

WE HAVE TO LEARN HOW TO DEAL WITH ARTIFICIAL INTELLIGENCE

An interview with Professor Frank Kirchner

For companies in all industries, artificial intelligence is becoming a key driver of competition. In this interview, Professor Frank Kirchner explains what it can and cannot do and where the challenges lie when implementing AI applications. Kirchner studied computer science and neurosciences and has been exploring how AI can be used in the real world for 25 years.

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Question: You once said that you came to artificial intelligence through music. How did that happen?

Kirchner: *I've always liked making music. (Kirchner plays guitar and piano.) When I started studying, I wasn't in a band at first and tried playing along with drum computers and synthesizers. What bothered me was that the rhythms from the computer were very sterile back then. When a human being plays the drums, there are always slight delays because the player gets emotionally involved. It is barely perceptible, but it has a huge impact on the music. So I started trying to teach my computer to vary the precision slightly at certain points in songs. In the end, I didn't succeed; it just sounded sterile in a different way. It was only later that I realized that this was an AI problem, but the exercise of programming taught me how creative computer science can be.*

Question: How intelligent is AI in reality and where are its limits?

Kirchner: *It's not yet possible to develop AI that acts like a human drummer or guitarist, perceiving or even producing emotional states and then adapting their playing accordingly. But with today's methods, we can mimic human emotions or playing styles by giving the algorithms thousands of examples. This works not only with music, but also with painting. You can train machine learning algorithms to reproduce pictures in the style of certain painters.*

Question: What aspects of AI are you currently working on at the Robotics Innovation Center?

Kirchner: *We are developing robotic systems with AI algorithms for various fields of application, ranging from exoskeletons for the rehabilitation of stroke patients to autonomous underwater robots for inspecting offshore wind turbines, production robots that can be deployed alongside human workers in tomorrow's production facilities and space applications. For example, we are currently building robotic systems for the European Space Agency that will autonomously map the lunar surface to detect cavities in the lava layers that can be used to build a lunar base.*

Question: What fields of application do you see as deriving the greatest potential benefit from AI?

Kirchner: *I see a massive benefit in the field of medicine, which is currently facing enormous pressure as a result of the coronavirus pandemic. In particular, machine learning processes could support human diagnosis or relieve hard-pressed medical staff of routine tasks that can be done by AI-based robots. In agriculture, which has a huge problem with the lack of seasonal workers, AI could automate the picking of strawberries or asparagus. Simple automation technology cannot cope with these jobs because each plant grows differently. You need machines with a certain amount of intelligence to recognize the context.*

Question: Did you deliberately not mention the field of production automation?

Kirchner: *Of course, that's also a field of application in which AI-based robotics plays an important role. For example, we are working with VW on hybrid teams of humans and robots to get away from the traditional production lines with "dumb" robots that always do the same thing. The aim is to create robotic systems that can be deployed flexibly and act as assistants to humans, even if they are only positioning workpieces, thus relieving them of heavy manual work.*





Question: In which industries is AI currently used most intensively?

Kirchner: In Germany, as in other countries, it has been in use for some time – and very intensively – in the financial sector. AI methods are used in office automation for text, voice and image recognition or in the security sector, e.g. at airports, although this is not always apparent. They are becoming increasingly widespread in medicine and have also made their mark in production in the context of Industry 4.0. The networking of machines using AI algorithms provides the basis for increasing productivity. We are working with VW on hybrid teams of humans and robots to get away from the traditional production lines with “dumb” robots that always do the same thing. The aim is to create robotic systems that can be deployed flexibly and act as assistants to humans, even if they are only positioning workpieces, thus relieving them of heavy manual work.

Question: What are the difficulties in implementing industrial AI applications?

Kirchner: I think one of the greatest bottlenecks is the lack of digital infrastructure. Alarmingly, a large proportion of German companies are still living in the analog world. The infrastructure for collecting data from production, logistics, administration and even management is not particularly well developed. We have some catching up to do in this area. Although many German SMEs and smaller companies have begun to wake up to the

problem, they don't know where to start with digitalization, as the rest of the infrastructure in Germany is not a great deal of help. We've been talking about the nationwide rollout of fiber broadband for 20 years, and nothing has happened. This is a real competitive disadvantage. To get away from the traditional production lines with “dumb” robots that always do the same thing. The aim is to create robotic systems that can be deployed flexibly and act as assistants to humans, even if they are only positioning workpieces, thus relieving them of heavy manual work.

Question: What opportunities does AI offer SMEs in particular?

Kirchner: I see massive potential there, which absolutely has to be exploited if SMEs want to remain successful. Because ultimately, they also are global players and their development, production and logistics have to be very fast and cost-effective to survive in the global market. And they have to be able to react quickly to varying market situations. The problem lies primarily with small companies, which often lack their own research capabilities. Our experts support them in the development of AI-based solutions in fields ranging from the automotive sector to mining – something that distinguishes us from other research institutes.

Question: You worked in Boston for several years. Are people more open to AI there?

Kirchner: In the USA, but also in China, people recognize the benefits of AI, whereas in Europe we tend to emphasize the risks. Leaving aside which is the better approach, it is vital that we Europeans be at the forefront of AI development. Only by playing with the big boys can we influence how it is developed and, above all, how it is used. Otherwise we will become dependent, with all the negative consequences that we are seeing in the pandemic. We need greater digital sovereignty.

Question: What are the challenges currently being faced in AI research?

Kirchner: One of the challenges lies in integrating the various AI methods. On the one hand, there is the area of symbolic AI in traditional, logic-based methods. These have weaknesses when it comes to physical phenomena in the real world. In such areas, sub-symbolic AI methods such as machine learning, neural networks and so on work very well. Then there is a third area that I call physical AI, i.e. the embedding of all these methods in robots or other objects of the physical world. The challenge is to integrate these three areas to form a hybrid overall system. At the same time, this forms a basis to allow AI decisions to be explained and become transparent, which is important if people are to trust the technology.

Question: Is it true that self-learning systems are trained with historical data and make decisions that are often not comprehensible?

Kirchner: *That's correct. On the one hand, we must provide the computer scientists who train these algorithms with the appropriate skills. They need a very high level of knowledge about the data they are using, where it comes from and how it was obtained. These data skills must be firmly anchored in the computer science curricula. The second issue is that the AI algorithms, for example when evaluating MRI scans, must also give the doctor an explanation as to why they have identified a carcinoma. Only then does the doctor have a basis for accepting the decision. It is precisely this kind of transparency that we have to incorporate.*

Question: Do we need something like ethical rules for the use of AI?

Kirchner: *Yes, of course. But we have to develop them on the basis of the ethical values that we already have and which apply to all technologies. I don't see that AI raises new ethical issues and I don't see any way in which this could be incorporated in the technology. It primarily concerns people.*

Prof. Kirchner, thank you very much for the interview.
(The interview was conducted by Michael Wendenburg)



Professor Frank Kirchner

has headed up the Robotics Group in the Faculty of Mathematics and Computer Science at the University of Bremen since 2002. He is also spokesperson for the German Research Center for Artificial Intelligence (DFKI) in Bremen and is in charge of the Robotics Innovation Center research department. Kirchner studied and obtained his doctorate in Bonn. He worked as a researcher for several years at the Northeastern University in Boston (USA) and took charge of establishing the Brazilian Institute of Robotics in Salvador de Bahia, which was founded in 2013 and was modeled on the DFKI. Kirchner is one of the leading experts in the field of AI-based robotics and has more than 350 publications on robotics and AI to his name.