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Contents

The cover shows a a number of photographs taken from the various events organised by IEEE groups: from top left going clockwise, the one of lab tours in St Vincent's Hospital Neo-Bionica organised by EMBS, Robot Sumo Hackathon's participants test their code on the real robots organised by IEEE Deakin Student Branch, and two last pictures of attendees in discussion at the ANZSCON 2022 in Adelaide.

Cover design: May Alhajri.

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From the Flight Deck

Annick Boghossian (Section Chair)

As the year is coming to an end I would like to take the opportunity to reflect upon an inspiring and immensely rewarding year 2022.

There have been a number of wonderful and engaging events that were organised by our passionate volunteers across the Victorian Section chapters, affinity groups and student branches. I would like to thank every single member and volunteer for their ongoing contribution in making the Victorian Section a welcoming and engaging Section and I am amazed about all the talent and the relentlessness of making your technical talks, workshops and conferences such a success.

Our inspiring members and volunteers have helped to grow our membership base in 2022 and the Section has been awarded with the "2022 Outstanding Section Membership Recruitment and Retention Performance" There have been a few flagship events this year, one of the biggest was the WIE ILS 2022 which was organised by Monash University, Victorian Section WIE Affinity Group, and some of our Victorian Section Committee members. Another notable event has been the IEEE EMBS Asia-Pacific International Student Conference which was held as a hybrid event which was a collaboration of a total of 7 student clubs, and 8 academic advisors across RMIT, Monash University, University of Melbourne, Swinburne University of Technology and Deakin University. Both events were a great success and I would like to congratulate the entire organising committees on the amazing organisational and leadership talent. I know how much work went into this event to achieve these great accomplishments and I can't be more proud.

The Victorian Section was delighted to support 4 of our outstanding members Ethan Grooby, Anu Sabu, Susmita Saha, Jing Zhu (who unfortunately wasn't able to attend), and May Alhajri to attend ANZSCON 2022 and we can't wait for them to share their experiences and learnings with our members.

We had a couple of hybrid monthly meetings this year as we saw Covid 19 still having an impact on people's well being and feeling at ease to meet in person which is understandable. I sincerely hope that the hybrid meetings will become a regular event for 2023.

It was recognised that there was a challenge for a lot of our members to apply for senior membership meeting the requirement of having a sufficient number of senior members act as a reference. This was addressed by the Victorian Section by having a selected and qualified team of senior members that are available to assess candidates and act as a reference when the candidate meets all requirements.

Our next meeting will have a strong focus on the strategic planning for 2023. It will be a very special year for the Victorian Section and the committee is planning on making it a year to remember with all of our volunteers' involvement.

One notable event that will enable the Victorian Section to grow their expertise in organising conferences will be the IEEE Engineering Informatics Conference to be held at Swinburne University of Technology in July 2023 that sees the Victorian Section become a financial co-sponsor with a number of our Victorian Section Committee members getting directly involved in the organising committee. I am looking forward to this exciting opportunity that promises to grow and strengthen the Victorian Section Committee further and provide a platform for our members and volunteers to professionally grow and gain experiences in organising and leading international conferences.

Another strong focus will be placed on collaboration between industry and academia to enable both areas to leverage the wealth of knowledge in their respective areas of expertise and advance technology further.

Our annual AGM is planned for the end of the year as an in-person event and I am looking forward to celebrating all of your achievements. With this I would like to invite you all to register for the event and hope to see you there and thank you all in person.

The IEEE Victorian Section wouldn't be what it is without every one of you. Please remain passionate about being an IEEE member and I am looking forward to a memorable year 2023.

Annick Boghossian, Chair, IEEE Victorian Section
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IEEE News

Annual General Meeting of IEEE Victorian Section

All members are welcome to attend the upcoming IEEE Victorian Section AGM. This event is on Wednesday the 14th of December beginning at 6:30 pm and will be held at the Savoy Hotel on Little Collins Street (opposite Southern Cross Station). The evening will commence with reports on the year's activities by the Section Committee followed by a main course meal. The event will feature a guest keynote speaker, reports on the activities of the Section in 2022, and presentation of prizes to the Section's Student Paper Competition winners and also of Section awards.

This is a great opportunity for members to come along and meet the Committee and fellow members in a relaxed setting and hear about what the Section has accomplished and what the coming year might bring.

Registration for the AGM is now open at https://bit.ly/VicAGM2022. Looking forward to seeing you there. Please do register early as there is a venue limit of 50 places.

IEEE Student Paper Competition

Each half year, the Section runs a competition for authors that have had a paper accepted for publication. The aim is to highlight the good work by Section student members. The competition is in two parts: one for first-time authors and the other for the best overall paper.

In the second half year we received five entries and the winner of the first-paper award was **Vyas O'Neill et al**. for a paper entitled 'Improving Fault Tolerance and Reliability of Heterogeneous Multi-Agent IoT Systems Using Intelligence Transfer'.

The best overall paper prize was awarded to **Youshan Hou et al.** for the paper 'Residential PV Hosting Capacity, Voltage Unbalance, and Power Rebalancing: An Australian Case Study'.

As Chair of the paper competition,, Mehrnaz Shoushtarian noted that the standard of entries was very high and would like to congratulate the authors of papers chosen for the awards. These awards will be presented at the Annual General Meeting in December.

Call for Volunteers for 2023

The IEEE Victorian Section has 19 Chapters, 3 Affinity Groups, 7 student branches and a number of special interest groups. These are listed on the IEEE Victorian web-site https://r10.ieee.org/victorian/ under Chapter & Units. All of these are run by volunteers interested in meeting other professionals and creating local events to learn more in their field. If you would like to be part of any group then send an email to Annick Boghossian, Victorian Section Chair annick.n.boghossian@ieee.org.

IEEE Renewal and Benefits

IEEE memberships can now be renewed for 2023 https://www.ieee.org/membership/renew.html. As you go through this process, also have a look at what publications are offered with each Society membership. You might be surprised by the wider range of publications available with each membership. One example is the Microwave Theory & Technology Society (https://www.ieee.org/membership-catalog/productdetail/showProductDetailPage.html?product=MEMMTT017) but check the society you are most interested in.

Interview:A/Prof. Gunes Karabulut-Kurt, Polytechnique Montréal

by Enn Vinnal

UPLINK. Prof. Gunes Karabulut-Kurt recently gave a IEEE Vehicular Technology Society talk for Australian, New Zealand and one China Chapters. We thought it would be interesting follow that up with an UPLINK interview.

UPLINK: Tell us a little about yourself, your background, what attracted you to engineering and where you have studied it.

GK-K: I have always enjoyed building systems that actually work. Also, my grandfather was an inspiration to me. He worked on train engines as a technician, and during my childhood he always explained to me how things function rather patiently. These lead me to pursue a degree in engineering. I received my B.S. degree (Hons.) in electronics and electrical engineering from Bogazici University, Istanbul, Turkey, in 2000, and M.A.Sc. and Ph.D. degrees in electrical engineering from the University of Ottawa, Ottawa, ON, Canada, in 2002 and 2006, respectively.

UPLINK: From your own experience, is engineering taught differently, or the engineering curriculum approached differently, in various countries, or is there a universal curriculum?

GK-K: My experience is that engineering education is taught very similarly in various countries compared to other disciplines. While accounting, medical practices, and rules could be very local, engineering relies on physical foundations and mathematical models, and it is about designing things that work efficiently and are beneficial for humans. That is a global value that does not change from one jurisdiction to other. So in time, I believe that the curriculums from different countries converged. What changes most is the collaboration with the industry within the curriculum. Since this depends on the availability and scale of engineering practices in a country, this practical element is different everywhere.

UPLINK: Is skill in mathematics still a key to teaching or learning to engineer or have sophisticated software tools largely overtaken this in basic engineering courses?

GK-K: Mathematics is still one of the most important skills for an engineer. The mathematical background provides a framework for systematic thinking, logic, and reasoning that are crucial to successful engineering applications. The sophisticated software tools, without denying their contributions, also provide a threat to engineering education if utilized as black box items by students without understanding the principles. For example, I suggest engineering students at least once apply back-propagation for machine-learning with pen and paper using matrices before using Python toolboxes.

UPLINK: What are the things you find intriguing or exciting in some of your fields of interest and what prediction would you make about advances we might see in these areas say in 10 years' time?

GK-K: I think space and also the use of artificial intelligence (AI) are the two most exciting fields in my field. As mankind ventures further into space, communication networks will have very novel challenges. All we know about telecommunication is based on communicating on Earth, from channel estimation to transceiver design. This will be fundamentally changed for space and even for other planets. On the other hand, the introduction of AI, particularly vehicles with AI, will bring a different angle to vehicular communication. From the beginning of this era, all communication was between two humans. But we will see for the first time the majority of communication requirements will be in between machines, which have many different needs, aims, and related performance metrics concerning transmitting and receiving information.

UPLINK: It seems more and more people are up-skilling with higher degrees or specialised courses - what advice might you like to give to people who are thinking about embarking on upskilling?

GK-K: While up-skilling is very important to stay relevant in an ever-increasing competition, I think it is

important to look into multiple disciplines. The rate of advance in science has never been faster in history. There is a potential to implement a proven method in a field. For example, a well known application in genetics could be very eye-opening for communication research. Therefore, investigation of fields such as biotechnology could prove surprisingly innovative.

UPLINK: You are a Distinguished Lecturer for the IEEE Vehicular Technology Society - can you tell us a bit about that Society and what it's niche might be?

GK-K: Dating back to early 20th century, as both vehicles and telecom became more and more part of our lives, the Vehicular Technology Society has been addressing major engineering problems. It seems that both vehicles and telecom are here to stay. We have moved from the earliest vehicles with 2-way radios to spacecraft with space communication, and the possibilities of new engineering systems seem endless.

UPLINK: space communications for consumers seems to becoming rapidly a reality for fixed and now mobile communications with the news about the Apple and Globalstar alliance, SpaceX and T-Mobile, along with other business models from Kuiper, OneWeb, Lynx and Omnispace. What do you see as the future technical challenges for space communications and are these different for the different business models?

GK-K: There are multiple challenges in these new generation of satellite communication systems. First of all, with thousands of low orbit satellites, there is a major issue of networking and coordination. Second, as visible physical systems, they are prone to physical layers attacks (as we have been reading about the jamming attacks), hence the security problems. Last but not least, since they need to communicate with terrestrial communication systems, there will be issues related to inter-connectivity and handovers. Perhaps standardization may help foster a profitable environment.

UPLINK: And what will be the critical parts - is it the link budget per se, or maintaining capacity / speed / latency as customers numbers increase, or perhaps building space-networks with inter-satellite links, or just access to spectrum allocations?

GK-K: Link budget is a severe problem yet with multi-antenna systems and large antenna sizes there are promising developments on this front. I think one critical design issues will be maintaining QoS for customers, while providing an end-to-end secure communication system. This of come comes with a harmonized use of frequency between the satellite networks and the terrestrial networks.

UPLINK: There seems to be two distinct business plans for space - one is a repetition of the standardisation one where the big standards players with patents dominate the scene (think 3GPP). Then there is the truly innovative ones like SpaceX that really have no need for standards because they define the whole solution from launch-to-customer. Will these parallel forces clash at some point in time or will each have sufficient part of the revenue pie and therefore a stable business model?

GK-K: I think it is a question of self-sustainability. If the satellite communication systems scale well, and they can provide the communication system end-to-end, non-standard versions will have the upper-hand. But the more they need to co-operate with standardized terrestrial systems. I hence believe that the standard-based approach will be advantageous.

Polytechnique Montréal

If you are interested in knowing more about Polytechnique Montreal, you can visit their web-site at https://www.polymtl.ca/en/

Startups - Technology versus Product versus Business - there is a lot of difference!

by Dilpreet Buxi

UPLINK. Dilpreet Buxi is an acting CEO and co-founder of Philia Labs which is a startup company which is developing precision stress technology and it is located in Melbourne. While at Monash University Dilpreet was chair of IEEE Monash University student branch.

As an introduction, Worldwide, 260 million people and 280 million people suffer from anxiety and depression disorders respectively. Prolonged 'fight or flight' or sympathetic arousal in the body without sufficient 'rest and digest' activity is a leading cause. Individuals, clinicians and enterprises typically use questionnaires to diagnose whether the individual has or is close to suffering from these disorders.

In 2017, I hit upon the idea to quantify sympathetic arousal. With my academic mindset, I thought : "let's build a prototype that quantifies sympathetic arousal using a wearable! Having just finished a PhD, I was fascinated by the idea of starting a company and finding someone to buy my product.

I spent a year reading up on stress and effects on people. I talked to about 50 clinicians, psychologists, HR people and anyone who was interested. In the end, I concluded there would be a market demand for quantified sympathetic arousal. Philia Labs was incorporated in December 2018 by my co-founder Alexander Senior and myself.

Nearly four years later, our co-founding team, including Melanie J White, has turned a technology on paper into a minimum viable product, built relationships with several potential customers, hired good people, parted ways with several others, raised over a million dollars and pivoted target markets several times, losing countless nights of sleep over team, money and product issues along the way.

I would like to share one of my biggest learnings: Building a successful technology is not the same as building a successful business. Nor is it the same as building a successful product!

Stating the obvious, a technology can show potential in several applications. Quantifying sympathetic arousal can have so many applications in consumer, corporate health and clinical market segments. However, these market segments are interested in a product, not a technology.

When we spoke to customers in corporate health and coaching about supplying metrics on stress and sympathetic arousal, they were extremely interested in what we had to offer. When they realised we had algorithms, but no wearable / app / APIs, they asked us to come back to them when we had a product.

Having no experience in building cloud servers / apps, Alex and I decided to build a proof of concept with a wearable. There was no way that Philia Labs could build a wearable, so we decided to look for one. Instead of focusing on a wearable that is affordable and easy to use, we went for a research-grade wearable that costs six times as much as a Fitbit. This is good for showing a proof of concept, but bad for business! When we told customers and investors that the wearable costs $1800 per piece, the conversations ended.

A successful product solves the pain point of a particular customer. This means designing something that integrates into their daily routines. For example, a mining company would love to have a solution that enables them to ensure that their staff are fit for work so that financial, operational and legal risks can be eliminated. If used properly, a stress management product can help miners do their best when they work, take a rest without fear of consequences and spell a colleague, when the colleague needs to rest from a shift fraught with sympathetic arousal.

A successful business can sell its products / business and can continue to grow in the future. This means sufficient profitability and having a market cap that brings its shareholders sufficient dividends to continue investing in it.

Why am I writing all of this? The best technology will not

sell, no matter how many journal papers we may have created. But a seamless experience for the product's users that lead to their problems being solved will lead to a successful product. However, if the product is not sold to the right customer for the right price, it will still not sell.

For example, Philia Labs' technology for quantifying sympathetic arousal, sits within its App / Cloud Server and remote monitoring dashboard called PhiliaHealth. This will be sold to mining companies to manage personnel risk and design safer working environments. Can this compete with a Fitbit? With the right product (evidence that it works, technical performance, user experience) and business operations (marketing, sales, customer support), Philia Labs can provide something that Fitbit cannot.

The technology however, plays a fundamental role in the product / business! The marketing people must be able to say "we are better than our competitors because we are the only ones computing sympathetic arousal. This allows us to predict performance and fatigue more reliably". A claim like this will require several pieces of evidence, mostly from trials in real-life settings.

In conclusion, I'd like to draw an analogy between technology, product and business using a cheese and egg sandwich. The best ingredients - hardboiled eggs, sourdough bread, cheese slices outsourced are your technology - which can make a big difference in the taste of the sandwich. The product is comprised of the way the sandwich is priced, and packaged, and branded to the end customer. For example, a sandwich for $25 may sell to a white collar worker with little time and high income in the Melbourne CBD, but not at a petrol station to a blue collar worker. A sandwich with the brand name "Mr Chef's special" will probably sell over a sandwich called "Mr Frumpy's".

A successful business will source its sandwiches from suppliers at the best pricing and packaging possible, provide impeccable customer service and competitive pricing over its competitors. This non-exhaustive list would form a part of its competitive advantage that would see it through challenging times. As an example, if a lockdown were to happen, people would still turn up to buy that sandwich, because it provides something that other sandwiches don't. Likewise maybe even the cafe that sells the sandwiches with an the owner that builds a great relationship with his / her customers.

Do you want to become an entrepreneur? Be clear on whether you want to build a successful technology or product or business. As seen in the sandwich analogy, the outcomes and activities are very different, as is your pathway to market.

Thanks for reading and hopefully this brought some clarity! Whether you found this article helpful or not, I'd love to hear from you at dilpreet@philialabs.com.au.

Further information about Philia Labs is available from https://philialabs.com.au/.

Bringing onshoring manufacturing back to Australia

by Ray Keefe

UPLINK. Ray Keefe is Managing Director, Successful Endeavours Pty Ltd and is a IEEE Senior Member. Successful Endeavours is an electronics design and embedded software development consultancy focusing on small to medium sized Australian manufacturers who want to improve their existing products through development of their next generation of market offerings.

Offshoring is the process of taking operations happening onshore, in our case in Australia, and moving them to another country. Lower cost of operation is the usual cited reason and most people would be aware of this happening to industries such as manufacturing and call centres starting in the 1980s.

The problem is that it is a single dimension, short term solution only looking at raw transactional cost and ignoring all the problems it creates such as loss of skilled jobs, loss of economies of scale for industries that remain onshore and loss of sovereign capability for critical supplies. In other words, offshoring has a cost that the country pays and the offshoring does not.

Onshoring is the reverse process. It is taking part of an industry that previously went offshore and bringing it back onshore. The benefits are wider than for that one industry. For manufacturing there are between 2.5 and 5 indirect jobs created for every direct job in manufacturing so it creates a lot of extra activity around it. Onshoring manufacturing builds jobs and the economy more rapidly than any other industry.

Onshoring Framework

To be successful at onshoring, we have found it very useful to have a systematic framework for evaluating what needs to be done. In many cases the electronics products are brought back onshore one at a time and could be very different in design.

The onshoring framework looks at the product Total Cost of Ownership and not just at individual Transactional Costs. This is especially important because not all costs are tracked and the real cost of a line item can be a lot more than its transactional cost. Total Cost of Ownership refers to all the outgoing costs incurred over the life of the product including customer support after the product is sold to the end customer.

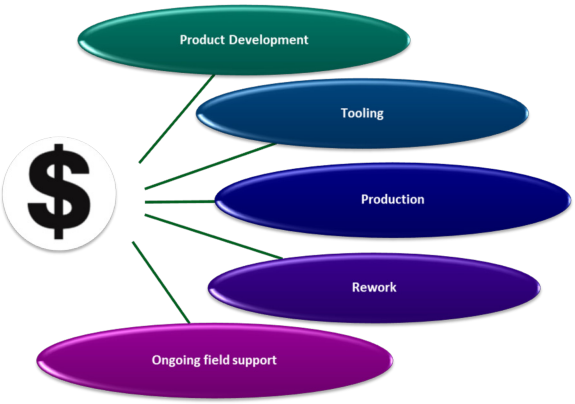
Transactional Costs or Line Items are things like the Bill of Materials (the parts you have to buy) and represent only part of one aspect of the Total Cost of Ownership of the product. I will unpack this in detail as we go.

As a comparison, when you buy a car, the costs don't stop there. You have annual insurance, annual registration, fuel, service and maintenance. You need a license to drive. Somewhere to park it. We would all recognize that the vehicle purchase cost, a Transactional Cost, is only part of the Total Cost of Ownership for the car.
The areas to consider for Total Cost of Ownership:

- Quality, reliability, confidence
- Remove unnecessary labour
- Automate everything including production, customer support, field support
- Know your customers
- And your value proposition to them

Total Cost of Ownership

This article describes a generic process for a product that is made, sold and supported through its lifecycle. It is the sum of all these costs that is the true Total Cost of Ownership of a product and not just a couple of line items like R&D and tooling amortization or Bill of Materials. And it is important to understand that a product will still cost you after you have sold it if the downstream stakeholders are not happy. A very dissatisfied stakeholder can cause a product to fail completely in the market.

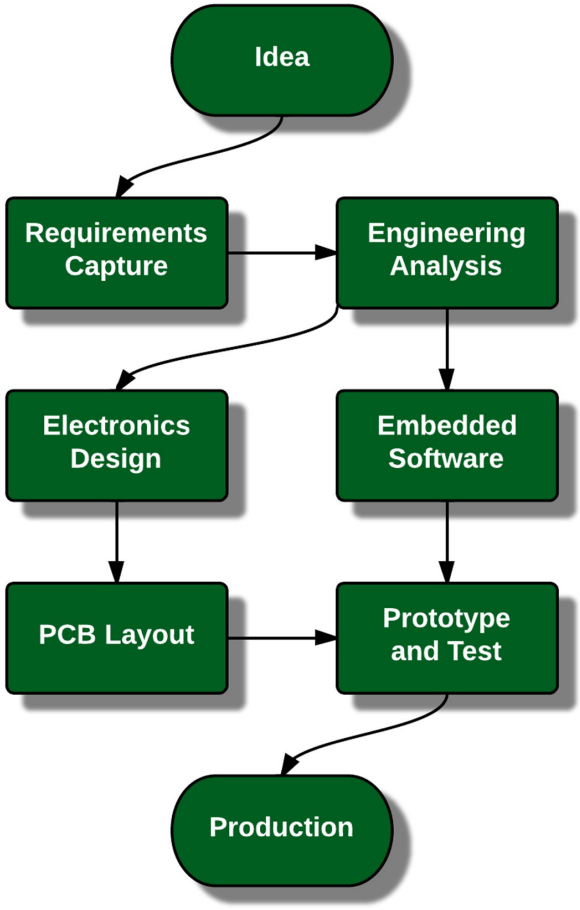


The above Onshoring Framework shows the order the costs are incurred in. By the end of Product Development all the important decisions have been made. Once in Production, it is hard to alter anything. The design is done, tooling made, processes defined, labour requirements set and the supply chain engaged. Let's briefly look at each of these areas.

Product Development

This sets up the rest of the project for success. As stated before, successful products adequately meet the needs of every stakeholder. The key thing we focus on is understanding what every stakeholder needs. Commonly forgotten stakeholders are production, sales and field support. Sometimes even the end customer.

Product development should be a structured process and while you might need to research the best way to do certain things, fundamental research is already completed. This diagram shows a generic process for the electronics and software part of the product which is what we do each day.



Tooling & Preparation

If the design has been done well and the tooling designed and built well, then you are in a good position to buy components and do your pilot production run. In general, mechanical tooling is much more expensive than PCB tooling and how much you need to spend on automation is a function of the production volume you want to achieve.

Production

At this point you don't have a lot of levers to pull. The development has already set the stage for most of this. You are buying the parts, doing the process and hopefully packing and shipping units without any rework.

Rework

Rework is waste. There are many potential sources. You must identify faults, rectify or scrap units and use labour, facilities and materials to do this.

If you are contracting out the electronics manufacturing then rework might not seem like it is your problem but the manufacturer will have to either raise pricing to cover it or charge you for it if it is related to a design issue.

Another Lean principle, design to the centre point of production capability as much as you can. Designing to the edge maximises the chances of issues including rework.

So keep rework as low as you can. There are tradeoffs in effort level to get to 0% rework so this also needs to be a business case driven outcome.

Ongoing field support

This affects the total business case so we have always had this as part of our design thinking. The field support and service areas are often not considered enough in design briefs. We have always built remote configuration and firmware updates into our communicating products. Phones, computers and smart appliances do this. It significantly reduces Total Cost of Ownership. Because products can still keep costing you after you have shipped them.

The core problem for onshoring

By the time you know your real Total Cost of Ownership for the product, all of the design and process decisions have been made and there are almost no variables to play with. If it is designed in Asia for Asian business practices then the design is probably not ideal for Australian manufacturing. It is necessary to address this before you start making the product here. Many of our onshoring projects involve some form of product design adjustment to make local manufacture economical. In the case study presented at the end, the only thing we kept were the connector locations and the power supply. But you can have an acceptable cost of manufacture if you go about this the right way.

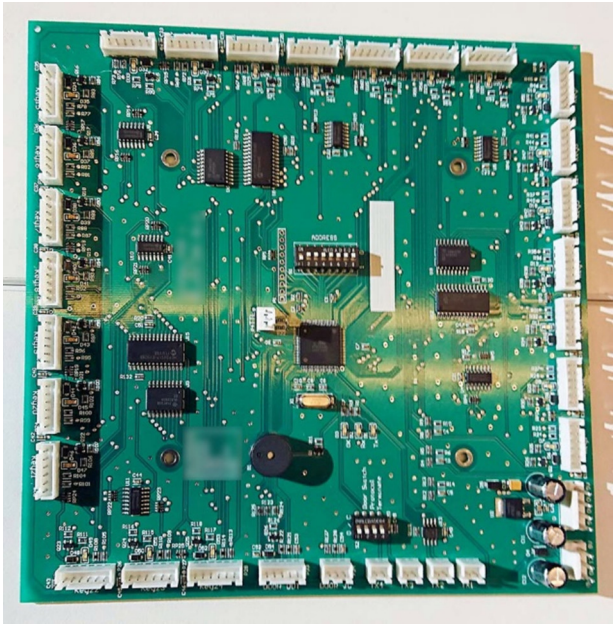
Local minima generally don't lead to overall system minima unless they are the cost/process bottleneck (theory of constraints). For instance, focusing on BOM cost generally gives you a more expensive product overall. The right level of tooling reduces costs in a lot of areas including product assembly, parts costs, product reliability, ease of service and inventory. Spending the right amount on design is where you have the highest profit leverage. So don't shortcut that part of the process. Use the design team to the full. It is your investment after all.

Software is usually one of the higher R&D expenses but you can reduce hardware cost by doing more in software. Which can reduce both BOM Cost, Process Cost and Support Cost. In one of our projects, increasing the software budget by $50,000 delivered $1,500,000 in extra profit to the manufacturer.

Case study

The existing design for a security product was done by a Chinese factory for free; the tooling is also free. The PCB costs $70 a unit. The rest of the product is built and assembled locally. PCBs fail within 2 years, most inside the warranty period. The factory can't offer a fix. The Australian business approaches us to design a replacement. This has to be drop in replaceable as they need to retrofit to existing field units. The design is terrible and can't just be tweaked. We are starting again. An Australian made PCB that works will be $200 per PCB allowing for R&D amortization in the batch needed to retrofit all their field units. Since they are already losing money, they don't see how they can afford to pay more for the PCB.

After reviewing the design and also the manufacturing process, together we identify $1200 in savings per system by making the PCB smarter so they don't have to do as much manual work to configure each system. They aren't tracking the cost of replacing PCBs in the field nor the potential loss of business so the real case is even better. The $200 PCB is therefore at least $1070 cheaper than the $70 PCB when you calculate the Total Cost of Ownership. They gave us the go ahead and have been selling their product with confidence ever since.



Conclusion

I am confident that great products, designed to meet the total value proposition, can be profitably Made in Australia. Australian manufacturing has been growing steadily since 2016 and the recent pandemic has shown us that local jobs matter to us all. I am also keen to bring as much manufacturing back to Australia as we can. Manufacturing creates fundamental value, generates lots of jobs and spreads wealth through a community more evenly than any other industry. Modern manufacturing is clean and technical and we need to cast off the old image of sweat shops and promote modern careers in modern manufacturing. I believe it should be a core strategic objective of any modern economy. Hopefully this article has provided some insight in how to go about this so you can do this profitably here in Australia.

Further information about Successful Endeavours is available from https://www.successful.com.au/

Modelling the non-invasive fetal electrocardiogram

By Emerson Keenan

UPLINK Emerson Keenan is a Research Fellow at the University of Melbourne. He completed his PhD in Electrical Engineering in 2021 developing methods for simulating the mechanisms of fetal electrical cardiac function in collaboration with the University of Oxford and other international institutions. His PhD was awarded the 2021 John Melvin Prize for Best PhD Thesis in the Faculty of Engineering. This is the story behind the work.

Introduction.

Although we may not remember them, the first nine months of our lives are some of the most dangerous. Stillbirth, defined as the loss of life after 28 weeks of gestation, results in over 2.6 million deaths annually worldwide, with the majority believed to be from preventable causes. This corresponds to an almost 2% mortality rate in the last trimester of pregnancy, where in many countries these extreme levels of mortality are not seen again until we are beyond 80 years of age.

In addition to the loss of life, congenital heart defects (CHDs) are present in approximately 1% of live births, with 10-20% of children with a CHD dying in their first year of life. Furthermore, many life-long diseases, such as coronary heart disease, type 2 diabetes and hypertension, have been linked to an impaired intrauterine environment, otherwise known as the “fetal origins of adult disease” hypothesis. These issues suggest that improved monitoring of fetal wellbeing and timely intervention in cases of fetal compromise could not only save lives but also ensure children are best placed to thrive throughout adulthood.

Currently, the primary real-time method used to assess fetal wellbeing is cardiotocography (CTG), which refers to the simultaneous assessment of the fetal heart rate (FHR) and uterine activity. CTG is an invaluable tool as it provides an understanding of fetal autonomic nervous system function and its responses to poor oxygenation and other stressors.

However, there are limitations to current CTG monitoring practices, as existing devices used to estimate the FHR typically utilise ultrasound, which must be mechanically directed towards the fetal heart, resulting in signal loss if incorrectly positioned. These limitations have led to the proposal of alternative technologies that aim to monitor fetal cardiac function through modalities such as electromagnetic and acoustic activity.

One of the most promising techniques for this purpose is non-invasive fetal electrocardiography (ECG), which is the study of electrical activity recorded from the maternal abdomen. The fetal ECG offers immense potential due to its passive, low-power characteristics, which are well-suited for long-term and remote monitoring. These characteristics provide the opportunity to develop a “fetal Holter monitor” that could be used to continuously monitor fetal wellbeing and distress outside the hospital environment.

However, there are still many challenges in reliably acquiring high-quality fetal ECG recordings and barriers to its widespread adoption in clinical practice. The most significant of these challenges is that fetal electrical signals are extremely weak compared to maternal cardiac and muscle activity signals and vary according to the placement of sensors with respect to the maternal-fetal anatomy and changes in the conductive properties of the intrauterine environment.

To understand the contributors to poor fetal ECG signal quality, a range of computational models have been proposed to simulate these signals. However, until now, there has been an absence of system-level models which enable the study of how different parameters impact fetal ECG signal quality in a holistic setting.

This research focused on understanding the factors influencing the reliability of the fetal ECG to provide recommendations to address challenges in obtaining high-quality signals.

Development of a fetal ECG simulation model.

To simulate the propagation of fetal cardiac electrical signals to the maternal abdominal surface, a model for representing the fetal cardiac activity and the conductive medium through which these signals travel must be determined. A diagram of the correspondence between the maternal-fetal physiology and this simulation process is shown in Figure 1.

To model the maternal-fetal physiology, this work involved developing a process which simulates dynamic maternal-fetal ECG mixtures using a finite element model of the maternal-fetal anatomy. This process builds upon prior work , as part of the fecgsyn toolbox (www.fecgsyn.com) which integrates capabilities for simulating maternal-fetal ECG mixtures including beat-to-beat variability, fetal movement and physiological noise.

To generate a simulation based on realistic maternal-fetal geometry, a publicly available set of 3D Fetus and Mother Numerical Models (FEMONUM) was utilised. These models were created using 3D ultrasound and magnetic resonance imaging (MRI) data from women with pregnancies ranging from 8 to 34 weeks of gestational age.

Using these 3D models, the surfaces of the fetal body, vernix caseosa (a highly non-conductive layer which forms on the fetal body surface), amniotic fluid and maternal body are represented as a series of connected triangular elements.

From these triangular elements, a finite element model is generated by filling in the inner volumes with a series of tetrahedral elements. Using a system of equations derived from these tetrahedral elements, it is possible to calculate the electrical potential generated at the maternal abdominal surface by current sources within the maternal and fetal body.

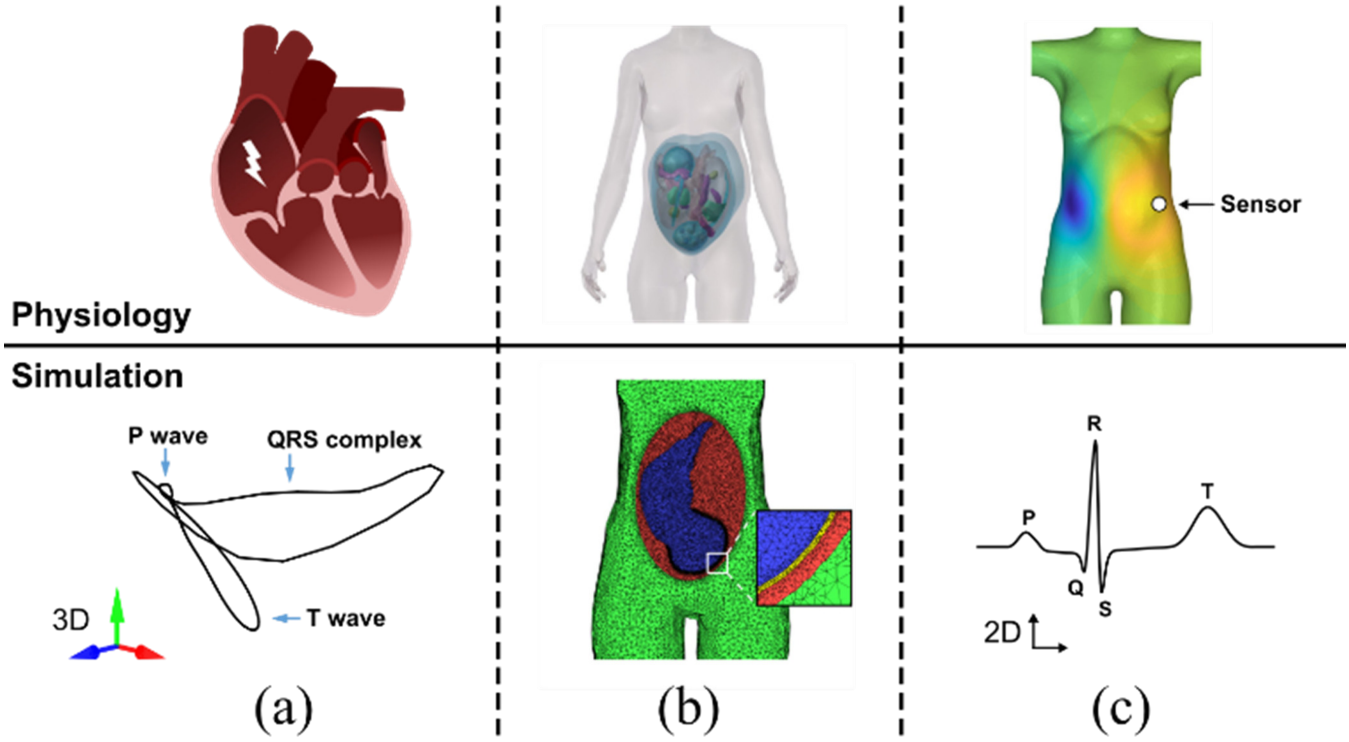


Figure 1: Links between fetal cardiac physiology and the simulation process showing (a) an electrical model of fetal cardiac activations, (b) a volume conductor model of maternal-fetal tissues and (c) electrical activity recorded on the maternal abdomen at a single sensor position.

Applications of the simulation model.

Using this model, a method for assessing the impact of anatomic variations on the generated fetal ECG signals was subsequently developed and validated. To achieve this, a data collection protocol which captured 14 channel fetal ECG data with minimal signal distortion alongside ultrasound (US)-based measurements for the maternal-fetal anatomy was utilised.

This method was based on modifying a reference geometry using subject-specific anatomic parameters, including the distribution of vernix caseosa across the fetal body surface, to create a personalized anatomic model for simulation.

To demonstrate its suitability for predicting abdominal potentials, the model's performance in characterizing the amplitude of the fetal ECG signal in six pregnant participants was initially assessed. Following this, its clinical utility was demonstrated by predicting an optimal sensor placement in a separate open-access database of sixty 24 channel fetal ECG recordings and its performance benchmarked for fetal heart rate extraction.

The prediction error of the model was highly accurate using a leave-one-out approach, demonstrating that the developed model is useful for characterizing the amplitude of the fetal ECG signal across the maternal abdomen.

Furthermore, the optimal 6 sensors selected by the model provided similar reliability for FHR extraction compared to the full 24 channel array. As using additional sensors impacts clinical setup time and patient comfort, this demonstrates that the developed model can be utilized to optimize the number of required sensors while maintaining strong performance for FHR extraction.

Conclusion.

This work developed a model for estimating the influence of anatomic variations on the fetal ECG. To assess its suitability for this task, a process for extracting fetal ECG waveforms with minimal distortion was developed along with a method for acquiring anatomic parameters to construct a personalized anatomic simulation model.

Using the developed simulation model and two clinical fetal ECG databases, accurate prediction of the fetal ECG signal amplitude and identification of an optimal sensor placement for FHR extraction was demonstrated. The developed model provides a practical foundation for estimating the influence of anatomic variations on fetal ECG signals and identifying optimal sensor placement schemes in a simulated setting.

A reference which you can follow up is 'Personalized Anatomic Modeling for Non-Invasive Fetal ECG: Methodology and Applications', IEEE Transactions on Instrumentation and Measurement, 2021, DOI: 10.1109/tim.2021.3069028 or visit Emerson Keenan's home page at https://emersonkeenan.net/research/.

Reducing false discoveries in resting-state functional connectivity using short channel correction: an fNIRS study

by Ishara Paranawithana

Uplink. This article is based on a paper which won the Best Overall Publication for the IEEE Victorian Section First Half Year 2022 Student Paper Competition.

The paper is 'Reducing false discoveries in resting-state functional connectivity using short channel correction: an fNIRS study' by Ishara Paranawithana, Darren Mao, Yan T. Wong and Colette M. McKay, Neurophotonics 2022 Jan;9(1):015001. doi: 10.1117/1.NPh.9.1.015001. Epub 2022 Jan 18. Ishara Paranawithana is currently a third year PhD candidate in the Department of Electrical and Computer Systems Engineering (ECSE) at Monash University and the Bionics Institute, Melbourne, Australia. In his PhD, he is investigating language development in infants using brain functional connectivity.

Introduction:

The human brain consists of large-scale spatially distributed, but functionally connected, networks that collectively work to perform complex cognitive tasks like speech perception and language comprehension. Understanding the intrinsic functional organization of the resting brain can help in interpreting how different regions of the brain function together at rest or in response to a task. Furthermore, resting-state functional connectivity studies have provided useful insights into developmental and neuroplastic changes of brain networks in different subject populations including infants, young children and people using cochlear implants.

Resting-state functional magnetic resonance imaging (fMRI) studies have already demonstrated the feasibility of detecting significant correlations of spontaneous fluctuations between distant brain regions in the low-frequency range (<0.1 Hz). Functional near-infrared spectroscopy (fNIRS) is another non-invasive functional neuroimaging technique that measures the relative changes of oxy-hemoglobin (HbO) and deoxy-hemoglobin (HbR) concentrations in the superficial brain tissues to infer the localized neuronal activity of brain regions of interest. fNIRS has been widely used as a portable, relatively less expensive, and less restraining alternative to fMRI in both task-related and resting-state neuroscience studies.

Despite these advantages, fNIRS signals contain unwanted noise components such as motion artefacts and systemic physiological noise including heartbeat (~1Hz), respiration (~0.2 Hz), and Mayer waves (~0.1 Hz) captured from cerebral and/or extracerebral layers of the brain. Functional connectivity analysis using fNIRS poses significant challenges as systemic physiological noise often violates the assumption of uncorrelatedness. Several techniques have been proposed and used to remove systemic artefacts from fNIRS signals. One of the most widely adopted temporal filtering method in resting-state functional connectivity studies to remove physiological noise is a low-pass filter with a cut-off frequency around 0.1 Hz. However, low pass filtering with this cut-off fails to remove the physiological noise caused by Mayer waves, which also occur in the frequencies below 0.1 Hz. This means that non-neuronal components of fNIRS signals can introduce spurious correlations and adversely impact the interpretation of the functional networks. It is apparent that methods should be developed to remove unwanted non-neuronal components from fNIRS signals to keep false discovery rates low in functional connectivity analyses.

Approach:

Short channel correction has been emerging as one of the standard methods to remove systemic physiological noise from fNIRS signals. Optical sources and detectors used in fNIRS are collectively called optodes. Our optode montage comprise short-distance channels with source-detector separation around 8 mm in addition to the standard long-distance channels with source-detector separation of around 30 mm (Figure 1A). In theory, long channels measure a combination of cerebral and scalp blood flow changes while short

channels are designed to only capture the blood flow changes in the outer layers such as scalp, as the optodes are close enough together to not capture light reflected from deep cerebral layers. Based on the assumptions that systemic noise such as heartbeat, respiration, and Mayer waves are homogeneous across the brain and the same noise structure exists in both long and short channels, a spatial filter can be designed to subtract the systemic responses captured by short channels out of the fNIRS measurements of long channels. Although there has been significant interest in developing methods to remove physiological noise from fNIRS data, these methods have been mostly applied to analyze task-related responses. Only a handful of studies have characterized the effect of noise removal with those methods in resting state functional connectivity studies.

In this study, published in Neurophotonics, we conducted a functional connectivity analysis with and without short channel correction to investigate the effect of spurious correlations in connectivity measures. A principal component analysis-based short channel correction technique (also known as short distance filter) was used to remove systemic physiological noise from the long channels of fNIRS data. We compared the performance of two approaches in terms of their ability to accurately quantify the connectivity of resting-state functional networks. The connectivity strength was measured using frequency domain connectivity measure; magnitude-squared coherence and compared for two known connectivity groups of homologous (structurally similar brain regions across hemispheres) and control channel pairs, one with known high connectivity and the other with low connectivity, respectively (Figure 1E).

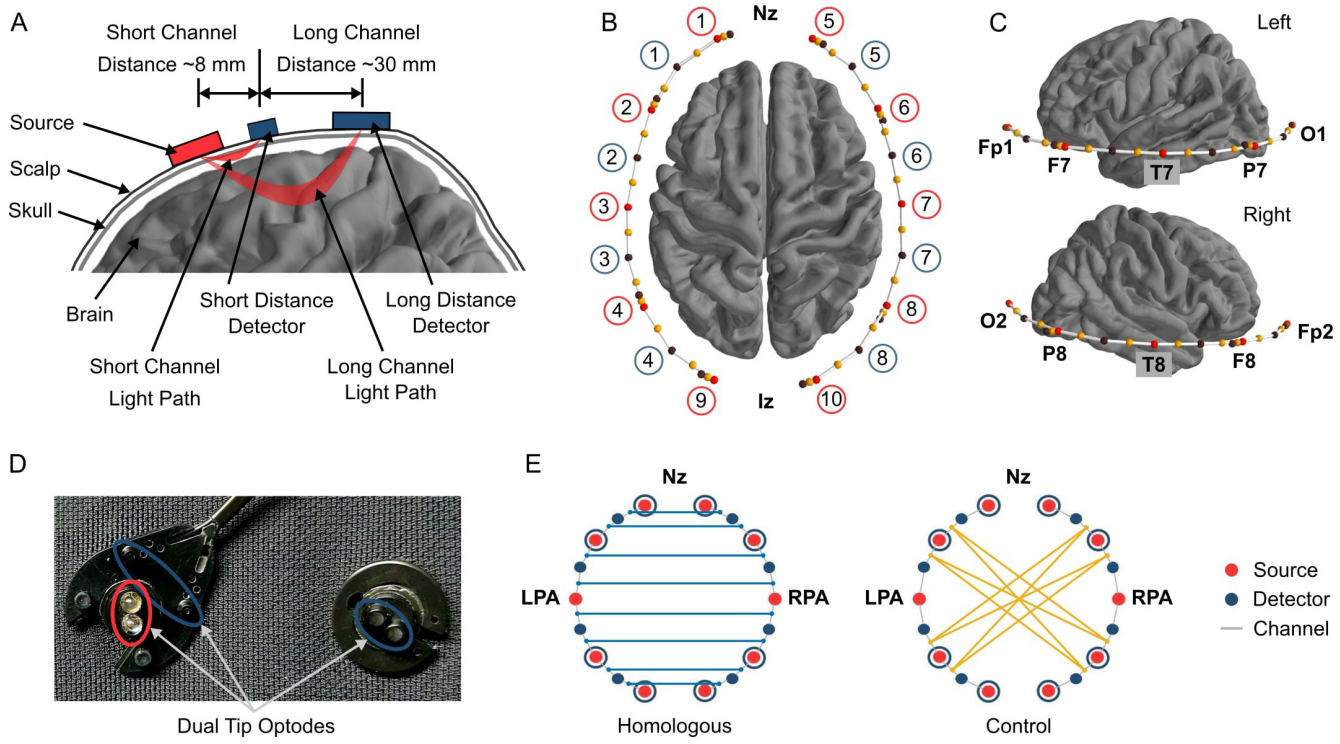


Figure 1: Illustration of the optode montage and the connectivity groups used in this study. (a) Schematic diagram showing the differences in light path and penetration depth of long channels and short channels. (b) Top view of the optode montage. Sources and detectors are marked with red and brown dots and their numbers are displayed in red and blue circles, respectively. Channels are marked with solid white lines and the mid-point of each channel is marked with a yellow dot. (c) Side-view of the optode montage. Registered channel positions are shown on left and right hemispheres of the brain with respect to the landmarks of international 10–20 standard (i.e., Nz, Cz, Iz, LPA, and RPA). (d) Physical layout of dual tip optodes. (e) Channel pair definition of the connectivity groups; homologous connectivity group linking channels in interhemispheric frontal, temporal, and occipital homologous regions and control connectivity group comprises long distance connections that have no known direct structural links.

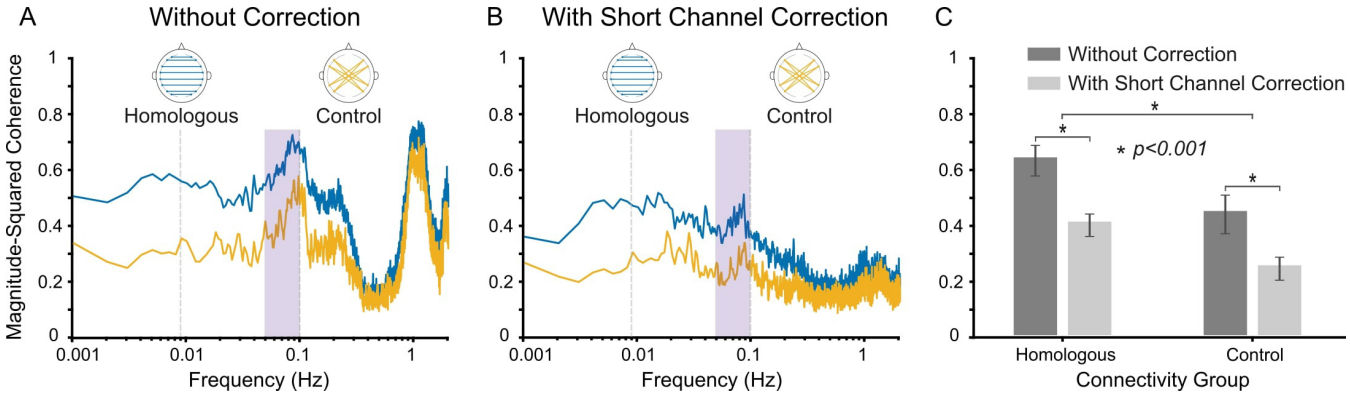


Figure 2: Comparison of participant-averaged magnitude-squared coherence of HbO signals for homologous and control connectivity groups (A) without short channel correction (B) with short channel correction. (C) Bar chart shows mean coherence of frequency band 0.05-0.1Hz (region shaded in purple) without and with short channel correction. Error bars represent the standard deviation of coherence in the same frequency band across subjects.

Prominent peaks were observed in HbO (oxy-hemoglobin) coherence plots for both homologous and control connectivity groups (Figure 2A) around 0.1 Hz. Coherence plots are a frequency domain connectivity measure. This observation suggests that the effect of Mayer waves present in fNIRS data is systemic rather than localized, thus introducing spurious correlations in both connectivity groups. An upward rising trend in coherence can be observed for both groups in 0.05 to 0.1 Hz frequency band. This upward trend is potentially due to the spurious correlations introduced by the Mayer waves. The peaks of coherence related to physiological noise (Mayer waves, respiration, and heartbeat) were suppressed in both connectivity groups when short channel correction was employed (Figure 2B).

With the removal of spurious correlations particularly due to Mayer waves, a reduction in mean and standard deviation of coherence was observed for both groups with short channel correction (Figure 2C). Thus, an improvement in discriminability was expected with short channel correction. Discriminability index (d') was calculated to quantify the separation and spread of the two coherence distributions corresponding to homologous and control connectivity groups. The separation and spread were defined as the difference of mean and the standard deviation of coherence across subjects in the resting-state frequency band that overlaps with Mayer wave frequencies between homologous (bilateral connectivity present) and control (bilateral connectivity absent) groups, respectively. The greater the discriminability, the better the method at accurately quantifying the bilateral connectivity reflected in homologous group. The d' values obtained for magnitude-squared coherence of HbO signals without and with short channel correction were 1.28 and 2.38, respectively.

Conclusions:

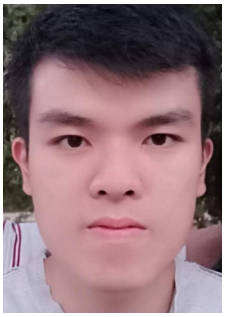
The results showed that spurious correlations are indeed present in connectivity measures particularly around Mayer wave frequencies within subject analysis.

We found that the principal component analysis based short channel correction technique used in this study consistently reduces Mayer wave-induced spurious correlations in connectivity measures and improves the discriminability between homologous and control connectivity groups. Resting-state functional connectivity analysis with short channel correction performs better than without correction in terms of the ability to enhance the reliability of connectivity measures and interpret connectivity characteristics of resting-state networks more accurately.

Therefore, we recommend using short channel correction to remove systemic physiological noise from fNIRS data in resting state studies whenever short channels are available and feasible to implement.

Virtual Reality assisted Motor Imagery for early post-stroke Recovery: A Review

by Chi Sang Choy



UPLINK This is an article based on the paper that won the First-Publication competition in the first half year's Section's Student Paper Competition. Chi Sang Choy (Student Member, IEEE) received the B.Sc. degree in Physics, and the M.Sc. degree in Physics (Experimental Particle Physics) from the University of Melbourne, Australia in 2017 and 2019, respectively. He is currently pursuing the Ph.D. degree in Electrical and Electronic Engineering with RMIT University, Australia. His research interests include stroke rehabilitation via motor imagery and virtual reality, physiological signal processing, and artificial intelligence.

The reference to the full paper and in turn its references is 'Virtual Reality Assisted Motor Imagery for Early Post-Stroke Recovery: A Review' by Chi Sang Choy, Shaun L. Cloherty, Elena Pirogova, and Qiang Fang,https://ieeexplore.ieee.org/document/9749920**.**

INTRODUCTION

Stroke is a serious neurological condition that often leads to disabilities and death. Motor impairment in particular makes it difficult for stroke patients to independently perform activities of daily living. Thus, post-stroke motor function recovery is essential in rehabilitation.

Rehabilitation relies on neuroplasticity to rewire the brain, a process that is most effective during the first month following a stroke. It is therefore crucial to begin motor rehabilitation early, but stroke patients often lose their ability to move voluntarily . Imagination of movement, known as motor imagery, provides an alternative way to trigger neuroplasticity and effectively start motor rehabilitation early without any physical movement. However, the ability to imagine a movement may deteriorate over time after a stroke. Virtual Reality (VR) technology provides an immersive virtual environment with an avatar to mimic a real-life movement that may assist the motor imagery of stroke patients.

VR assisted motor imagery (VR-MI) is a non-invasive and relatively economical strategy for motor rehabilitation that has been shown to be effective by various studies. Nevertheless, further research is required to implement VR-MI into a standard clinical procedure. This article provides an overview of the state-of-the art VR technology in combination with motor imagery for post-stroke motor rehabilitation as a promising alternative to methods limited by physical obstacles.

CURRENT STROKE REHABILITATION

The outcome of stroke rehabilitation depends on the responses over time once a stroke patient is identified. To maximise recovery, stroke survivors may begin motor rehabilitation 24-48 hours following the stroke upon the approval of a neurologist from a stroke unit. The standard clinical rehabilitative strategy often relies on physical movement. Physiotherapy and occupational therapy are the mainstream methods dependent on residual movement to help stroke patients regain their motor functions and independent life skills. Other strategies involve complex machineries, electrical stimulation and chemical and biological interventions which are limited by cost or safety concerns. On the contrary, VR-MI is safe and relatively cost-effective, making it especially suitable for stroke patients with no voluntary movement at all.

VIRTUAL REALITY AND MOTOR IMAGERY

The aim of using VR technology during motor imagery is to simulate the intended physical movement of stroke patients even if no real movement is executed in the hope of activating the motor brain areas (i.e. primary motor cortex, premotor cortex and supplementary motor area) and motivating participation. There are generally three aspects of VR-MI: immersion, interaction and imagination. The virtual environment should be sufficiently complex to engage

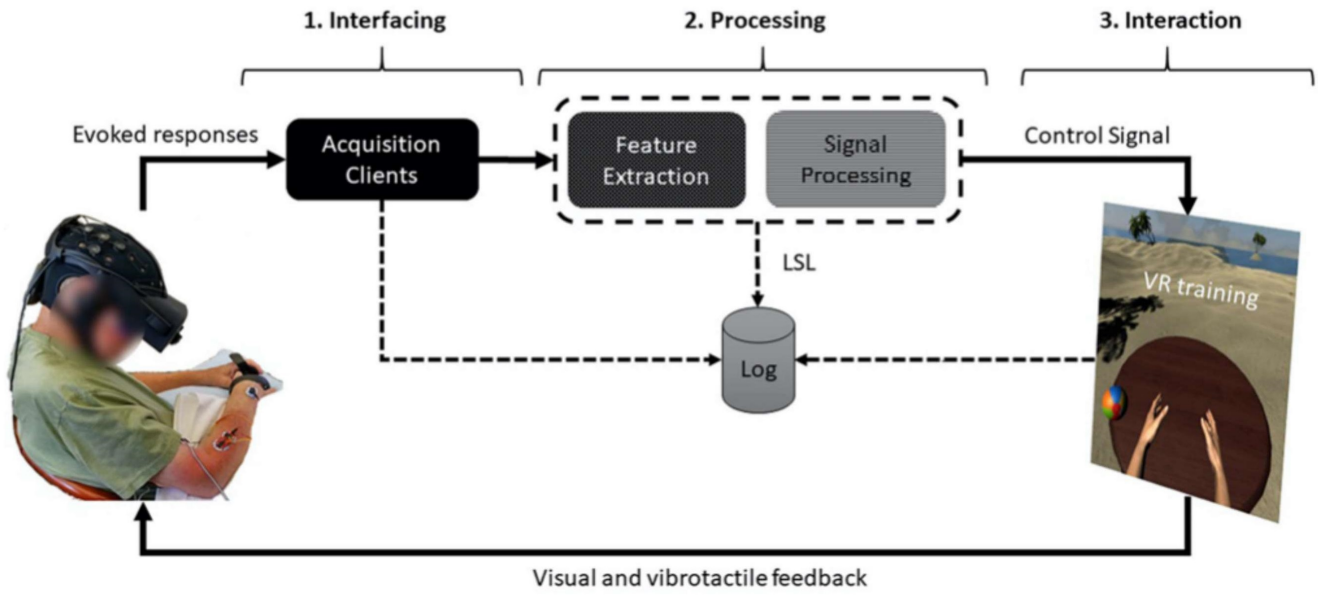


Figure 1: Schematic of the REINVENT platform with neurofeedback. Figure courtesy of A. Vourvopoulos et al.

stroke patients and provide multisensory feedback to promote motor learning. The most effective mode of motor imagery is in the first-person perspective with muscular sensation; however, simply observing actions in the third-person perspective may still activate the motor cortex and promote neuroplasticity.
Image.

The evaluation of motor imagery is important. Performance of motor imagery is mainly studied from the motor brain areas, which generate sensorimotor rhythm modulations in the α and β frequency bands (8-30 Hz). Electroencephalogram (EEG) is a non-invasive technology with high temporal resolution for measuring the overall activation of different brain areas, and it has been applied in VR technology to detect brain signals. Artificial intelligence involving neuroscience-based flexible boundary conditions of fuzzy models and convolutional neural networks is suitable for analysing real time, rapidly varying EEG signals.

The rehabilitative method of motor imagery in combination with VR has gained supporting research-based evidence and may transition to a feasible clinical practice. Figure 1 is a typical example of how a stroke patient controls the virtual arms of the REINVENT platform by imagination. Firstly, during interfacing, brain signals predominantly from the motor cortex are measured by EEG and transmitted to the acquisition clients. Secondly, during processing, the EEG signals are extracted as features of the brain neuronal responses. Thirdly, during interaction, the features are decoded for outputting signals to control the virtual arms. The goggles visually show the synchronised movement of the virtual arms along with vibrotactile feedback to the hands via two Oculus touch controllers. Technologies with similar functions as the REINVENT platform, even without EEG neurofeedback or control, may still facilitate stroke motor rehabilitation as long as the technologies provide an illusion of real movement resembling imagination of stroke patients.

CONCLUSION AND FUTURE OUTLOOK

The application of VR technology incorporated with motor imagery for post-stroke motor rehabilitation shows promising outcomes in recovery. VR-MI potentially activates the motor brain areas via imagination of movement, thus providing an alternative way to begin motor rehabilitation, particularly for stroke patients with severe motor impairment. The insights of various state-of-the-art VR-MI studies may guide future research to develop innovative strategies for further examination of the effectiveness and feasibility of VR-MI in early stroke rehabilitation.

IEEE Women in Engineering Victorian Section Affinity Group

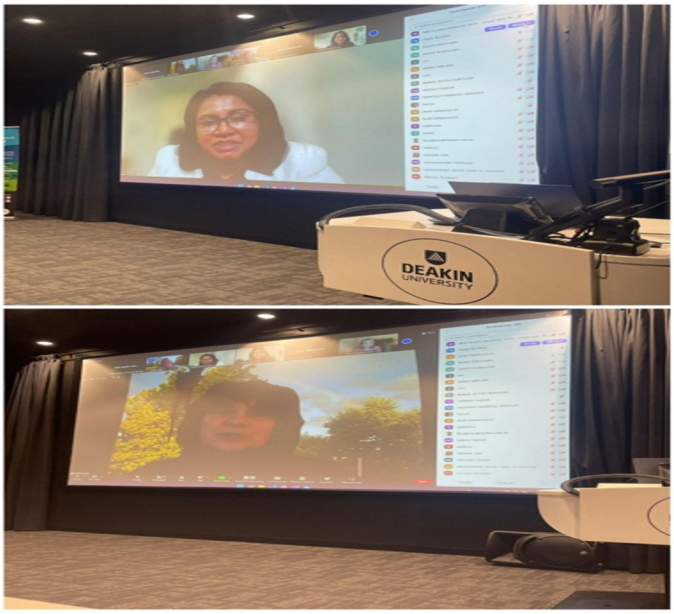
Th IEEE Women in Engineering (WIE) Victorian Section affinity group has been an active group under the IEEE Victorian Section since 2015. Aligning with the goals of the global IEEE WIE network, we are dedicated to promoting women engineers and scientists, and inspiring ladies in Victoria to pursue a career in science, engineering, and technology.

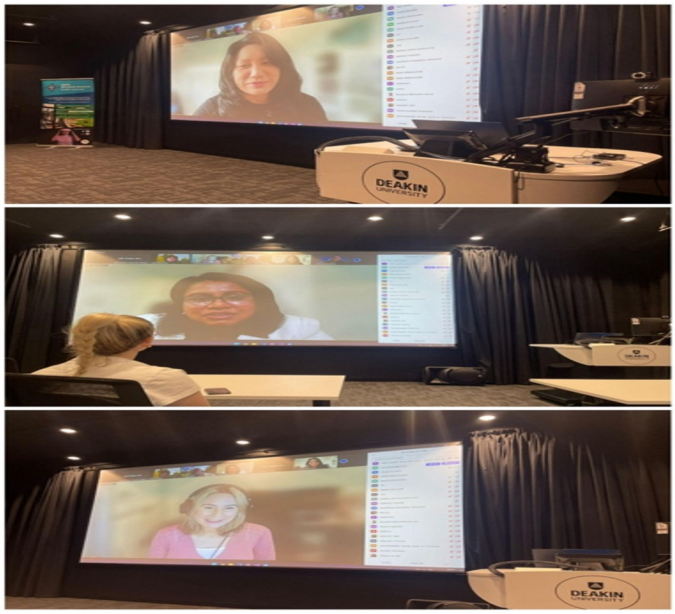
This year has been exciting for us, with global IEEE WIE celebrating its 25th anniversary. Therefore, we kick-started this year by collaborating with the IEEE Deakin University student branch, and organised a panel discussion on the topic of career success in celebration of the 25th anniversary of IEEE WIE. The event was held in a hybrid format at the Deakin University Waurn Ponds campus. Dr. Ruwini Edirisinghe, from RMIT University and our Victorian Section WIE Treasurer, guided this discussion as panel chair. The panellists included Professor Salley Male from the University Melbourne, Professor (Adjunct) Frada Burstein from Monash University, Annick Boghossian (IEEE Victorian Section Chair) from Telstra, Dr Wanita Sherchan from IBM, and Dr Imali Hettiarachchi from Deakin University.

This year has also been exciting for us, as Monash University hosted the IEEE WIE International Leadership Summit (ILS) in Melbourne in August. Our volunteers helped to organise the WIE ILS, which presented a great opportunity and platform for undergraduate and graduate female students and early-career women engineers and researchers to learn and engage with some of the leading personalities in science, technology, engineering and mathematics (STEM).

Another fantastic event we organised this year was the discussion on entrepreneurship for women interested in learning about entrepreneurship and the opportunities available to start their own companies in Australia. This discussion was facilitated by Laxmi Pun, Director of Early-Stage Investments in Breakthrough Victoria, founder of the Illume Foundation, and our Victorian Section WIE Vice-Chair Maneesha Perera, a start-up co-founder herself.

We have two more events planned for this year, which will be held in September. The first event is a webinar on “Fairness in Machine Learning". We are organising this technical event to create awareness of biases and inequalities (e.g. gender biases) artificial intelligence (AI) systems can have when making decisions so that anyone relying on decisions provided by automated systems is aware of such inherit biases. This talk will be





presented by Associate Professor Jeffery Chan from RMIT University. Our next event will be a wearable technology workshop for high school students as a part of the IEEE Engineering in Medicine and Biology Asia_Pacific International Student Conference and will be held by our amazing volunteers at the WIE Victorian Section. This workshop will be an introductory session on wearable technology, showing the fun aspect of engineering to high school students by giving hands-on experience in using LilyPad Arduino boards to design fun and exciting circuits.

We are also hoping to organise a WIE gathering in Melbourne towards the end of this year for current and past WIE Victorian Section volunteers and student branch volunteers to engage and network with each other. So, stay tuned, and feel free to follow us on LinkedIn to be updated with our events. The Victorian Section WIE Committee behind all the hard work.

Chair: Maneesha Perera

Maneesha is a final year PhD Candidate at the Faculty of Engineering and IT at the University of Melbourne working on renewable energy forecasting and deep learning. She is also a Co-Founder of a Melbourne-based start-up, Solstice AI. Maneesha has been volunteering with IEEE WIE Victorian section since 2019 and is passionate about empowering women in engineering and technology. She is the Vice-Chair and has been the acting chair (since April 2022) of the WIE Victorian section.

Treasurer: Ruwini Edirisinghe

Ruwini Edirisinghe is a lecturer at RMIT University. Ruwini is a passionate and effective advocate for diversity and inclusion. As the Co-chair of the Diversity and Inclusions Advocacy Group (DIAG) at the School of PCPM, she leads teams to promote diversity and she is also a member of RMIT's Athena SWAN DIAG. Ruwini is also a steering committee member of Women Researchers' Network (WRN) at RMIT. As an executive committee member of IEEE Women in Engineering VIC and the Asia Pacific region, she has actively promoted gender diversity activities nationally and internationally.

Secretary: Lakna Liyanarachchi

Lakna Liyanarachchi is a Research Assistant in the Faculty of Science, Engineering & Built Environment in the School of Engineering, Deakin University, Waurn Ponds Campus. She is currently working on assessing power system strength challenges with inverter-based resources.

Webmaster: Rashindrie Perera

Rashindrie Perera is the Webmaster at the Victorian section. She is a third-year Ph.D. candidate in the Optimization and Pattern Recognition Group at the University of Melbourne, and the Bioinformatics Core at Peter MacCallum Cancer Centre, Australia working in deep learning and bioinformatics fields.

Activity Organiser: Ifrah Saeed

Ifrah Saeed is serving as an Activity organiser at IEEE WIE Victoria. She is a PhD candidate in the department of Electrical and Electronic Engineering at the University of Melbourne.

Immediate Past Chair: Ishita Akhtar

Ishita has completed her PhD in Electrical and Electronic Engineering from The University of Melbourne in 2021. She is currently serving as an Academic Advisor in Trinity College, The University of Melbourne. Her research and work interests include network optimisation, programming, academic program management, teaching, and so on.

IEEE Engineering in Medicine and Biology Society International Student Conference (EMBS ISC) Asia-Pacific

By Ethan Grooby

Introduction

IEEE EMBS ISC Asia-Pacific was a biomedical engineering conference organised by students for students primarily in the Asia-Pacific region. The main components of the conference were the student paper competition, keynotes, panel sessions, workshop, lab tours and most importantly networking.

The idea of hosting the conference arose from the IEEE EMBS ISC Series, which started back in 2013 in Egypt. This series has since been formalised by IEEE EMBS Student Activities Committee (SAC) to be that 5 ISCs occur around the world in the regions of Asia-Pacific, North America, Latin America, Europe, and Middle East/ Africa each year. You can learn more about IEEE EMBS ISC Series and running one here.

This appeared to be the prime opportunity to help foster the community and showcase the diverse field of biomedical engineering within Victoria, Australia. These overall aims were then translated into the conference theme of "Victorian Ecosystem of Engineering in Medicine and Biology". This was further broken up into goals for the conference which were:

- **Goal 1:**
  - Motivate and inspire the next generation of biomedical engineers.
  - How: Keynote speakers, lab tours, workshops, panel discussions and student presentations
- **Goal 2:**
  - Accessible and inclusive environment for all attendees, presenters, and organisers.
  - How: Focus on diversity, equity, and inclusion in the conference design with the support of relevant advisors and clubs. Accessible venues chosen and conference offered for free to anyone interested in biomedical engineering both in-person and virtually.
- **Goal 3:**
  - Establish collaboration between the Victorian student biomedical engineering clubs.
  - How: Through engagement of existing clubs to organise, volunteer and run events within the conference
- **Goal 4:**
  - Promotion and expansion of IEEE EMBS membership.
  - How: Conference in general, including marketing before and afterwards and having a lasting website of the event.
- **Goal 5:**
  - Showcase the possible career opportunities and biomedical engineering environment with Victoria
  - How: Panel sessions and lab tours
- **Goal 6:**
  - Improve students' technical and soft skills
  - How: Workshops, reviewing papers, student paper, poster, oral and BioDesign competitions, and through organisation of the conference.

Overview

The conference ran from 26th-28th September 2022 for high school through to post-graduate students around the world in a hybrid format (both in-person and online). To showcase biomedical engineering within Victoria, the venue changed over the course of the conference with Day 1 being at St Vincent's Hospital and RMIT, Day 2 at Monash University and Day 3 at the University of Melbourne.

Overall, during the 3 days, we had 25 guess speakers which included 2 keynotes, 2 lab talks, 5 panel talks, 14 tours across 10 sites, 5 workshops, a Vinuri De Silva BioDesign Pitch Competition, and a trivia night

Set-up Phase

Team

The core organising committee (Ethan Grooby, Emma Perkins, Samin Haque, Anu Sabu, Mon Wittayacharoenpong, Sabrina Meikle and Luke Lu) for the conference comprised of individuals all of which had past student club experience or are currently in relevant clubs and for the most part all knew each other beforehand. Past/current club experience was essential as it meant we were familiar with running subcomponents of the conference effectively and had relevant contacts for speakers, tours guides, workshop demonstrators, funding, collaboration with student clubs and promotion. Familiarity within the organising

committee meant people were more comfortable to speak freely and we knew each other's capabilities. Overall, this meant we were more efficient in organising a conference which was essential given the size of this endeavour.

In addition to the core organising committee, we had a set of academic advisors that provided feedback and assisted us throughout the journey of organising and running the conference. Then most importantly, we involved student clubs (IEEE WIE Monash Affinity Group, Melbourne BioInnovation Student Initiative (MBSI), Biomedical Engineering RMIT Student Society (BERSS), PACBER, Monash Young MedTech Innovators (MYMI), IEEE Monash University Student Branch, and IEEE EMBS SAC) and professional groups (IEEE EMBS Victorian Section and IEEE WIE Victorian Section). These groups assisted with promotion of the conference, running events within the conference, and most importantly was meeting our goal to form collaborations.

Besides this, there were numerous emails and meetings with past conference hosts, academics, student club leaders, and industry that provided invaluable feedback and advice for the conference.

Financing

Running a conference is quite an expensive endeavour, especially with the aim of offering the event for free and the club having $0 in funding to begin with. Given this, a base proposal document and variants for the conference was constructed and submitted to industries, IEEE groups and universities to secure funding. Through this proposal, meetings, and numerous emails, we were fortunate to obtain funding from Department of Biomedical Engineering at the University of Melbourne, Faculty of Engineering at Monash University, Alliance for Digital Health at Monash, and IEEE Victorian Section.

Once the above funding was secured, we applied for more standard funding from Monash Graduate Association, IEEE EMBS, and IEEE Young Professionals, some of which required proof of initial funds for matching purposes for instance. There were also agreements with some of the student clubs which meant they covered the costs of the events they were running within the conference.

Additionally, we were able to obtain merchandise for the conference from IEEE EMBS, Monash Graduate Association, Bionics Institute, MBSI and IEEE WIE International Leadership Summit.

Marketing

As we were a brand-new club wanting to host a large event, marketing was key. In the initial setup phase, we decided to create our main club website (and later on our conference website and Eventbrite page), Facebook and LinkedIn as these were determined to be the best avenues for promotion and where our supporting clubs are most active and are able to easily share our information. In addition, we utilised existing mailing lists for relevant students in universities or that were IEEE EMBS/IEEE Victorian members.

Over the course of the year, we were able to amass 374 and 56 followers on LinkedIn and Facebook respectively. For the conference itself, we had 211 registrations from 24 countries, 42 universities, 2 high schools and 14 companies/research institutes (Fig 1).

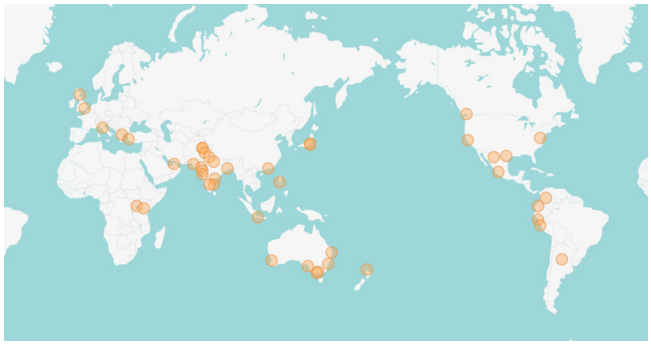


Figure 1: Distribution of Registered Attendees

Conference Design

Student Paper, Poster, and Oral Presentation Competition

The main part of the conference was the student paper submissions and associated poster and oral presentations. As we wanted original works of 1-page for undergraduates and 4-pages by post-graduates, we needed to do three things initially. First, was to generate call for papers and a simplified word and LaTeX paper templates. These documents provided all the necessary information to students and simplified the process for them. Second, we promoted early (i.e., in May), promoted widely (i.e., not only Victorian Universities but interstate and internationally as well), promoted consistently and provided room for extensions. Finally, as LaTeX is the ideal method for writing IEEE style conference papers, but many students are unfamiliar with this, we collaborated with IEEE WIE Monash Affinity Group to run a workshop using Overleaf with our LaTeX template. Overall, we had 44 people attend virtually.

Once we received all the papers, we wanted to complete a review process so that students gain experience in reviewing papers and that students that submitted get feedback. To achieve this, we invited a combination of PhD students and academics to review papers. To simplify and formalise the process we created a google form for all reviewers to submit to.
In total we had 20 reviewers and review 22 papers, we each paper having at least 2 reviewers. The reviewer feedback was then provided to students, who then had the opportunity to address this and resubmit.

Finally, for paper judging, through the combination of initial reviewer scores (and some fancy maths) and publication team of the organising committee, papers were shortlisted. These shortlisted papers were then judged by 2 academics to determine the overall winners of the paper competition.

For the presentation, students were given 10-minute slots for a 7-minute presentation and 3-minutes Q&A and changeover. Judging was then conducted by one academic to determine the overall winners. For the poster presentations, 2 academics and 1 industry representative judged all the poster to determine the overall winner. Additionally, there was a people's choice award.

Lab Tours

One of the more unique offerings for the conference was lab tours (Figure 2). These provided an opportunity to showcase the world-class facilities and research within Victoria in biomedical engineering. Overall, we held 14 tours at 10 locations which included:

- Day 1- St Vincent's Hospital
  - Neo-Bionica
  - BioFab3D
- Day 1- RMIT Advanced Manufacturing Precinct
  - Digital Manufacturing Facility
  - Micro Nano Research Facility
  - RMIT Microscopy & Microanalysis Facility
- Day 2- Monash University
  - CSIRO
  - Robotics in Medicine and Interaction Lab
- Day 3- University of Melbourne
  - Computer Assisted Rehabilitation Environment (CAREN) Lab.
  - Melbourne Brain Centre Imaging Unit (MBCIU)
  - Centre of Dynamic Imaging at Walter and Eliza Hall Institute of Medical Research (WEHI)

Figure 2: Lab Tours. (Top Left) Neo-Bionica, (Top Right BioFab3D, (Middle) CSIRO, (Bottom Left) MBCIU and (Bottom Right) CAREN Lab

Workshops

The aim of the workshops was to improve the technical skills of students, as well as provide the opportunity for students to run workshops. Within the conference, four workshops were conducted which included (Figure 3): the first was on Medical Imaging using 3D Slicer by Tom Williamson, the second was ECG and Heart Rate Variability Analysis using Arduino by Emerson Keenan, the third on Brain Computer Interfaces using Python by MBSI and finally, Wearable Technology using Arduino Lilypad by IEEE WIE Victorian Section.

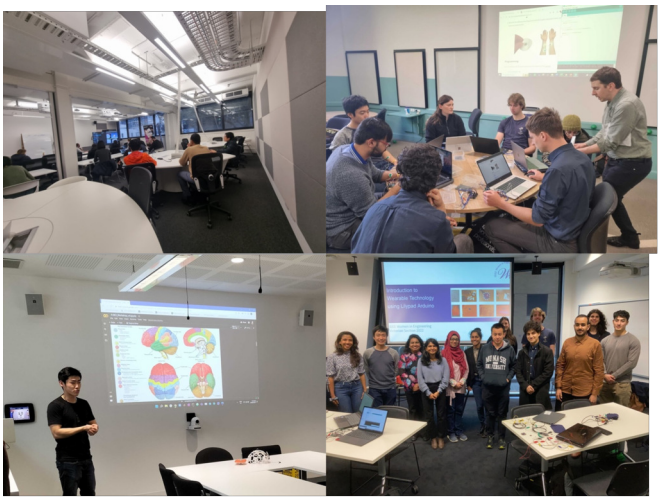


Figure 3: Workshops. (Top Left) Medical Imaging, (Top Right) ECG and Heart Rate Variability Analysis, (Bottom Left) Brain Computer Interfaces) and (Bottom Right) Wearable Technology

Results

Over the course of the 3-day conference plus the pre-conference LaTeX workshop we had more than 130 people attend online and more than 90 people attend in-person (Figure 4).

Figure 4: Poster Sessions. (Left) Day 2- Monash University and (Right) Day 3- University of Melbourne

We received a total of 22 papers, 13 posters and 18 oral presentations from undergraduate through to post-graduate students in 9 different universities. Within Victoria, Australia, we had submissions from Monash University, University of Melbourne, RMIT University, and the Swinburne University of Technology. Interstate, we had submissions from Flinders University, University of Sydney, and UNSW. Internationally, we had submissions from Salim Habib University and the National University of San Marcos. awards were given out for best paper, poster and oral presentation in the undergraduate and post-graduate categories (Figure 5). The winners are as follows:

Best Paper

- **Undergraduate:**
  - Improving the Sensory-motor loop for Prothesis by Gaurav Sobti, Monash University
  - Effect of Self-Reported Low Sleep Duration on Walking Gait and the Use of Movement Sonification to Promote Normal Gait by Jaber Jaber, RMIT University
- **Post-Graduate:**
  - The Impact of the Neocortical Architecture on Current Steering by Sabrina Meikle, Monash University
  - Altered Functional Connectivity in Response to Transcutaneous Vagus Nerve Stimulation (tVNS): A Study using Magnetoencephalography (MEG) by Charlotte Keatch, Swinburne University
  - Clinical Evaluation of a Portable Fluorescence Based Medical Device for Chronic Kidney Disease Monitoring by Anh Tran Tam Pham, Flinders University

Best Poster

- **People's Choice Best Poster (It was a tie!):**
  - Numerical Investigation of the Flow Hyperbolic Channel: Flow Features associated with Platelet Activation by Mariia Timofeeva, University of Melbourne
  - Non Invasive Screening Tool to Detect Anemia by Ajmal Azees, RMIT University
- **Undergraduate:**
  - Glycerol Plasticised Silk Proteins for Electrospinning Vasculature Grafts by Jaydon Chai, University of Melbourne
- **Post-Graduate:**
  - Altered Functional Connectivity in Response to Transcutaneous Vagus Nerve Stimulation : A Study using Magnetoencephalography (MEG) by Charlotte Keatch, Swinburne University
  - Fusion Peptide Interactions with the Lipidic Cubic Phase by Izabela Miłogrodzka, Monash University

Best Oral Presentation

- **Undergraduate:**
  - o Computational Fluid Dynamics Analysis on the Effects of Dual Lumen Cannula Positions in Extracorporeal Membrane Oxygenation by Wong Zhun Yung, Monash University
  - o Evaluating the Functionality and Feasibility of a Paediatric Ankle Foot Orthosis Constructed using a Composite 3D Printer in Comparison to a Commercially Fabricated Equivalent by Kritika Warrier, Monash University
- **Post-Graduate:**
  - o Cellular Uptake of Lipid Nanoparticles in Various Crystalline Phases by Sue Lyn Yap, RMIT University
  - o Simulated Comparison of Decision Policies Used for Shared Brain-Computer Interface Control of Robotic Arms by Kirill Kokorin, University of Melbourne
  - o Clinical Evaluation of a Portable Fluorescence Based Medical Device for Chronic Kidney Disease Monitoring by Anh Tran Tam Pham, Flinders University

Figure 5: Awards. (Top Left) Trophy, (Bottom Left) Trophy and Certificate and (Right) Award Ceremony.

Finally, the conclusion of the 3-day conference and MBSI's 10-week Vinuri De Silva BioDesign Competition was the pitch competition and associated awards (Figure 6). This was in honour of Vinuri De Silva, whom was a teammate, start-up co-founder and close friend to the chair of the conference organising committee (Ethan Grooby) and lead of the BioDesign Competition (Can Ertan). So, a personal thank you from us for providing a platform to promote biomedical engineering, innovation, and collaboration, which Vinuri and ourselves are very passionate about.

Congratulations to the winners of the Vinuri De Silva BioDesign Pitch Competition:

- People's Choice: Vision Medical,
- Graeme Clark Institute Prize: Mobi
- Vinuri De Silva BioDesign Competition Prize: TENSible

Figure 6: Winners of the Vinuri De Silva BioDesign Competition TENSible

Closing Remarks

This was a massive undertaking starting back in January 2022 which overall was a success, so we (IEEE EMBS Monash University Student Club) would like to thank everyone that helped and attended this event. We are considering whether to run the conference again next year and are now accepting expression of interest to join the organising committee or run events within the conference. If you are interested in contributing to the potential 2023 conference or have ideas for the conference, please contact us here ieee.embs.monash@gmail.com.

Robot Sumo Hackathon

by Deakin IEEE Xtreme

On September 12, the IEEE Deakin Student Branch held an 8-hour sumo robot hackathon with custom robots and participants from three different faculties and institutes from Deakin University. Robot sumo is a well-known style of competition in the robotics community where two robots fight, and the goal is to push the opposing robot out of the arena. During the competition teams of up to three collaborated to develop a high-level controller, or “fighting algorithm” for a custom robot provided by the Student Branch. The robot, named Sparpuckus, has a couple of special features that make the game more interesting. First, it is programmed to randomly disengage its drivetrain every now and then by lifting its tracks which makes the robot vulnerable to attacks. Second, it can charge forward at elevated speeds which provides a form of special attack that can be used on demand with a cooldown of 10 s. Thus, teams had to come up with fighting algorithms capable of dodging, attacking, and dealing with randomised robot deactivations. To speed up the software development process participants had access to a realistic simulation environment where they could test different strategies and train against pre-programmed opponents.

On the day of the competition everything ran smoothly and on schedule. The event started with an information session on how to control Sparpuckus and how to use the simulation environment. This was followed by two programming sessions with a lunch break in between, and during each programming session each team was allocated a 10-minute window to test their code on the real robots. At first most participants were confused and unsure of where to start but by the end of the first programming session all teams were up to speed and fully engaged in the task. Most teams even cut their lunch short and during the second round of testing on the real robots many interesting strategies started to emerge. Finally, at the end of the day an instant elimination bracket tournament was held where teams put their algorithms to the test against each other on the real robots. Prizes for the top three teams were $200, $100, and $50 respectively. All participants were very excited during the battles and many stated that they had more fun than they were expecting. Overall, the day was a great success for the Deakin Student Branch.

This event would not have been possible without the financial support from the IEEE Victorian Section and Deakin’s Institute for Intelligent Systems Research and Innovation. We hope to hold this event again in the future, perhaps at an inter-university scale. In the meantime, if you are interested in replicating the event in your university, we are happy to share the hardware and software we have developed so far, just getting in touch with us at ieeesb@deakin.edu.au.

IEEE WIE International Leadrship Summit (ILS) - Melbourne, July 2022

The Faculty of Engineering at Monash University and the IEEE Victoria Section teamed up and put in an application to host the IEEE Women in Engineering International Leadership Summit 2022 (ILS) in Melbourne, Australia. The application, led by Associate Professor Sudha Mokkapati (Monash University), was strongly supported by the IEEE Region10 and all of the Australian IEEE Sections. The IEEE WIE ILS was first hosted in Australia in 2018, by the IEEE Queensland section, in Brisbane. The 2022 summit would be the second or the first post-pandemic ILS organised in Australia.

Monash University's Faculty of Engineering is a global top 100 Engineering school, and is one of the largest schools in Australia, renowned worldwide for the quality of its teaching, research and the calibre of its graduates.

The organising committee saw the WIE ILS as an excellent platform to bring together leaders from various government funded agencies, academia and industry to inspire our younger generation of female engineers. This was an opportunity for us to arm our young engineers with tools to be confident, resilient and successful in the post-pandemic world. We were hoping to provide an opportunity for them to see a range of career possibilities in the future and to build a strong network.

The event preparations started as soon as we learnt of the outcome of the application process. The event was scheduled for 4th and 5th of August, 2022. We chose to host the event at 'The Pavilion' on Monash University's Caulfield campus. The Pavilion boasts one of the most spectacular views across Melbourne and the Bay and is a purpose-built premium function space at Caulfield campus.

Our media team, comprising Ethan Grooby (Ph.D. candidate, Monash University) and Dr Negin Amini (Research Fellow, Deakin University), put together the event websites: https://attend.ieee.org/wieils-melbourne-2022/ and https://www.monash.edu/engineering/wieils and publicised the event through various student and early career researcher groups and social media platforms such as Linkedin (Monash Alumni network) and Twitter (to target our industry partners). The event was also published through various eNewsletters associated with the University partners and IEEE sections/affinity groups.

Marc Pizzi, Industry Portfolio Manager, Faculty of Engineering, Monash University and our finance team lead, Dr Erin Brodie approached potential sponsors for funding the event. Our sponsors include Monash University, University of Melbourne, Deakin University, IEEE Victoria Section, IEEE Young Professionals, IEEE Women in Engineering affinity group, Reliance World Corporation (RWC) and Woodside Energy. Dr. Brodie, with assistance from the finance team members managed all expenses and finances related to the event.

The organisers are grateful to Ms. Shelly Pawsey and Rohan Bell for over-seeing all the event related arrangements. This event would not have been possible without their support and hard work behind the scenes. Vijay Paul (Deputy Chair, IEEE Victoria Section, Chair, IEEE Young Professionals) was an invaluable resource in planning and organising this event. The General Chair for the ILS also extends a special thank you to Professor Joanna Batstone (Director, Monash Data Futures Institute) for her guidance in making this event possible.

Dr. Trina Majumdar (Monash University) led the local arrangements committee. She made things happen to plan with her contagious enthusiasm and energy. Together with Ms. Kris Wirthensohn and Ms. Edna Tan, she was responsible for making all the local arrangements (including catering), manning the registration desk and ensuring the event ran smoothly. Special thanks and Due to Dr. Majumdar for the time and effort she has volunteered for this event.

The program committee, led by Dr. Fouad Karouta put together an impressive program by convincing eminent speakers from academia, industry and government organisations to participate in the event. His efforts are especially commendable considering the program was put together in only a few weeks' time. The ILS was opened by Prof. Chris Davies, Interim Dean, Faculty of Engineering, Monash University, and was organised around the themes of Empowerment, Entrepreneurship and Leadership. The speakers included: Dr Cathy Foley, AO, Chief Scientist of Australia, Prof. Bronwyn Fox, Chief Scientist, CSIRO, Prof. Chennupati Jagadish, AC, President, Australian Academy of Science, Ms Jane MacMaster, Chief Engineer, Engineers Australia, Ms Sally-Ann Williams, CEO, Cicada Innovations, Dr Katie Allen, Former member of Federal Parliament, Dr. Sue Keay, Chair – Robotics Australia, Ms. Ange Ferguson, Chief Transformation Officer, Thoughtworks, Ms Janelle Delaney, Delivery Excellence executive, IBM, Lesley De Garis, Boeing Aerostructures. Short biographies of all of the speakers can be found at: https://attend.ieee.org/wieils-melbourne-2022/speakers/.

Ms Madeleine McManus, OAM chaired the first session of the event and set it up on a trajectory for success. The program included a discussion panel, moderated by Dr. Susmita Saha and a networking session on Day 1. The panel consisted of Ms Jane MacMaster, Professor Sally Male, Ms Paula Burton, Emeritus Professor Lance Fung, Ms Annick Boghossian and Dr Mehrnaz Shoushtarian and discussed the role of volunteering in career advancement.

In addition to the organisers, speakers and volunteers, 97 (22 non-IEEE members, 75 IEEE members) attendees registered for the ILS. They have all taken time from their very busy schedules to participate in the event. We hope that they found the summit useful and benefitted from the insights presented by our speakers and panellists on career planning and progression and the networking opportunities created by the event.

ANZSCON 2022 - Student Conference Report

by Ethan Grooby, May Alhajri and Susmita Saha

ANZSCON is an Australian and New Zealand student congress and this year it was held in October in Adelaide. The Victorian Section sent four student committee members to this for training and here is a short report of the event.

Networking

One benefit of attending this conference was to meet with other students running similar organisations as we do in Victoria and learn from what they are doing and vice versa.

For example, the students in the Victorian Section recently ran the IEEE Engineering in Medicine and Biology Society (EMBS) International Student Conference and we were able to discuss opportunities for other IEEE Sections to support the organisation of similar events in their States. There were also discussions to promote future IEEE EMBS events in Victoria and send student delegates to attend if Victoria organises a similar conference next year. This all would further encourage the set-up of IEEE EMBS Student Clubs within universities in these other States, a plus for the IEEE in Australia.

Additionally, the opportunities for co-operation flow the other way too because, while not IEEE related (at least not yet), it is hoped that the connections made at ANZSCON will help set up student teams from other States to take part in the heart hackathon competition (https://www.hearthackathon.com/), which is a global artificial heart design challenge being organised by Monash University.

There was also an opportunity to meet with leaders of IEEE Young Professionals to discuss on the beginning stages of an IEEE student club and how to ensure its continuity. Furthermore, we talked about how best to incorporating IEEE Young Professionals in IEEE EMBS Monash University Student Club and IEEE EMBS Student Activities Committee's future events.

Other people there had a STEM (Science, Technology, Engineering, Mathematics) focus and it was interesting to hear how STEM was being promoted and run in high schools, and gain a better understanding why there is still a gap in females undertaking engineering as a career despite several high school programs existing in Australia to address this. Also there was quite an interest in how it is important to expose kids to STEM-related programs at an early age.

Figure 1 Pictures of speakers during day 1 and day 2 of ANZSCON, at University of Adelaide

Presentations

Presentations during the conference included interesting keynote speakers who shared insights coming from their own experiences in professional life and recent work in the field of engineering. Most notable ones were the Artificial Intelligence/Machine Learning Computer Workshop, IEEE Special Interest Group on Humanitarian Technology (SIGHT), Teresa Janowski, Bisma Manzoorand Prof. Sharath Siram's research presentation.

Figure 2: Pictures from AIML Computer Workshop: MathWorks with David Tien, Charles Sturt University.

Cross discipline work in engineering and biology can incorporate a lot of MATLAB-based artificial intelligence and machine learning. The workshop presented by MathWorks showcased a new workflow with live scripts and several quick visualisation tools to better understand how to approach these research problems.

Figure 3: Prof Sharath Siram's presentation on a diverse range of monitoring medical devices

Prof Sharath Siram's presentation showcased a diverse range of monitoring medical devices ranging from mattress covers for health monitoring to smart face masks for COVID-19 detection. Besides the breadth of research presented in the biomedical engineering space, what was really inspiring was the design thinking process and collaboration with manufacturers to see then devices actually get translated, tested and used in real-world scenarios. Since Prof Sharath Siram is at RMIT university, this would be a useful connection to have for future research collaborations.

Figure 4 Teresa Janowski's presentation on learning how to network to increase your net worth, the CEO and founder of STEM Fast Track

Teresa Janowski's presentation on learning how to network to increase your net worth encouraged students to maximize the benefit from attending events by exchanging knowledge and learning from others' experiences. There were a few tips that are helpful in networking, such as attending events that interest you and your community, starting a conversation by asking genuine questions, and being an active listener. Also highlighted how much knowledge you gain when every time meets someone you learn something new.

Figure 5: Dr Bisma's presentation on Revolution of the space industry and career opportunities in the space sector, a DSP Engineer with Fleet Space Technologies

Bisma Manzoor's presentation on revolutions in the space industry and career opportunities in the space sector started by showing the first detection of an artificial satellite and how satellite now work to provide global connectivity and explore different planets. Besides the good communication infrastructure, we have on Earth known as terrestrial-based

communication, it is still hard to provide terrestrial coverage to hard-to-reach areas or those with lower population density. Therefore, satellite-based communication can provide access in these scenarios. For that reason, there are plans by the 3rd Generation Partnership Project (3GPP) toward implementing satellite communication (Non-Terrestrial Networks (NTN)) and making it part of the infrastructure. Then, Bisma highlighted efforts toward reducing the massive size of the satellite to nano-size satellites that in their own way can provide global connectivity.

Figure 6: Delegates presenting their idea on the problem of accessibility of understanding/learning Auslan.

Finally, Matt Imhoff presented on IEEE SIGHT, which is IEEE's mechanism for humanitarian projects. Currently there is no projects occurring within Australia, which Matt is hoping will change after this conference. To achieve this, the conference included a pitching competition by teams on potential projects. One team, which included Victorian Section attendee Ethan Grooby, presented on the problem of accessibility of understanding and learning Auslan (Australian Sign Language) and how engineers can play a part in addressing this.

Figure 7: Delegates presenting the exponentially growing requirement of STEM skills in the workforce

Another team that included Susmita Saha and May Alhajri from the Victorian Section, presented a proposal about inspiring young Australians (up to grade 12) to choose to undertake prerequisite subjects for maths/ engineering/technical studies for their tertiary education, which would ultimately help Australia to overcome the exponentially growing requirement of STEM skills in the workforce.

Food

Last but not least is food. It was good to see a lot of gluten free options - something to remember from a conference organisers perspective.

Conclusion

So you can see there was a lot of IEEE business transacted at this Congress and we look forward to building on these links with like-minded IEEE student members in the other States. We would like to thank the IEEE Victorian Section for the opportunity to attend and participate in the Congress and we hope we have acquired and bought back something that will be of use in organising more events here is Victoria.

Figure 8: Picture of delegates taken from ANZSCON reception dinner in Adelaide Zoo (day one).

Figure 9: Pictures from Adelaide Zoo

Further information about ANZSCON is available from https://attend.ieee.org/anzscon-2022/

**All pictures photographed by Tahlia Rosenberg, IEEE SA section, Adelaide, 1-2 Oct 2022.*

Publications Corner

Here, for your interest, are some recent theses and publications by IEEE Victorian Section members.

Publication: Virtual Reality Assisted Motor Imagery for Early Post-Stroke Recovery: A Review

Chi Sang Choy
(RMIT University)

Publication: A Distributed Deep Reinforcement Learning Technique for Application Placement in Edge and Fog Computing Environments

Mohammad Goudarzi
(Melbourne University)

Publication: Noisy Neonatal Chest Sound Separation for High-Quality Heart and Lung Sounds

Ethan Grooby
(Monash University)

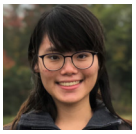
Publication: A Machine-Learning-Based Risk-Prediction Tool for HIV and Sexually Transmitted Infections Acquisition over the Next 12 Months.

Xianglong Xu
(Monash University)

Publication: Producing Realistic EV Demand Profiles for Distribution Network Studies.

Jing Zhu
(Melbourne University)

Publication: Human-in-the-Loop Auditory Cueing Strategy for Gait Modification



Tina LY Wu
(Monash University)

Publication: Risk-Constrained Scheduling of Energy Hubs: A Stochastic p -Robust Optimization Approach

Afshin Najafi-Ghalelou
(Monash University)

Publication: Probabilistic Assessment of Static Load Model Parameters in Renewable-rich Power Systems

Mir Toufikur Rahman
(RMIT University)

Publication: Reducing false discoveries in resting-state functional connectivity using short channel correction: an fNIRS study

Ishara Paranawithana
(Monash University)

Publication: Factoring Variants of Chebyshev Polynomials with Minimal Polynomials of cos(2 π / d)

David A. Wolfram
(Australian National University, Canberra)

Publication: Evaluate the effect of graphene and milled glass fibre on the thermal, flame and dielectric properties of silicone elastomer filled with aluminium hydroxide.

Tariq Nazir
(RMIT University)

Publication: Overhead Lines and Wildfires: Role of Outdoor Insulators: Prepared by a Task Force of the IEEE DEIS Outdoor Insulation Technical Committee.

Publication: Development of novel hybrid 2D-3D graphene oxide diamond micro composite polyimide films to ameliorate electrical & thermal conduction.

Publication: Improving the polarisation and depolarisation current measuring method to avoid ground wire interference. High Voltage

Publication: Improving Fault Tolerance and Reliability of Heterogeneous Multi-Agent IoT Systems Using Intelligence Transfer

Vyas O'Neill
(La Trobe University)

Publication: Applying aspect-oriented design methodology to manage time-validity of information in internet-of-things systems

Publication: Isolation Kernel Estimators.

Publication: A new distributional treatment for time series and an anomaly detection investigation.

Publication: Streaming Hierarchical Clustering Based on Point-Set Kernel.

Ye Zhu
(Deakin University Burwood Campus)

Editors' Page

How was this edition created?

Scribus is free and open-source desktop publishing (DTP) software available for most desktop operating systems. It is designed for layout, typesetting, and preparation of files for professional-quality image-setting equipment: https://en.wikipedia.org/wiki/Scribus. Text is received from contributors in document format and is converted to plain-text to remove hidden format commands and then copy / pasted into a Scribus UPLINK template one article at a time. Images and diagrams are then added and the text is flowed around these. Each article is then edited for length to fit column or page boundaries. The penultimate edition is proof-read again by the contributors and the final Scribus file is exported to a PDF and slimmed down in size using GPL Ghostscript: https://directory.fsf.org/wiki/GPL_Ghostscript. Each edition takes six months from the formation of the editing team for that edition through to the final PDF output.

Editors for the next edition of UPLINK

Each edition of Uplink has its own set of editors. People can learn how articles are sourced, edited and transferred into the Scribus publishing tool. If you enjoy team work and working collaboratively, Uplink would be an ideal environment for you. Please contact: May Alhajri.

Editors for this edition

May Alhajri

May is undertaking PhD studies in Cybersecurity and is a Teaching Associate at Monash University. She also worked as Teaching Associate at KFU, Saudi Arabia. She previously worked as an Industrial IoT Systems Engineer at TAQNIA. May holds a M.Sc. degree in Cybersecurity from Monash University and a B.Sc. Degree (Hons.) in networking and telecommunication systems from Princess Nora University.

Enn Vinnal

Enn runs Wireless Frequency Studio, a consultancy specialising in assessment of spectrum sharing and co-existence between different radio services. Previously he worked for Telstra in radio system and antenna performance assessment. He is past Chair of the Victorian Section and ComSoc Chapter. Currently he is the Chair of the Vehicular Technology Chapter and is on the Treasurer of the Antenna & Propagation / Microwave Theory and Technology Chapter.

Champake Mendis

Champake is currently the Chief Data Scientist of Triple A Super; an adjunct lecturer, Charles Sturt University, currently serving as the Asst Treasurer of IEEE VIC/TAS Section. He holds a PhD in Computing and Information Systems and MEngSc in Mechatronics from University of Melbourne and was a member of one of the best AI research groups in Australia. He has more than 20 scholarly publications, including a book.

Priya Rani

Priya is a Lecturer at RMIT University. In IEEE, she was the Co-Convenor and founding Chair of IoT Community at Victorian Section in 2020. Currently, she is serving as Treasurer at the Victorian Section. She is also a STEM Ambassador with Science and Technology Australia, promoting and raising awareness of STEM across Australia.

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