**AI in Acoustics- A London Branch Event**

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On the 22nd May 2024 the Institute of Acoustics London Branch with the support of UKAN+ (www.acoustics.ac.uk) held an all-day meeting at the Hub of London South Bank University. The event was entitled, “AI in Acoustics “ and was attended by 103 delegates. They enjoyed ten presentations divided in to four sessions given by Architects, Software Engineers , AI programmers, Academics and Acousticians. The hosts were Professor David Waddington of the University of Salford and Professor Mark Plumbley of the University of Surrey. Each of the sessions ended with a discussion panel, except for the morning session which ended in an unscheduled fire alarm. The tea, coffee and cakes were excellent and the venue large enough to cope with the number of delegates.

The first session began with, “The Day the Robots Came for Acousticians” by Tony Trup of Timbral to explain the difference between AI (strategy) and Machine Learning (tactic). Followed by a double act of Ed Elbourne and Andrea Felciuc of Arup on, “AI Paintbrush – can machines hallucinate”. This compared images for pre-conceptualisation of concert halls from 10 AI software programs, see Photo 1. This was followed by Gordon Hunter who presented on machine learning to predict the swarming behaviour of honeybees. Using only inexpensive acoustic equipment to record the sound produced by honeybees in their hive, swarming behaviour was captured. This is when a new queen is born and the hive splits into two fractions. The recordings were labelled and used to train a machine learning model. This model showed excellent predictions being able to predict a hive split 28 days before it occurred. A knowledgeable beekeepers would only know with certainty 7 days before the swarming occurs.

After coffee/fire alarm we had Nikhilesh Patel of Hoare Lea present on, “Potential of AI in Acoustical Data Analyses”. This involved fitting data to an AI model through supervised training to validate unseen data on CLT for sound insulation just described using one parameter, thickness. The model achieved +/- 3 dB accuracy. This was followed by Rory Fotheringham of TNEI who looked at, “Analysis of Frequency Modulation from Wind Turbines”. Rory used Machine Learning to identify complex patterns for infrequent events using a Generalised Additive Model to produce a probabilistic model which had 80% confidence. Rory said this could be improved with more data. A recurring theme for AI models. To finish the morning, a 30 minute discussion panel was held led by Mark Plumbley with all presenters contributing to the debate. This covered how AI is currently used, and what are the ethical implications of using AI, photo 2.

Before lunch there was a short Extra General Meeting where all corporate members voted on the pursuit of Chartership from the Privy Council. The result was an overwhelming agreement to pursue Chathership with a handful of abstentions. This confirmed the voice of membership as taken a month earlier through an on-line survey.

After lunch Luca Marchesotti of Risso presented on, “Automated Audio Analysis”. His approach was designed to reduce reporting time and reduce listening time through analysis of audio files. This resulted in 94% accuracy and possibly 97% accuracy for environmental sounds. The analysis either being through an API or through a web portal via uploading the appropriate wav file. Jinhua Liang of Queen Mary University followed Luca with a presentation on, “ Machine Learning using Natural Language”. This used a Large Language Model which was greatly assisted by a Multi-Modal model (e.g. Visual cues). The helped This was demonstrated through a query in English to remove train noise from a wave file by simply asking for it to be removed in CHAT-GPT. The final presentation of the session was given by Shenzhi Su of Cundall on, “Harnessing Generative AI for Noise Survey Note Taking”. This used CHAT-GPT 4o (not a typo) to help produce detailed site notes including Whisper to describe the audio recordings and voice notes to text. The prototype platform then improved the grammar of the notes, embedded an acoustic calculator to adjust for background noise and finally automate the identification of sound events.

After coffee and cake the final session took place. This began with Finnur Pind (Icelandic) from Treble introducing, “Various Applications of AI related to Acoustic Simulations”. This focused on producing accurate simulated training data for the computer model. An example was to rent 500 Alexas in 500 rented Airbnbs to measure the room acoustics to train an AI model on room acoustics. Finnur presented a better/quicker/cheaper solution to use 10000 room acoustic simulations of possible room configurations to train the AI model. The final presentation was another double act, Professor Mark Plumbley and Dr Arshdeep Singh both from the University of Surrey gave a presentation on, “Efficient AI Model for Audio Classification”. The approach was Sound@home, Sound@Work, Sound@Tools produced as part of a sustainable AI project. These all require electrical power, so better optimisation is required to mitigate this issue. The memory and computational requirement of large AI model reduced by 50 percentage through data compression and efficient data pruning, therefore improving inference and reducing memory load on low-power devices such as Raspberry Pi.

A final discussion panel was held led by David Waddington with all afternoon presenters contributing to the debate, see Photo 3. This covered the sustainability of AI (electrical use), the potential for an AI to listen more careful than a human and how AI can help write reports or answer academic exam questions!

Throughout the conference there were a series of interactive questions and polls delivered through Mentimeter. This is a survey tool which through preprepared on screen QR codes allowed delegates with smartphones to participate. These questions were designed to gauge the background of the conference attendees, as well as their knowledge of and attitudes to AI.

The conference opened with the first question which asked how the attendees would 'best describe themselves', with 75% of those that responded indicating that they were acoustic consultants. The next two questions delved into the knowledge and use of AI for the participants, with 60% familiar with tools such as ChatGPT and 20% of the participants had studied machine learning (ML) or artificial intelligence (AI), and 10% self-confessed 'pros', that design ML/AI methods; with 32% using AI fairly often and around 8% using it daily, see Photo 4. To summarise the polls showed the majority of delegates don’t have much experience yet, but pockets of acousticians, especially in academia and recent graduates, that are already shilled in AI.

The participants were then asked to rank how they thought AI could most empower their work in acoustics, with data processing and analysis as the clear winner, followed by identifying noise sources, then drafting text and generating imagery. When asked about what excites them the most about AI, the participants listed many words related to efficiency,  creativity, opportunity, analysing data and automation. This was presented to the audience as a Wordcloud.

When asked how AI can collaborate with humans to enhance our expertise, listing a number of different options relating to automation, data, feedback, learning and collaboration, 60% of participants said 'all of the above'. When asked to rank the ethical considerations when using AI, the biggest concern was about the misuse of data, and when asked about the ideal balance between human expertise and AI, the balance was just leaning towards the use of AI. This indicates that people are more inclined to collaborate to ensure a safety focus and to tackle ethical concerns over misuse.

When asked how AI could be useful in your job, the participants suggested report writing, QA, timesheets, survey notes, pricing, identifying sounds, summarising meetings, prioritising tasks, processing data and verification. However, there is still a place for humans in acoustics, with participants indicating that we are still needed for listening, creativity, common sense, insight and intuition, understanding client's requirements, communication of ideas, human connection/compassion, some types of maths/coding, troubleshooting, personalisation, lateral thinking, surveys and "the sheer love of acoustics”!

The final question of the day asked how much investment the IOA/UKAN+ should make in research on the potential of AI in acoustics. only 9% said that it is a low priority, with all other participants saying that it is as important as other changes, if not the main priority. Overall, this demonstrates that even without much experience, people are interested in AI and see big benefits, primarily in data processing. It will be interesting to see how we can come together as an industry to move forward with AI.

The day ended as in normally does with drinks at the Student Bar and discussions into the night. These discussions can be summarised as let’s do this again next year! Many thanks go to Londo South Bank University for hosting the event, the London branch committee for organising the event and of course Linda for being Linda.

A person standing in front of a large screen

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Photo 1: Ed Elbourne and Andrea Felciuc of Arup presenting AI as a Paintbrush for pre-conceptualisation.



Photo 2: The morning discussion panel taking questions from the audience.

A group of people standing in front of a large screen

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Photo 3: The afternoon discussion panel taking questions from the audience.

![A screenshot of a computer

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Photo 4: A Mentimeter audience participation result based on 53 responses.