

The humans at the heart of AI

The Technical University of Munich (TUM) is ahead of the game when it comes to **AI AND ROBOTICS**. And that includes the societal side as much as the technological.

“AI and robotics development pull us right into the heart of what it is to be human,” says Sami Haddadin, founding director of the Munich School of Robotics and Machine Intelligence (MSRM) at TUM. “We’re not looking to usher in an ‘age of automatons’. Rather, we hope to enable a smooth transition to an age of human-machine interaction.”

MSRM’s research agenda covers the understanding of humans in order to develop intelligent machines that can, in turn, help humans. Haddadin

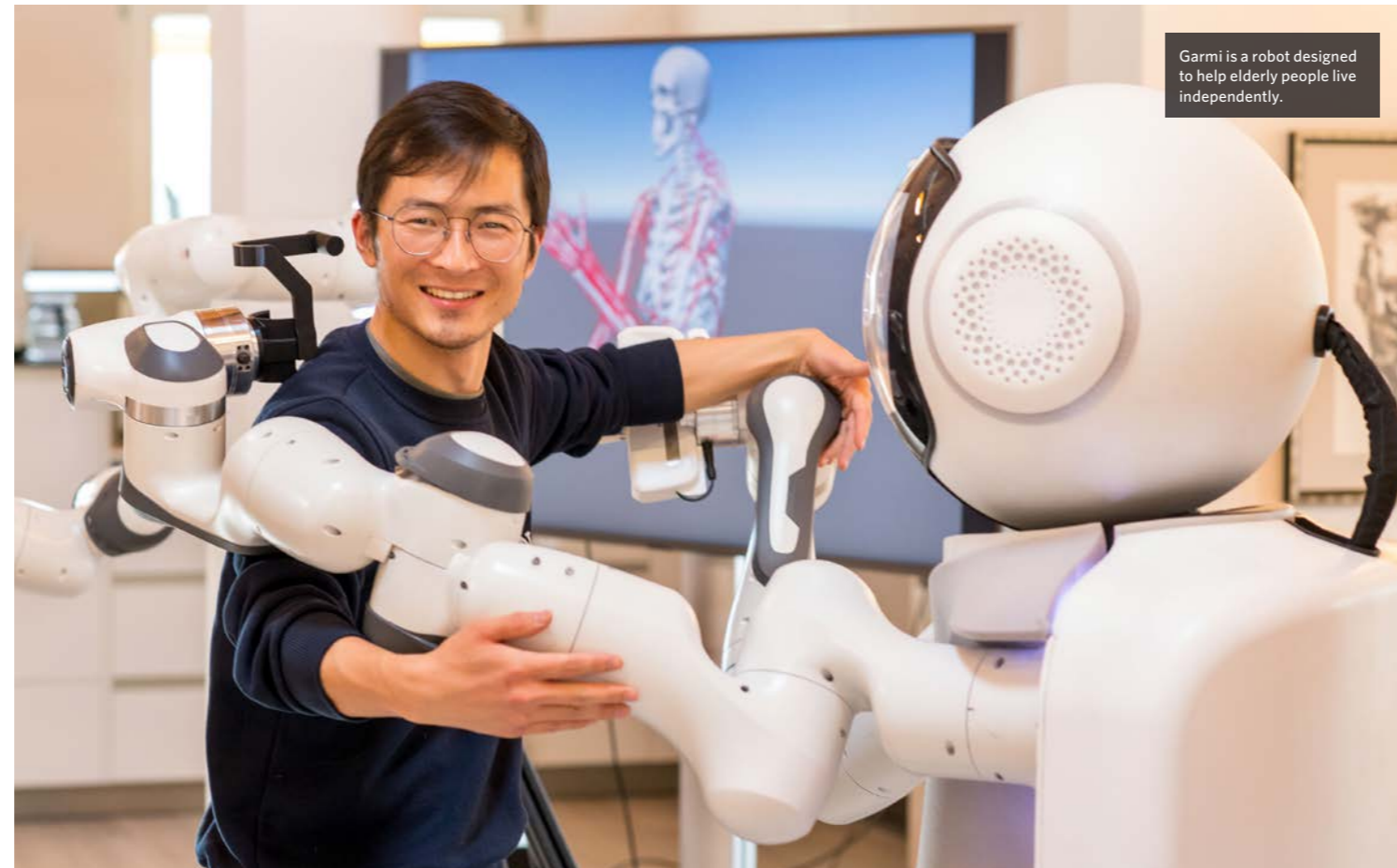
“AI WILL GIVE MEDICAL PROFESSIONALS MORE TIME TO FOCUS ON PATIENTS”
DANIEL RÜCKERT

gives an example: give a young child a key and, within around 20 tries, they can unlock a door. A child’s intuitive ability to manipulate a tool is one aspect, but they also watch and

learn from adults. Humans are born with this ability to transfer knowledge, but robots are not. It could take several million trials for a robot to use a key.

“We don’t have time to wait for a single robot to insert a key into a keyhole, let alone learn how to turn it,” says Haddadin. “But we can connect AI robots so they can share what their algorithms have learned while trying. Basically, we run a robot kindergarten here at TUM.” MSRM is one of TUM’s Integrative Research Centers, bringing together researchers from various fields, from computer sciences to natural sciences, from medicine to social sciences. “We are not just doing engineering, but we are creating a new discipline,” says Haddadin. TUM pursues an “embedded ethics approach” integrating ethics throughout the whole technology development process.

This applies not least to technologies intended for everyday life. The robot called Garmi was designed through consultations with elderly people and caregivers to help



Garmi is a robot designed to help elderly people live independently.

the elderly to continue living independently. Garmi can do general tasks, collect medical data, help with rehabilitation exercises, and act as an avatar for communication with doctors and family members. “Garmi will learn from, and teach, the other robots in its network, so each robot can quickly adapt to an individual’s needs,” says Haddadin.

In its AI research, TUM focuses on two fields. While MSRM concentrates on embodied AI, the recently founded Munich Data Science Institute (MDSI) has a data-centric perspective. On the one hand, it investigates the basic mathematical, informatics and algorithmic questions of

data analysis and develops new fundamental theories and methods, especially for machine learning. On the other hand, the MDSI will develop applications in the different research fields of TUM, including quantum technology, climate science, aerospace and genome research.

Daniel Rückert, professor for artificial intelligence in healthcare and medicine, is one of the MDSI members. His lab is within TUM’s university hospital, allowing his team to collaborate directly with doctors and radiologists. “That was one of the reasons why I returned to Germany after 20 years in the UK,” says Rückert, who until a few months ago worked at

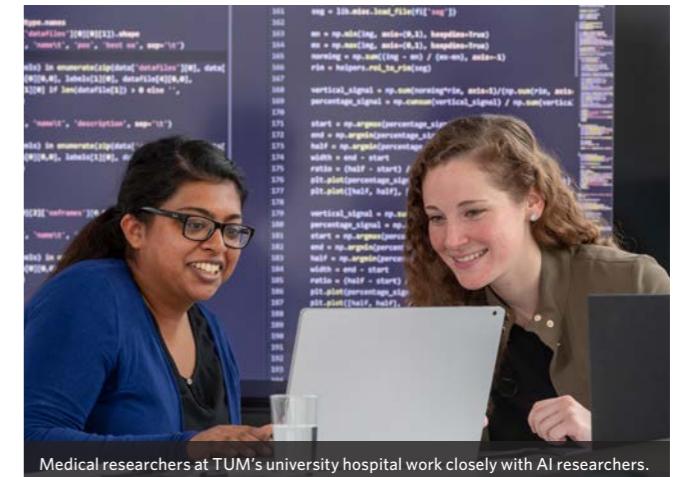
Imperial College London.

Rückert and his team are working on using AI to generate medical images more efficiently and to facilitate their interpretation. Currently, they are developing a ‘smart’ MRI scanner that can detect whether it has generated enough information to make a comprehensive diagnosis. The technology could also compensate for movement, to improve scanning of active young children, for example, and even fetuses.

Rückert believes that AI will ultimately make health-care more humane, not less. “By taking on the routine, time-consuming tasks inherent in data acquisition, image

reconstruction and analysis, AI will give medical professionals more time to focus on patients.” And because it can leverage the power of big data in its analyses, AI can pick up on rare phenomena that the human eye might miss.

“TUM is strong in both foundational and applied AI,” says Rückert. Recent research successes highlight the university’s broad range of disciplines. With machine learning methods, a research team has succeeded in making the mass analysis of proteins significantly faster than before and almost error-free. Another team has developed algorithms for autonomous vehicles that prevent accidents by predicting



Medical researchers at TUM’s university hospital work closely with AI researchers.



Sami Haddadin runs a ‘robot kindergarten’ where intelligent machines learn from each other.

different variants of a traffic situation every millisecond.

The university, together with other scientific institutions, global companies and start-ups, has emerged as one of the most outstanding research ecosystems worldwide. Munich was recently heralded by the European Commission as the best ICT hub in Europe. TUM, in particular, is driving many innovations. “One of our key strengths is the translation of research into useful technologies via strong partnerships with industry,” says Sami Haddadin.

Now, with funding from the regional government of Bavaria, TUM is further boosting AI research and will

create some 20 professorships in the coming months alone.

“We welcome inquisitive, adventurous researchers from diverse disciplines to join us. Look at Leonardo DaVinci, who combined his imaginative, artistic flair with mathematical and scientific concepts to design beautiful machines,” says Haddadin. “This kind of multidisciplinary creativity is at the heart of TUM.” ■