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Report on the International Medical Leaders Forum (IMELF)

Auckland - 21 March 2019

Table of Contents

Plenary 1: Overview of Artificial Intelligence (AI) globally.

Speaker: Associate Professor Federico Girosi
Associate Professor, Chief Scientist and Director of Education, Digital Health Cooperative Research Centre and Associate Professor at the Translational Health Research Institute, Western Sydney University, New South Wales, Australia.

IMELF Convenor: Professor Richard Doherty
Professor, Department of Paediatrics, Monash University Department of Infectious Diseases, Monash Children's Hospital.

Main topics

- What is AI?
- How does it work?
- Removing the mystery out of AI with examples.
- When does it work?
- What are the barriers to using AI in health?

Summary

The speaker provided an overview of AI from a global perspective, removing the mystery from AI by giving examples that demonstrate when it is effective. The presentation focused on machine learning simulating human behaviour, reasoning and learning from examples. One comparison was made with the process of language learning and extracting and applying rules. Machine learning operates based on similar inputs mapped to similar outputs, and the map between input and output is deduced from examples. Machine learning only knows about examples that have been seen before. The scope has to be well defined to ensure effective examples are reproduced. It requires a very large number of examples to be effective, and in some cases, there may not be enough information to solve the problem sufficiently well.

AI has been most successful with images and text. Machine learning performs well with large, multidimensional administrative/clinical data. Barriers to adoption include difficulty in accessing data (ethics/privacy/security), lack of guidance, understanding leadership expertise, and agreement on when a digital solution is "good enough".

Plenary 1: Questions and feedback from delegates

1. **How do you see AI playing a role in your practice? If yes, which problems would you like AI to solve for you?**

   Summary of responses from delegates

   Participants identified that for machine learning to be effective there is a need to integrate diverse data sets, such as images, demographics, statistics for risk prediction and tailored therapies, and collation of data for Multidisciplinary Team (MDT) meetings. They also indicated that machine learning has the potential to support recruitment processes, health workforce planning, and mass screening programs. Further problems that machine learning could help with are billing issues and understanding Private Health Insurance coverage.

2. **Which issues regarding privacy, security and ethics worry you the most when placing Artificial Intelligence (AI) in the doctor's office? Include both you and your patients in your considerations.**

   Summary of responses from delegates

   Participants raised concerns that responsibility for complications resulting from AI decisions could be unclear.

   Consent for data to be recorded and shared is a complex issue. Not all patients will be comfortable with their data being used, and this may be more prevalent depending on different clinical contexts and a patient's age. It will be difficult for ethics and privacy issues to keep pace with AI developments.

   How consent should be managed in the context of potential impact on insurance is a critical issue. Early identification of disease in particular, may affect insurance cover. These concerns could lead to some important information not being recorded.

   There could be risks to effective privacy controls and concerns on the scope of access to the data and whether individuals can be identified. Managing access and security will be challenging in the day to day practice from different locations.

   Some doctors may have more concerns than patients when using patient data. Patients may be happy for their data to be more readily shared and used if informed how it will benefit the development of AI to improve health outcomes. The participants raised an important question "Do patients need to be aware that AI has been used to support clinical decision making for them?".

   For AI to be used effectively there needs to be confidence in AI systems. The data provided for AI systems and potential for bias from the data being introduced into the AI system can be a significant problem that puts the success of AI at risk. The ethics and use of the AI systems needs to be carefully considered.

Plenary 2: Physician/Clinician applications of Artificial Intelligence (AI)

Speaker: Dr Jaron Chong
Assistant Professor, Department of Radiology, McGill University Montreal, Quebec, Canada.

Moderator: Dr Viren Naik
Director of Assessment, Royal College of Physicians and Surgeons of Canada.

Main topics

- Who needs to be involved in AI?
- Limitations or bias in data and the AI model.
- Development and use of algorithms – Learning from successes and failures.
- AI performance.
- Task replacement as opposed to job replacement.

Summary

The speaker explored the application and use of AI by physicians and clinicians as AI continues to develop. Clinicians should have informed knowledge and opinions on AI to understand its potential in a clinical setting. The data used in AI models can introduce bias. Differences in the target population and the dataset can cause failures through generalisation. The quality of the data used for AI will impact on the quality of the AI's application. Minor nuances in dataset design can falsely amplify the performance of AI. It should be recognised that there are hidden complexities in simple tasks for AI such as complications with developing algorithms that can distinguish images, colour and light. Creating an algorithm to perform one task requires the correct combination of algorithm, dataset, and computational power. The errors AI makes should be examined to learn more and to improve its application.

Examples of applying AI include:

- Screening to save eyesight using algorithms developed from more than 1.6 million retina images each evaluated by ophthalmologists.
- Google's AI algorithm that seeks to predict heart disease by looking at people's eyes.

The impact of AI on medical practitioners' roles should be considered in terms of task replacement rather than job replacement, to support changes in clinicians' practice for improved health outcomes rather than roles becoming obsolete.

Plenary 2: Questions and feedback from delegates

1. **Job loss: As Artificial Intelligence (AI) technologies improve what factors could contribute to job loss versus task replacement? How concerned should we be?**

   Summary of responses from delegates

   AI will enable provision of medicine to reach populations locally and globally that are currently under-serviced. Physicians/clinicians use of AI will be essential to keep their practice up to date.

   AI should enable underfunded and under-resourced services to be enhanced, and support planning processes. For example, radiation could be made possible without technologists, and AI may replace them. Societal impact is a broader problem. Eliminating and changing roles at various socio-economic levels becomes a societal problem.

   The number of tasks that can safely be replaced by AI will influence job loss or task substitution and changes to the scope of certain roles. AI developments are more likely to cause job losses for lower level health practitioners through relatively routine task replacement.

2. **Artificial Intelligence (AI) System funding: Who will/should be responsible for the financing and material support of future medical AI systems? (Who pays for AI?)**

   Summary of responses from delegates

   The state funded health services must have mechanisms for oversight since they also control funding. Specialist users should consult on evaluation and assessment before committing to the development and use of AI.

   The potential for financing from insurance companies would raise concerns on priorities. Financing, control and oversight are likely to be needed at different levels depending on which level AI is applied, such as population level, through a health service/hospital or at a clinical practice.

   Potentially funding could be left to the free market and those with the most potential for a return on their investment and risk mitigation would finance the development and operation of AI systems and technology. Some costs may be offset by what is paid for by patients. Those who are likely to benefit from AI systems and save money are most likely to want to invest in AI technology and pay for services provided by AI.

Plenary 3: Artificial Intelligence (AI) and the patient - Improving patient outcomes

Speaker: Kate Reid
Director of Digital Health Deloitte and Chair NZ Health IT (NZHIT).

Moderator: Adrian Cosenza
CEO, Australian Orthopaedic Association.

Main topics

- Value of AI to individuals' health and wellbeing.
- What does AI mean to the patient?
- The role of AI in improving patient experience.
- Outcome predictions.

Summary

The speaker asked, "What does AI mean to the patient?". AI technologies are changing the definition of the patient. Patient implies the person in front of the doctor that is sick that the doctor is treating. But that is changing. AI has the potential to restore the essential human element of medical practice by enabling machine support of tasks better suited to automation. This can free up time for doctors, nurses and other healthcare professionals to focus on providing real care for patients. The opportunity AI provides to impact on patient experience needs to be explored. It is not possible to predict what will be possible with AI in the future, but the impact of technological developments need to be considered in terms of the way healthcare services are delivered. With more real-time access to information, there is increased potential for the delivery of personalised healthcare and advice. Doctor will be able to look at prospective and real-time information, rather than relying on retrospective information to make decisions.

Key examples include:

- Virtual humans, digital consultation and coaching.
- Alexa Healthcare Assistant to support requests from patients and nurses that can be prioritised and resourced effectively.
- AiCure app to monitor a patient's medication use, using a smartphone webcam with AI to autonomously confirm patients are taking their medications and to help them manage their condition
- Wearable health trackers that can send alerts to the user to get more exercise and provide information that a patient can share with their doctor and AI systems to have additional data on their needs and habits.

AI is improving the prediction of health outcomes, for example for stroke patients and patients following surgery, helping to determine what type and level of care are likely to be needed.

Plenary 3: Questions and feedback from delegates

1. **Why is healthcare falling so far behind other industries in the adoption of digital technologies?**

   Summary of responses from delegates

   The healthcare sector is extremely risk averse and adopting digital technologies in healthcare can raise major security and privacy concerns. The potential to make money on the amount of resourcing required for the development of technologies is often questioned. People are fearful of changes to roles and job losses. They do not have information on what is possible and are not seeing early adopters of the technology. Data collection, uniformity and reporting can all be poorly managed. The community and public funders need to be convinced of the benefits of technologies being provided and the benefits of what they can provide for medical professionals and patients.

2. **Do you think that a virtual human could do a better job than a clinician and if so, where and when?**

   Summary of responses from delegates

   The use of virtual humans to provide medical advice needs to enable real-time decision support and requires the review of clinical guidelines to keep up to date with the services that can be provided.

   A virtual human may be better at screening for subtle radiological abnormalities, compared to interpretation by different doctors. A virtual human has more potential for gathering information and conducting triage rather than diagnosis. Potentially protocolised triaging, the analysis of data to explain risk and the analysis of evidence from literature can be conducted more effectively by a machine, saving time for the clinician to explain this information.

   AI could provide for augmented patient interviews that update comprehensive data reports on patients to allow more time for doctors to address the primary problem.

   Where the patient does not speak the same language, a virtual human could help support interaction with a two-way translation facility.

Plenary 4: Is Artificial Intelligence (AI) the key to unlocking the healthcare potential of genomics and big data?

Speaker: Professor David Thomas
NHMRC Principal Research Fellow, Director of the Kinghorn Cancer Centre, Head of the Cancer Division of the Garvan Institute, New South Wales, Australia.

Moderator: Adrian Cosenza
CEO, Australian Orthopaedic Association.

Main topics

- Genomics and the cancer landscape
- Genomics on an industrial scale
- Big data and cancer
- The human phenome
- Machine learning concept
- Genomics and personalised medicine

Summary

The sophistication of AI, its many applications, and its contribution to the medical field will increase over time. Genomic information can diagnose or clarify the risk of inheriting disease and help identify appropriate treatments. It can help predict how patients will respond to medicines, provide insights into how patients respond to infection and influence the patient's physical characteristics.

Genomics is reshaping the cancer landscape, as cancer is a genetic disease. As an example, paediatric osteosarcoma is characterised by multiple somatic chromosomal lesions, including structural variations (SVs). To define the landscape of somatic mutations in pediatric osteosarcoma, whole-genome sequencing of DNA is performed from 20 osteosarcoma tumor samples and matched to normal tissue in a discovery cohort, as well as 14 samples in a validation cohort.

The National Human Genome Research Institute has tracked the costs associated with DNA sequencing performed at the sequencing centers funded by the Institute. As an example, to illustrate the nature of the reductions in DNA sequencing costs, a graph was presented showing hypothetical data reflecting Moore's Law, which describes a long-term trend in the computer hardware industry that involves the doubling of 'compute power' every two years. Technology improvements that 'keep up' with Moore's Law are widely regarded to be doing exceedingly well, making it useful for comparison in the field of Genomics.

The use of the petascale supercomputers to handle big data in genomics research has allowed the highest performance in research and storage of data in the Southern Hemisphere. The speaker referred to the use of big data in cancer research citing examples including the International Cancer Genome Consortium, the 100,000 Genomics Projects undertaken by Genomics England, and the Cancer Genome Atlas Program (National Cancer Institute).

The development of a novel series of systems genetics tools to identify new links between genes and phenotypes are using cloud platforms to support the development of precision medicine. For example, the Medical Genome Reference Bank is a publicly-available repository of genotypes of approximately 2,570 healthy elderly Australians.

The speaker also referred to research by the Garvan Institute on 'Common variant burden in the wellderly' and 'Somatic variation and ageing' and cited further relevant projects including:

- Bio-marker has driven precision Oncology trials (Australian Genome Cancer Medicine)
- IBM Watson for Genomics that supports clinicians' provision of personalised care to cancer patients.

Plenary 4: Questions and feedback from delegates

1. **What is the balance between confidentiality and privacy, and the need to aggregate data for Artificial Intelligence (AI)?**

   Summary of responses from delegates

   Key considerations and risks depend on who is aggregating the data which potentially could be at Government level through not for profit or research organisations. It is important to consider the ultimate purpose of the data such as population level service planning or insurance premiums based on genomic risk profiles?

   It should not be assumed that patients do not want to share data. Many will readily share their data if they know it will benefit others and be for the greater good of society and the quality of healthcare. There is a growing awareness of the need to share data as part of collective social accountability given the difference it can make to the pace of development and quality of AI.

   Regulation and legalities need to be developed to keep pace with the development of AI to reach its potential for maximum benefit to the public interest.

   The use and benefits of AI can vary significantly in different contexts. For example, there is a big difference between patients who have few or no options compared to patients who are going to benefit from more routine diagnostic and therapeutic approaches.

2. **Is AI better than a clinician at diagnosis of cancer?**

   Summary of responses from delegates

   AI will increasingly improve but context, empathy, and care are human needs which only humans can provide. It is important to consider the purposes for which AI has the greatest potential and where human input cannot be effectively replaced by AI.

   Computers and AI can deal with big data with increasing sophistication, resulting in quality and benefits for healthcare and patient outcomes, leaving doctors to best engage

with patients even if there is a need to supplement some advice provided through AI enabled services such as by virtual humans.

Concluding remarks

Machine learning, Artificial Intelligence (AI) and genomics, have risen dramatically in the last decade.

How will all of this have an impact on the medical sector in general and on medical education and specialist medical training to keep pace with the developments in AI and machine learning?

The challenge for Medical Education Leaders is:

- What are we going to do differently in our daily practice?
- What are we going to do in our colleges to adapt?
- What are we going to do together as the Tri-nations alliance to respond effectively to these changes?

It is paramount to have a shared strategy that will be best achieved through the Alliance's meetings and related networking opportunities.