



Universität Karlsruhe (TH)
Forschungsuniversität • gegründet 1825



Fakultät für Informatik



Workshop

Benchmarking in Humanoid Robotics

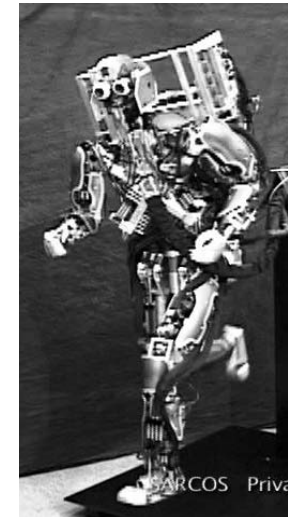
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How to benchmarking humanoid robots?

- How to compare results of different approaches?
- How to assess the quality of the research?
- reported results are tested by:
 - solving a limited set of specific examples
 - on different types of scenarios
 - in “sun-shine” environments
 - using different underlying software libraries
 - incompatible problem representations
 - implemented by different people
 - using different hardware (computers, sensors, arms, hands/grippers..)
 - ...





Benchmarking humanoid robots?

Definition of clear and reproducible evaluation performance metrics and benchmarking procedures in terms of methodology and test data sets, which are both

- representative for the different aspects of a specific robotic task and
- have the chance to be accepted by a wide community.



Obvious Topics

- Benchmarking Natural Human-Humanoid Interaction
- Benchmarking Motion Planning
- Benchmarking Object and Action Recognition
- Benchmarking Grasping and Dexterous Manipulation
- Benchmarking Middleware Standard
- Benchmarking Humanoid System Integration
- Benchmarking Learning for Humanoid robots



Competitions and Benchmarks

ROBOCUP SOCCER

- International research and education initiative
- Promote robotics and AI research,
- Goal of the RoboCup Initiative is:

By mid-21st century, a team of fully autonomous humanoid robot soccer players shall win the soccer game, complying with the official rule of the FIFA, against the winner of the most recent World Cup.

- RoboCup Simulation League
- Small Size Robot League
- Middle Size Robot League
- Four-Legged Robot League
- Humanoid League



Competitions and Benchmarks

ROBOCUP RESCUE

- RoboCup Rescue Simulation League:
 - open resource of research results
 - single robot level and the multi-agent system level
- RoboCup Rescue Robot League
 - mechatronics for advanced locomotion
 - perception and planning
 - full autonomy.
- Evaluation in special test settings (NIST rescue arenas)



Competitions and Benchmarks

FIRA

- Federation of International Robot-soccer Association
- Idea: Prof. Jong-Hwan Kim, KAIST,
- first international championship was held at KAIST, Daejeon, Korea in 1996.
- FIRA was established on June 5, 1997 during the micro-robot soccer tournament (MiroSot'97) held at KAIST in Daejeon, Korea.



Competitions and Benchmarks

ROBOCUP@HOME

- RoboCup@Home is a new league inside the RoboCup competitions that focuses on *real-world applications* and *human-machine interaction* with *autonomous robots*. The aim is to foster the development of useful robotic applications that can assist humans in everyday life.
- Tests should:
 - include human machine interaction
 - be socially relevant
 - be application directed/oriented
 - be scientifically challenging
 - be easy to set up and low in costs
 - be simple and have self-explaining rules
 - be interesting to watch
 - take a small amount of time



Competitions and Benchmarks

ROBOCUP JUNIOR

- Introduction to the field of robotics,
- develop technical abilities through experience with electronics, hardware and software
- Promote project-oriented, team-based education, giving children with a variety of interests and abilities an opportunity



Competitions and Benchmarks

DARPA Grand Challenge

- DARPA Grand Challenge is a field test that requires autonomous robotic ground vehicles to successfully navigate a course of approximately 200 miles
- terrain is cleared of nonparticipating vehicles.
- Competitors' entries must be unmanned, autonomous ground vehicles, and cannot be remotely driven.



Competitions and Benchmarks

- **ROBOCUP SOCCER**
- **ROBOCUP RESCUE**
- **FIRA** (Federation of International Robot-soccer Association)
ROBOCUP@HOME
- **ROBOCUP JUNIOR**
- **DARPA GRAND CHALLENGE**



Program (1)

- **Bechmarking Humanoid Robots: Scenarios, Tools and Metrics**
Tamim Asfour, and Rüdiger Dillmann
University of Karlsruhe, Karlsruhe, Germany
- **Benchmarking in humanoid motion planning**
Kensuke Harada, Eiichi Yoshida, and Kazuhito Yokoi
Humanoid Research Group, Intelligent Systems Research
Institute National Institute of Advanced Industrial Science
and Technology (AIST)
- **Benchmarking Integrative Humanoid Systems.**
Gordon Cheng, NiCT (National Institute of Information and
Communications Technology)
ATR International, Kyoto, Japan



Program (2)

- **Benchmarking of Dexterous Manipulation and Assembly Tasks**
Robert Platt
NASA, USA
- **Integration and standardization: experience in open-source development**
Giorgio Metta
Italian Institute of Technology & University of Genova
- **Evaluation of perception and dialogue components of a human-friendly robot**
Rainer Stiefelhagen, and Alex Waibel
University of Karlsruhe, Germany
- **On Benchmarking Benchmarking**
Christian Goerick
Honda Research Institute Europe GmbH



Presentations

Presentations will be available on-line on the workshop homepage