

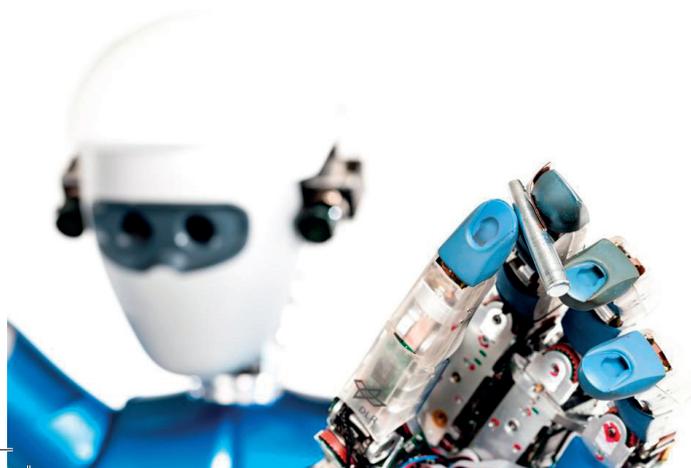


Overview

- Joint torque sensing
- Human-like dimensions
- Anthropomorphic structure
- Fully integrated electronics
- Modular design
- Suitable for highly dynamic tasks and fine manipulation
- Wireless operation

Specifications

- Degrees of freedom
2 x 7 (arms) + 2 x 12 (hands) + 2 (head) + 8 (platform)
- Weight 45 kg (upper body) + 150 kg (platform)
- Whole body control 1 kHz
- Stereo cameras
- RGB-D camera
- Tactile skin
2 mm resolution on hands
1–5 cm resolution on body
- Computing resources
onboard: 4 x Intel Xeon Quadcore
external: GPGPU cloud (16 x Kepler)



Agile Justin_English_09/2016

DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international co-operative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 16 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Goettingen, Hamburg, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.



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Agile Justin

Advanced Humanoid
Robot for Research in
Autonomous Learning



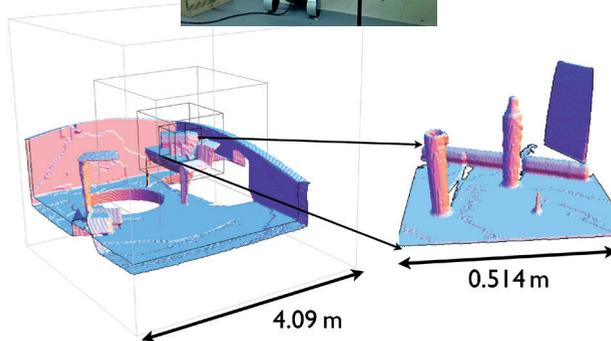


Autonomous learning robots

We investigate learning as the core principle in perception, modelling and action in autonomous systems, which operate in complex and perpetually changing environments. Such an endeavour can only be pursued with a research platform like Agile Justin, one of the worldwide most advanced humanoid robots with sensorial and motor skills coming close to human performance.

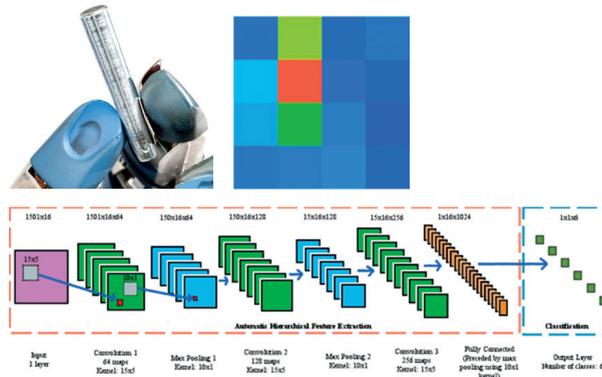
Learning Visual 3D models

A prerequisite for autonomous operation in previously unknown environment is a 3D model of it. Agile Justin learns with high precision (2 mm) about the environment's geometry by processing the depth information from its head-mounted RGB-D on an external GPGPU cluster.



Deep learning for tactile material classification

For safe autonomous interaction with the environment, Agile Justin's whole body is covered with a highly sensitive tactile skin (spatial resolution 1 to 5 cm). For learning dexterous manipulation skills, the tactile skin on the finger tips with its high spatial (2 mm) and temporal resolution (750 Hz) comes already close to human performance. Using deep learning, the robot can, for instance, classify different materials by simply touching them.



Learning to move and manipulate

The demanding task of planning whole-body motion and manipulation can be significantly sped up by using pre-knowledge. By interacting with the environment, the robot learns such low-dimensional, abstract representation – like a human baby does when playing in the world.



Application scenarios

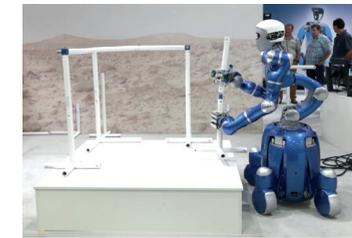
Ball catching

Catching flying balls is not easy. A tight interplay of fast perception, realtime whole-body motion planning and precise execution is needed.



Mars habitat

Building a complex structure from simple components in an unstructured environment is a challenging testbed for autonomous manipulation and self-adaption.



Elderly care

The personal assistant for the elderly has to execute everyday household tasks autonomously and robustly.

