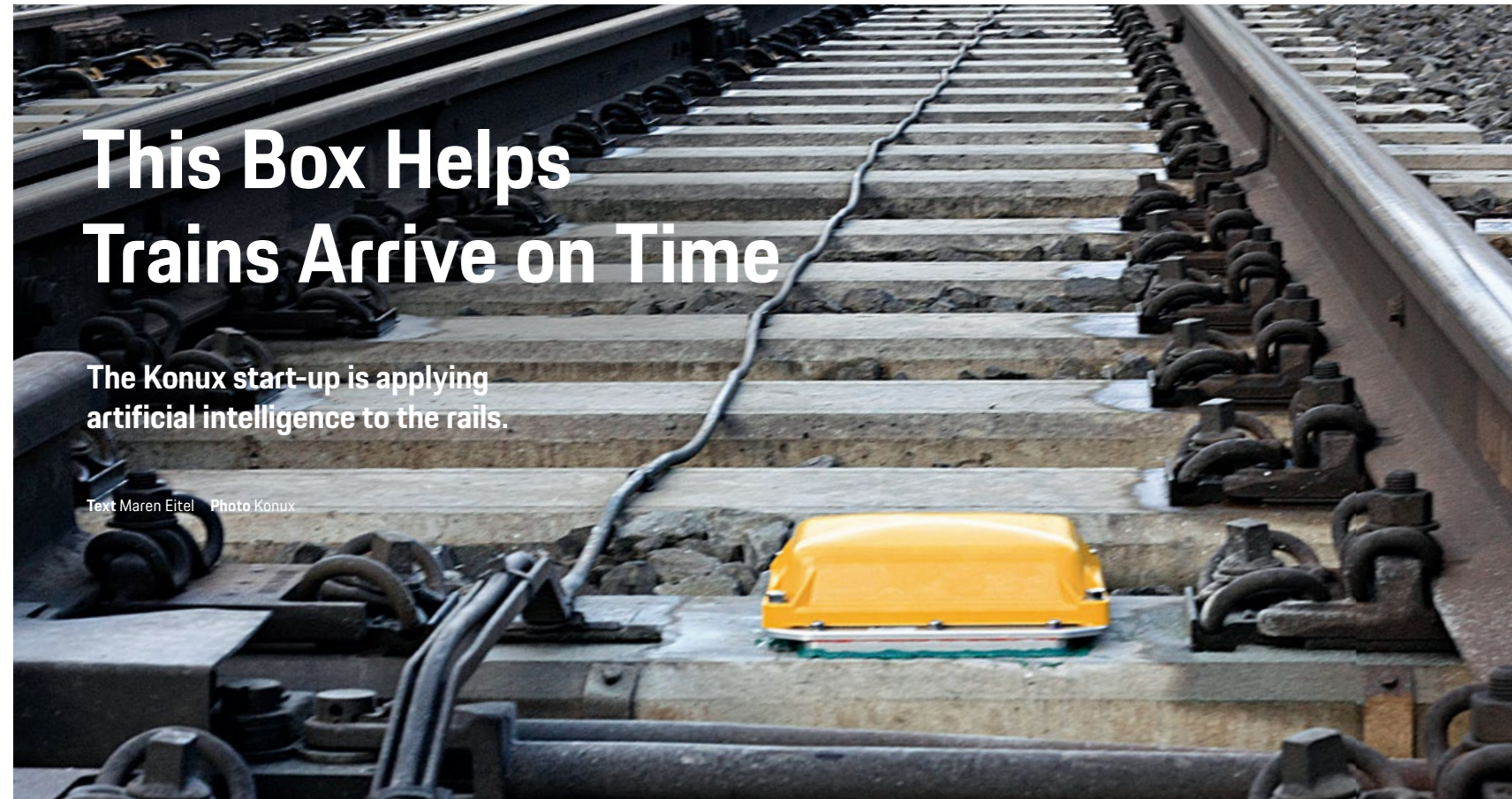


This Box Helps Trains Arrive on Time

The Konux start-up is applying artificial intelligence to the rails.

Text Maren Eitel Photo Konux



Germany has the largest train network in Europe, with more than 20,500 miles of track. That is three times as long as the country's freeway system, yet parts of it are also three times as old. Maintaining the network is not an easy job. Nor an inexpensive one. Deutsche Bahn AG, a federally owned company, is investing around \$10.8 billion in 2018 to renew and modernize its tracks and stations, as well as to expand and build new facilities. The network's approximately 67,000 switch points are particularly critical in ensuring smooth operations. They enable trains to maneuver easily on multi-track stretches, such as at railroad crossings, around construction sites, or when passing slower trains. If a switch point breaks down, this affects numerous timetables at once. When trains come to an unscheduled halt, often it is due to a problem with a switch point. To help solve this situation, Deutsche Bahn is now using artificial intelligence.

The requisite technology comes from Konux, a Munich-based start-up founded in 2014. Thanks to cutting-edge sensor systems and data analyses that use machine learning, the company is extending the service lives of rail systems. For Deutsche Bahn, that also means improving on-time arrival rates. Konux's development is being used on high-speed routes throughout Germany—between the cities of Frankfurt am Main and Mannheim, for instance. If the ties sink into the track bed or if unusual vibrations indicate increased wear, technical personnel are automatically notified with a specific recommendation for when they should do maintenance.

Using sensors to monitor industrial systems is nothing terribly new. Rail companies have been measuring temperature and electrical power levels on a widespread basis for years now, especially at

switch points. What makes Konux's development so innovative is the use of algorithms to compare these data with the "digital footprints" of intact switch points. This makes it possible to identify deviations early on and report them to a platform. The high-performance sensors can register up to 216,000 data points in just 15 seconds. These data points are grouped in intelligent ways and processed right in the boxes before being transmitted wirelessly to a processor. The analyses then draw on additional data. "The new technical possibilities are breathtaking," says Andreas Kunze, founder and CEO of Konux. "Our systems are learning to recognize patterns in the data. That gives our customers a comprehensive picture of the state of their facilities."

Konux's idea has been well received. Since its founding, the company has received around \$38 million from leading investors worldwide and has built up a team of more than 30 employees. Its supporters include UnternehmerTUM, a start-up hub and innovation center at the Technical University of Munich (TUM). "Konux is one of the few really successful German start-ups in the field of artificial intelligence," says Dr. Helmut Schönenberger, CEO of UnternehmerTUM. "We need a lot more if we want to play a major role in this important future-oriented sector." The "appliedAI" initiative is expected to help. Together with Porsche Consulting and other established companies, start-ups, and researchers, UnternehmerTUM is seeking to develop concrete industrial applications for artificial intelligence.

Interview with Professor Emeritus
Dr. Klaus Mainzer, Technical University of Munich

How computers learn



How would you explain artificial intelligence?

Klaus Mainzer: There are different degrees of intelligence, such as those of people and animals. If a system can solve problems largely independently and efficiently, it is intelligent. In artificial intelligence, this job is done by computer programs. In order for a program to find solutions on its own that are not predetermined, it needs the ability to learn.

How does a computer learn?

Machine learning is based on algorithms that simulate the synapses between nerve cells in the brain. They enable the system to recognize similarities among data—for example, to identify different pictures that contain images of a cat. Constant feedback enables the system to improve its performance, so it becomes faster and more accurate. When systems become more efficient at solving problems, this is known as "deep learning," which is analogous to neural networks in the human neocortex. The neural layers there deepen in connection with increased learning.

Can artificial intelligence surpass human intelligence?

It will certainly change the world of work. Intelligent systems will be taking over repetitive tasks in the near future because they are more efficient. But new jobs will arise—especially ones where creativity and versatility are needed. Moreover, jobs that require social skills and empathy will not soon be replaced by algorithms.

Will computers always be emotionless?

There are programs that beat humans in poker games. In poker the players do not have a complete picture of the situation, and they disguise their intentions and try to mislead the other players. But what the algorithms do is solve the problem with mathematical calculations. They run through millions of possibilities and thereby minimize incorrect decisions. Companies also often need to make decisions without a complete picture of the situation. Algorithms can support the process of finding answers to complex questions. But they cannot replace gut feelings.

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