Pediatric Research and Child Health

EDITORIAL

Artificial intelligence and Robotics in pediatrics

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Editorial

Artificial intelligence advances and applications have developed fast in the past decade, and the transformative changes enabled by AI in many areas of society as well as in science are well under way. These provide exciting opportunities to enhance lives and to address some of the major challenges that the world is facing. This conference will focus on areas where AI is making a large impact (or is expected to make it in the near future), such as digital medicine and collaborative robotics. It will be an opportunity to discuss how to make best use of the transformative technologies enabled by AI while taking into account concerns regarding security, fairness and other ethical issues.

Artificial intelligence (AI, E artificial intelligence, AI) is a branch of computer science that deals with the investigation of mechanisms of intelligent human behaviour (intelligence). This is done by simulation with the help of artificial artifacts, usually computer programs on a calculating machine (computer simulation; see additional info 1). The term "artificial intelligence" was invented by the American computer scientist John McCarthy (*1927). He used it in the title of a project proposal for a conference lasting several weeks, which took place in 1956 at Dartmonth College in the USA. At this event programs were presented which played chess and checkers, proved theorems and interpreted texts.For some years now, robotics has also been discovering the service sector. Whereas in the past only machines were built by experts for experts, today we want to develop "social" and "emotional" robots for everyday use. They should function as toys, therapeutic aids, assistants, entertainment objects or love objects. Parallel to the increasing sales figures for toy robots such as Aibo or Pino and the discussion about care robots, the importance of human-robot interaction (human-robot interaction) as a field of research is increasing [1]. In research, which is also called social robotics, attention is primarily focused on the users of the new service technologies. The aim is to develop friendly machines that, as reliable and credible interaction partners, communicate naturally with people, learn from them and ideally even develop their own approach to the world. The origins and current significance of human-robot interaction are connected with a small evolution in the development of autonomer systems. In the early days of classical artificial intelligence as well as in robotics, the focus of research was for a long time on algorithms, on calculations, planning and processing of symbolen. It was not until the eighties that "interaction" increasingly became a leading metaphor in the technical design of information systems. Robotics experts such as Rodney Brooks from the AI Lab of the US-American Massachusetts Institute of Technology (MIT), Luc Steels from Sony in Paris or Rolf Pfeifer from the AI Lab of the ETH Zurich rang in a trend reversal towards behavior-based approaches in the mid-1980s. Under the motto "Fast, cheap and out of control" (Brooks), they developed autonomous and embodied systems that were no longer to operate only in the toy worlds of the laboratories, but in the real physical environment.

Empirical Definition

The general definition of AI suffers from the fact that the terms "intelligence" and "intelligent human behaviour" themselves are not yet very well defined and understood. On the other hand, AI is also a tool for empirically testing theories of intelligence. The execution of programs on computers is an empirical experiment. In contrast to other areas of computer science, artificial intelligence is an empirical discipline. This kind of definition of AI raises further questions, above all it leads to the paradox of a science whose main goal is to define itself. In 1950, the British mathematician A.M. Turing (1912-1954) wrote the essay "Computing Machinery and Intelligence", which was decisive for the AI. He poses the question of how to determine whether a program is intelligent. He defines intelligence as "the reaction of an intelligent being to the questions posed to it". This behavior can be determined by a test, the Turing test, which is now well known. A test person communicates via a computer terminal with two invisible partners, a program and a human being. If the test person cannot distinguish between a person and a program during this communication, the program is called intelligent. The questions asked can come from any area, but if the area is restricted, it is called a restricted Turing test. A restricted area could be e.g. medical diagnosis or playing

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chess. This definition of intelligence bypasses questions that are difficult to answer: Do programs even use a suitable form of representation? Are intelligent programs aware of their actions (consciousness)? Can intelligent behaviour only be produced by living organisms? - This empirical way of defining intelligence has far-reaching consequences for the development of AI, especially the separation of architecture from hardware. One criticism of the Turing test, however, is that perception remains unconsidered. Intelligent behavior can be formed by different methods. Most researchers, who write programs to imitate intelligent behavior after the Turing test, hardly concentrate on perception, but rather on symbolic knowledge representation, which is supposed to describe the environment.

Social Robotics

Social robotics deals with (semi-)autonomous machines that interact and communicate with people in accordance with social rules and that are sometimes humanoid or anthropomorphic and mobile. In this context, some experts only accept physically existing robots, others also virtually implemented bots. Social robots often feign feelings and are also referred to as "emotional and social robotics". If machines are to be capable of making morally adequate decisions, machine ethics is called for. Social robotics with its roots in the 1940s and 1950s and a boom since about 1990 is a branch of robotics that deals with (semi-)autonomous machines that interact and communicate with people in accordance with social rules and are sometimes humanoid or anthropomorphic and mobile. In this context, some experts only apply physically existing robots, others also virtually implemented agents or bots. Social robots often feign feelings, and one also speaks of "emotional robotics" and "social-emotional robotics". If machines are to be capable of making morally adequate decisions, machine ethics is called for. The machines produced by social robotics are socially compatible in their actions and statements and thus fulfil everyday expectations or satisfy fundamental needs. They try to avoid both physical and psychological injuries and the suffering of people in general. This includes not touching people as hard as (insensitive) things, helping and supporting them as much as possible and not insulting and insulting them. New systems are being developed to draw rules and cases for their decisions, as well as new technologies such as artificial skin and combined sensors. As moral machines that are the subject of machine ethics, they distinguish between good and bad (speech) acts. Generally accepted rights and obligations such as human rights or pragmatic models, such as those based on the user's views, take a back seat. Social robotics plays an important role in the development of cyber-physical systems (CPS). In CPS, information and software technology are connected with mechanical or electronic components, whereby data exchange and, to some extent, control and monitoring are carried out in real time via an infrastructure such as the Internet. The main components are mobile and mobile machines, embedded systems and interconnected objects (Internet of Things). Thus social robotics is also of importance for industry 4.0, which is characterized by the individualization or hybridization of products and the integration of customers and business partners into business processes, whereby automation and new forms of human-machine communication or interaction, not least through the use of social robots, are of importance. In industry 4.0, the aim is to achieve greater autonomy in machine operation as well as closer (yet conflict-free) interaction between man and machine. Animals can also be considered in social robotics (and machine ethics). In this case, the machines try to promote the welfare of all living beings by means of social conventions (or moral convictions). A direct relation to the animal is also possible, such as avoiding its suffering for its own sake, whereby the concept of the social should be questioned here. This is also necessary when machines interact and communicate with other machines (machine-machine communication). A fundamental discussion in social robotics is also a fundamental discussion in artificial intelligence (AI). Finally, the concept of weak AI has dominated. It is primarily concerned with the simulation of intelligent behaviour and the representation of individual aspects of human intelligence. However, practical needs have now been added in which abilities are in demand that one would have previously rather assigned to the strong AI, which - since its beginnings in the 1950s - wants to reach machines thinking in the true sense and thus their consciousness and feelings, and which in essential aspects are more intelligent.

Artificial robotics in childcare

In Japan, old and sick people are already being cared for by robots. Researchers are now working on making these artificial helpers available for childcare. The renowned learning researcher Elsbeth Stern recommends robots as language trainers. The renowned learning researcher Elsbeth Stern from ETH Zurich believes that the use of robots in kindergartens and day-care centres makes sense. On Deutschlandradio Kultur, she said that robots were a good idea, for example as language trainers. In the end, a robot is nothing more than a computer, "just a little more flexible," said the learning researcher. With a robot one can certainly correct deficits in the linguistic field. It is clear that robots cannot replace social ties, Stern continued. But a stuffed animal cannot do that either. It is not necessary to be afraid of social disturbances if the robot is used "in moderation", she emphasized: "It must always be clear that this is temporary and that the children also have the possibility of real social interaction.

Example of social robotic in childcare: Pepper

More and more industries are using the humanoid robot Pepper as a rolling contact for information - be it at airports, in banks or in sushi restaurants. According to the Japanese manufacturer Softbank Robotics, Pepper is the world's first humanoid robot that can perceive the emotions of its counterpart and react to the situation in question. It is also believed to have great potential for widespread use in nursing care or clinics - intensive experiments are already being carried out here in Japan. For patients and those in need of care, it offers entertainment and information, but also support in cognitive training. Basic functions such as movement and simple communication are already included in the Pepper social robot. However, depending on the purpose Pepper is to perform in concrete terms, additional software will have to be developed and installed. Companies such as the Berlin-based software service provider BoS&S have specialised in applications in the field of nursing care. BoS&S buys Pepper robots from Softbank and equips them with the appropriate programs that, in combination with the BoS&S care software, are designed to simplify administrative processes in care facilities. If health care facilities decide to purchase Pepper, they don't have to do much to get it up and running successfully. BoS&S will also install and support Pepper. Since the beginning of the year, Charité has been using BoS&S Pepper on the Virchow campus of Charité as part of a project. At regular intervals, he provides entertainment and encouragement for the patients, some of whom are severely weakened, in the paediatric oncology department and the pediatric accident surgery ward. Especially for the young patients on the accident surgery ward, Pepper is a highlight that not only entertains them for a few hours, but also makes their stay in hospital much more pleasant. In addition to the ability to have informal conversations, Pepper also has the ability to play. Thanks to his quiz and quiz games, he not only makes patients' time on the ward more entertaining, but also more entertaining. In addition to the ability to play multimedia content, Pepper can also have simple conversations with patients, which ultimately facilitates the work of nurses. Pepper is particularly useful for training the memory and cognitive abilities of older patients, who not only need to be challenged regularly, but also need to be patient. For example, patients suffering from Alzheimer's disease may repeatedly ask the same question, and it takes a long time for the nursing staff to answer it. Pepper can take on such concerns and thus significantly relieve the burden on nursing staff. Pepper is also particularly well suited to passing on information and adopting documentary processes. By connecting to a software interface, such as that offered by BoS&S, Pepper can, for example, manage the medication plan and remind patients to take their medication. Pepper's purchase price is comparable to that of a mid-range car. This can be reasonably achieved thanks to various financing models for care facilities, but there are other obstacles to a broader introduction into the German market. Health insurance companies have not yet reimbursed nursing robots such as Pepper. In contrast, the Federal Ministry of Education and Research (BMBF) has recognised the potential of nursing robots and is currently funding pilot projects in this area with a volume of around ten million euros. For nursing staff, the relief of physical activities such as lifting patients or gripping movements is one of the greatest challenges in their daily work, which not only requires a lot of strength but also a lot of time. In contrast to other robots, Pepper is not yet able to provide any relief here, so that clinics and nursing homes generally rely more on mechanical systems with which obese patients can be lifted more easily. So far, Pepper's hands have only been designed for stabilization and gesticulation.

In conclusion, social robotics are the future in daily pediatric childcare. Due to the immense costs of producing social robotics for childcare interacting in a productive way with younger and older children is a challenge for robot technology.

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