

## **European PhD Schools in Robotics**

### **First Call for Participation**

**August 27-31 (School 1), September 17-21 (School 2), January 28-February 1, 2013 (School 3) University of Leuven, Belgium**

Under the auspices of the euRobotics Coordination Action, a novel concept of PhD School has been prepared, and the first implementations of these "PhD Schools in Robotics" will start to run from later this Summer.

These PhD Schools are primarily targeting PhD students and post-doc researchers in robotics, but we also invite 2-3 senior researchers and professors to participate ("teach the teacher!"). Participation is limited to about 15 people per School.

The system-level, top-down focus of the PhD Schools in Robotics is meant to be complementary to the large variety of Summer and Winter Schools that our robotics community has been organising successfully since about a decade.

More in particular, the topics on the agenda of the PhD School in Robotics are:

#### 1. System-level, top-down focus

Robots must, almost by definition, integrate results from various scientific and technological domains, such as mechanics and physics, perception and reasoning, control and planning, software engineering and cognitive science, task specification and human-robot interaction, etc. However, there are close to no conferences, journals, textbooks or software frameworks that really support such multi-disciplinary integration.

So, instead of focusing on the most advanced, bottom-up state of the art in one of the many sub-domains of robotics, the PhD Schools in Robotics make their participants aware of the extremely large overlap in methodologies, ideas, algorithms and software in all these domains. Participants are helped and stimulated to find the commonalities between, say, iterative learning control and reinforcement learning, RRT planners and realtime motion controllers, the junction tree algorithm in Bayesian networks and the full hybrid dynamics of tree-structured kinematic chains, etc.

In summary, the motto of the PhD Schools is "more with less": we want to find the least amount of essential knowledge (that is, concepts and their relationships) that is necessary (and sufficient!) to become a first-class researcher in the domain of robotics. And that can be re-used in all of the robotics sub-domains, that are currently more and more drifting apart, via the seemingly unstoppable drive to organize ever more "topical" conferences and workshops in robotics.

Participants are expected "to dissect" one or two sub-domains of robotics, in addition to their own field, and to find and document commonalities between these sub-domains; that is, shared concepts and (parts of) algorithms, fundamental relationships, synonymous terminology, etc.

#### 2. Knowledge representation ("robotics ontology"), for humans and for robots

The first target public of the PhD Schools are, obviously, PhD students, but the Schools also have the explicit aim to transform the knowledge that is in the head of the teachers and the

students into formal, computer-readable representations, such that also our robots will, eventually, be able to use and exploit that knowledge. Indeed, the lack of formally accessible (and integrated!) knowledge is a major hurdle towards the dream of really cognitive robots. The Schools introduce participants to the state of the art and the practice in knowledge representation, also known as "ontologies";

"RDF/OWL", "Topic Maps" and "Model Driven Engineering" are the major (but still insufficiently integrated) paradigms and software infrastructures in the domain of knowledge engineering.

Participants are expected to critically discuss, to document and to extend, the already available formal knowledge relationships and representations. The driver behind this effort must be the above-mentioned "more with less" motto of the PhD Schools.

### 3. Identification and annotation of seminal publications

The broad, system-level scope of the PhD Schools in Robotics provides the ideal context to let participant discover, and appreciate, the publications that really introduced new ideas and concepts into the domain of robotics.

Participants are expected to document and annotate such publications (many of which go back to the 70s!), and to link their content to the "ontology of robotics". Over time, this coordinated effort is expected to lead to the "perfect" literature survey for all beginning PhD students in robotics, and can hence hopefully become a landmark in our domain.

Because of its long history in robotics, the library of the University of Leuven contains most of the conference proceedings and journals of the "early days" in robotics.

Participants are stimulated to consult and to exploit these resources, and to publish the results for critical discussions in the broad community.

### Approach.

The programme of each day of the PhD School contains a mixture of the following learning and creativity instruments: presentations and group discussions on various complementary ways to represent knowledge in formal (robot-centric) and didactical (human-centric) ways; critical brainstorm sessions about the already existing "ontologies of robotics" and towards the extension of those ontologies; "semantic tagging" of the seminal literature in the domain of robotics.

The concrete schedule will grow during each School, based on the interactions and interests of the participants. However, the main aim of the School is to make participants aware of what exists in all sub-domains of robotics, and not just in their own "narrow" research field.

Participants are expected to make several concrete contributions to the ontology, such that the PhD School can become a sustainable source of (formally and textually) represented knowledge about robots and about robotics.

### Future.

The new concept of the PhD Schools in Robotics will be tested and fine-tuned within the context of the euRobotics Coordination Action, but the ambition is to make the Schools' concept, and all knowledge content created during them, publicly available, under a "Creative

Common" license.

This must allow reuse and extension by all motivated researchers and teachers of robotics, also outside of the Schools' context. Hence, the construction of, and critical discussions about, the "ontology of robotics" will not just take place within the confines of the PhD Schools in Robotics, but also via a public forum, that will be launched together with the first PhD School, later this Summer.

The Wikipedia ecosystem would be a perfect place to host all the formal knowledge that the PhD Schools in Robotics are creating, but its current software infrastructure is, unfortunately, not yet optimally prepared to support sufficiently formal knowledge representations that could be used by robots. Hence, ideas and suggestions to improve this situation are definitely welcome, on the PhD Schools and on the public forum.

Practical arrangements.

This Summer's PhD Schools in Robotics take place at the University of Leuven, Belgium, with Prof. Herman Bruyninckx as coordinator and main lecturer.

The start of each School is on Monday, at 10h00; the Schools end at noon, on Friday.

There are no costs to the participants: coffee and lunch are provided, but no travel or lodging grants. Participants "pay" their participation via constructive contributions to the knowledge and publication material produced and improved by the PhD Schools.

Information about hostels and hotels in Leuven can be found here:

<http://www.leuven.be/en/tourism/staying-over/>

Leuven is a very lively city, with lots of opportunities to wine-and-dine, at very competitive prices and quality, due to the high student population (about 50.000 students on a total of 100.000 inhabitants!).

Location.

Department of Mechanical Engineering University of Leuven  
Celestijnenlaan 300, 3001 Heverlee (Leuven) Belgium

Application.

The Schools will host about 15 participants, and aim for a balanced mixture of junior and senior people, with complementary robotics interests. Please, send your candidacy by email to [Herman.Bruyninckx@mech.kuleuven.be](mailto:Herman.Bruyninckx@mech.kuleuven.be)

, by the end of July 2012, for the Schools in August and September; a new Call (and application procedure) for the School in January 2013 will follow later, but candidacies for that School can be submitted now already.

It is possible to apply to one or more Schools.

Acknowledgements.

The initiative of the European PhD School in Robotics was taken by the euRobotics Coordination Action, funded by the European Commission under its Framework Programme 7. Contributions to the knowledge engineering content were made in the FP7 projects BRICS and Rosetta, and by the individual experts John Hallam, Alessandro Saffiotti, Erwin Aertbeliën and Davide Monari. Preliminary version of the PhD School concepts were discussed with the community during the European Robotics Forums of 2011 and 2012, and within inter-project workshops with the FP7 projects RoboEarth and GeRT, and the French ANR project Proteus.

