Interview mit Giulio Sandini

Giulio Sandini is research director for robotics, brain and cognitive science at the Italian Institute of Technology and full professor of bioengineering at the University of Genoa. After his graduation in Electronic Engineering at the University of Genova in 1976 he was research fellow and assistant professor at the Scuola Normale Superiore in Pisa until 1984. He has been visiting research associate at the department of neurology of the Harvard Medical School in Boston. After his return to Genova in 1984 as associate professor, in 1990 he founded the Laboratory for Integrated Advanced Robotics. Giulio Sandini's research activities are in the fields of Biological and Artificial Vision, Computational and Cognitive Neuroscience and Robotics with the objective of understanding the neural mechanisms of human sensory-motor coordination and cognitive development from a biological and an artificial perspective.

KI: What sparked your interest in humanoid robots?

The main reason for studying humanoid robots is that we are interested in understanding some aspects of human intelligence. At the same time, we think that it is possible to advance technology in the areas of sensors, actuators, machine learning, and adaptation. The latter two technologies are still missing in most robots.

We want to understand human intelligence

KI: What are humanoid robots good for?

In my view, there are two streams of applications. The first, traditional, one is the most obvious, which is to help people in houses, offices, and factories to carry out tasks that are unpleasant, dangerous, or too expensive to be carried out by other means. The other stream is most interesting in the short and medium term. This is the application of humanoid technologies, like adaptation, machine learning, and human-machine interfaces to other areas. For example, Bill Gates said one and a half years ago that if someone would solve the machine leaning problem, he would become richer than himself. Machines from camcorders to cars to factories are still lacking our ability to learn from experience.

KI: You mentioned service tasks, but there are simpler service robots, like vacuum cleaners. Why is it necessary for certain applications to have a humanoid body?

For specific tasks there are certainly much cheaper and more efficient solutions. The humanoid shape becomes important when one considers the robot as a helper that works together with humans. Together they might carry out a given task, for example fixing a car or cooking. Having a humanoid body with hands makes it possible for the robot to use the same tools as the human. The robot might also express the same gestures and by doing so communicates with the human in a natural way.

KI: In the European RobotCub project you developed iCub, a child-like humanoid with dextrous hands. How important are hands and manipulation for a humanoid?

We started the design of the iCub from the hands, because we wanted to build a humanoid able to perform dextrous manipulation, because this is essential if you want to have a machine able to use tools and also because having hands and using tools is one of the key stimuli to develop intelligence. Manipulation skills are found in many animals, which are considered to be intelligent.

KI: Humanoid robots are very complex machines. What are the major technical challenges in their development?

One can divide the challenges in two streams: One stream is what we could call the mind. The intelligence, the learning ability, the recognition, and the understanding of actions, are in my view the biggest challenges, because in these areas we are still far from being able to achieve something similar to humans. On the other side, there are technological challenges related to the body of the system. There, the main challenges are related to the ability for the robot to measure accurately the parameters of its own body, like the tension of the tendons, the force exerted with the arm, and touch. The other challenge for the future is related to materials. Today, our robots are made of hard materials, like steal and aluminium, while biological systems are made of soft elastic materials. These characteristics, which I think are an important ingredient of human intelligence, are still missing in our humanoids.

KI: Is it a good idea to be inspired by the biological model, I mean the human, to solve these challenges?

Do not copy without understanding

Inspiration from biology is important, but one must understand the principle behind. One of the dangers in this field is to start copying things without understanding what there is behind. This would be only a technological exercise, but does not lead to advancement of knowledge. What we are trying to do is to replicate the biological aspects that we feel are relevant. For example, as I was saying, I think that if we want to develop intelligence, we need dextrous hands, which are more capable than simple grippers or the trunk of an elephant.

KI: I would like to talk also about the economic aspects of robotics research. What is your major source of funding?