Short Communication

Artificial Intelligence in Healthcare

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Artificial Intelligence as Future Technology and Driver of Innovation

Artificial intelligence will become very important for complex medical issues in the future. The term artificial intelligence emerged as a new research theory as early as 1955, when the computer scientist John McCarthy from the USA used the term "Artificial Intelligence" in a project application to the Rockefeller Foundation.

So far there is no universal definition of artificial intelligence. What is certain, however, is that it is a sub-area of computer science and that solutions to problems should be found with powerful data sets. Like human intelligence, which can grasp complex ideas, learn from mistakes, develop new concepts, and solve problems, these abilities are transferred to computer-based programs and are known as artificial intelligence. With the help of computing power, an artificial intelligence is generated to simulate and imitate important functions of the human brain, such as perception, understanding, action and learning. The performance of artificial intelligence is directly dependent on computing power. A quantum computer can develop an artificial intelligence much better than a conventional performance computer. Like human intelligence, which is evaluated using intelligence quotients, artificial intelligence requires gradations that depend on the computers used. This realization led to a distinction being made in applied research between weak and strong artificial intelligence. Software programs with weak artificial intelligence can effectively improve individual problem solutions in automation and to support specific human actions or activities. Regarding the strong artificial intelligence, research is still underway. It should be able to solve general problems just as well or even better than a human being. It has not yet been proven whether this will succeed. So far, artificial intelligence has been directly dependent on people's programming skills and the computing technology used. Artificial intelligence as a future technology and driver of innovation demands that ethical principles and guidelines be observed. The ethics guidelines of the European Union name four ethical principles and seven core requirements. These include respect for human autonomy, damage prevention, fairness and explainability (cf. European Union, Independent High-Level Expert Group on Artificial Intelligence, 2019, p.14).

Practical Use of Artificial Intelligence in Healthcare

A high quality of care in the healthcare sector can only be guaranteed in the future if applications based on artificial intelligence are used. As a requirement for quality assurance, software based on artificial intelligence must meet the requirements for high-quality and tested medical devices. This is necessary to ensure desired medical and nursing outcomes and to prevent treatment harm. In the technically highly developed countries, various possible uses of applications with artificial intelligence are already being tested in medical and nursing practice. This applies to systems for diagnosing and treating cancer patients. In pathology, systems are used that check tissue samples from colonoscopies and provide treatment recommendations. A chatbot as a text-based dialogue system uses intelligent artificial intelligence to answer questions about the symptoms of patients. In nursing, there are pilot projects for the use of intelligent and adaptive robots. When researching new medicines, new active ingredients for medicines are reliably generated with the help of algorithms. In the future, more and more areas of medicine and care will be able to use artificial intelligence to diagnose and treat diseases. A large database is required to be able to use the various systems in healthcare based on artificial intelligence. However, this is not a problem, as structured and unstructured data has always been determined in hospitals, hospitals or other healthcare companies and documented in a wide variety of forms and formats. While in the past all data and findings were recorded in writing, there are now large digital databases in a wide variety of databases in the healthcare sector. As a rule, a data

warehouse is available as a topic-oriented, integrated, time-related and permanent collection of information to support management's decision-making.

As early as 1993, William H. Immon defined the data warehouse as follows: "A data warehouse is a subject-oriented, integrated, timevarying, non-volatile collection of data that is used primarily in organizational decision making". (Inmon, William H.: 1993, Building the Data Warehouse, Wiley John + Sons, New York.) When data is transferred to the data warehouse, it is standardized despite the great heterogeneity of the data sources. A consistent, unchangeable database is generated that cannot be changed and can only be used for reading. Cloud solutions can be used for storage. However, the storage of the recorded medical data is not standardized. Above all, the general anamnesis and examination results, the laboratory values, the electrocardiograms, or the operation documentation are stored. This also includes the vital signs of patients such as blood pressure and pulse, blood sugar or diet and exercise habits. Likewise, the digital recordings from imaging processes in medicine such as sonography, computer tomography or magnetic resonance imaging are stored in databases and can be called up if required. In order to use all data collected by doctors, hospitals, rehabilitation facilities or other healthcare companies in the future for the development of efficient medical systems with the help of artificial intelligence, it must be stored in a standardized and anonymous way. From this, a virtual network of health data can be developed. In this context, big data technologies as so-called mass data are gaining in importance. Big data are particularly large, weakly structured data volumes that are not static but complex. Therefore, big data is used for many digital technologies and communication processes. In healthcare, big data is increasingly enabling comprehensive data analysis to improve medical treatment and care processes.

There is a direct connection between data warehouse, business intelligence and big data. Business intelligence uses suitable software solutions to analyze the data stored in the data warehouse and converts it into action-oriented knowledge. This process runs in three phases. In the first phase, the quantitative and qualitative basic data are made available for the analysis in a structured or unstructured form. In the second phase, relative connections, patterns or discontinuities are recorded. Business intelligence programs provide sophisticated systems based on artificial intelligence. The third phase uses the knowledge gained for far-reaching medical and nursing decisions. The information obtained from the business intelligence can be actively transmitted to individual users or medical treatment and care teams with a publishing function using a content management system. In this way, this information can be used effectively and efficiently. With a subscription function, interesting content of any kind can be regularly transmitted to a specified group of recipients using web pages. The content can be text documents or multi-media documents. The operation by the users is relatively easy, since the software usually has a graphical user interface.

The change in the provision of medical and nursing care services for patients that is taking place with digitization in the healthcare system requires new strategies in the healthcare sector. Modern medicine is becoming increasingly complex. Willingness to innovate and flexibility, competition, product differentiation and segmentation for the benefit of patients are increasingly expected of healthcare companies. The day-to-day work of doctors and nurses will be heavily influenced by artificial intelligence in the near future. This does not mean, however, that they are controlled by intelligent computers or other machines that are absolutely alien. Smartphone users are familiar with the self-learning systems of these devices, which can be unlocked with facial recognition or biometric fingerprints. Using artificial intelligence and defined algorithms, the technology remembers which services are used often and offers them immediately when opened. When using artificial intelligence in healthcare, particular attention must be paid to ethical requirements. Therefore, the sensitive data histories based on artificial intelligence must be programmed in such a way that they meet all ethical requirements and cannot be manipulated. Harmful effects of artificial intelligence on people and the environment must be consistently ruled out. For the artificial intelligence to remain controllable and manageable for the doctors and nurses in the healthcare companies, the algorithms in the computer programs must be programmed in such a way that they identify risks and inadequacies in the healthcare system in good time. Artificial intelligence will not fully dominate or completely replace humans in the future either. Striving for effectiveness and efficiency as well as an optimal cost-benefit ratio for medical and nursing services will increase the demands on those responsible in the healthcare system. Many future digital developments in healthcare companies are currently difficult to predict. Nevertheless, it is necessary to think about tomorrow's future today and to deal with the seemingly unknown.