BY ERIK RANSCHAERT, PETER VAN OOIJEN, WIRO NIESSEN

EuSoMII: radiologists should actively engage in imaging informatics

Medical imaging informatics is a rapidly evolving field in radiology thanks to new technologies that have evolved at a dazzling pace over the past few years; in areas such as radiomics, machine learning, augmented and virtual reality, and 3D planning and printing. The European Society of Medical Imaging Informatics (EuSoMII) is convinced that radiologists' should be more actively engaged in these developments as they are vital to the future of radiology.

The EuSoMII Academy took place in Rotterdam on November 18, 2017.

Medical imaging informatics, also known as radiology informatics, is a subspecialty of biomedical informatics that aims to improve the efficiency, accuracy, usability and reliability of medical imaging services within the healthcare enterprise. As radiology is an inherently data-driven and technology-driven specialty, radiologists have become leaders in medical imaging informatics. The field of imaging informatics is not only rapidly expanding in radiology, other specialties such as cardiology, dermatology, neurology, pathology and ophthalmology are also increasingly using digitised images. As a result, imaging informatics is becoming a specialism-transcending discipline.

This development is demonstrated by the progressively ongoing shift in many hospitals towards the integration and use of imaging data throughout the health enterprise. Besides radiologists and other physicians, IT experts, clinical physicists, various industry players and vendors involved with medical imaging are actively participating in this rapidly expanding discipline. There is also a growing tendency to combine imaging data with data from other medical disciplines such as genetics and metabolomics, which has increased the number of stakeholders in this domain.

EuSoMII aims to stimulate consultation and the exchange of information between the various parties involved and to increase the active participation of radiologists in scientific research related to imaging informatics. This is reflected in the composition of the EuSoMII board, on which radiologists, computer scientists, and medical physicists from all over Europe and other parts of the world are represented.

The digitisation in radiology is increasing at a breath-taking speed, a fact that cannot be ignored. At the RSNA 2017 convention it became clear that a seismic shift is taking place in healthcare and that the age of artificial intelligence (AI) has begun. At many of the AI-related scientific sessions it was standing room only, and several refresher courses were filled to capacity. More than 100 researchers from around the world described the potential and applications of AI in a variety of clinical scenarios. At the industry exhibition there was a machine learning area where dozens of AI start-ups demonstrated their activities and some clinical use cases.

Likewise, the EuSoMII Academy on AI, which took place one week earlier at the Erasmus MC University Medical Center in Rotterdam, was fully booked. Approximately 50% of the participants were radiologists, and the rest were a mix of IT professionals, clinical physicists and industry representatives. This made it a unique meeting of radiologists and technological experts in the field.

Imaging is one of the most advanced areas of AI, and will undoubtedly have a huge impact on diagnostics and prognostics through revolutionising medical image acquisition, analysis and subsequent clinical decision support. Smart algorithms will improve image quality, enable more accurate and automated analysis of MRI, CT scans, x-rays and any other medical images, and be able to detect signs in the recordings that are not possible with the human eye[1]. Deep learning in particular has recently been shown to rival or outperform human performance in a number of tasks. Therefore, AI applications will increasingly be integrated into the daily radiological workflow, which means that it can be considered as one of the main game changers in radiology.

As well as automated image analysis, many other AI supported applications will emerge which are able to improve the value of radiology services, such as tools to intelligently minimise the radiation dose in CT, improve the radiological workflow, facilitate communication with referring doctors and patients, and link image-derived information with other data for integrated diagnostics.

The common thread throughout most presentations at the RSNA and EuSoMII Academy was that radiologists should not feel threatened by AI, but view it as a source of support, as long as they are eager to embrace these new developments, and are willing to actively coordinate and steer their clinical usability.

As Dr. Keith Dreyer, Vice Chairman of Radiology at Massachusetts General Hospital, stated at the RSNA: "Radiologists and AI will be far better together than either one alone." According to Dreyer the greatest challenge however lies in the creation of an AI ecosystem in which new applications can be created, validated, approved, integrated, surveyed and adopted. This ecosystem should be based on a framework in which radiologists and other healthcare professionals involved in imaging informatics and data-intensive domains in medicine are included, i.e. biomedical computer scientists, clinical physicists, healthcare institutions, professional organisations, industrial and pharmaceutical players and regulating authorities. Such an AI ecosystem should be able to support and facilitate the standardisation of the entire development process of AI software, from creation through to adoption. It should guarantee the optimal integration and added value of AI applications.

Imaging informatics is an interdisciplinary field enabling its practitioners to better understand and analyse medical images. If radiologists want to be actively involved and reap maximum benefit from developments in this field, they should also receive training in computer science and sub-fields of artificial intelligence and machine learning, similar to the training radiologists already receive in, for example, the physical principles of MRI. This will enable them to better understand the decision processes that are active in artificial intelligence, and to gain a better insight in what's going on in the 'black boxes' in which these automated choices and proposals are being made. To increase knowledge in medical imaging informatics, a specialised training programme should be developed and implemented to train radiologists in this area.

EuSoMII wants to increase awareness among radiologists of this on-going revolution in radiology and increase their engagement in these new developments in a multidisciplinary environment. To achieve this it will, for example, organise hands-on workshops in deep learning. Several webinars on the topic of imaging informatics will also be offered in 2018, and the programme will be available at eusomii.org. The EUSOMII annual meeting will take place in October 2018 in Rotterdam, where many research projects and new developments will be presented.

Erik Ranschaert, MD, PhD, is Radiology Consultant at ETZ Tilburg, the Netherlands, and Vice-President of the EuSoMII. Peter Van Ooijen, MSc, PhD, is Associate Professor at the University of Groningen, UMCG, Groningen, the Netherlands, and a EuSoMII Board Member. Wiro Niessen, MSc, PhD, is Professor of Biomedical Image Analysis at Erasmus MC in Rotterdam, the Netherlands, and a EuSoMII Board Member.

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BY YULIA SHEVCHUK

Medical imaging driving innovation

Medical imaging is among the most innovative fields in European healthcare. According to an analysis of data from the European Patent Office, medical imaging patents have constituted almost one third of patents in the field of medical technology over recent years.

"Imaging is no longer a pure diagnostic tool. New imaging techniques help us to predict diseases, to see biochemical changes and as a result to start treatment earlier," said ESR President Prof. Bernd Hamm.

Medical imaging is continually developing and every year brings us unique new clinical capabilities such as 3D imaging and printing, hybrid and molecular imaging, Computer Aided Detection (CAD), and tumour-specific biomolecules tagged with isotopes. All of these are dramatically increasing specificity and sensitivity of diagnostics and improving health outcomes for patients.

Information technology innovations in medical imaging make access to examinations quicker and mean they are available everywhere, thereby optimising collaboration between all specialists involved in the treatment of patients. Real-time visualisation helps to control interventional procedures or analyse the function of the organ. Machine learning will be the next step in medical imaging, and should help us to optimise workflow and improve quality of service.

Discoveries in medical imaging have changed healthcare systems, but there are many research projects still being conducted and maybe the most significant discoveries are yet to come.

BY GUY FRIJA

EuroSafe Imaging as role model for medical radiation protection initiatives worldwide

The EuroSafe Imaging campaign was launched by the European Society of Radiology (ESR) in 2014 to support and strengthen medical radiation protection across Europe using a holistic, inclusive approach. The ESR and the EuroSafe Imaging Steering Committee issued a Call for Action to better achieve the EuroSafe Imaging objectives: promoting appropriateness in radiological imaging, maintaining radiation doses within diagnostic reference levels, using the ALARA principle and promoting the use of up-to-date equipment, empowering patients, and joining forces with various stakeholders.

Photo taken during the IAEA International Conference on Radiation Protection in Medicine: Achieving Change in Practice (December 11–14, 2017, Vienna). From left to right: Monika Hierath, ESR EU/Int. Affairs Department, Renato Mendonca, ISR Treasurer, David Koff, CanadaSafe, Boudjema Mansouri, Arab Safe & AFROSAFE-FR, Dina Husseiny, Egypt, Guy Frija, EuroSafe Imaging, Donald Frush, Image Gently Alliance, Maria Perez, WHO, Michael Kawooya, AFROSAFE-EN, William Mayo-Smith, Image Wisely, Luis Donoso, ISR President-Elect, El Hadj Niang, Senegal.

In addition to EuroSafe Imaging's comprehensive activities to promote quality and safety in medical imaging in Europe, it is also committed to promoting radiation protection beyond Europe's borders. In particular, EuroSafe Imaging is supporting safe imaging initiatives worldwide and attending conferences and meeting all over the world to inform others about EuroSafe Imaging's activities and to inspire further action.

EuroSafe Imaging is represented at more than 50 events annually around the globe. Its representatives regularly attend meetings organised by the International Atomic Energy Agency (IAEA), the World Health Organization (WHO) and the Heads of European Radiological Protection Competent Authorities (HERCA).

EuroSafe Imaging also had a strong presence at various talks and poster sessions at the IAEA International Conference on Radiation Protection in Medicine: Achieving Change in Practice held in Vienna, Austria, in December 2017. Discussions at the conference confirmed for EuroSafe Imaging that their work is helping them achieve their objectives. However, EuroSafe Imaging concluded that still more training, more awareness and more effective implementation of regulations are needed worldwide to better protect patients and health professionals from undue radiation exposure related to medical imaging procedures.

The success of EuroSafe Imaging has inspired radiology societies in other regions to follow suit and establish campaigns to promote radiation protection. Due partly to EuroSafe Imaging's example, a number of campaigns have been launched in recent years.

The **AFROSAFE** campaign was launched at the Pan African Congress of Radiology and Imaging (PACOR1) in February 2015 in Nairobi, Kenya. The campaign consists of an English and a French branch and aims at raising awareness on the need for medical radiation protection to prevent unnecessary medical radiation exposure. The activities are primarily focused on providing education and raising awareness. Since its launch, Africa has made reasonable progress in implementing some areas of the Bonn Call for Action, despite limited resources.

In Canada, although the delivery of healthcare is a provincial responsibility, a focused national strategy and a unified effort are needed to ensure radiation safety in medical imaging. Thus, **Canada Safe Imaging** was launched in December 2015. The campaign is a multidisciplinary undertaking with the vision to strengthen medical radiation protection in patients and to foster a culture of radiation safety in Canadian healthcare. As a first step, an environmental survey of all national and provincial organisations in Canada that involve medical imaging was performed to identify if the organisations were following the Bonn Call for Action recommendations. The survey showed that no single organisation in Canada has implemented all of the recommendations of the Bonn Call for Action. Canada Safe Imaging now envisions another survey on the awareness and application of the principles of the Bonn Call for Action amongst Canadian healthcare professionals working with radiation equipment in medical imaging. Activities will be planned according to the results of both surveys.

LatinSafe was established in April 2016 with the aim to promote safe diagnostic imaging in Latin America, placing an emphasis on radiological protection of patients and staff. In particular, LatinSafe uses educational activities to raise awareness among radiologists, referrers, technicians, patients and the general public.

The **Japan Safe Radiology** initiative was launched in June 2016. It targets a variety of topics related to safety and efficiency of medical imaging including equipment/scanner distribution, radiation dose management, standardisation and optimisation of image quality and the radiology report, as well as appropriate use of imaging. The initiative aims to generate, analyse and use a national database of diagnostic imaging to improve medical techniques in terms of safety, standardisation and optimisation of image scanning, and to apply it to medical policy.

Arab Safe is the most recent safe imaging campaigned launched in May 2017. It consists of both an English and French branch. The initiative aims to impact the current diagnostic imaging practice, support self-regulation, increase awareness of radiation safety of patients, workers, and the general public, and promote a radiation safe culture. In particular, Arab Safe focuses on the establishment of diagnostic reference levels (DRLs), the organisation of radiation protection training courses for healthcare staff and the promotion of safe paediatric imaging.

Last but not least, the Image Gently Alliance and Image Wisely initiative need to be highlighted. The mission of the **Image Gently Alliance,** launched in 2007, is to improve safe and effective imaging care of children worldwide through advocacy. Recently, the Image Gently Alliance launched the 'Think A-Head' campaign to promote the justification and optimisation of CT imaging in minor paediatric head trauma. This campaign is targeted at a broad spectrum of healthcare professionals who care for children in the acute care setting, as well as patients and their families.

The American **Image Wisely** initiative launched in 2009 aims to raise awareness and provide up-to-date educational resources for radiology professionals and referring clinicians regarding the use of ionising radiation in adult medical imaging examinations. Building awareness through the initiative's annual pledge is one of the major aspects of the initiative.

The **International Society of Radiology Quality and Safety Alliance** (ISRQSA) acts as an umbrella organisation for these radiation protection initiatives. The overarching objective for the ISRQSA in the area of radiation safety is to establish a strategic plan for global efforts related to quality and safety. This strategic plan should reflect the efforts of these campaigns.

Prof. Guy Frija is Chair of the EuroSafe Imaging Steering Committee and Co-Chair of the new International Society of Radiology Quality and Safety Alliance.