

# *Why benchmarking and standardization are important*

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# Outline

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## *Challenge 2: Cognitive Systems and Robotics FP7-ICT Call 6 Questions & Answers\**

- © Q: Why is benchmarking important?
- © A: Benchmarking allows to **objectively evaluate** key system properties, depending on the particular R&D issues and application scenarios addressed. Each project is therefore expected to use reliable criteria for **assessing progress**, to make them **public** and, if possible, **compare** and contrast them with criteria proposed by other research groups.

\*downloadable on <http://www.cognitivesystems.eu>

# Robotics Benchmarking and Standardisation: EU-funded effort

- **EUropean RObotics research Network (EURON)**  
<http://www.euron.org/>
  - Benchmarking Initiative <http://www.euron.org/activities/benchmarks/>
  - Research Roadmap <http://www.euron.org/activities/roadmap.html/>
- **Strategic Research Agenda (CARE) -  
EUropean RObotics Platform (EUROP)**
- <http://www.robotics-platform.eu>
  - benchmarking and standardisation identified as a key requirement
- **Robot Standards and Reference Architectures (RoSta)**  
<http://www.robot-standards.eu/> <http://www.robot-standards.org/>
  - “promote common measures and definitions, measurability and comparability, and integrability, portability and reusability of robotics and automation technology”
  - Action Plan for “benchmarking for mobile manipulation and service robots”
- **Robotics Advancement through Web-publishing of Sensorial and Elaborated Extensive Data Sets (RAWSEEDS)**  
<http://www.rawseeds.org>
  - Benchmarking toolkit for SLAM (data sets, benchmarks problems and solutions)

# Benchmarking and Standardisation: An illustration in ongoing projects

- **DEXterous and autonomous dual-arm/hand robotic manipulation with SMART sensory-motor skills: A bridge from natural to artificial cognition (DEXMART)** <http://www.dexmart.eu/>
  - Definition of benchmarks and metrics suitable for performance evaluation of one and two armed/handed systems
- **Skin-Based Technologies and Capabilities for Safe, Autonomous and Interactive Robots (ROBOSKIN)** <http://www.roboskin.eu>
  - Human-robot interactions tasks evaluated using a variety of established qualitative and quantitative evaluation methods: analysis of video data, analysis of touch-sensor data, questionnaires, etc
- **Smart Eyes: Attending and Recognizing Instances of Salient Events (SEARISE)** <http://www.searise.eu>
  - Performance evaluation of components against the existing approaches (common public image data bases, comparison with human operator)
- **Robot control for Skilled ExecuTion of Tasks in natural interaction with humans, based on Autonomy, cumulative knowledge and learning (ROSETTA)** <http://www.fp7rosetta.org/>
  - Assembly as challenging application and a good benchmark to measure the success of the project when comparing with the flexibility, speed and accuracy of a human worker.
- **Best Practice in Robotics (BRICS)** <http://www.best-of-robotics.org/>
  - Harmonisation, Robot Software libraries and benchmarking for robotics

# *Why Benchmarking and Standardization?*

- © To measure performance of systems
- © To test and evaluate in a reproducible way
- © To allow comparison of research results

## USEFUL FOR

- © Scientific community: to focus efforts, to exchange results, to drive research and allow tangible progress
- © Industrial community: to assess quality, to meet users needs, to speed up development and testing time

## *Open questions*

- How to evaluate a complex system?
- How to decompose into components or sub-components?
- How to define suitable metrics?
- How to reproduce an experiment?
- How to impose benchmarking as a scientific recognised valuable activity?
- How to benefit from standards without preventing innovation?

## *The EURON effort on benchmarking (2008 ...)*

### © Research Benchmarks deliverable DR2.7 (2008)

Exhaustive lists and inventory of

- Benchmarking and Metrics Workshops
- Robotics competitions and challenges
- Benchmarks initiatives (inside/outside EU)

### © Special Interest Group on Good Experiment Methodology

#### © GEM guidelines (2008)

*towards “high quality reporting of replicable experimental work”*

#### © Point of contact / room for discussion and collaboration



## *The RoSta survey (2009)*

- Technologies to benchmark: navigation, grasping, reliability (degree of failure), autonomy, specific tasks involving various technologies (scenarios)
- Beneficial standards: non-profit, clear specifications, allow comparability of systems and components
- Contributors: academic researchers, industrial world, end-users
- Benchmarking culture: centralised certifying body, mandatory scientific activity

## *What next?*

- EU-funded research is an asset to gather efforts, define metrics and develop benchmarks
- Standardization will help
- Open-source technologies are a starting point
- Think global, not local: your project results will benefit the whole community
- How to impose a benchmarking culture?



## *At a EU level*

As a EU-funded project, you have a RESPONSIBILITY

- © Share your knowledge
- © Help building a better science, a more competitive European industry
- © Exchange your data, your results, your best practices
- © Build a network
- © Think benchmarking and standards
- © Go one step further and submit a project proposal about benchmarking and standardization

*Thank you for attention*

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