Fighting constant stress in the OR with artificial intelligence

The use of artificial intelligence (AI) is becoming an essential element in many technological innovations. Travelling on a driverless local underground railway, using an online translation program, or talking to digital virtual assistants like Alexa and Siri – AI is already there in many aspects of our day-to-day life. Used properly, they can be of great value to us as humans. Numerous industries have already recognised the fact, and have established AI as a part of their products and workflows. For medicine, too, having AI in place creates previously unimagined opportunities. In the vision of a Smart Hospital of the future, the use of AI could not only make work much easier when it comes to registration formalities, but for diagnosis and in the OR, AI also has the potential to take the load off doctors, help them to achieve greater accuracy, and also save them valuable time.

The opportunities offered by AI and its implementation in medical technology systems are just one aspect of the many future-oriented subjects covered by the MedtecLIVE exhibition, being held at the Exhibition Centre Nuremberg from 21 to 23 May: "Innovations and developments by established businesses and start-ups alike will be premiered at the Innovation Market Place and the Novelty Stand at MedtecLIVE," says Alexander Stein, Director MedtecLIVE at NürnbergMesse. "All the players in the medical technology sector will have the opportunity to learn about the next generation of medical devices."

Artificial intelligence – taking the load off doctors

Doctors experiencing constant stress and a growing shortage of skilled medical employees – this is a problem that many hospitals and practices in Germany currently have to face. The use of artificial intelligence in medical practice has the potential to take the load off doctors in specific ways. The

attractive opportunities the new technologies offer will be there for visitors to MedtecLIVE, the international exhibition for the supply and manufacturing sector of medical technology, to experience for themselves: "MedtecLIVE is where developers and experts from all around the world gather to share ideas and work together to shape innovations," promises Stein.

A companion for the doctor

Siemens Healthineers, a global leader in medical technology, is working on ways to support doctors using AI. The shortage of skilled employees is just one reason AI is urgently needed: for example, the number of CT scans performed every year is rising by ten to twelve percent, while the number of radiologists, by comparison, is increasing by only three to four percent. This is why radiologists normally have only a few minutes to look closely at an image. One current problem that studies have revealed is that the rate of diagnostic errors increases with the speed of diagnosis, notes Jörg Aumüller, Head of Digitalizing Healthcare Marketing at Siemens Healthineers. "The AI-Rad Companion Chest CT, an AI-based application for computed tomography, is intended to help radiologists to interpret chest images faster and more accurately," says Aumüller, describing one of the approximately 40 applications from Siemens Healthineers that use AI. He does not believe that AI will ever fully replace physicians. Instead, it should be there to offer support as a kind of assistant. "That's why the word 'companion' is used in the product descriptions. In addition to the AI-Rad Companion, the AI-Pathway Companion rounds out the family of digital assistants. This enables physicians to standardise and speed up workflows in oncological procedures, for example. As an extension to precision medicine, AI helps physicians to make decisions as part of the clinical treatment process."

More than 40 AI-based applications are already integrated into products from Siemens Healthineers. A further example is the FAST 3D Camera used in the Somatom go CT scanners. "Based on AI and deep learning technologies, this camera enables patients to be isocentrically positioned, automatically and precisely," Aumüller explains. Studies suggest that there is room to improve patient positioning in more than 90 percent of clinical

images. Even minor differences in patient positioning can be important: "A difference of just a few centimetres from the ideal position can have a negative impact on x-ray dose and image quality." The Somatom go CT scanner is therefore equipped with a 3D infrared camera based on AI and deep learning technologies. "Right at the start of the diagnostic chain, this lets us reduce undesired deviations and avoid the potential need to repeat scans," Aumüller comments. Manufacturers of diagnostic imaging systems will be among those represented at MedtecLIVE in May this year.

Mixed Reality in the OR

The best possible accuracy is also a goal that apoQlar, a start-up established in 2017, would like to achieve with its Virtual Surgery Intelligence (VSI). The underlying idea is visionary: ensuring the right perspective in the OR – also in the figurative sense – using mixed reality. "The AI-based VSI software presents CT and MRI images in 3D, using HoloLens glasses from Microsoft, which the surgeon wears for the purpose. Because the virtual images are positioned directly above the patient, the physician can operate faster and with greater precision," explains Sirko Pelzl, CEO of apoQlar. For some operations, e.g. on epilepsy patients (FCD, focal cortical dysplasia), the surgeon cannot visually distinguish between diseased and healthy tissue in the exposed brain, but must rely on assistance from MRI images. Using VSI puts the relevant images right in front of the surgeon's eyes. "This can make a crucial difference to the workload in the OR, including significant time savings," Pelzl observes.

Optimising medication using gait analysis

"On average, a doctor sees a patient for 15 minutes, once every quarter," says Ralph Steidl, CEO of Portabiles Healthcare Technologies GmbH, established in Medical Valley Erlangen-Nuremberg in 2016. The co-founders of this young company are Professor Björn Eskofier, holder of the Chair of Machine Learning and Data Analysis at the University of Erlangen-Nuremberg, and Professor Jochen Klucken, neurologist and expert in Parkinson's Disease at Erlangen University Hospital and Medical Director of the Medical Valley Digital Health Application Centre. The company is developing a system for analysing the way patients walk, the Mobile GaitLab, which is designed to provide an objective measurement of how

effective treatment is for patients with mobility disorders, Parkinson's Syndrome in particular. Steidl notes that these patients experience major fluctuations in their ability to move: "Physicians therefore do not know what condition the patients are in when they are examined. A 'normal' analysis of gait, without AI, gives the physician the benefit of an objective and comprehensive image of the patient's motor condition." The measurement itself uses motion sensors integrated into a pair of shoes. The fact that the patients can wear these shoes all day as they go about their normal activities gives attending doctors the opportunity to stay completely up to date with their patients' mobility. "That means they can adapt their treatments to the patients' individual needs in good time." The intention now is to give further support to this innovation using AI. This provides a major opportunity in terms of establishing causality: "Although AI does not always permit a clear connection to be established between cause and effect, it can already be used to investigate connections between symptoms and the disease," comments Steidl. "In this way it can feed the development of 'traditional' mathematics-based algorithms that will make it easier to understand the results." It is already possible to calculate highly accurate gait parameters using Deep Learning algorithms. But AI can do still more: "By using artificial intelligence we want to draw on the patient's gait pattern to predict the course of the disease to a certain extent, and calculate, for example, the patient's individual risk of falling." This gives physicians the opportunity to adjust their treatments to their patients' individual requirements in good time.

Dr Marc Batschkus, who specialises in medical information processing and is a consultant in this area, can see the added value of AI in prognosis using sensors: "Small devices will be able to give chronic patients, in particular, a better indication of the course of their disease and the potential need for intervention. The focus is on the sensors more than on AI in this case. Even so, this data is used for large data collections and prognoses are formed on that basis." Many software and sensor technology suppliers will be on hand at MedtecLIVE in the Exhibition Centre Nuremberg to illustrate the way hardware and software work together to form the basis for the future implementation of AI.

Machine learning

Before AI can perform tasks of this nature at all, it first needs to be trained. "With machine learning, humans have to feed an algorithm with data," explains Dr Matthias Weidler, of ASTRUM IT, a service provider located in Medical Valley that offers both IT consulting and software engineering. Weidler explains that the AI has to be trained accordingly: "For example, the system is shown images of healthy and broken bones. The intention is to use the data to show the system what belongs to which class." He also considers it important for the data to be all-encompassing and of high quality.

The limits of AI

His colleague Dr Jan Paulus points out, however, that there are still a few limitations: "AI is still a long way from being able to further process rules by itself. It has no awareness, no creativity, and is not yet capable of identifying why something is the way it is." Weidler adds, "AI is also unable to classify anything on which it has not been trained. That's why a large corpus of training data is indispensable. "Collaborative arrangements between hospitals are essential if we are to achieve the required volume of training data," observes Aumüller. Siemens Healthineers relies on international cooperation in this regard: "This means that AI can be trained across multiple continents and cover a range of populations based on the data compiled in the process." Portabiles has also put a lot of work into training its AI system, which is still in the development stage: "We performed more than 2,000 clinically stratified gait analyses for this purpose, mainly on Parkinson's patients," reports Steidl. "That means we already have a large pool of data. And it will grow even further thanks to three clinical studies that are currently running."

In Europe, in particular, data collection involves comparatively more time and effort than in other countries such as China, a trail-blazer when it comes to AI, because of the stringent data-protection laws in place in Europe. International competition was one of the reasons why Germany's federal government passed its Artificial Intelligence Strategy on 15 November 2018. Its objective is to promote R&D into AI here in Germany and to bolster the country as an AI research location. The federal

government is aware of the problem posed by the great need for data for system training combined with limited access to that data, and this is something the Strategy aims to remedy: "To keep up with the potential provided by the data volumes available in other regions of the world, we need to think and act directly at an EU level. The European Science Cloud (EOSC) offers an initial starting point in this regard." Germany's government also perceives a potential solution in establishing "data partnerships": "There is great potential in sharing data and data pooling in industrial processes, where huge volumes of data are generated and analysed. The German government is reviewing the opportunities for maintaining mutual "data partnerships" between companies, for example by increasing the visibility of existing platforms like the International Data Space (IDS)." Whether the strategy is a success will become clear in the next few years – it will run until 2025. The federal government would like to invest about three billion euros during this time to implement it.

At this year's MedTech Summit, too, the programme will include data protection, secure transmission and Big Data applications. Machine learning and artificial intelligence are also among the key themes of this summit of experts in the medical technology sector, taking place as part of MedtecLIVE, in the Exhibition Centre Nuremberg from 21 to 23 May. Providing a focused discussion with new contacts to prepare the way for projects is the aim of the B2B Matchmaking Event "Partnering" at the MedTech Summit, which will provide the perfect setting to get to know each other and share ideas during pre-arranged discussion sessions.

Batschkus will also address another issue, the fact that just having a lot of data is not enough to achieve the desired result: "The term 'AI' and the methodology underlying it are inseparably linked with Big Data, since large volumes of data are essential for the creation and training of AI systems. But there are still many weak points in the methodology of Big Data, and we are jumping the gun with the idea that 'more data means more knowledge'. Sometimes this results in working without any theoretical approach, which means that errors and poor decisions in the development process are a foregone conclusion." In fact, a measure of expertise in AI training is a mandatory precondition: "Errors are often not made

maliciously, but happen simply because the necessary knowledge isn't there," Paulus observes. To remedy such cases, ASTRUM IT offers supporting advice, which is currently in greater demand than ever before: "Since last year, we have been offering consulting, training and planning activities specifically tailored to the subject of artificial intelligence in response to growing demand," says Weidler. "We are now there to assist with the entire development process."

Discussion and contacts

For planning, development and production of innovative technologies, collaboration between manufacturers, developers and consultants forms the ideal basis for turning promising ideas into reality together. And for the topical subject of artificial intelligence, an interdisciplinary approach and close-up discussion covering everything from regulations and data protection to hardware, software and the users appears to be a key success factor: "We want to network all disciplines at MedtecLIVE, so we can work together to shape these important themes for the future," notes Stein. "In Nuremberg, the unique mix of congress, exhibition and the B2B matchmaking event 'Partnering' offered by the MedTech Summit will help companies to create a foundation for further collaboration."

Press and media contact

Jens Fuderholz, TBN Public Relations
Leonie Hagen, Simon Kögel, NürnbergMesse GmbH
T +49 9 11 86 06-89 02
simon.koegel@nuernbergmesse.de

All press releases and more detailed information and photos are available from:
www.medteclive.com/news

Further services for journalists and media contacts:
www.medteclive.com/presse