# IEEE/RSJ IROS 2012 – WORKSHOPS & TUTORIALS

## IROS 2012 WORKSHOPS and TUTORIALS

Thanks to the valuable contribution of all the event organizers, we are proud to host the following workshop and tutorial events at the 2012 IEEE/RSJ International Conference on Intelligent Robots and Systems:

### Sunday, October 07, 2012, Full-day

**SW1: Human Behavior Understanding**
**ST2: Handling ROS - Introductory tutorial to ROS and its use for robot in-hand manipulation**
**SW3: Optimality Principles and Adaptation in Humanoid Robotic Control**
**SW4: Planning, Perception and Navigation for Intelligent Vehicles**
**SW5: Cognitive Assistive Systems: Closing the Action-Perception Loop**
**SW6: Color-Depth Camera Fusion in Robotics**
**SW7: Bio Assembler for 3D Cellular System in Collaboration with Micro-Nano Robotics**
**SW8: Robotics for Environmental Monitoring**
**SW9: Active Semantic Perception (ASP'12), Context and Semantic Prior in Active Perception**

### Thursday, October 11, 2012, Half-day (afternoon)

**TW1: Lifelong Learning for Mobile Robotics Applications**
**TW2: Agricultural Robotics: Enabling Safe, Efficient, Affordable Robots for Food Production**
**TW3: Visual Control of Mobile Robots (ViCoMoR 2012)**
**TW4: Sensors and Robots Integration in Future Rescue Information System (ROSIN 2012)**
**TW5: Aerial Physically Acting Robots (AIRPHARO)**
**TW6: Smart materials and alternative technologies for bio-inspired robots and systems**
**TW7: Advances in tactile sensing and touch-based human-robot interaction**
**TW8: Human-Agent Interaction (iHAI 2012)**
**TW9: ECHORD - scientific results and tech transfer opportunities**
**TW10: Smart CAmeras for roBoTic applications (SCaBot)**
**TW11: Robot Competitions: Benchmarking, Technology Transfer and Education**

### Friday, October 12, 2012, (mostly) Full-day

**FW1: Assistance and Service Robotics in a Human Environment**
**FW2: Magnetically Actuated Multiscale Medical Robots**
**FW3: Motivational Aspects of Robotics in Physical Therapy**
**FW4: Progress, challenges and future perspectives in navigation and manipulation assistance for robotic wheelchairs**
**FW5: Safety in Human-Robot Coexistence & Interaction: How can Standardization and Research benefit from each other?**
**FW6: Learning and Interaction in Haptic Robots**
**FW7: Beyond Robot Grasping: Modern Approaches for Dynamic Manipulation**
**FT8: 3D Point Cloud Processing: PCL (Point Cloud Library) Tutorial**
**FW9: Cognitive Neuroscience Robotics**
**FW10: Robot Motion Planning: Online, Reactive, and in Real-time**
**FW11: Metrics of sensory motor integration in robots and animals**

# IEEE/RSJ IROS 2012 – WORKSHOPS & TUTORIALS

The workshops and tutorials will be held before and after the main conference, on the 7th of October, on Thursday afternoon and on Friday the 12th of October. The events will take place at the main conference venue, with sessions from 8h30 or 14h00 until 18h30. The technical sessions range from regular paper presentations to keynote invited talks, panel discussion or even poster sessions.

The IROS2012 workshop and tutorial proceedings will be published in DVD format and distributed to attendees.

A special invited workshop on *EU funding opportunities* will be held on Thursday afternoon.

In the next pages a brief description of the workshops and tutorials is presented, further details are provided on the main conference website with links to each workshop and tutorial website.

**Workshops and Tutorials Chairs:**

Jorge Lobo, University of Coimbra, Portugal
Peter Corke, Queensland University of Technology, Australia
Radu Bogdan Rusu, Willow Garage/Stanford University, USA

Workshop on
 **Human Behavior Understanding**

**Organizers:** Albert Ali Salah, Javier Ruiz-del-Solar, Çetin Meriçli, Pierre-Yves Oudeyer

**Workshop website:** http://www.cmpe.boun.edu.tr/hbu/2012/

**Abstract:**
   Domains where human behavior understanding is a crucial need (e.g., robotics, human-computer interaction, affective computing, and social signal processing) rely on advanced pattern recognition techniques to automatically interpret complex behavioral patterns generated when humans interact with machines or with others. This is a challenging problem where many issues are still open, including the joint modeling of behavioral cues taking place at different time scales, the inherent uncertainty of machine detectable evidences of human behavior, the mutual influence of people involved in interactions, the presence of long term dependencies in observations extracted from human behavior, and the important role of dynamics in human behavior understanding. Implementing these methods on robotic platforms introduces further constraints on processing resources, tracking over time, model building, and generalization.
   This workshop, organized as a satellite to IROS'2012, will gather researchers dealing with the problem of modeling human behavior under its multiple facets (expression of emotions, display of relational attitudes, performance of individual or joint actions, imitation, etc.), with particular attention to implications in robotics, including additional resource and robustness constraints of robotic platforms, social aspects of human-robot interaction, and developmental approaches to robotics.
   The HBU Workshops, previously organized as satellite to ICPR and AMI Conferences, have a unique aspect of fostering cross-pollination of different disciplines, bringing together researchers of robotics, HCI, artificial intelligence, pattern recognition, interaction design, ambient intelligence, psychology. The diversity of human behavior, the richness of multi-modal data that arises from its analysis, and the multitude of applications that demand rapid progress in this area ensure that the HBU Workshops provide a timely and relevant discussion and dissemination platform.

Tutorial on
 **Handling ROS - Introductory tutorial to ROS and its use for robot in-hand manipulation**

**Organizers:** Jorge Dias, Jorge Lobo, Pedro Trindade, Véronique Perdereau

**Workshop website**: http://mrl.isr.uc.pt/events/iros2012tutorial/

**Abstract:**
   This tutorial provides a hands-on introduction to ROS - Robotic Operating System - and its use for robot in-hand manipulation.
   ROS has been emerging as a standard for robot software development. It is an open-source, meta-operating system that provides hardware abstraction services. It implements low and high level functionality components addressing robot perception, control and planning, focusing on the modularity and reusability of code contributed by a growing user community.
   ROS is designed to be as thin as possible, with no wrapping of user code so that it can be used with other robot software frameworks. The preferred development model is to have ROS independent libraries with clean interfaces. It is language independent, easy to use and scalable to large runtime systems and processes.
   The speakers at the tutorial are researchers that are currently working on in-hand manipulation and using ROS for their work, providing practical case studies and examples, and bringing along some hardware to showcase and eventually test the attendees' tutorial code.
   As an outcome of this tutorial, attendees will have a basic knowledge on how to use ROS for manipulation, experience practical cases related with perception and action for robotic in-hand object

manipulation, and also have a good insight on how ROS can be used as a software development tool in the context a of a robotics research team.

The speakers are currently using ROS for research and development on autonomy and dexterity with robot hands for manipulation and grasping. Many of those activities are supported by international projects (e.g. European project HANDLE - Developmental pathway towards autonomy and dexterity in robot in-hand). ROS was a natural choice for the integrated work in the robotic in-hand object manipulation system, integrating perception using the Kinect sensor and tactile sensing, and control of the robotic arm and the SHADOW robotic hand.

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**Sunday, October 7, 2012**                                   **full-day, room Gemini 3                    SW3**

Workshop on
 **Optimality Principles and Adaptation in Humanoid Robotic Control**

**Organizers:** Serena Ivaldi, Bastien Berret, Francesco Nori, Olivier Sigaud

**Workshop website:** http://macsi.isir.upmc.fr/index.php?perma=iros2012workshop

**Abstract:**
    The availability of new mechatronic platforms such as humanoid robots has driven robotics control research to new paradigms where optimal control of movements and adaptation to perturbations or unforeseen situations are becoming the key challenges. In these new lines of research, inspiration from human motor control and learning capability is playing a central role. But the corresponding frameworks come with very large computational costs so a lot of effort is required in designing practical methods that can address meaningful control and learning problems up to the whole body control of humanoids.
    The goal of this workshop is to get an accurate picture of the current state of the art and discuss the hot questions of the application of optimal control and adaptation models of human motor control to robotics:
    • The inverse optimal control being ill-posed, how can we determine the cost function underlying human movements?
    • Do we truly behave optimally in some sense?
    • Shall we address whole body control with standard optimal control approaches, or are there some higher level organization principles to be considered?
    • What are the next challenges to be addressed?
List of topics:
    •   Optimal control methods and their derivatives (OFC, SOC, SOFC...)
    •   Reinforcement learning methods for robotics
    •   Practical implementations of the above methods in robots
    •   Humans to humanoids transfer
    •   Models of human movements based on optimality : successes and limitations
The workshop will bring together roboticists, optimal control and machine learning experts interested in the use of these methods in robots, as well as computational neurosciences researchers interested in modeling these processes in animals and humans, so as to generate a fruitful discussion between both communities.

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**Sunday, October 7, 2012**                                   **full-day, room Fenix 2                    SW4**

Workshop on
 **Planning, Perception and Navigation for Intelligent Vehicles**

**Organizers:** Christian Laugier, Philippe Martinet, Urbano Nunes, Christoph Stiller, Alberto Broggi

**Workshop website**: http://ppniv12.irccyn.ec-nantes.fr/

**Abstract:**
    Autonomous driving and navigation is a major research issue which would affect our lives in near future. The purpose of this workshop is to discuss topics related to the challenging problems of autonomous

navigation and of driving assistance in open and dynamic environments. Technologies related to application fields such as unmanned outdoor vehicles or intelligent road vehicles will be considered from both the theoretical and technological point of views. Several research questions located on the cutting edge of the state of the art will be addressed. Among the many application areas that robotics is addressing, transportation of people and goods seem to be a domain that will dramatically benefit from intelligent automation. Fully automatic driving is emerging as the approach to dramatically improve efficiency while at the same time leading to the goal of zero fatalities. Theses new technologies can be applied efficiently for other application field such as unmanned vehicles, mobile service robots, or mobile devices for motion assistance to elderly or disable peoples. Technologies related to this area, such as autonomous outdoor vehicles, achievements, challenges and open questions would be presented.

Main Topics: Road scene understanding; Lane detection and lane keeping; Pedestrian and vehicle detection; Detection, tracking and classification; Feature extraction and feature selection; Cooperative techniques; Collision prediction and avoidance; Driver assistance systems; Environment perception, vehicle localization and autonomous navigation; Real-time perception and sensor fusion; SLAM in dynamic environments; Real-time motion planning in dynamic environments; 3D Modelling and reconstruction; Human-Robot Interaction; Behavior modeling and learning; Robust sensor-based 3D reconstruction; Modeling and Control of mobile robot; Multi-agent based architectures; Cooperative unmanned vehicles (not restricted to ground transportation); Multi autonomous vehicles studies, models,techniques and simulations.

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**Sunday, October 7, 2012**                                **full-day, room Lince**            **SW5**

Workshop on
**Cognitive Assistive Systems: Closing the Action-Perception Loop**

**Organizers:** Dima Damen, Gabriele Bleser, Lazaros Nalpantidis, Gert Kootstra, Renaud Detry, Ardhendu Behera, Luis Almeida

**Workshop website**: http://www.cs.bris.ac.uk/~damen/cas2012/

**Abstract:**
It is becoming increasingly clear that future robotic systems will need to exhibit sophisticated assistive capabilities, highly tuned and responsive to the needs of human users. Whether on autonomous platforms or within personal computing systems, awareness of human intentions and requirements will be an essential attribute of any robotic system aiming to be genuinely useful. In essence, they will need to be capable of empathising with human behaviour if they are to be truly assistive in the fullest sense of the word.

Realising such cognitive assistive (CA) systems will require advances along the complete processing pipeline, from sensing through to learning and interaction. For instance, sensing will need to be proactive, anticipating user actions and environment changes to optimise data capture; whilst learning will need to exploit knowledge gained from observation of past actions and behaviours to predict likely human responses and reactions under different scenarios. During task-performance, assistive systems need to predict the perceptual changes that result as a consequence of human actions. These are challenging tasks which are likely to require step changes in current state of the art capability if they are to be addressed.

The aim of this workshop is to bring together researchers from relevant disciplines to exchange ideas and results on these and related tasks, as well as on the form of existing and future cognitive assistive systems. This will include those working in sensing, such as speech and vision, machine learning and AI, human computer interaction, biomechanics, and on systems and applications, including autonomous platforms, sensor networks and wearable computing, for example. One area in which CA systems are likely to have significant impact is in industrial manufacturing and training, and applications in this area will be of particular interest for this workshop.

Workshop on
 **Color-Depth Camera Fusion in Robotics**

**Organizers:** Seungkyu Lee, Hwasup Lim

**Workshop website**: https://sites.google.com/site/iros2012ws/

**Abstract:**
   Depth cameras, e.g., time-of-flight and structured-light sensors, have become increasingly popular for the last couple of years. These devices are able of providing depth images at 30 frames per second, at a resolution ranging between 0.03 and 0.3 million pixels, and at a very affordable price. In parallel, video camera technology has made tremendous progress in terms of photometric/color quality and of image resolution, namely 2.0 to 5.0 million pixels. The ambition of this workshop will be to provide an opportunity to disseminate recent theories, methods, and practical algorithms that explicitly exploit the enormous potential of combining low-resolution depth cameras with high-resolution color cameras for a wide variety of robotics tasks. The workshop will bring together researchers and practitioners from multiple fields: computer vision, robotics, computer graphics, image processing, and sensor architecture.
   List of Topics: Calibration of depth-color camera systems; Registration of depth and color data; Depth-color sensor fusion; Depth-stereo fusion; 3D reconstruction with mixed camera systems; 3D scene segmentation and interpretation; 3D content production; Visual-based robot navigation; Object recognition; Object localization; Visually guided object grasping and manipulation; Action and gesture recognition; Human Motion Capture

Workshop on
 **Bio Assembler for 3D Cellullar System in Collaboration with Micro-Nano Robotics**

**Organizers:** Tatsuo Arai, Makoto Kaneko, Masahiro Nakajima, Fumihito Arai, Toshio Fukuda,
           Brad Nelson, Pasi J. Kallio

**Workshop website**: https://sites.google.com/site/iros2012bioasm/

**Abstract:**
   This workshop intends to discuss a new and innovative methodology aimed for creating 3D cellular systems such as functional tissues in in-vitro environments, in which active functional cells selected from a living organism are used to create the 3D cellular system with the assistance of micro-nano robotics technology. The workshop consists of two parts:
   1. Bio Assembler for Creating 3D Cellular Systems
   2. Bio Medical Application by Micro-Nano Robotics
   The topics in the first half cover high speed measurements and controls of single and/or multiple cells based on micro and nano mechatronics technology, assembly of 3D cellular system, and analysis and evaluation of active functional cellular systems toward future organ construction in vitro. The topics in the second half cover innovative bio medical application, especially with the help of micro-nano robotics technology. Speakers will be invited from the world who are active in the cutting-edge of the field. You are strongly encouraged to join this workshop and discuss the current hot topics in the field together with us.

Workshop on
 **Robotics for Environmental Monitoring**

**Organizers:** Lino Marques, Ryan Smith, Volkan Isler, Matthew Dunbabin

**Workshop website**: http://www2.isr.uc.pt/~embedded/events/WREM-IROS2012/Home.html

**Abstract:**
   In the past decades a huge progress in robotics have been achieved, with robots moving from the common manipulator, fixed on the factory floor to more flexible and autonomous devices, capable to operate in natural environments.
   Nowadays, robots are fundamental data gathering tools to scientists studying the Earth environment. Robots can be seen in areas ranging from the study of deep oceans, the track of water surface blooms and pollution spread, the wide area monitoring of climate variables, or even in the study of volcanoes activity.
   From the robotics community point of view, the utilization of robots in the environmental research also presents significant challenges to the field robotics research, stimulating new findings in the direction of robots more capable to perceive, move and actuate in natural environments. These Environmental Monitoring Robots require increased energy autonomy to allow for extended periods of operation. Low energy design and energy harvesting can be used for that purpose. Additionally, they should be able to exchange information and to cooperate with other agents of a large data gathering network.
   The full-day Workshop on Robotics for Environmental Monitoring intends to bring together researchers with different backgrounds in at least one of the areas relevant to this new multidisciplinary field of research, namely researchers from field robotics, sensors for environmental variables, sensor networks, environmental data processing, low energy robot design, low energy design and energy harvesting.

Workshop on
 **Active Semantic Perception (ASP'12), Context and Semantic Prior in Active Perception**

**Organizers:** Alper Aydemir, Dirk Holz, Radu Bogdan Rusu, Andrzej Pronobis

**Workshop website:** http://www.activeperception.org/

**Abstract:**
   The problem of semantic perception and mapping received a lot of attention in the recent years, with many approaches proposed and workshops devoted to the topic. At the same time, in realistic complex systems operating in large-scale environments, the perception of semantic cues must be considered an active process. Robots need the ability to seek semantic cues beyond sensory horizon, exploit them to generate active behavior and do it robustly and efficiently. To this end, this workshop focuses on active exploration and search for semantic cues and their exploitation for generating a more efficient and informed behavior.
   The workshop is a second edition of the successful event organized during IROS'11 in San Francisco which attracted considerable attention.  The theme of this year's edition builds upon the last year's introduction to active perception and focuses on the problem of acquisition and exploitation of contextual information as well as general world knowledge. It will bring together researchers in such fields as robotics, computer vision and neuropsychology in order to exchange ideas and discuss opportunities in using context and semantic prior for building active robotic systems.

Workshop on
 **Lifelong Learning for Mobile Robotics Applications**

**Organizers:** Rudolph Triebel, Luciano Spinello

**Workshop website:** http://ais.informatik.uni-freiburg.de/lifelonglearning_ws12iros

**Abstract:**

   In recent years robots left controlled laboratory settings and started to address real world scenarios and situations.  In order to tackle 'the wild', robots need to adapt their knowledge and their behaviour over time. Lifelong and online learning techniques are currently being established as one of the major research goals in mobile robotics. The rising interest in lifelong learning stems from the fact that all major mobile robot tasks, including mapping, navigation, manipulation, target tracking, planning or learning in general can be performed more accurately and more reliably when formulated and addressed as online learning problems. Given that modern mobile robot systems are being employed in highly dynamic environments such as cities, the capability of improving and refining the internal representation and performance of algorithms for mobile robots during their operation becomes a crucial requirement.

   The aim of this workshop is to specifically show how the formulation as lifelong learning problems can be done, to give solutions and show results to these problems, and to create a platform for interchanging ideas between the different areas of mobile robotics on the topic of online and lifelong learning. Some of the leading researchers from robotics, computer vision and machine learning will give invited talks, but there will also be time for presentations of submitted and peer-reviewed contributions.

Workshop on
 **Agricultural Robotics: Enabling Safe, Efficient, Affordable Robots for Food Production**

**Organizers:** Marcel Bergerman, Eldert van Henten, John Billingsley, John Reid, Mingcong Deng

**Workshop website:** http://www.cs.cmu.edu/~mbergerm/agrobotics2012/

**Abstract:**

   Sixty years after making their debut in industrial environments, robots are making their way into our everyday life. Farmers have benefited for some time from self-guided machinery including combines and harvesters. More recently, multi-purpose autonomous vehicles have started to be deployed in orchards, groves, nurseries, and other agricultural environments to automate or augment operations such as pruning, thinning, harvesting, mowing, and spraying. Successful commercialization of such vehicles will depend largely on the robotics community overcoming technological, socioeconomic, and regulatory barriers to deployment and adoption. The chairs of the Robotics and Automation Society Technical Committee on Agricultural Robotics & Automation invite academic and industrial robotics and agricultural researchers, engineers, practitioners, and students to come together and create a future where robots enable safe, efficient, and affordable food production.

   The objectives of the workshop are to provide a forum for researchers in agricultural robotics to survey the state-of-the-art in the field, discuss new ideas, and create a roadmap of research opportunities and field applications, and convene experts and beginners, scientists and students, and academics and industry personnel in an informal setting to foster cross-country collaboration networks.

   The target audience includes: academic and industrial researchers, engineers, practitioners, and students, either currently working in agricultural robotics or interested in learning more about this exciting and growing field.

Workshop on
**Visual Control of Mobile Robots (ViCoMoR 2012)**

**Organizers:** Youcef Mezouar, Gonzalo Lopez-Nicolas

**Workshop website:** http://vicomor.unizar.es/

**Abstract:**

   The purpose of this workshop is to discuss topics related to the challenging problems of visual control of mobile robots. Visual control refers to the capability of a robot to visually perceive the environment and use this information for autonomous navigation. This task involves solving multidisciplinary problems related with vision and robotics, for example: motion constraints, vision systems, visual perception, safety, real-time constraints, robustness, stability issues, obstacle avoidance… The problem of the vision-based autonomous navigation is also compounded of the different constraints imposed by the particular features of the platform involved (ground platforms, aerial vehicles, underwater robots, humanoids…)

   Over the last years, increasing efforts have been made to integrate robotic control and vision. Although there is an important number of works in the area of visual control for manipulation, which is a mature field of research, the use of mobile robots add new challenges in a still open research area. The interest in this subject lies in the many potential robotic applications in industrial as well as in domestic settings that involve visual control of mobile robots (automation industry, material transportation, assistance to disabled people, surveillance, rescue, etc).

   This workshop is aimed to promote exchange and sharing of experiences among researchers in the field of visual control of mobile robots. Previously, the first edition of ViCoMoR was held in San Francisco during IROS'11. This new edition of the workshop will consist of invited talks and selected papers for oral presentation and interactive session.

Workshop on
**Sensors and Robots Integration in Future Rescue Information System (ROSIN 2012)**

**Organizers:** Fumitoshi Matsuno, Congduc Pham, Serge Stinckwich

**Workshop website:** http://www.doesnotunderstand.org/out/public/ROSIN2012.html

**Abstract:**

   Intelligent rescue systems including ITC and robotics technology have been proposed to mitigate disasters, especially in Japan after the 1995 Hanshin-Awaji Earthquake. Ideally, these future search&rescue systems will involve a complex mixture of humans performing high level decision-making, intelligent agents coordinating the response, sensing capabilities to provide real-time observations and possibly mobile robots undertaking physical tasks at difficult or risky remote places in order to provide an efficient disaster response on a large-scale environment. However, there are several challenges to address before such a scenario could take place because the considered environments are prone to uncertainty, ambiguity and incompleteness given their dynamic and evolving nature. First, in the robotic domain for search&rescue most of nowadays robots are operated by humans. While this is required by the harsh conditions commonly found in disaster sites (collapsed buildings, gaps, holes, flooding ...), there are many limitations in human operated robots where the dependency on well-trained operators obviously limits the deployment of such robots. In addition, due the very limited number of available robots and their very customized hardware (both in terms of mobility and actuation capabilities), it is necessary in a disaster recovery campaign to carefully and rapidly identify both the deployment location and the type of the robots to be deployed. Secondly, while the monitoring capability of Wireless Sensor Networks (WSN) make them very suitable for large scale surveillance systems random deployment can not guarantee coverage both for sensing and connectivity and concerns. In addition, while scalar sensors are quite easy to manage they however provide very limited information compared to what multimedia sensors could bring if video or images were available. In general, a wide range of wireless sensor network applications can be strengthened by introducing a vision capability

and, in the domain of search&rescue, which is extremely mission-critical in nature, adding visual capabilities is considered to be of the utmost importance. Unfortunately, video or image sensors are much more difficult to manage on a large scale because of the more demanding resources they need for their operation and for transmitting visual information to a control center.

**Thursday, October 11, 2012**                                         **afternoon, room Vega**          **TW5**

Workshop on
**Aerial Physically Acting Robots (AIRPHARO)**

**Organizers:** Anibal Ollero, Lorenzo Marconi

**Workshop website:** http://airpharo.arcas-project.eu/

**Abstract:**

This workshop is jointly organized by the IEEE RAS TC 1 Aerial Robotics and Unmanned Aerial Vehicles, and the coordinators of the projects "Aerial Robots Physically Interacting with the Environment" (ARCAS) and "Innovative Aerial Service Robots for Remote Inspection by Contact" (AIRobots). The panel includes senior representatives of the partners involved in these projects together with distinguished researchers leading the aerial robotics community. It also counts with industrialist. These panelists are from Universities, Research Centers and Industry.

This workshop is focused on aerial robots physically interacting with the environment. It should be noted that the main methods, technologies and applications of aerial robotics and unmanned aerial systems have been related to information exchanges of the aerial robots with objects in the environment, with ground stations and between several aerial robots. Recently, new applications that involve physical interaction such as load transportation and inspection are being researched and new methods and technologies have been developed. These include load transportation and deployment by means of one or several robots, remote inspection by contact, structure construction, and cooperative assembly and manipulation by several aerial robots.

The workshop will include presentations related to the main scientific and technological topics related to aerial robots physically interacting between them and with the environment (see below) including the cooperation of several aerial robots. The presentations will include the presentation of new methods and technologies together with simulations and implementations by using quadrotors, helicopters and fixed wing aerial robotic platforms. Relevant application scenarios will be analysed by specialists.

In addition of the presentations, the program will include round table discussions with the attendants.

**Thursday, October 11, 2012**                                         **afternoon, room Gemini 3**          **TW6**

Workshop on
**Smart materials and alternative technologies for bio-inspired robots and systems**

**Organizers:** Claudio Rossi, K.H. Low, Ravi Vaidyanathan, Justin Seipel

**Workshop website:** http://www.disam.upm.es/~ATBio2012/ATBio.html

**Abstract:**

Bio-inspiration is a fast growing field of research, and new bio-inspired robots are being developed with notable similarity to their biological counterparts. Many of these, however, still adopt "classical" actuation technology.

New concepts demand new technology. Smart -or functional- materials may provide a powerful alternative technology, enabling the design of robots difficult or even impossible to develop with classical servo-motor technology. Artificial muscular hydrostats and not-so-young technologies such as shape memory alloys and piezo-electric actuators can also play an important role in future robots. Such technologies can allow a more faithful reproduction of the muscular architecture of animals and plants, where no rotating parts and gearings can be found. New technologies even allow foreseeing the imitation of the internal structure of natural muscles, pushing bio-inspiration to a lower scale.

The new concepts and technologies being studied and developed in the field of bio-inspired robots have a great potential for the next generation robots, and pose new challenges. Such potential and challenges will be discussed in the proposed workshop.

**Thursday, October 11, 2012**                                     **afternoon, room Fenix 3            TW7**

Workshop on
 **Advances in tactile sensing and touch-based human-robot interaction**

**Organizers:** Fulvio Mastrogiovanni, Lorenzo Natale, Giorgio Cannata, Giorgio Metta

**Workshop website:** http://www.roboskin.eu/index.php/workshop-iros-2012

**Abstract:**
   The problem of "providing robots with the sense of touch" is fundamental in order to develop the next generations of robots capable of interacting with humans in different contexts: in daily housekeeping activities, as working partners, as caregivers, etc. Through tactile sensing it is possible to estimate physical properties of grasped or touched objects. Tactile feedback may enable the detection and the safe control of the interaction of the robot with object or humans. Finally, touch based cognitive processes can be involved by developing body self-awareness to differentiate "me" from "not me" thus opening new relevant problems.
   The objective of this Workshop is to present and discuss the most recent achievements in the area of tactile sensing starting from the technological aspects, up to the application problems where tactile feedback plays a fundamental role.
   The Workshop will cover, but will not be limited to, the following three main areas:
   - Technological aspects of robot skin design and implementation including: advanced transduction devices, large scale sensing technologies, embedded electronics, system level solutions, etc.
   - Software and algorithmic aspects related to tactile data processing: software engineering, robot control, touch based reactive behaviors, touch classification, object recognition, etc.
   - Cognitive issues related, but not limited, to skin-based behaviors and task level control, including: human-robot interaction, learning and assistive technologies etc.

**Thursday, October 11, 2012**                                     **afternoon, room Gemini 2            TW8**

Workshop on
 **Human-Agent Interaction (iHAI 2012)**

**Organizers:** Seiji Yamada, Tetsuo Ono, Helmut Prendinger, Rui Prada

**Workshop website:** http://www.ymd.nii.ac.jp/ws/iHAI/12/

**Abstract:**
   In recent years anthropomorphic, mechanic and pet-like agents have spread globally, which allows various types of ordinary end user to interact with them. Although interaction design for robots and software agents has been investigated in different research fields, few studies were done on the subject for various agents in a unified aspect.
   HAI (Human-Agent Interaction) is a novel research field to investigate and develop interaction design methods across conventional interactive platforms including robots, software agents and human-human communication through digital media. In HAI, mixtures of interactions of these platforms (human-robot, human-software agent, and human-human through agents) are studied. We aim to collect ideas of and clarify the common design policies through these interactions to further generate and develop HAI design methods based-on knowledge obtained from state-of-the-art research and studies presented in this workshop.
   Hence the 2012 International Workshop on Human-Agent Interaction (iHAI 2012) will gather researchers from relevant but diverse fields, such as human-robot interaction, anthropomorphic agent design and interface design for the mutual adaptation between agent and human user, to accelerate the progress of this direction.

Workshop on
 **ECHORD - scientific results and tech transfer opportunities**

**Organizers:** Reinhard Lafrenz, Florian Röhrbein, Bruno Siciliano

**Workshop website:** http://echord.info/wikis/website/iros-2012-workshop

**Abstract:**
   ECHORD (European Clearing House for Open Robotics Development) is a project funded by the European Commission emphasizing the need for a tighter cooperation between academia and industry in robotics.
   After the set-up phase, where 51 focused projects, so-called experiments, were selected based on independently evaluated proposals, this project has the unique opportunity to accompany these projects scientifically by the mechanism of a "structured dialogue" and thus to gain additional knowledge for the whole community. At the time of the WS, a part of the experiments will have finished and the others are at different stages of their work, so that an exchange of experiences and plans for knowledge transfer to the industry can take place. ECHORD is funded by the European Commission within the 7th Framework Programme, Challenge 2: Cognitive Systems, Interaction, Robotics (FP7-ICT-231143, http://www.echord.info).
   The experimenting partners will be asked to present their results to an international audience and to discuss the transfer opportunities. Besides that, the workshop will also play an important role as a networking event for the ECHORD partners.

Workshop on
 **Smart CAmeras for roBoTic applications (SCaBot)**

**Organizers:** François Berry, Dominique Ginhac

**Workshop website:** http://eunevis.org/scabot2012/

**Abstract:**
   Smart cameras combine video sensing, processing, and communication on a single embedded platform. This approach has emerged thanks to a confluence of simultaneous advances in three key disciplines: computer vision, image sensors and embedded computing. One of the major advantages of this kind of embedded system is that they are able to deal with a wide range of problems, presenting several advantages which can be categorized as:
   - Communication bottlenecks: embedded processing allows reducing the data communication between sensors and the host system, avoiding the bottlenecks that frequently occur in real-time image processing.
   - Autonomous or Mobile devices: avoiding the use of a mainframe computer system, compact sizes (for unmanned aerial vehicles for example) and low power consumption can be obtained.
   - Active perception: for these applications, a high-speed feedback link between sensing and processing is fundamental.
   - Camera networks: distributed processing using smart cameras have major advantages over centralized processing systems, since it avoids the transmission of large amounts of information.
   The motivation for SCaBot' is to bring together researchers working on Smart camera. A half day workshop provides a unique opportunity to get to know the work and the people researching in the field, and allow a fruitful exchange of ideas. In the above abstract the scientific motivation is already stated.

Workshop on
 **Robot Competitions: Benchmarking, Technology Transfer and Education**

**Organizers:** Pedro Lima, Rui Cortesão

**Workshop website:** http://www.iros2012.org/site/node/43

**Abstract:**

   Robot competitions (e.g., DARPA Grand Challenge, RoboCup, IEEE ICRA Robot Challenge, ELROB) have emerged in recent years as a complementary approach to advance Robotics R&D through grand challenges based on the integration of robotic systems, benchmarked on a common reference testbed (e.g., a urban driving scenario, the NIST USaR arena). Some of the challenges take place in outdoor scenarios, others indoors. Many competitions focus on research problems, others enforce the educational viewpoint. All of them are excellent vehicles for the dissemination of Robotics relevance in research and education to the citizens, in particular to the youngsters. Competitions such as RoboCup pose long-term challenges and have developed well-established principles for research progress through annual rule updates, so that the innovation is a fundamental requisite. In other cases, as in the DARPA Grand Challenge, teams are challenged to tackle a difficult large-scale problem, which is, in principle, solvable by a suitable integration of the state of the art. Once the problem is solved, a new grand challenge is set. In both cases, innovative approaches are developed along the way and part of the resulting technology is transferred to real world applications. In this Workshop we want to discuss and compare how do different robot competitions achieve their goals, and learn lessons to improve them, with the goal of fostering research advances in Intelligent Robot Systems. With that purpose, we will invite a set of experts in Robotics and robot competitions to present their different views on this subject, and to trigger the brainstorming with the attendants on the raised issues.

Workshop on
 **Assistance and Service Robotics in a Human Environment**

**Organizers:** Anne Spalanzani, David Daney, Olivier Simonin, Jean-Pierre Merlet

**Workshop website:** http://emotion.inrialpes.fr/people/spalanzani/WorkshopIROS12/WorkshopIROS12.html

**Abstract:**

   Robotic for people assistance is a major research issue which would affect our lives in near future, with a particular focus on frail people. The purpose of this workshop is to discuss topics related to the challenging problems of assisting people in their everyday life. Topics related to social interaction, intelligent habitat, mobility assistance will be presented. Technologies related to this area, such as autonomous indoor vehicles, sensor and actuators networks, human-robot interaction, application to elderly and disabled people, achievements, challenges and open questions will be presented.

   This workshop aims to present research activities in the area of robotic assistance of human in different contexts of human life. The integral assistance systems are robotic modules and technological aids in general for personal assistance, such as robots, mobile bases, electric wheelchairs, soft robot manipulator arm. They can support disabled and elderly people with special needs in their living environment. Intelligent Service Robotics cover a broad spectrum of research axis, from intelligent robots acting as a servant, secretary, or companion to intelligent robotic functions such as autonomous wheelchair navigation, embedded robotics, ambient intelligence, or intelligent space. This workshop will focus on the assistance of human in terms of its mobility, its social interaction, as well as its everyday chores that are especially pertinent to the elderly. Intended Audience concerns researchers and PhD students interested in assistive robotics, personal robotics, manipulation, Mobility aids, social interaction, teleoperated robots, Human-machine Interfaces for assistive robotics, Acceptance, Activity monitoring systems, Activity recognition, Elderly care assistive robots, Rehabilitation system, transfer machine, Sensor networks, Perception, Smart environments...

Workshop on
**Magnetically Actuated Multiscale Medical Robots**

**Organizers:** Pierre E. Dupont, Christos Bergeles, Panagiotis Vartholomeos

**Workshop website:** http://robotics.tch.harvard.edu/workshops/iros2012

**Abstract:**

   A broad variety of magnetically actuated robotic devices are being developed for minimally invasive diagnosis and intervention in many regions of the human body including the eye, ear, abdomen, heart, brain and vasculature. Potential applications include targeted drug delivery, diagnostic imaging, insertion of implants, biopsy and tissue ablation. Prototype devices range in size from sub-millimeter to tens of centimeters and vary in concept from swimming or bacteria-propelled microrobots to catheters, capsule endoscopes, and robotic mechanisms. Even though the design and implementation of each system poses unique challenges, these devices are based on the same underlying physical principles. Little effort has been devoted, however, to exploring and exploiting these commonalities. This full-day workshop will bring together researchers from academic, industrial, and clinical environments, in order to identify unifying research questions and approaches in the design, implementation, and evaluation of magnetically actuated interventional devices.

Workshop on
**Motivational Aspects of Robotics in Physical Therapy**

**Organizers:** Marina Fridin, Mark Belokopytov, Adriana Tapus, Mindy Aisen

**Workshop website:** http://www.ariel.ac.il/research/projects/iros-2012

**Abstract:**

   Motivation is an important factor in physical therapy and is frequently used as a determinant of training outcome. Motivated rehabilitation treatment leads to active participation, emotional arousal, and higher performance.

   Over the past years, assistive robotic and computer-based devices made significant progress in the therapeutic rehab practice. Recently, more and more attention is given to the motivational aspects of their use.

   In this multidisciplinary workshop, we invite researchers from the field of robotics, physical therapy, psychology, and game development to share and discuss state of the art of the use of robots in rehabilitation accenting the aspects of motivation increase and emotional arousal.

   The workshop aims to: bring together researchers from the fields of robotics, physical therapy, psychology, and game development; create the common ground and knowledge for this cutting-age interdisciplinary subject; and get the state of the art of motivational aspects of robotics in physical therapy from the presentations of the resent works in the field.

Workshop on

 **Progress, challenges and future perspectives in navigation and manipulation assistance for robotic wheelchairs**

**Organizers:** Eric Demeester, Emmanuel Vander Poorten, Alexander Hüntemann, Joris De Schutter,
          Wolfram Burgard, Urbano Nunes, José Millán, Matteo Matteucci, Yiannis Demiris

**Workshop website:** http://www.radhar.eu/events/IROS2012-robotic-wheelchairs

**Abstract:**

   Research on robotic wheelchairs has been performed for over 20 years now, yet no commercially available system is currently available on the market. However, the increasing use of sensors and navigation assistance in the automotive market is likely to eliminate earlier bottlenecks for commercial robotic wheelchairs. Furthermore, with the advent of novel and powerful sensors, with the development of novel planning and statistical algorithms, and due to the ever increasing speed and memory of nowadays computers, research in this field is still very active today.

   This workshop fits well in the IROS 2012 theme of robots for quality of life, and in the theme "robotic adaptation to humans adapting to robots" of the FP7 project RADHAR that co-organises this workshop (www.radhar.eu). The workshop will present recent developments, current bottlenecks and future directions in the field of navigation and manipulation assistance for robotic wheelchair users. More specifically, the workshop welcomes papers on novel human-machine interfaces, approaches and design guidelines for navigation and manipulation shared control, benchmarking and evaluation of such assistive approaches by end users, and modelling and prediction techniques of dynamic environments.

   The workshop aims to address the following questions: How to make shared control systems intuitive and trustworthy? How to evaluate and compare shared control systems? What are good benchmark tests? What are the bottlenecks to bring shared control systems to the market?

Workshop on
 **Safety in Human-Robot Coexistence & Interaction:**
   **How can Standardization and Research benefit from each other?**

**Organizers:** Sami Haddadin, Gurvinder Virk, Susanne Oberer-Treitz, Yoji Yamada

**Workshop website:** http://www.safe-robots.com/iros2012-safety-ws.html

**Abstract:**

   First real-world applications that incorporate physical Human-Robot Interaction have been put to operation. This new trend of introducing interactive robotic devices into the market that are capable of safe acting in unstructured dynamic environments, is certainly a main driving factor of nowadays robotics. Both, research and industry believe that direct physical interaction between humans and robots will enable novel applications and create new markets, to finally bring robots into our everyday life comprehensively. From the standardization side, there has been considerable effort in reflecting complex interaction into existing industrial robot standards and define close human-robot interaction for service robotics, which is still significantly evolving. It seems that we are finally getting to the stage of enabling coexistence and interaction not only in research lab environments and in terms of proof-of-concept installations in industry, but fundamentally changing the role of robotics for humans' everyday life. However, this is a major effort and several questions and requirements regarding safety remain open and unsolved yet. In this sense, the workshop intends to bring together researchers, standardization experts, and industrialists, who are all together responsible for ensuring that robots can finally come off the research labs into all aspects of everyday life. This event shall initiate close interaction and collaboration between the different interest groups in order to bring closer the different viewpoints, define remaining challenges in the field of safety in robotics together, and converge to a common roadmap that all can commit to in order to reach a coordinated action at some point.

Workshop on
 **Learning and Interaction in Haptic Robots**

**Organizers:** Dongheui Lee, Sylvain Calinon

**Workshop website:** http://www.iit.it/en/workshops/iros-2012-workshop.html

**Abstract:**
   Research on robot learning from demonstration has received great attention in the last decade since it can serve a useful methodology for intuitive robot programming, even by general users without robotics expertise. In the pioneering research investigations of this field, demonstrations were provided either by teleoperating the robot, or by vision/motion sensors recordings of the user doing the task. The recent hardware and software developments towards compliant and tactile robots are changing this picture. New solutions are now being offered to the user to physically interact with the robot to transfer or refine skills. This full day workshop will focus on the new robot learning perspectives that such new interaction modality offers.
   Physical interaction in the context of robot learning is a young but promising upcoming research topic. It provides a natural interface to kinesthetic transfer of skills to the robot, where the user can demonstrate or refine the task in the robot's environment while feeling its capabilities and limitations. With the new development of compliant controllers, backdrivable motors and artificial skins, new perspectives in learning arose by exploiting the natural teaching propensity of the user, already being familiar with social interaction such as scaffolding, molding or kinesthetic teaching. In this workshop, experts in machine learning, physical human robot interaction, and compliant robot control will introduce their research along this direction, sharing their views from different research perspectives, and discussing new challenges in this uprising field. Topics such as skill transfer, kinesthetic teaching interfaces, learning and prediction, compliant robot control, safe physical interaction, haptic and tactile guidance will be covered.

Workshop on
 **Beyond Robot Grasping: Modern Approaches for Dynamic Manipulation**

**Organizers:** Heni Ben Amor, Ashutosh Saxena, Oliver Kroemer, Jan Peters

**Workshop website:** http://www.ias.informatik.tu-darmstadt.de/Research/IROS2012

**Abstract:**
   The field of robot grasping and manipulation is reaching an important milestone. In recent years, we have seen various robots that can reliably perform basic grasps on unknown objects in unstructured environments. However, these robots are still far away from being capable of human-level manipulation skills such as in-hand or bimanual manipulations of objects, interactions with non-rigid objects, and multi-object tasks such as stacking and tool-usage. As such advanced manipulations involve interacting with uncertain real-world environments, they pose major problems for current approaches and traditional methods that depend on accurate models of the robot and its surrounding.
   This workshop focuses on how modern machine learning techniques and sensor technologies can help robots go beyond basic grasping abilities towards advanced manipulation skills. In recent years, innovations from these fields have played a pivotal role in developing state-of-the-art approaches for robot grasping under uncertainty. By further refining and improving upon these approaches, we strive towards creating robots that are capable of complex manipulation skills in real-world environments.

Tutorial on
 **3D Point Cloud Processing: PCL (Point Cloud Library)**

**Organizers:** Stefan Holzer, Leonardo Rubio, Alexander J. B. Trevor, Nizar K Sallem, Koen Buys

**Workshop website:** http://www.pointclouds.org/media/iros2012.html

**Abstract:**

The number of research initiatives that employ 3D point cloud processing has increased substantially since the introduction of affordable off-the-shelf 3D cameras, such as the Microsoft Kinect. This is shown, among other things, by the number of workshops on related topics in the fields of robotics and computer vision. The proposed tutorial will equip researchers, developers and R&D engineers with the tools necessary to start realizing new and interesting ideas, based on the Point Cloud Library (PCL), which builds on its large set of tools and state-of-the-art algorithms to allow advanced 3D processing. For this, we introduce the available methods, present existing systems realized using the framework, as well as give advice on how to use it in new projects. The goal is to provide an overview of standard solutions to common 3D processing problems and to present modules such as filtering, feature estimation, segmentation, registration, object recognition and surface reconstruction. Furthermore, we will emphasize hot topics in 3D processing, how they can be attacked using PCL and show this in live demonstrations. The invited speakers will talk about the features in PCL, present how they use it in their work, and will be available to answer spontaneous questions of the participants during the sessions and in separate conversations during the brakes. This way, we hope to provide an extensive walkthrough through the field of 3D point cloud processing and show PCL's strengths in prototyping and building solutions for complicated perception problems.

Workshop on
 **Cognitive Neuroscience Robotics**

**Organizers:** Kenichi Narioka, Yukie Nagai, Minoru Asada, Hiroshi Ishiguro, Renaud Ronsse

**Workshop website:** http://www.gcoe-cnr.osaka-u.ac.jp/iros2012workshop/

**Abstract:**

While traditional technologies have made our society convenient, their effects on our cognitive functions have been disregarded. In order to reveal their effects and to establish a new design principle for safe and adaptable Information and Robot Technology (IRT) systems, the organizers have promoted the global center of excellence (GCOE) project supported by Japanese government, in which world-famous research groups in robotics, cognitive science, and brain science, working at Osaka University and ATR in Japan, are highly-integrated to establish an interdisciplinary research area called "Human-friendly Robotics Based on Cognitive Neuroscience (Cognitive Neuroscience Robotics)". In this workshop, starting from the keynote talk by Prof. Hiroshi Ishiguro who is the leader of the GCOE, some members and international collaborators of the GCOE will give their talks about the most-advanced studies mainly on the fields of human-robot interaction (HRI), cognitive science, brain science, and the interdisciplinary area. Moreover, some presenters will talk about interdisciplinary studies of the movement planning and control based on the biological motor control and robotics. Based on the talks, we will discuss the way to integrate these research fields for the establishment of a novel research area of human friendly IRT system.