Connecting challenges and solutions through measurement science

PGI PostGraduate Institute for measurement science

University of Strathclyde Glasgow

UNIVERSITY OF SURREY

NPL

Join us in commemorating the milestone return of the in-person annual conference of the PGI, marked in this exclusive post-conference digest. This event, held on 7th and 8th June 2023, marked a triumphant step in the post-COVID era. Themed "Connecting Challenges and Solutions through Measurement Science," the conference rallied more than 100 registered delegates, weaving together students, researchers, and esteemed keynote speakers.

Situated in the University of Strathclyde's freshly unveiled Teaching and Learning Building (TLB), the conference was a beacon of scholarly exchange, featuring keynote lectures, thought-provoking student presentations, and immersive training sessions. The conference was officially inaugurated by Gillian Doherty, the Chief Commercial Officer at Strathclyde, with significant emphasis on 'Responding to Immediate Crisis,' 'Building Security and Resilience,' and 'Engineering the Future.'

Our distinguished keynote speakers, Allister Ferguson, Adrian Burden, and Rowena Innocent, ignited intellectual curiosity and set the pace for the conference. Subsequent student talks and breakout sessions further enriched the discourse. In recognition of his substantial contributions to the PGI, Prof Billy Kerr was given an honourable mention.

One of the conference's most unforgettable facets was its vibrant social segment, encapsulating a drinks reception, sumptuous dinner, and the lively energy of a ceilidh, a traditional Scottish dance. The second day was replete with inspiring panel discussions on carving out a PhD mindset, promoting diversity in science, and cultivating entrepreneurial skills. The cherry on the cake was a keenly focused training session on the 'Imposter Phenomenon,' steered by Dr Marc Reid.

The enthusiastic feedback from our delegates was the true testament to the conference's success, with many accolades for the excellent networking opportunities and lucid representation of cross-disciplinary research. Finally, we extend our profound gratitude to the organising committee, and the whole PGI team, who were the driving force behind turning this event from a vision into a reality.

On behalf of the conference team,
Tarek Haloubi & Agnieska Sierhej, Conference chairs

Best Talk Awards

Robert John from the University of Surrey, winner of the first prize for the best talk, gave an insightful presentation on the use of Positron Emission Tomography and Computed Tomography (PET-CT). This essential imaging technique provides crucial morphological and anatomical information for accurate cancer diagnosis, staging, and treatment planning. In his study, a 5-layer 3D convolutional deep learning texture model was utilized to identify glycolytic regions in PET-CT data. This approach achieved an average sensitivity and specificity of 96.1% and 99.4%, respectively, for binary classification targeting primary tumour patches. Using a dataset of PET-CT data from 486 oesophageal patients, the team analyzed network activations across each layer for characteristic activation patterns of four glycolytic uptake classes: primary tumour, bladder, liver, and myocardium. They performed PCA analysis of the activations to isolate uncorrelated features learned during training and reveal unique feature clusters in PCA space.

This project, a collaboration between Alliance Medical LTD, Centre for Vision Speech and Signal Processing (CVSSP, University of Surrey), NPL and the Royal Surrey County Hospital, brings explainability to medical imaging deep learning models. By understanding why decisions are made, radiologists can gain a better understanding of the decisions made by deep learning models used for cancer detection and have greater confidence in their ability.
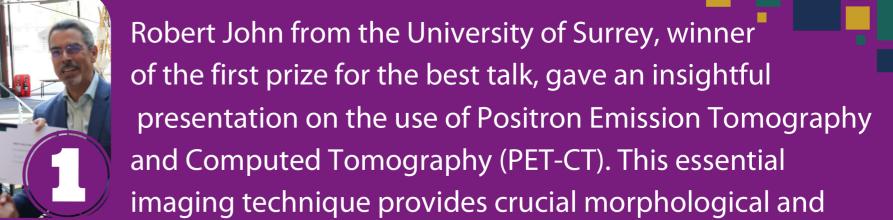

Patrick Hunter from the University of York discussed the need for effective cancer therapeutics, especially considering the annual 375,000 new cancer cases in the UK. His work centers on how tumours establish pro-tumorigenic microenvironments by 'educating' immune cells, like chemokine receptor CCR5 and its partner CCL5. As CCR5 links to drug resistance and metastasis, it's a potential therapeutic target. To tackle the conformational 'pools' challenge, his team used super-resolution structured illumination microscopy (SIM) and partially TIRF-coupled HILO (PaTCH) microscopy on fixed CCR5 cells. Results showed a non-random spatial distribution of CCR5 assemblies and dimeric subunits unaffected by CCL5 perturbation. Future research on the effect of CCR5 antagonists can offer key insights into possible therapeutics. The project is funded by the BBSRC, based in the University of York, and partnered with NPL.

Reflecting on the conference, Patrick said, "It was an excellent networking opportunity and showcased the PGI's great work. The atmosphere of Strathclyde and inspiring career case studies from keynote speakers have given me valuable takeaways."

Martin Knapp from the University of Oxford discussed the development of a Compact Cold-Atom Microwave Clock, emphasizing the issue of strong dependency on the Global Navigation Satellite System (GNSS). Much of our national infrastructure relies on timing signals provided by GNSS. Disruptions to these signals can cause severe problems for all sectors that depend on it. Compact clocks can serve as holdover references until GNSS is restored. However, existing compact clock systems that use thermal atoms have limitations in terms of their long-term performance. This leads to a strong interest in developing higher-performance compact clocks for improved long-term stability, thereby offering increased resilience during GNSS disruptions.

The project tackles this problem by developing a compact cold-atom microwave clock. Improved long-term stability can be achieved by laser cooling the atoms, but this increases the experimental complexity and size. The challenge lies in implementing this while maintaining a compact form factor. As GNSS, often referred to as the "invisible" utility, operates in the background of our daily lives and many of our services depend on it, the technology being developed will improve the security and resiliency of the GNSS system.

Best Poster Awards

Purnank Aggarwal from King's College London shared insights into light-induced immune therapy, a project funded by the Department for Science, Innovation & Technology (DSIT). His project focuses on inducing apoptosis (a type of cell death) in Mesenchymal Stem Cells (MSCs) in an in vivo-like 3D setting, as these cells drive therapeutic immunomodulation. Presently, in vitro generated apoptotic MSCs (ApoMSCs) struggle to effectively induce immunosuppression as they lose their ability to home, in large numbers, to the site of inflammation. To address this, a novel technique, optogenetics, will be used. This technique controls the expression of a pro-apoptotic gene through a photosensitive protein when excited by a light source. The optically-inducible ApoMSCs will then be co-cultured with immune cells in a 3D system to determine the system's efficacy. The importance of this work lies in its potential to be translated into clinical cell therapy for patients suffering from autoimmune diseases, as it can be used to dampen the immune system.

Reflecting on the conference, Purnank commented, "The conference was an excellent gathering of various disciplines of science and technology, and provided a great networking opportunity. There were several exceptional talks by both PhD students and keynote speakers that educated the audience with ground-breaking science."

Tarek Haloubi, a student at NPL and the University of Edinburgh, presented a poster illustrating the need for faster lung inflammation screening methods. His research, part of an initiative led by the Translational Healthcare Technology group and funded by GlaxoSmithKline and the National Physical Laboratory, seeks to accelerate this process by developing a Fluorescence Lifetime Imaging (FLIm) based technology for real-time lung imaging.

However, the project faces challenges like motion artifacts due to breathing and operator movements. This PhD project is exploring solutions such as signal and image processing, medical image registration, fusion, and machine learning-based analytical tools. The goal is to build an image processing framework that improves computational speed and alignment quality.

Tarek shares, "As the chair of the organizing committee, attending this conference was illuminating. It was a reminder of the diversity of perspectives in our community, each conversation sparking new ideas. The various career paths showcased the limitless opportunities in the scientific field, emphasizing the importance of curiosity, flexibility, and openness over rigid planning."

Karim Daramy, a PhD student at the University of Strathclyde, presented a poster outlining the aims of his project to a broader audience and was a recipient of one of the prizes for the best poster. The project's aim is to develop a robust pipeline for characterizing nanoparticle interactions with complex biological media. This project is funded by an EPSRC Doctoral Training Partnership (DTP) in collaboration with NPL.

While nanoparticles are increasingly being explored for the development of new medicines, the translation from bench to clinic remains limited. By gaining a deeper understanding of nanoscale particle interactions with biological systems, we can design novel formulations for safer and more effective drug delivery.

Karim is quoted as saying: "The 7th Annual PGI conference provided a multi-disciplinary overview on the importance of metrology for emerging technologies across different subject areas. I am so pleased that my poster won against such stiff competition."

Post PGI Conference Digest

The PGI 7th Annual Conference
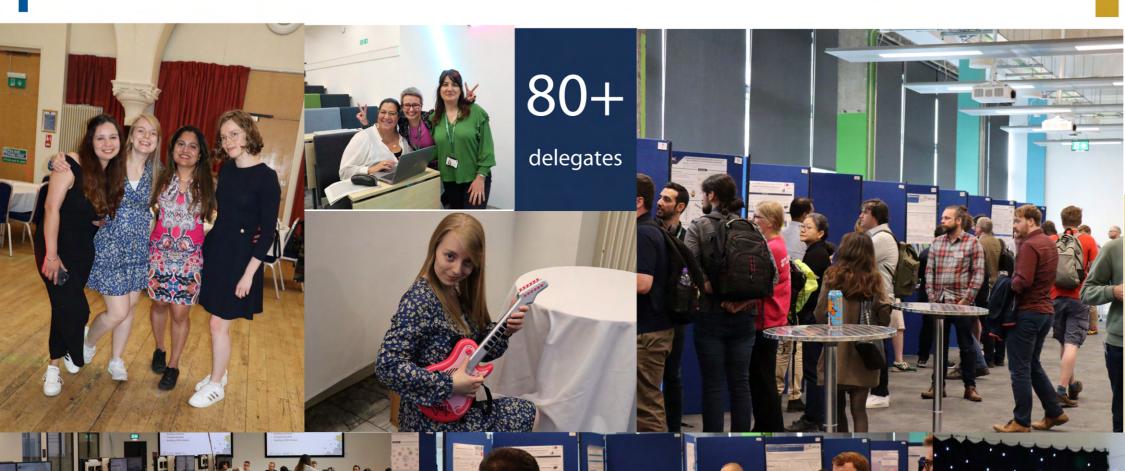7 - 8 June 2023 | University of Strathclyde, Glasgow

PGI PostGraduate Institute for measurement science

30+ student talks and poster across different areas of reserach

80+ delegates

8 UK Universities

11 cities

""Interesting keynote speakers, good presentations from the students"

"It was a great opportunity for networking. The multiple field the PGI conference embraces allows the attendees to get to know more of the other topics and research being conducted outside of their own research bubble."

"Exceeded my expectation as all presenters presented in a way that make people outside of their discipline be able to understand their research"

"Ceilidh was a lot of fun - I've attended ceilidhs many times and love it each time, nice way to socialise with people"

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