. Rajith Vidanaarachchi (Research Fellow, Transport, Health and Urban Systems Research Lab, Melbourne School of Design AI; Optimisation and Pattern Recognition Research Lab, Faculty of Engineering and IT, University of Melbourne, Australia) held on 25th of February 2025 from 2.00 p.m. to 3.00 p.m. via Zoom.



3

"Dependable AI and Predictive Maintenance" by Mrs. Jyotika Athavale (President (2024) IEEE Computer Society; RAS Director, CTO Office, Synopsys) held on 28th of February 2025 from 7.30 p.m. to 8.30 p.m. via Zoom.



4

"Cracking the Code: Mastering Online Interviews for IT Success" by Ms. Isuri Dissanayake (Senior Executive, Talent Acquisition, IFS) held on 6th of March 2025 from 1.00 p.m. to 2.00 p.m. via Zoom. This session was organised in collaboration with the IFS, Sri Lanka.



5

"Overall Expectation of the Software Engineers" by Mr. Yasoma Jayasinghe (Senior Engineering Manager, Wiley) and Mr. Janaka Bandara (Senior Software Engineer, Wiley) held on 19th of March 2025 from 6.00 p.m. to 7.30 p.m. via Zoom. This session was organised in collaboration with the Wiley, Sri Lanka.



6

"Unlocking Discovery Combining Knowledge Graphs and LLMs with GraphRAG: Practical Considerations and Applications" by Dr. (Mrs.) Saatviga Sudhakar Shaseevan (Senior Machine Learning Scientist, Healx, UK) held on 26th of March 2025 from 7.00 p.m. to 8.00 p.m. via Zoom.



7

Workshop on "mSpace Digital Platform" held on 08th of April 2025 from 1.00 p.m. to 3.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna. The workshop was hosted by IEEE-CIS-SBC-UoJ, powered by SLT-Mobitel (Pvt) Ltd., and partnered with hSenid Mobile Solutions. Mr. Madura Hewage (Senior Manager, VAS Services, SLT-Mobitel) and Ms. Mudara Bandaranayake (Associate Lead, Business Solutions & Community Development, hSenid Mobile) served as the resource persons.



## 8

"**Meta Concerns in ML Security/Privacy**" by Prof. N. Asokan (David R. Cheriton Chair in Software Systems, University of Waterloo, Canada) held on 14th of May 2025 from 9.00 a.m. to 10.30 a.m. at the Auditorium of the Department of Computer Science, University of Jaffna.

## 9

"**IEEE and Professional Development**" by Mr. Heshan Mallawaarachchi (Chair of IEEE Young Professionals Sri Lanka), Ms. Chamodi Wickramasinghe (ExCo Member of IEEE Young Professionals Sri Lanka), and Ms. Vismini Amarasingha (ExCo Member of IEEE Young Professionals Sri Lanka) held on 28th of July 2025 from 7.00 p.m. to 8.00 p.m. via Zoom. This session was organised in collaboration with IEEE Young Professionals Sri Lanka and co-hosted by the IEEE Student Branch of the University of Jaffna, along with its IEEE CS, PES, and RAS Chapters, and the WIE Affinity Group.

## 10

"**Build Your Career Path**" by Mr. Kuldeep Sharma (Salesforce MVP, Marketing Champion, VP - Salesforce at Vanshiv Tech) and Mr. Mir Roshan Mir Niyaz Ali Zaidi (Senior Consultant Salesforce Marketing Cloud) held on 12th of September 2025 from 2.00 p.m. to 4.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna. This workshop was organised in collaboration with the Yarl Salesforce Ohana.

## 11

"**AI has lot more to offer than ChatGPT**" by Prof. Saman K. Halgamuge (Fellow IEEE; University of Melbourne, Australia) held on 22nd of September 2025 from 9.30 a.m. to 10.30 a.m. at the Auditorium of the Department of Computer Science, University of Jaffna in hybrid mode.

## 12

"**Deep Dive into OSI & TCP/IP with Packet Tracer Demonstration**" by Ms. Sanyukta Pawaskar (Routing TAC Engineer at Cisco; Secretary of IEEE R10 Young Professionals) held on 15th of November 2025 from 6.30 p.m. to 7.30 p.m. via Zoom. This session was organised in collaboration with the IEEE Young Professionals Sri Lanka.

## 13

"**How to Build a Global Tech Career: Skills, Mindset & Realities**" by Ms. Dinuka Jayaweera (Project Manager, National University of Singapore; Former Senior Project Lead, Sysco LABS, Sri Lanka) held on 16th of December 2025 from 1.30 p.m. to 2.30 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna in hybrid mode.

## 14

"**Machine Learning in Health and Biology**" by Prof. M. Niranjan (Chair of Signals, Images, Systems Research Group, University of Southampton, UK) was held on 20th of January 2026 from 1.30 p.m. to 2.45 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna.



# Professional Development Workshop for GIT Teachers (Northern Province)

The Provincial Department of Education of the Northern Province, in collaboration with the IEEE Computational Intelligence Society (CIS) Student Branch Chapter of the University of Jaffna, organized a Professional Development Workshop for General Information Technology Teachers from 12 to 13 June 2025. The event was held at the Department of Computer Science, University of Jaffna, from 9:00 a.m. to 5:00 p.m. each day.

A total of 100 school teachers from across the Northern Province participated in the workshop. Participants included educators from the Zonal Education offices of Vavuniya (North and South), Mannar, Madhu, Mullaitivu, Thunukkai, Kilinochchi (North and South), Thenmaradchi, Jaffna, Island, Valikamam, and Vadamaradchi.

Day	Topic	Resource Person/s
01	Computer Systems	Prof. A. Ramanan & Dr. E.Y.A. Charles
	Computer Networks	Dr. K. Thabotharan
	Multimedia Technologies	Dr. (Ms.) R. Nirthika
	Database Management System	Dr. (Mrs.) B. Mayurathan
	Software Engineering	Dr. (Ms.) J. Samantha Tharani
02	Operating System	Prof. M. Siyamalan
	Web Development	Dr. K. Sarveswaran
	AI in Education	Dr. T. Kokul
	Internet of Things (IoT)	Mr. S. Suthakar
	Panel Discussion	Dr. K. Thabotharan Dr. (Mrs.) B. Mayurathan Mr. S. Suthakar



# STEM Workshop for Secondary School Students (Vavuniya North Education Zone)

A School-level Awareness Workshop on AI and IoT with Hands-On Training was held in person on 10th July 2025 at the Department of Computer Science, University of Jaffna, targeting students from the Vavuniya North Education Zone. Organized by the IEEE WIE Student Branch Affinity Group in collaboration with the IEEE Computational Intelligence Society Student Branch Chapter and the Vavuniya North Education Zone, the workshop aimed to empower Grade 9 to 13 students with foundational knowledge in Artificial Intelligence (AI) and the Internet of Things (IoT). Around 57 participants, including ICT teachers and students from seven schools, attended the event. Dr. (Mrs.) B. Mayurathan led a session on "AI Tools for School Students: Empowering Learning with Artificial Intelligence," while Mr. S. Suthakar conducted a session on "IoT and Hands-On Arduino Programming." Supported by educational leaders Mr. T. Lenin Arivalakan (Zonal Director of Education - Vavuniya North) and Mr. Sivarajah, the workshop concluded with an interactive Q&A and feedback session, leaving students inspired and informed about emerging technologies.



# AI Tools for Efficient and Responsible Office Administration:

The workshop titled "AI Tools for Efficient and Responsible Office Administration" was successfully conducted on 27 and 28 December 2025 at the Department of Computer Science, University of Jaffna, for approximately 200 officers from the District Secretariat, Kilinochchi. Organised by Prof. A. Ramanan, Advisor of the IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna in collaboration with the District Secretariat, Kilinochchi, the programme aimed to enhance administrative efficiency while promoting the ethical and responsible use of Artificial Intelligence (AI) in public sector offices.

The workshop provided a balanced combination of theoretical foundations and practical applications of AI for office administration. Prof. A. Ramanan delivered sessions on Introduction to Artificial Intelligence, Generative AI and Its Ethical Use, and Prompt Engineering, focusing on core concepts, ethical considerations, and effective interaction with AI tools. Dr. T. Kokul conducted hands-on sessions on AI-assisted presentations, writing, generative AI tools for office productivity, and audio-visual content generation, demonstrating their practical use in enhancing productivity and communication. Dr. (Mrs.) M. Barathy led the session on AI for spreadsheets and data handling, highlighting AI-supported approaches for data organisation, analysis, and reporting in administrative tasks.

The sessions were held from 9.00 a.m. to 4.45 p.m. on both days, with around 100 participants each day. Participants were highly engaged and expressed positive feedback, noting increased confidence and awareness in adopting AI tools responsibly in their professional roles. Certificates of participation were awarded to all attendees.



Conducted By:  University of Jaffna Student Branch Chapter

In Collaboration With: 



# Zero Trust at the Edge: How 6G Will Redefine Network Security

Mr. Sankalpa Fernando  
Graduand  
Department of Computer Science  
University of Jaffna

For decades, when a phone connects to a cell tower, it belongs to a licensed telecom operator, which operates under strict regulation and forms part of a centralised, well-controlled infrastructure. However, as we move toward the 6G era, that assumption has begun to break down. As the telecom industry is getting ready for its next evolution, 6G, researchers are exploring high-frequency terahertz communication combined with ultra-dense deployments, device-to-device relaying, and edge intelligence to deliver the ultra-low latency and extreme data rates promised by 6G. To maintain connectivity, devices may need to relay traffic through nearby nodes, as these terahertz signals are highly directional and easily blocked by obstacles, weather, or even human movement. As a result, the "network" is no longer limited to operator-owned base stations. It may temporarily include vehicles, drones, smart infrastructure, or IoT devices acting as intermediate relays. Even though this approach improves coverage and resilience, it introduces a serious challenge well-known in distributed systems research, which is known as the rogue node problem, where the participation of a compromised or malicious device in network routing makes the network vulnerable. This opens the door to devastating attacks that are currently the focus of intensive cybersecurity research.

The Sinkhole attack, often referred to as a 'black hole', is considered the most concerning threat of this kind. In a Sinkhole attack, a compromised device, for instance, a hacked digital billboard, broadcasts a signal falsely claiming it offers the fastest, strongest route to the internet core, and when nearby devices route their traffic through this node, the malicious machine simply deletes the data instead of forwarding it. Even though the victim's device still shows a full signal, the user is effectively offline. In critical applications such as remote surgery or autonomous driving, this sudden, silent communication blackout can be catastrophic.

Another major threat is the Sybil attack, which targets the democratic nature of a decentralised network. Because 6G networks will rely on local consensus to identify and isolate bad actors, an attacker can manipulate this voting process. By purchasing a single physical device and programming it to simulate hundreds of fake digital identities, the attacker creates a 'fake crowd', and when the local network attempts to vote on whether a specific node is malicious, the attacker uses their fabricated identities to outvote honest devices, protecting their own malicious nodes or framing innocent users.

Perhaps the hardest threat to detect is the "On-Off" or Sleeper Attack. A sophisticated attacker understands that acting maliciously all the time will result in immediate detection and isolation. Instead, the rogue node behaves perfectly normally for the majority of the time, building up a high reputation within the network, then, during a critical window, such as a surge in financial transactions, it briefly drops packets or injects malware before immediately returning to good behaviour. Following this strategy allows the node to inflict damage while gaming the system to stay just above the threshold of being banned.

In an environment like this, traditional security models based on identity and authentication are no longer sufficient, which

means knowing who a device claims to be matters less than knowing how it behaves over time. As a result, 6G security research is increasingly moving toward continuous behavioural trust, which constantly evaluates its neighbouring devices instead of simply authenticating once and then operating freely. In this way, when a device forwards traffic consistently and reliably, its trust increases, and when it behaves erratically, drops packets, or manipulates routing, its trust is downgraded in real time.

Because these decisions must be taken quickly and locally, researchers are exploring lightweight distributed trust records maintained at the edge of the network, where the nearby devices share observations of misbehaviour to create a local history of trust, rather than relying on a distant centralised authority. Because of this, a node that attempts to exploit the network may find that its past actions follow it, limiting its ability to participate even if it repeatedly reconnects.

One of the most effective countermeasures against large-scale identity manipulation does not come from software at all but from the physical world itself. Unlike previous generations, 6G tightly integrates communication with sensing, and therefore, the same signals used to transmit data can also act as ultra-precise radar, measuring location, movement, and physical characteristics with extreme accuracy. This makes it far harder for a single device to convincingly pretend to be many. If dozens of claimed identities all produce identical physical signatures and occupy the same space, the network can infer that they originate from one physical source, regardless of how many digital names they present.



Taken together, these shifts mark a fundamental change in how mobile networks are secured. The future of wireless communication is not built on blind trust in infrastructure but on continuous verification, local judgment, and behaviour-based accountability. Moreover, instead of trusting the devices because they are part of the network, now the devices are part of the network because they remain trustworthy.

In the 6G era, security is no longer about building higher walls around the network. Instead, it is about surviving inside a network where trust is never assumed but must be earned, moment by moment.

# Retrieval-Augmented Generation (RAG): Enhancing Large Language Models with External Knowledge

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Artificial Intelligence (AI) has witnessed rapid advancements with the emergence of Large Language Models (LLMs), which have significantly improved natural language understanding and generation. These models are capable of producing coherent and contextually relevant text, making them valuable in a wide range of applications. However, despite their impressive capabilities, traditional LLMs rely primarily on static training data. This limitation restricts their ability to access up-to-date information and perform effectively on knowledge-intensive tasks. Retrieval-Augmented Generation (RAG) is an architectural framework designed to address these challenges. First introduced by Lewis et al. (2020) [1], RAG integrates information retrieval mechanisms with generative language models to produce more accurate, reliable, and context-aware responses.

## Limitations of Traditional Language Models

Modern language models, including systems such as GPT, are trained on large-scale datasets. While powerful, they face several key limitations:

- ❑ Knowledge cutoff constraints
- ❑ Inability to access real-time or private data
- ❑ Hallucination and factual inconsistencies

Research has shown that generative models may produce fluent but factually incorrect outputs, particularly in tasks such as summarization and open-domain question answering [5]. These limitations highlight the need for mechanisms that can ground model outputs in reliable external knowledge.

## Foundations of Retrieval-Augmented Generation

RAG builds upon earlier advancements in dense retrieval and retrieval-augmented modeling. Dense Passage Retrieval (DPR) introduced efficient semantic search using vector representations of text [2]. Similarly, the REALM framework demonstrated the potential of retrieval-augmented pretraining [3].

Subsequent research has further refined the integration of retrieval systems with generative models, leading to more robust and scalable AI systems capable of handling complex, knowledge-driven tasks [4].

## RAG Architecture and Workflow

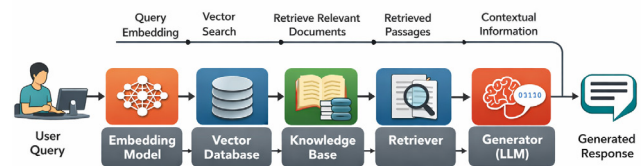
A typical RAG system consists of the following components:

1. **Knowledge Base** - A collection of documents or data sources
2. **Embedding Model** - Converts text into vector representations
3. **Vector Database** - Stores embeddings for efficient similarity search
4. **Retriever** - Fetches relevant documents based on the query
5. **Generator (LLM)** - Produces the final response

## Workflow:

1. The user submits a query
2. The query is converted into an embedding
3. Relevant documents are retrieved from the database
4. Retrieved content is appended to the prompt
5. The LLM generates a contextually grounded response

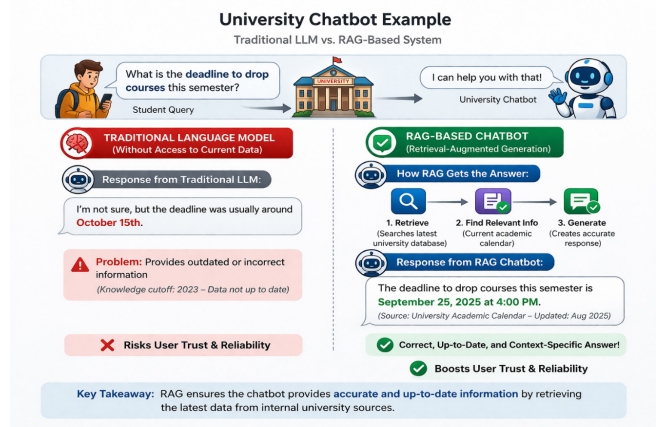
This hybrid approach significantly improves performance in knowledge-intensive tasks by combining retrieval accuracy with generative fluency [1].



## Practical Example

Consider a university chatbot designed to answer student queries about course schedules and regulations. A traditional language model may provide outdated or incorrect information if such details were not included in its training data.

In contrast, a RAG-based system retrieves the latest information from an internal university database and incorporates it into the response. As a result, the chatbot can deliver accurate, up-to-date, and context-specific answers, improving both reliability and user trust.



In modern AI engineering practices, retrieval-based context construction is considered a fundamental design pattern. Instead of retraining large models for every new dataset, organizations can connect LLMs to structured knowledge sources through retrieval pipelines [6].

This approach enables faster updates, domain adaptability, and cost efficiency, making RAG a practical solution for real-world AI deployment.

### Advantages and Challenges

✔ Advantages:

- ▣ Reduces hallucination through grounded responses
- ▣ Enables access to real-time and private data
- ▣ Scales effectively across domains
- ▣ Avoids costly retraining of models

✔ Challenges:

- ▣ Retrieval quality directly impacts overall performance
- ▣ Effective document chunking is essential
- ▣ Increased system and infrastructure complexity
- ▣ Embedding model selection influences accuracy

### Conclusion

Retrieval-Augmented Generation represents a significant advancement in AI system design. By integrating information

retrieval with generative modeling, RAG transforms language models from static knowledge predictors into dynamic systems capable of reasoning over external data.

As AI adoption continues to grow in academic and industrial settings, architectures like RAG will play a crucial role in developing trustworthy, scalable, and context-aware intelligent systems. Future developments are expected to further enhance retrieval efficiency, integrate multimodal data, and support more autonomous AI applications.

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# IEEE Sri Lanka Section Awards 2025

The IEEE Sri Lanka Section Awards 2025 were conducted in two distinguished phases to recognise excellence and impactful contributions across the IEEE community in Sri Lanka.

Phase 1 of the awards ceremony was held on 27 September 2025 at the Jie Jie Beach Hotel, Panadura. This phase recognised the outstanding achievements of IEEE Student Branches, Chapters, and Affinity Groups, with awards presented across several categories, including Best Student Branch Project.

Phase 2 was held on 12 January 2026 at the Taj Samudra Hotel, Colombo, honouring excellence across Organizational Units, Special Activities, Individual Volunteers, and External Contributions, thereby celebrating the achievements of IEEE chapters and members nationwide.

## Awards Secured – Phase 1:

- 🏆 Emerging Chapter Award (Student Branch Category)  
Awarded to the IEEE Computational Intelligence Society (CIS) Student Branch Chapter, University of Jaffna, for its impactful initiatives during 2025, under the advisorship of Prof. A. Ramanan and the leadership of Miss. Vinuki Samaraweera



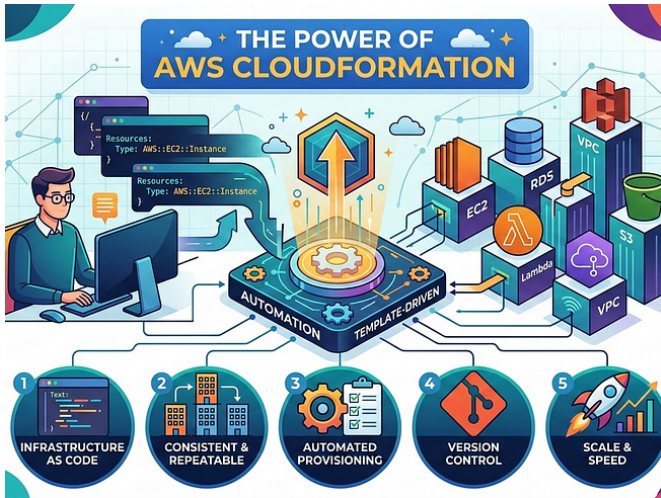
## Awards Secured – Phase 2:

- 🏆 IEEE Sri Lanka Section Outstanding Student Branch Chapter Advisor Award - Awarded to Prof. A. Ramanan for his significant contributions to the IEEE CIS Student Branch Chapter, University of Jaffna.



# The Power of AWS CloudFormation: Why DevOps Engineers Love It

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Nowadays, most developers are very familiar with the AWS Console. Many of them work daily using the graphical interface. Even DevOps engineers use it. It's interactive, visual, and easy to explore.

But today, I'm going to talk about something very essential for DevOps maturity and automation. A service that changes the way we create infrastructure. That tool is CloudFormation – AWS's built-in Infrastructure as Code (IaC) service.

First question: Why do we even need it? Let's think practically. Our main goal in DevOps is faster delivery, automation, repeatability, less human error, and consistency across environments.

When you create resources manually using the console, it takes time. You might forget a configuration. You might misconfigure security groups. You cannot perfectly replicate the same setup again.

Now imagine you need the same infrastructure for development, testing, staging, and production. Will you manually create everything four times? That's risky and not scalable. This is where CloudFormation becomes powerful.

```

ElasticBeanstalkSample.template
1 {
2   "AWSTemplateFormatVersion" : "2010-09-09",
3
4   "Description" : "AWS CloudFormation Sample Template ElasticBeanstalkSample: Configure and
5
6   "Parameters" : {
7     "KeyName" : {
8       "Description" : "Name of an existing EC2 KeyPair to enable SSH access to the AWS Elast
9       "Type" : "String"
10    }
11  },
12
13  "Resources" : {
14    "SampleApplication" : {
15      "Type" : "AWS::ElasticBeanstalk::Application",
16      "Properties" : {
17        "Description" : "AWS Elastic Beanstalk Sample Application",
18        "ApplicationVersions" : [
19          "VersionLabel" : "Initial Version",
20          "Description" : "Version 1.0",
21          "SourceBundle" : {
22            "S3Bucket" : { "Fn::Join" : [ "-", [ "elasticbeanstalk-samples", { "Ref" : "AWS::R
23            "S3Key" : "elasticbeanstalk-sampleapp.war"
24          }
25        ]
26      },
27      "ConfigurationTemplates" : [
28        "TemplateName" : "DefaultConfiguration",
29        "Description" : "Default Configuration Version 1.0 - with SSH access",
30        "SolutionStackName" : "64bit Amazon Linux running Tomcat 7",
  
```

So what exactly is CloudFormation? In very simple words, we write a YAML or JSON file that describes all the AWS

resources we want. Then we run it, and AWS creates everything automatically according to our instructions. That's it. Instead of clicking buttons in the console, we describe infrastructure as code.

What can we create using it? Almost everything: EC2 instances, S3 buckets, VPC, subnets, security groups, IAM roles, load balancers, and RDS databases – all inside one single file. Now think about that. One file. Entire infrastructure created in minutes.

But is it easy? Let's be honest. At first glance, it feels harder than using the console. When using the console, you click, you select, and you see options clearly. But in CloudFormation, you must know the resource type, you must know the correct properties, you must specify region-based AMI IDs, and you must define dependencies correctly.

For example, if you create an EC2 instance, you must provide the correct AMI ID for that region. You don't "see" it visually; you must define it properly in code. So yes, initially it feels harder, and that feeling is correct.

Then why do we do this "hard" thing? The simple answer is reusability and automation. When you create resources using CloudFormation, everything is grouped into something called a Stack. A Stack is like a packaged infrastructure set.

You can create it, update it, delete it, reuse it later, and version control it in Git. Now imagine you deploy a stack and something fails in the middle. CloudFormation automatically rolls back. It deletes all partially created resources.

That means no half-configured infrastructure, no messy environment, and no manual cleanup. Isn't that powerful?

Another important benefit is consistency. If five DevOps engineers deploy the same CloudFormation template, they get the exact same infrastructure. No difference. No "it works on my account" issues. That is real DevOps quality.

Think like an enterprise. In big companies, infrastructure must be auditable, version controlled, repeatable, and reviewed before deployment. CloudFormation templates can be stored in Git, reviewed via pull requests, approved before deployment, and tracked for changes. You cannot do that with manual console clicks.

So what's the final mindset shift? The console is good for learning and exploration, while CloudFormation is good for production and automation.

In DevOps, we move from manual to automated, from clicking to coding, and from temporary setups to repeatable infrastructure. Yes, at first it feels complex. Yes, writing YAML is not as fun as clicking buttons. But once you understand it, you realize you are not just creating resources – you are designing infrastructure professionally.

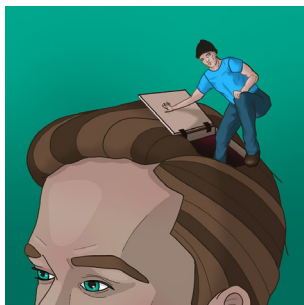
So ask yourself: Do you want to create infrastructure once, or do you want to create it infinitely, reliably, and safely? That's the power of CloudFormation.

# Deepfake Social Engineering Cyber Attack

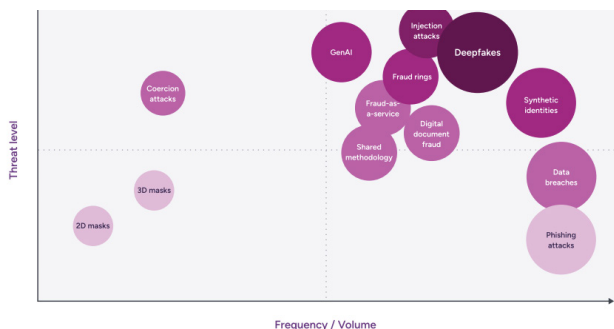
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A social engineering attack is a type of cyber attack that targets human behaviour rather than technical weaknesses. Attackers deceive individuals into revealing sensitive information or performing actions that compromise security, often by posing as trusted entities and using tactics such as urgency, authority, or emotional pressure.

Deepfake technology has made social engineering attacks more convincing. A deepfake social engineering cyber attack uses artificial intelligence generated audio or video to impersonate real individuals and deceive victims into taking harmful actions. By exploiting natural human responses to familiar faces, voices, authority, and urgency, attackers create highly believable content that builds trust and reduces the likelihood of verification, making these attacks more effective than traditional social engineering methods.

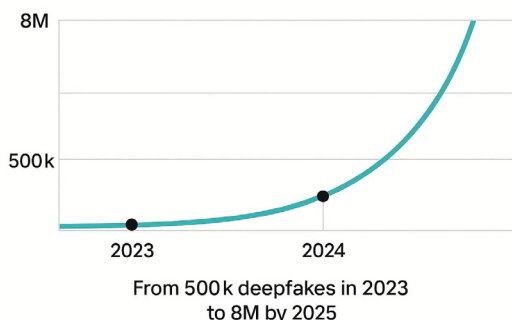


In recent years, deepfakes have evolved from a novelty technology into a serious cybersecurity threat, as shown in Figure 1. By 2025, attackers increasingly use deepfake media, as illustrated in Figure 2, to impersonate trusted figures such as company executives or public officials in order to conduct scams, fraudulent financial requests, and data theft. This trend is significant because it erodes confidence in digital communication and bypasses traditional security measures.



<https://www.enrust.com/sites/default/files/documentation/reports/2025-identity-fraud-report.pdf>

Figure 1: Distribution of cyber attack types by frequency and threat level



<https://deepstrike.io/blog/deepfake-statistics-2025>

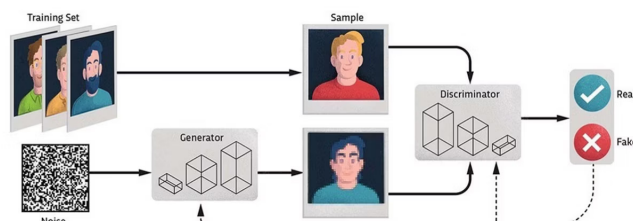
Figure 2: Rapid increase in deepfake volume from 500K in 2023 to 8M by 2025

## Key stages of the attack

1. Reconnaissance and data collection - Attackers gather publicly available videos, images, voice recordings, and background information about the person they intend to impersonate, as well as details about the target organisation.
2. Deepfake media creation - The collected data is used to train artificial intelligence models that generate realistic fake audio or video. These models replicate facial expressions, voice tone, and speaking style to produce convincing deepfake content.
3. Attack deployment - The deepfake media is delivered through channels such as video calls, phone calls, emails, or messaging platforms. Attackers impersonate trusted individuals to issue urgent or authoritative requests.
4. Multi-channel reinforcement - In some cases, attackers combine multiple communication methods, such as an email followed by a deepfake call, to strengthen credibility and reduce suspicion.

## AI Models Used in Deepfake Creation

- Generative Adversarial Networks (GANs) - Consist of two competing neural networks, a generator and a discriminator. The generator synthesizes fake images or videos, while the discriminator attempts to distinguish real samples from generated ones. As shown in Figure 3, this adversarial training loop iteratively enhances the realism of the generated media.



<https://www.ibm.com/think/x-force/weaponizing-reality-evolution-deepfake-technology>

Figure 3: Architecture of a Generative Adversarial Network (GAN) used for deepfake generation, showing the interaction between the generator and discriminator.

- Autoencoders and transformer-based systems - These models are commonly used for face and voice synthesis. They learn key facial features, expressions, and speech patterns, allowing attackers to accurately reproduce a person's appearance or voice with a high level of realism.

## Impact and Consequences

- Financial loss - Deepfake social engineering attacks cause significant monetary harm to individuals and organisations. Victims may be tricked into transferring money through impersonation, investment, or fraud schemes.
- Emotional and psychological harm - The manipulation

of personal trust can lead to stress, anxiety, and loss of confidence, particularly when deepfake content involves familiar faces or voices.

- ▣ Identity and trust exploitation - Deepfakes enable attackers to impersonate trusted individuals, increasing the likelihood that victims will share sensitive information or comply with fraudulent requests.
- ▣ Reputational harm - The use of deepfakes to impersonate leaders or spread false statements can undermine trust among customers, partners, and investors, with long-term effects on credibility.
- ▣ Threats to public confidence - Deepfakes can be used to spread disinformation or manipulate public opinion, weakening trust in official communications and institutions.

### Recent Top five Real-World Incidents

#### ❖ Deepfake trading scam in Bengaluru, India (December 2025)

A woman was deceived by a deepfake video appearing to show India's Finance Minister promoting a fake investment platform. She shared personal and banking details and transferred funds over several months. The total loss exceeded 33 lakh after the promised profits never appeared. <https://timesofindia.indiatimes.com/city/bengaluru/deepfake-of-nirmala-sitharaman-costs-woman-rs-33-lakh-in-bengaluru/articleshow/125875466.cms>

#### ❖ Singapore-linked deepfake video conference scam (March 2025)

A finance director joined a video call featuring deepfake executives discussing a fake restructuring plan. Believing it was genuine, he authorised a transfer of nearly USD 500,000. Authorities later traced and froze most of the funds. <https://www.channelnewsasia.com/singapore/deepfake-scam-impersonate-ceo-company-finance-director-5048706>

#### ❖ Hong Kong AI voice-cloning crypto scam (January 2025)

Cybercriminals used AI voice cloning to impersonate a company finance manager during WhatsApp conversations. The victim was persuaded to transfer cryptocurrency worth about USD 18.5 million. The fraud was discovered only after the funds were irretrievable. <https://www.bangkokpost.com/world/2957936/hong-kong-lose-b870m-to-scams-in-a-week-ai-voice-cloning-used>

#### ❖ Arup engineering deepfake executive scam (February 2024)

An employee joined a video meeting where senior executives appeared to request urgent fund transfers. All

participants were later confirmed to be AI-generated. Approximately USD 25.6 million was lost before the scam was uncovered. <https://www.theguardian.com/technology/article/2024/may/17/uk-engineering-arup-deepfake-scam-hong-kong-ai-video>

#### ❖ Deepfake celebrity investment scam network (March 2025)

Fraudsters used deepfake videos of well-known public figures to promote fake investment schemes online. Thousands of victims were persuaded to invest through social media adverts. The operation stole around USD 35 million across multiple countries. <https://www.theguardian.com/money/2025/mar/05/revealed-the-scammers-who-conned-savers-out-of-35m-using-fake-celebrity-ads>

### Prevention and Mitigation Strategies

- ▣ Use multi-layer verification - Require secondary confirmation for sensitive requests, such as call-backs to known numbers or secure email approval, to prevent action based on a single audio or video interaction.
- ▣ Deploy deepfake detection technologies - Use AI-based detection tools to analyse audio, video, and metadata for signs of manipulation before trusting or acting on digital communications.
- ▣ Implement strong authentication controls - Enforce multi-factor authentication with liveness detection, biometrics, or hardware tokens to reduce the risk of impersonation and account takeover.
- ▣ Train users and staff on deepfake awareness - Conduct regular awareness training and simulations to help recognise suspicious behaviour, unusual requests, or inconsistencies in audio and video content.
- ▣ Respond quickly and strengthen controls after incidents - Immediately contain suspected attacks, reset compromised credentials, analyse affected communications, and update internal policies to prevent recurrence.

### Example Tools and Technologies for detecting and preventing deepfake attacks

- ▣ Deepfake Detection Tools: Reality Defender, FakeCatcher, Vastav AI - for scanning and flagging manipulated media.
- ▣ AI-Based Monitoring & Security Suites: Splunk, Microsoft Sentinel, Darktrace - for behavioural monitoring and threat alerts.
- ▣ Authentication Solutions: Multi-factor authentication (MFA), biometric liveness systems - strengthen identity verification.
- ▣ Verification Protocols: Digital signatures, cross-platform identity checks - confirm authenticity before action.

## Formation and Growth of IEEE

The Institute of Electrical and Electronics Engineers (IEEE) was formed in 1963 through the merger of the American Institute of Electrical Engineers (AIEE, founded in 1884) and the Institute of Radio Engineers (IRE, founded in 1912). The goal was to create a global organization to advance technology for humanity, covering areas such as electrical engineering, electronics, computer science, and related fields.

At its inception, IEEE had a relatively small membership and consisted of a few technical societies and chapters primarily based in the United States. Over the decades, IEEE has grown exponentially, both in membership and global presence. Today, IEEE has:

- ❖ Over 420,000 members worldwide.
- ❖ Over 1,200 local sections in more than 100 countries.
- ❖ Hundreds of technical societies and councils, covering specialized areas such as robotics, communications, computing, and artificial intelligence.

The growth of IEEE chapters is supported by initiatives such as Student Branches, local sections, technical chapters, and affinity groups, enabling members to collaborate, share knowledge, and organize conferences, workshops, and competitions. This global expansion reflects IEEE's mission to foster innovation and technological excellence around the world.

# Cyberpsychology: The intersection of technology and human behavior

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The field of cyberpsychology is an emerging area that focuses on psychological processes associated with human interaction and technology. It defines how technology influences cognition, emotions, human behavior, and social interactions. As we are living in an age where technology looms larger than ever before, understanding how technology impacts our mental well-being is crucial for the upcoming years of integrating technology into our lives.

The field of cyberpsychology rose due to the rise of smartphones, social networks, and other advanced communication media. Due to these advances, it gave new perspectives on the behavior and habits of individuals from professional bodies, academics, and researchers. Cyberpsychology is an interdisciplinary field that comprises psychology, computer science, neuroscience, and sociology.



## History of cyberpsychology

In 1940, Norbert Wiener brought forward a concept called "Cybernetics," derived from the Greek word for "Pilot" and "Governor," which laid the foundation for understanding human-computer interactions [1]. But, due to the widespread use of the World Wide Web (WWW) during the 1990s, cyberpsychology became a formal discipline. John Suler first pioneered the study of online behavior in primitive chat rooms and forums [2]. Although it began within a narrow scope, with the expansion and advancement of communication methods the study expanded to different domains.

By the late 1990s, a journal named CyberPsychology and Behavior (1998) formalized the discipline. With a large internet community growing in the United States, the early study focused on emotional attachments to computers and unique behaviors on digital platforms. In 2010, there was a great expansion in the field of cyberpsychology, which focused on the influences of social media and the impact of AI [3]. And with Covid-19, the significance of cyberpsychology was felt heavily, and remote telepsychology and digital mental health tools started to emerge. As for today, cyberpsychology includes extended reality (XR), AI and psychology, and algorithmic influences, which serve as key disciplines to understand the modern human-technology relationship.

There are few issues that cyberpsychology mainly covers based on how technology shapes psychological processes. Let's explore some of those...

## Online identity and self-presentation

Cyberpsychology addresses one of the major problems that arise through the rise of mass communication platforms. That is online identity and self-presentation. Online identity is often how one virtually represents themselves on a digital platform. Due to hyperpersonal models in online environments, it becomes an issue where a person makes himself an idealized or different identity online.

Some traits like desire to appear perfect, may lead to these types of idealized versions of themselves on digital platforms. This causes negative impacts on society, like cyberbullying, perpetration, rumination, and depression, which deprives people of normal life. Sometimes through social media people present an impression of themselves, which may make them overlook the mundane tasks and forget their own life outside of online.

## Social interactions in virtual environments

Virtual environments facilitate engaging with the society in an easier and simpler way. Some advanced technological ways, like Immersive Virtual Environments Technology (IVET), allow for manipulating variables like appearance and environment, which may influence trust and communication. Whatever it is, it fascinates us without proper communication. These are only a form of fantasy without any real bonding. This only creates the mirage of a relationship but does not give the satisfaction of a real human connection.

## Internet addiction

Internet addiction is often called excessive use of the internet, which may impair daily life, relationships, and emotional stability. It brings major psychological problems, including impulse control disorders like preoccupation, loss of control, and withdrawal. Prevalence rates in the U.S. and Europe are often comorbid with anxiety, depression, and poor coping strategies [5]. Among adolescents, rumination and low self-care are prevalent, while adults show links to online gaming and sexual activities.

## Cyberbullying and its psychological effects

Cyberbullying can be identified as using technology to harass another, often using social media. This situation may affect any individual in different ways, from anxiety and depression to suicidal ideation [6]. Also, the mental impacts can also be low self-esteem, social isolation, sleep disturbances, and even self-harm. This form of bullying can leave deep emotional scars, which affect individuals similarly to trauma.

## Psychological effects of social media

Social media is often the root cause for modern societal problems. It has affected youth in unexpected ways, like anxiety, depression, and disrupted sleep. Also, regular emotional regulation and cognitive abilities have also been greatly affected due to overt use of social media. The negative comparisons and

FOMO (Fear of Missing Out) have led to low self-esteem and distress. Even under extreme circumstances, self-harm and suicidal thoughts are also prominent among individuals.

**Privacy and security concerns**

Privacy often involves risks of misuse of personal data, while security often involves unauthorized access. Studies suggest that individuals who are more aware of privacy risks tend to exhibit higher levels of digital stress, a phenomenon sometimes referred to as "privacy fatigue," where users feel overwhelmed by the constant need to manage their digital footprint. Some phenomena, like catfishing, where trust is used to deceive individuals, are also concerns that are prevalent in the modern world.

**Future of cyberpsychology**

Cyberpsychology contributes to cybersecurity by addressing human biases and by promoting defenses through psychological insights. The future of cyberpsychology lies in algorithmic psychology, Extended Reality (XR) integration, and digital ethics while addressing AI integration, metaverse impacts, and telepsychology expansion. As a relatively new emerging field, cyberpsychology will form policy, therapy, and innovation related to the use of technology by considering its

safe use. It will shape how the digital world should facilitate human experiences. It also will address some novel issues faced by society, like addiction, bullying, and privacy, offering practical solutions. As technology evolves, cyberpsychology will be vital for promoting healthy digital interactions and mitigating risks.

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## IEEE Computational Intelligence Society Student Branch Chapter Executive Committee 2026



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# IEEE CIS High School Outreach Programme 2025 Inspires Future Technology Leaders in Jaffna

The IEEE Computational Intelligence Society Student Branch Chapter at the University of Jaffna successfully conducted the IEEE CIS High School Outreach Programme 2025, following the award of a competitive grant of USD 2,900 from IEEE CIS, USA. Held from March to June 2025 under the theme "Explore the Future of Technology," the programme aimed to inspire and educate G.C.E. (A/L) students and ICT teachers by introducing key concepts and real-world applications of Computational Intelligence, with a focus on the Internet of Things (IoT) using Arduino and Generative Artificial Intelligence.

The outreach workshops were conducted across five educational zones in the Jaffna District: Vadamaradchy (13 March), Thenmaradchy (31 March), Valikamam (18 April), Island (10 June), and Jaffna (28 June), in collaboration with the Provincial Department of Education, Northern Province, and respective Zonal Education Offices. Each one-day session featured a lecture and introductory hands-on component on Generative AI delivered by Prof. A. Ramanan, followed by an interactive hands-on session on IoT and Arduino programming conducted by Mr. S. Suthakar, Senior Lecturer, Department of Computer Science, University of Jaffna.

A key highlight of the programme was the Smart Device Design Competition, where students worked in teams to develop innovative prototypes. Participants were also provided with workshop kits, refreshments, and opportunities to showcase their ideas. Each session concluded with an award ceremony, distribution of participation certificates, and a feedback discussion.

The programme reached 61 schools and engaged over 400 participants, including approximately 307 students and 100 teachers. Teachers were trained as Trainers of Trainers to ensure sustained knowledge dissemination within their schools. Around 100 smart device prototypes were developed, demonstrating strong student engagement and creativity.

Organised under the leadership of Prof. A. Ramanan, Advisor of the IEEE CIS Student Branch Chapter, the initiative was carried out in collaboration with the Department of Education, Northern Provincial Council, with the generous support of Mr. K. J. Bratley (PDE) and Mr. T. Thevathas (DDE). The programme significantly strengthened ties between the University of Jaffna and local schools, paving the way for future collaboration.

Aligned with IEEE's mission of advancing technology for humanity and IEEE CIS's focus on promoting Computational Intelligence, the initiative made a meaningful contribution to STEM education and pre-university engagement, while encouraging the next generation of technology innovators and future IEEE contributors.





# SLSWCS'25

Student Workshop on Computer Science

The eighth national workshop, Sri Lanka Student Workshop on Computer Science (SL-SWCS'25), was held on 13 December 2025, organized by the Department of Computer Science, with approximately 150 participants attending physically. The German Academic Exchange Service (DAAD) was the Platinum Sponsor; the University of Jaffna, Golden Sponsor; WSO2 and 99X, Silver Sponsors; and People's Bank and the Bank of Ceylon, Bronze Sponsors. The event was recognized by the IEEE Sri Lanka Section and conducted in collaboration with the IEEE Computational Intelligence Society student branch chapter of the University of Jaffna.



# Where Data Meets Maps: The Rise of Geospatial Intelligence

**Ms. Ahrane. M**  
Research Assistant  
Department of Computer  
Science University of Jaffna

Location has emerged as a critical data dimension in contemporary computational systems. Across domains such as AI-driven navigation, autonomous systems, climate modeling, and smart city infrastructures, geospatial intelligence underpins many core technological advances. By integrating spatial data with advanced analytical and computational methods, geospatial analysis enables both machines and human decision-makers to develop a more structured and contextualised understanding of complex real-world processes.

Geospatial data extends beyond conventional cartographic representations. It encapsulates spatial coordinates, attribute information, and temporal dimensions to model dynamic real-world phenomena. Applications such as real-time fleet monitoring, satellite-based wildfire detection, and urban heat island modeling demonstrate how geospatial data provides contextual depth that is typically absent in non-spatial datasets.

At the core of the geospatial ecosystem are Geographic Information Systems (GIS), cloud platforms, and high-resolution sensors. Modern GIS architectures support ingesting and managing of large-scale vector datasets, including transportation networks, built infrastructure, and administrative boundaries, alongside raster datasets derived from satellite imagery, unmanned aerial vehicles, and LiDAR sensors.

The integration of multi-source spatial datasets facilitates the identification of spatial correlations, patterns, and dependencies, which are essential for predictive modelling and automated decision-making.

A defining characteristic of contemporary geospatial technology is its tight integration with cloud-native infrastructures and artificial intelligence methodologies. Cloud-based geospatial platforms enable scalable processing of petabyte-scale spatial datasets, while machine learning and deep learning models automate tasks such as object detection, land cover classification, and spatial prediction.

These technological advancements have significantly expanded the applicability of geospatial intelligence across multiple sectors. In transportation and logistics, spatial analytics optimise routing, enhance fuel efficiency, and support autonomous navigation systems. In the energy and utilities sector, geospatial modelling contributes to grid optimisation, asset management, and outage prediction. Public sector institutions and private enterprises increasingly depend on location intelligence for infrastructure planning, urban resilience, and national security applications.

Environmental monitoring and climate science have also been transformed through advances in geospatial technology. Continuous Earth observation enables systematic analysis of deforestation, glacier dynamics, atmospheric pollution, and marine ecosystems. When combined with real-time sensor networks and AI-based predictive models, geospatial systems provide significant support for early warning mechanisms and climate adaptation strategies at regional and global scales.

As geospatial technologies evolve, spatio-temporal and three-dimensional geospatial models are evolving into dynamic digital representations of the Earth that enable simulation, scenario analysis, and immersive decision-support environments.

## Annual General Meetings of IEEE-CIS-SBC-UoJ

The IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna commenced its journey with the Inaugural General Meeting (IGM) held on 14 March 2022.

Subsequently, the chapter has consistently conducted its Annual General Meetings (AGMs) to appoint new Executive Committees and review its progress:

- ▣ 2023: Held on 24 January 2023
- ▣ 2024: Held on 16 January 2024
- ▣ 2025: Held on 8 February 2025
- ▣ 2026: Held on 24 January 2026

All meetings took place at the Auditorium of the Department of Computer Science, University of Jaffna.

These gatherings reflect the chapter's commitment to continuity, leadership, and sustained growth over the years.



# AI-Augmented Physical Rehabilitation: A Fusion of Computer Vision and EMG Intelligence

Mr. T. Mukunthan  
Lecturer  
Faculty of Engineering  
University of Jaffna

The digital transformation of healthcare is accelerating at an unprecedented pace, with AI-augmented physical rehabilitation emerging as a primary frontier where computational intelligence (CI) is redefining therapy delivery. With the global rise in sedentary lifestyles, musculoskeletal disorders, obesity-related complications, and post-stroke rehabilitation needs, demand for physiotherapy has surged dramatically. During the COVID-19 pandemic alone, physiotherapy sessions declined by nearly 84%, exposing the vulnerability of traditional, clinic-dependent therapy models. The industry urgently requires scalable, intelligent, and remote solutions. This article presents a state-of-the-art Virtual Physical Therapy Trainer (VPT), a multimodal AI-driven system that merges pose estimation, signal processing, embedded systems, and adaptive feedback mechanisms to deliver clinical-grade therapy in home environments.

## INTRODUCTION

The global healthcare ecosystem is undergoing a profound digital transformation. Among the sectors experiencing rapid innovation is physical rehabilitation, where computational intelligence (CI) is redefining how therapy is delivered, monitored, and optimised. The convergence of computer vision, electromyography (EMG), embedded systems, and intelligent feedback mechanisms has paved the way for AI-augmented physical therapy platforms capable of delivering clinical-grade rehabilitation beyond hospital walls.

Recent global events, particularly the COVID-19 pandemic, accelerated the adoption of remote healthcare solutions. Physiotherapy sessions declined by nearly 84% during pandemic lockdowns, highlighting a major vulnerability in traditional in-person therapy models [1]. At the same time, rising rates of sedentary lifestyles, obesity, musculoskeletal disorders, and post-stroke rehabilitation needs have significantly increased demand for accessible physical therapy services. These pressures underscore the importance of scalable, intelligent, and remote rehabilitation systems.

This article presents the design and impact of a Virtual Physical Therapy (VPT) Trainer that integrates computer vision-based pose estimation with EMG-based muscle activation monitoring, drawing on recent research and deployment experience.

## THE NEED FOR INTELLIGENT REHABILITATION SYSTEMS

Traditional physiotherapy requires frequent in-person clinical visits. However, patients often face the following barriers:

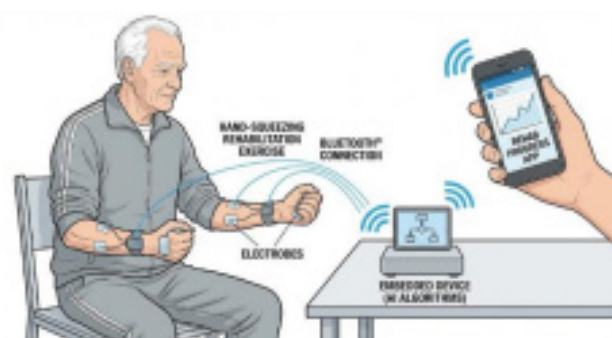
- ▣ Geographic limitations
- ▣ Transportation challenges
- ▣ Mobility constraints
- ▣ Time and cost constraints
- ▣ Therapist shortages

While telehealth platforms have expanded consultation capabilities, many lack objective performance evaluation tools. Effective rehabilitation depends on two key measurable components as outlined below:

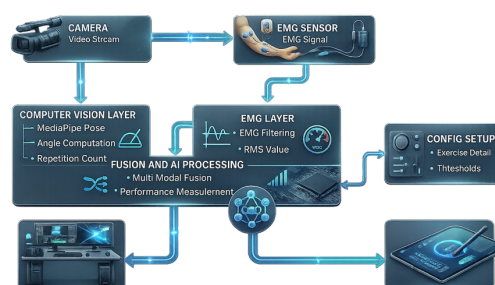
- ▣ Movement accuracy (kinematics)
- ▣ Muscle activation and effort (physiology)

Most camera-only systems monitor posture but ignore muscle engagement. Conversely, standalone EMG systems capture muscle activity but lack contextual understanding of motion. The fusion of both technologies creates a comprehensive computational intelligence framework for rehabilitation.

## SYSTEM ARCHITECTURE



As shown in Figure 1, the Smart Multimodal Rehabilitation Ecosystem is designed to bridge the gap between clinical physical therapy and at-home recovery. It integrates wearable sensing, embedded AI, and mobile visualisation to ensure exercises are performed both correctly and effectively.



As shown in Figure 2, the AI-augmented rehabilitation platform integrates three core layers:

- ▣ Computer Vision layer
- ▣ EMG layer
- ▣ Fusion and AI Processing layer for Intelligent Customisation

### A. Computer Vision Module

The system uses the MediaPipe Pose and Hands framework to identify 33 body keypoints in 3D space [2] and 21 hand landmarks [3] for computational purposes. Using OpenCV for video capture and rendering, the system performs the following actions.

- ▣ Elbow angle calculation
- ▣ Finger flexion and extension detection
- ▣ Repetition counting
- ▣ Hand verification (detecting incorrect arm usage)
- ▣ Posture correction prompts

Joint angles are calculated continuously frame-by-frame. If movement deviates from predefined thresholds, corrective feedback is displayed instantly. This real-time, markerless tracking aligns with modern CI approaches in pose estimation and human activity recognition.

## B. EMG Signal Acquisition and Processing

While vision ensures correct posture, EMG ensures the quality of muscle engagement [4]. Surface EMG sensors are selected due to:

- Non-invasive nature
- Cost efficiency
- Ease of deployment

The raw EMG signal typically requires conditioning to remove noise and amplify it. Therefore, the system integrates:

- Instrumentation amplification (LM324N-based)
- Band-pass filtering (50-150 Hz range) [5]
- Envelope detection
- Root Mean Square (RMS) computation

An ESP32 microcontroller can perform 12-bit ADC sampling and real-time RMS calculation. The RMS value serves as a quantifiable measure of muscle activation intensity. Bluetooth Low Energy (BLE) can be used for communication, enabling low-latency, low-power communication with the laptop or mobile device. If muscle activation is insufficient, the patient is prompted to continue the exercise to ensure meaningful rehabilitation rather than passive motion. This fusion represents a practical embodiment of multimodal computational intelligence, combining sensory data streams for robust decision-making.

## C. Fusion and AI Processing Layer for Intelligent Customisation

A defining strength of the proposed platform lies in its Fusion and AI Processing Layer, where data from the Computer Vision and EMG modules are intelligently combined to produce context-aware rehabilitation decisions. Individually, each modality provides only partial insight:

- The computer vision layer evaluates kinematic accuracy, including joint angles, posture alignment, repetition counts, and movement symmetry.
- The EMG layer evaluates physiological engagement, including muscle activation intensity, contraction quality, and effort consistency.

When used independently, these systems cannot fully guarantee rehabilitation effectiveness. A movement may appear biomechanically correct yet lack sufficient muscle activation. Conversely, strong muscle activation may occur during incorrect or compensatory movements. The fusion layer resolves this limitation by synchronising visual and physiological signals in real time. Exercise validation is therefore based on dual-condition intelligence:

- Kinematic correctness (angle thresholds, posture validation)
- Physiological sufficiency (RMS-based muscle activation thresholds)

Only when both conditions are satisfied does the system confirm successful execution; otherwise, it indicates that corrective action is required. This multimodal decision mechanism significantly enhances reliability, reduces false positives,

and prevents ineffective or unsafe exercise repetitions. This system represents a practical implementation of multimodal computational intelligence, where heterogeneous sensory streams are fused to derive high-confidence rehabilitation insights.

Another feature is the system's dynamic configuration framework, which enables flexible customisation and seamless integration of new exercises. All exercise parameters are stored in a structured JSON file, including:

- Angle thresholds (minimum and maximum joint angles)
- RMS activation thresholds
- Recommended limb or muscle group
- Required repetitions and sets
- Exercise duration parameters
- Session history and timestamps
- Progress metrics and performance trends

This modular configuration design allows:

- Rapid addition of new exercises without modifying core software logic
- Custom threshold tuning for individual patients
- Multi-stage rehabilitation progression planning
- Integration of new muscle groups or motion patterns
- Adaptive scaling based on the recovery stage

For example, introducing a new shoulder abduction exercise requires only:

- Defining relevant joint key points
- Setting angular thresholds
- Specifying corresponding EMG activation ranges
- Establishing repetition requirements

The AI engine automatically applies the same fusion logic for validation, making the system extensible and scalable. After each session, updated performance metrics are written back into the JSON structure and synchronised with the web dashboard and mobile interface. Therapists can remotely monitor longitudinal progress, adjust parameters, and progressively increase rehabilitation complexity.

This configuration-driven architecture transforms static physiotherapy routines into a data-driven, adaptive, and intelligent rehabilitation ecosystem, enabling personalised therapy pathways grounded in objective multimodal analytics.

## D. ADVANTAGES OF AI-AUGMENTED REHABILITATION ACCESSIBILITY

AI-augmented rehabilitation offers significant advantages across clinical and societal dimensions. It enhances accessibility by enabling home-based therapy for individuals in rural areas and those with mobility limitations, ensuring that rehabilitation is no longer restricted by geography. Cost efficiency is improved by reducing travel expenses and frequent in-person clinic visits, thereby lowering both direct and indirect healthcare costs. The system also supports clinical scalability, allowing a single therapist to remotely monitor and supervise multiple patients simultaneously without compromising care quality. Through objective assessment, rehabilitation becomes data-driven, providing quantifiable metrics that replace subjective evaluation methods. Furthermore, it ensures continuity of care during pandemics, emergencies, or other disruptions, maintaining consistent therapeutic engagement. Most importantly, real-time feedback mechanisms empower patients to take an active role in recovery, fostering confidence, adherence, and self-managed rehabilitation.

### E. TECHNICAL AND RESEARCH CHALLENGES

Despite promising results, further research is required to address:

- ▣ EMG noise issue
- ▣ Pose robustness issues under occlusion and low light
- ▣ Multi-muscle coordination tracking issues
- ▣ Regulatory compliance issues for medical-grade deployment
- ▣ Privacy considerations

### F. THE ROAD AHEAD

AI-augmented rehabilitation represents far more than an incremental improvement to conventional physiotherapy. It signifies a fundamental paradigm shift in how rehabilitative care is designed, delivered, and optimised. By integrating computer vision with EMG-driven physiological intelligence, the system achieves a new standard of rehabilitation defined by:

- ▣ Clinical precision, through synchronised biomechanical and muscle activation validation
- ▣ Data transparency, via measurable, objective performance metrics
- ▣ Adaptive personalisation, enabled by multimodal feedback and configurable thresholds
- ▣ Scalable telehealth integration, supporting remote supervision without compromising quality of care

As computational intelligence continues to mature within healthcare ecosystems, multimodal rehabilitation platforms will become foundational pillars of digital medicine. Future advancements will move beyond static threshold validation toward fully adaptive intelligence models. EMG-based activation thresholds and fusion-layer decision mechanisms can be dynamically personalised using machine learning algorithms trained on longitudinal patient data. Such systems will continuously refine performance benchmarks based on recovery stage, muscle fatigue patterns, biomechanical symmetry, and individual variability.

In the coming years, predictive analytics, reinforcement learning, and AI-driven progression modelling will enable rehabilitation

systems to autonomously adjust therapy intensity, recommend optimised exercise sequences, and detect early signs of stagnation or improper compensation patterns. The fusion layer itself will evolve into a learning engine, capable of contextual interpretation rather than simple rule-based validation.

The future of physiotherapy is therefore not only remote but also intelligent, multimodal, predictive, and deeply personalised. The convergence of computational intelligence, embedded sensing, and digital health infrastructure has already initiated this transformation. What lies ahead is a healthcare landscape where rehabilitation is continuously optimised by data, guided by intelligent systems, and centred around the individual patient experience.

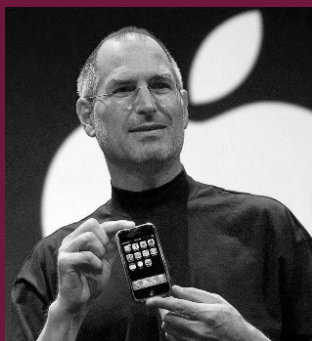
### ACKNOWLEDGEMENT

The author acknowledges that some parts of the Article were rephrased with the assistance of OpenAI's ChatGPT and that images were enhanced with Google's Gemini. This support was used to enhance readability, ensure professional flow, and align the content with academic standards. However, the responsibility for the accuracy, interpretation, and conclusions remains entirely with the author.

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## Pioneers of Computer Science!



**Steve Jobs** [1955 - 2011]

Co-founder of Apple Inc. Revolutionized consumer technology with innovative and user-friendly products like the iPhone and Mac.



**Bill Gates** [1955 to Present]

Co-founder of Microsoft. A pioneer of the personal computer revolution and a global philanthropist.



**Larry Page** [1973 to Present]

Co-founder of Google. Developed PageRank, transforming how search engines rank information.

# DCS TALENT SHOW — 2025 —



Third year students of the Department of Computer Science (DCS), with the support of the IEEE Computational Intelligence Society (CIS) Student Chapter, successfully organized the DCS Talent Show 2025 on 27th September 2025, from 9:00 a.m. to 1:30 pm at the Kailasapathy Auditorium, University of Jaffna.

The programme provided a vibrant platform for students to showcase their creativity, teamwork, and artistic talents beyond academic activities. A total of 30 performances were staged, featuring a variety of items such as solo and group songs, dances, instrumental performances, and orchestra pieces. This event was particularly special, as it marked the first-ever talent show organized by the Department of Computer Science.



# Workshops & Technical Talks:

**Workshop on "Developing Full-stack Application Using MERN Stack"** by Mr. Y. Achchuthan (Instructor in Computer Technology, Faculty of Management Studies and Commerce, University of Jaffna) was held on 31st of January 2026 from 9.00 a.m. to 12.00 p.m. at the Computer Laboratory of the Department of Computer Science, University of Jaffna.



The **"Workshop on AI for Efficient Administration"** was successfully held on 25 January 2026 at the Department of Computer Science, University of Jaffna, for approximately 80 officers from the District Secretariat, Kilinochchi. The programme was organised by the IEEE Computational Intelligence Society Student Branch Chapter of the University of Jaffna in collaboration with the District Secretariat, Kilinochchi, with the objective of enhancing administrative efficiency while promoting the ethical and responsible use of Artificial Intelligence (AI) in the public sector.



The workshop offered a well-balanced blend of theoretical knowledge and practical applications of AI in office administration. Prof. A. Ramanan conducted sessions on Introduction to Artificial Intelligence, Generative AI and Its Ethical Use, and Prompt Engineering, emphasising fundamental concepts, ethical considerations, and effective utilisation of AI tools. Dr. T. Kokul facilitated hands-on sessions covering AI-assisted presentations, writing, generative AI tools for office productivity, and audio-visual content creation, showcasing their practical relevance in improving productivity and communication. Dr. (Mrs.) M. Barathy led the session on AI for spreadsheets and data handling, focusing on AI-enabled methods for data organisation, analysis, and reporting in administrative workflows.

The sessions were conducted from 9.00 a.m. to 4.45 p.m., with around 100 participants in attendance. The workshop saw active engagement from participants, who provided positive feedback and reported increased confidence in adopting AI tools responsibly within their professional duties. Certificates of participation were awarded to all attendees.



## 01

**"Software Quality Assurance: Industry Practices and Career Opportunities"** by Ms. Tharsha Loganathan (Senior Quality Assurance Engineer, UnicomSD) was held on 2nd of February 2026 from 1.00 p.m. to 3.00 p.m. at the Auditorium of the Department of Computer Science, University of Jaffna.



## 02

**"No Cybersecurity without Cyberpsychology"** by Ms. Vinorra Shaker (Head, School of Psychology, Asia Pacific University of Technology and Innovation, Malaysia) was held on 24th of February 2026 from 6.00 p.m. to 7.00 p.m. via Zoom. This session was organised in collaboration with the IEEE CIS, Sri Lanka Chapter.



## 03

**"Why Healing Minds Matter"** by Ms. Rasini Bandara (Reading PhD in Psychology at Girne American University; MSc in Applied Psychology from Coventry University, UK) was held on 25th of February 2026 from 6.30 p.m. to 7.30 p.m. via Zoom. This session was organised in collaboration with the IEEE CIS, Sri Lanka Chapter.



# Reach Us through our Website & Social Media Pages

The screenshot shows the website's header with navigation links: Activities, About Us, Committee, Gallery, Contact Us. A search bar is present. The main content features a seminar announcement for 'MACHINE LEARNING IN HEALTH AND BIOLOGY' on 20 January 2026, 1:30 - 2:45 P.M. at the Auditorium, Department of Computer Science, University of Jaffna. The speaker is Prof. M. Niranjana, Chair of Signals, Images, Systems Research Group, University of Southampton, UK. The event is organized by the IEEE Computational Intelligence Society.

<https://society.jfn.ac.lk/cis/>

The screenshot shows the Facebook profile for the IEEE Computational Intelligence Society Student Branch Chapter - UoJ. It features a cover photo with a blue background and a glowing head silhouette. The profile name is 'IEEE Computational Intelligence Society Student Branch Chapter - UoJ' with 204 followers and 2 following. The bio states: 'Welcome to the IEEE Computational Intelligence Society (CIS) Student Branch Chapter of the University of Jaffna, Sri Lanka. We are dedicated to promote and foster a collaborative environment for the technological development of Computational Intelligence. Nonprofit organization'. There are buttons for 'Contact us', 'Message', and 'Follow'.

<https://www.facebook.com/IEEECISSBCUOJ>

The screenshot shows the LinkedIn page for IEEE CIS SBC UOJ. The header includes the IEEE Computational Intelligence Society logo and the text 'University of Jaffna Student Branch Chapter'. Contact information is provided: 'www.society.jfn.ac.lk/cis' and 'ieeeci@univ.jfn.ac.lk'. The page title is 'IEEE CIS SBC UOJ' and it is categorized as a 'Non-profit Organization' with 275 followers. A section for employees shows 'View all 8 employees' with profile pictures of the staff members.

<https://www.linkedin.com/company/ieee-cis-uoj/>

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