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ROBOTIS



Aldebaran Robotics

IROS 2009 Plenary Talk I

8:15-9:15, Monday, October 12, 2009

Fish biorobotics

Professor George V. Lauder

Alexander Agassiz Professor of Zoology
Professor of Organismic and Evolutionary Biology
Harvard University, USA



Abstract

There are over 28,000 species of fishes, and a key feature of this remarkable evolutionary diversity is a great variety of propulsive systems used by fishes for maneuvering in the aquatic environment. Fishes have numerous control surfaces (fins) which act to transfer momentum to the surrounding fluid. Fishes are unstable and use several control surfaces simultaneously for propulsion and to maintain body position. In this presentation I will discuss the results of recent experimental kinematic and hydrodynamic studies of fish fin function, and their implications for the construction of robotic models of fishes. Recent high-resolution video analyses of fish fin movements during locomotion show that fins undergo much greater deformations than previously suspected. Experimental work on fin mechanics shows that fishes possess a mechanism for actively adjusting fin surface curvature to modulate locomotor force. Fish fin motion results in the formation of vortex rings of various conformations, and quantification of vortex rings shed into the wake by freely-swimming fishes has proven to be useful for understanding the mechanisms of propulsion. Experimental analyses of propulsion in freely-swimming fishes have led to the development of two self-propelling robotic models: a pectoral fin robotic device and a dual flapping foil model of fish median fin interactions. Data from both will be presented and discussed in terms of the utility of using robotic models for understanding fish locomotor dynamics.

Brief Biography

George V. Lauder received the A.B. and Ph.D. degrees in biology from Harvard University in 1976 and 1979 respectively. From 1979 to 1981 he was a Junior Fellow in the Society of

Fellows at Harvard and he then joined the faculty at the University of Chicago. Since 1999 he has been Alexander Agassiz Professor of Zoology, and Professor of Organismic and Evolutionary Biology at Harvard University. His research interests focus on the biomechanics and evolution of fishes, with a special focus on laboratory analyses of kinematics, muscle function, and hydrodynamics of freely-swimming fishes. Current work involves application of analyses of fish locomotor function to the design of fish-like robotic biorobotic test platforms.

IROS 2009 Plenary Talk II

8:00-9:00, Tuesday, October 13, 2009

The roles automation and robotics can play in resolving global energy issues



Mr. Edward C. (Ted) Fox

Deputy Associate Laboratory Director
Energy and Engineering Sciences Directorate
Oak Ridge National Laboratory, USA

Abstract

The energy issues that face the world seem very complex and intractable. Complicating the energy supply issues is the intersecting issue of carbon emissions and the potential role it can play in global climate change. However, the problems can be expressed quite simply, particularly in the context of the United States, as the dependence on oil and maintaining a reliable supply of electricity. While the scope of these problems is large there are technological approaches that can truly make a difference. For instance, vehicles that are powered by electricity, vehicles that are lighter in weight and more fuel efficient can lessen the dependence on petroleum. Breakthroughs in renewable energy technology such as solar, and wind as well as revitalizing nuclear power can provide carbon free electricity. To make these technologies cost effective application of advanced automation and robotic technologies will be needed. This

talk discusses the opportunities that automation and robotics can play in making energy technologies more affordable and efficient.

Brief Biography

Ted has B.S. and M.S. Degrees in Chemical Engineering from the University of Idaho. He has over 30 years experience at ORNL conducting and managing all aspects of energy research (nuclear, fossil and energy efficiency) and in developing new technologies. As the Deputy Associated Laboratory Director of the Energy and Engineering Sciences (EES) Directorate, he is responsible for formulating and overseeing many aspects of ORNL's energy strategies and research. The EES Directorate is the U.S. Department of Energy's (DOE) largest energy research and technology organization, annually executing over \$350M of programs for a variety of government and industrial sponsors in all aspects of energy science and technology. Included is research in all forms of energy production, distribution, and utilization. Specific initiatives include energy efficiency and renewable energy concepts in storage, transportation, electrical and pipeline distribution, traffic management, hydrogen economy, enhanced buildings technology, design and application of solar concepts, policy analysis and investigating the intersection of technology and policy, and concepts to impact industry's approach to energy demand reduction.

IROS 2009 Plenary Talk III

8:00-9:00, Wednesday, October 14, 2009

Insect-Machine Hybrid System

Professor Ryohei Kanzaki

The Research Center for Advanced Science and Technology
University of Tokyo, JAPAN



Abstract

Adaptability, the capability to behave properly in accordance with ceaselessly changing environments, is an excellent feature of animals. In particular, insects are the most diverse and

abundant animal group representing >70% of all known species. They display a diversity of sophisticated behaviors that have been adapted to their environments through the processing of a simple nervous system, a so-called microbrain system. Insects will become an excellent model for understanding adaptive control in biological systems and in turn, inspire control and communication in engineered systems.

Adaptive behavior appears in the interaction between a body, brain and the environment. Therefore, an experimental system for evaluating and understanding adaptive behavior is required to be a closed-loop system, in which environmental information is fed back to an animal. This system must be capable of optionally manipulating the external environment or the properties of the animal, allowing the adaptive behavior to be systematically investigated. We have developed an insect-machine hybrid system, which moves depending on the behavioral or the neural output of an insect, as a novel experimental system: the interaction between an insect and the real environment can be manipulated in order to evaluate and understand environmental adaptation. The robot is controlled by the behavior of an insect tethered on the robot or by the neural activity of the insect brain. Therefore, by arbitrarily manipulating the motion system of the robot, changes similar to those done by manipulating the sensory-motor system of the insect are possible. At first in this lecture, as an example of adaptive behavior of an insect, odor-source orientation behavior of a male silkworm and its neural basis will be shown. Second, the extent of adaptation in the behavioral strategy, as governed by the neural system and investigated via a robotic implementation, will be shown. Finally, I will demonstrate an insect-machine hybrid system that will lead to great insight for evaluating and understanding adaptive behaviors.

Brief Biography

Ryohei Kanzaki received his B.S., M.S. and D.Sc. degree in Neurobiology from the Institute of Biological Sciences, University of Tsukuba in 1980, 1983 and 1986, respectively. From 1987 to 1990 he was a postdoctoral research fellow at the Arizona Research Laboratories, Division of Neurobiology, University of Arizona. From 1991 to 2003 he was successively an assistant professor, associate professor, and full professor at the Institute of Biological Sciences, University of Tsukuba. From 2004 to 2006 he was a full professor at Department of Mechano-Informatics, Graduate School of Information Science and Technology, University of Tokyo. Since 2006 he is a full professor at the Research Center for Advanced Science and Technology (RCAST), University of Tokyo. He is a vice president of the Japanese Society for Comparative Physiology and Biochemistry.

IROS 2009 Workshops and Tutorials

SuT1- SuT11, 8:30 - 17:30, Sunday, Oct. 11, 2009

1. Angelika Peer*, Sandra Hirche. [Workshop on Haptic Human-Robot Interaction](#)
2. Barbara Caputo*, John Tsotsos, Giorgio Metta. [Fifth International Cognitive Vision Workshop \(ICVW 2009\) Categorization, Attention and Embodiment](#)
3. Urbano Nunes* [Workshop on Planning, Perception and Navigation for Intelligent Vehicles - PPNIV Workshop](#)
4. Steven M LaValle*. [Tutorial: Filtering and Planning in Information Spaces](#)
5. Hitoshi Aonuma*, Hajime Asama, Jun Ota. [Mobiligence: Social Adaptive Functions in Animals and Multi-Agent Systems](#)
6. Tetsuo Kotoku*, Noriaki Ando, Geoffrey Biggs. [Introduction to RT-Middleware \(OpenRTM-aist\)](#)
7. K. H. Low, Jorge Solis*, Ravi Vaidyanathan, Xinyan Deng. [Biologically-Inspired Robotics](#)
8. Minoru Asada*. [Synergistic Intelligence: approach to human intelligence through understanding and design of cognitive development](#)
9. Samir Bouabdallah*, Kimon Valavanis. [Micro Aerial Vehicles from Technologies to Commercialization: Ready or not ready?](#)
10. Danil Prokhorov*. [Autonomous mental development for intelligent robots and systems](#)
11. Stéphane Doncieux*, Nicolas Bredeche, Jean-Baptiste Mouret. [Exploring New Horizons in Evolutionary Design of Robots](#), Half day, Afternoon session

ThT1 – ThT8, 8:30 - 17:30, Thursday, Oct. 15, 2009

1. Stephen Balakirsky, Stefano Carpin*, Michael Lewis. [Robots, Games, and Research: Success stories in USARSim](#)
2. Radu Bogdan Rusu*, Gary Bradski, Kurt Konolige, Michael Beetz. [Semantic Perception for Mobile Manipulation](#)
3. Nils T Siebel*, Josef Pauli. [International Workshop on Evolutionary and Reinforcement Learning for Autonomous Robot Systems \(ERLARS\)](#)
4. Angel P. del Pobil, Raj Madhavan, Fabio Paolo Bonsignorio*. [Performance Evaluation and Benchmarking for Next Intelligent Robots and Systems](#)
5. Ravi Vaidyanathan*, Roger, D. Quinn, K. H. Low, Xinyan Deng, Jorge Solis, [Critical Impediments and Future Challenges for Multi-Modal Robotic Locomotion](#)

6. Sebastian Wrede*, Ingo Lütkebohle, Davide Brugali. [IEEE TC-Soft Workshop on Event-based Systems in Robotics \(EBS-RO\)](#)
7. Norihiro Hagita, Alberto Sanfeliu, Hiroshi Ishiguro, Takayuki Kanda*. [Network Robot Systems: Network Robot Services for the Elderly](#)

SuT1: Workshop on Haptic Human-Robot Interaction

Organizer: Angelika Peer*, Sandra Hirche

This workshop is exclusively dedicated to the topic of haptic (physical) human-robot interaction. In recent years this particular field enjoys increasing popularity, but is still largely underrepresented when compared to other fields of human robot interaction such as communication via speech and gestures. As robots are no longer restricted to industrial applications, but also enter human environments, physical human-robot interaction is one of the major challenges in designing future robotic systems. Robots are expected to haptically interact with human partners to extend the human workspace to dangerous or inaccessible environments, to assist as autonomous helpers in a broad range of tasks, and to enhance training as well as rehabilitation.

Research in this field is characterized by a high amount of interdisciplinary. This workshop tries to bring together researchers from the fields of haptics, telerobotics, autonomous control, neuro-rehabilitation, behavioral studies, human-human and human-robot interaction. One of the most relevant objectives is to become a contact point for all people interested in this field. Thus, a great effort has been made to invite internationally renowned scientists covering many aspects in the field of haptic human-robot interaction. The workshop will provide a deep overview of the most recent advances in the field and it will form an ideal environment for the emerging community to meet and exchange ideas.

SuT2: Fifth International Cognitive Vision Workshop (ICVW 2009) Categorization, Attention and Embodiment

Organizer: Barbara Caputo*, John Tsotsos, Giorgio Metta

Computer vision is gaining importance in the fields of artificial cognitive systems and robotics, due to the progress achieved in the last years in recognition, categorization and scene analysis as well as its low cost and versatility. From robot localization to manipulation, the integration of state of the art vision algorithms into robotic systems is a success story. Still, the two fields are largely separated. While vision has been traditionally studied using a reductionistic approach, issues such as multi-cue integration, embodied categorization and situated attention can only

be studied in the context of systems. The goals of this workshop are to document the progress of the relatively young field of cognitive computer vision and systems, to bring together the researchers working and interested in this field and giving them a platform to discuss the most recent advances in the field and what are the research challenges that is timely to attack today.

SuT3: Workshop on Planning, Perception and Navigation for Intelligent Vehicles - PPNIV Workshop

Organizer: Urbano Nunes*

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. This workshop will address robotics technologies, which are at the very core of this major shift in the automobile paradigm.

SuT4: Tutorial: Filtering and Planning in Information Spaces

Organizer: Steven M LaValle*

One of the greatest challenges and frustrations arising from uncertainty is the burden of modeling. Although robots and sensors may have imperfect or incomplete information of the environment, many approaches attempt to model everything probabilistically and then design filters that attempt to estimate likely states. This tutorial will cover some new techniques that in some contexts may allow the modeling burden to be completely avoided by carefully studying the amount of information that is minimally necessary to achieve some task. A mathematical framework will be presented for modeling cheap, minimalist sensors, which can then be used for a variety of tasks, such as exploration, navigation, tracking, monitoring, and security. The approach relies on the introduction of powerful, new combinatorial filters, which are a minimalist analog of common techniques such as Bayesian or Kalman filters. Once minimal information requirements are understood, simple, cheap robot systems can be constructed that are robust to uncertainties that never need to be explicitly handled. Furthermore, one can place probabilistic models over the minimalist structures to obtain even greater robustness in practice. Therefore, the methods from this course are compatible and complementary to common probabilistic techniques used in robotics and sensor networks.

SuT5: Mobiligence: Social Adaptive Functions in Animals and Multi-Agent Systems

Organizer: Hitoshi Aonuma*, Hajime Asama, Jun Ota

Human and Animals can behave adaptively even for diverse and complex environments in various types of behaviors, such as locomotive behaviors in the form of swimming, flying and walking, manipulation behaviors such as reaching, capturing and grasping, social behaviors to the other subjects, etc. Such an adaptive function is considered to emerge from the interaction of the body, brain, and environment, which is induced by the active mobility of the cognitive subject. We call this mobiligence. Namely, the mobiligence can be defined as intelligence for generating adaptive motor function which is emerged by mobility.

This workshop focuses on mechanisms of social adaptive functions in animals and artificial agents. There are various organisms living on the earth, and they have evolved adaptive functions to survive in the changing environment. Social adaptive function is one of the most fundamental features of animals to survive. One of the common interests between engineers and biologists is to understand how animals alter their behaviors in order to respond to the demands of changing environments. Multidisciplinary contributions from biology and engineering must be important for a deeper understanding of the adaptive functions.

SuT6: Tutorial: Introduction to RT-Middleware (OpenRTM-aist)

Organizer: Tetsuo Kotoku*, Noriaki Ando, Geoffrey Biggs

With the rapid progress in computer and communication technology, the robot systems are fast becoming larger and more complicated. Therefore, there is a real need for the software technologies for efficient developments. Now various software technologies are proposed and implemented respectively. Unfortunately, most of these pioneering initiatives are developed independently of the others, driven by specific applications and objectives. In order to settle this state of chaos, we would like to contribute to the promotion of standardization in the field of robotics based on mutual understanding between the relevant parties.

The objective of the tutorial is to provide you (robotics researchers and robotics professionals) with information about OMG Robotic Technology Component specification, OpenRTM-aist robot software development, and to hold discussions about the Robot Technology (RT) Middleware software framework for robotics and the similar and preceding activities around the world. OpenRTM-aist is available at <http://www.openrtm.org/>.

SuT7: Biologically-Inspired Robotics

Organizer: K. H. Low, Jorge Solis*, Ravi Vaidyanathan, Xinyan Deng

In recent years, the benefits of “biologically inspired” approaches have become increasingly clear in engineering design. Living organisms are complex systems exhibiting a range of desirable engineering characteristics that have proved difficult to realize using traditional engineering methodologies. Research in this field has successfully fused techniques from sensor development, artificial intelligence, neuroscience, simulation/modeling, and robotics. The goal of this workshop is to provide a forum for the examination of the interplay between biological and artificial (autonomous or semi-autonomous) systems, and present biology as a learning tool for novel robotic paradigms.

SuT8: Synergistic Intelligence: approach to human intelligence through understanding and design of cognitive development

Organizer: Minoru Asada*

Emergence of higher order cognitive functions through learning and development is one of the greatest challenges in trying to make artificial systems much more intelligent since existing systems are of limited capability even in fixed environments. Related disciplines are not simply robotics and AI but also brain science, neuroscience, cognitive science, developmental psychology, sociology, and so on, and we share this challenge. An obvious fact is that we have too poor and little knowledge and too superficial implementations based on such knowledge to declare that we have only one unique solution to the mystery.

The first step to conquer this situation is to discuss how higher order cognitive functions are acquired involving the context and dynamics of the whole system instead of separately realizing each higher order function as a single module. A promising approach is a synthetic one based on both the explanation theory and more importantly the design theory that is expected to fill in the gap between the existing disciplines instead of staying at one closed discipline, and to provide new understanding of human cognitive development.

This WS first revisits the cognitive developmental robotics (Asada et al. 2001) that aims at providing new understanding how human's higher cognitive functions develop by means of a synthetic approach, and expands discussion toward the principle of cognitive development. Next, several speakers including not only confirmed but also ones whose papers are submitted and accepted present their position papers with some experimental results. Finally, panel discussion on the new research direction of understanding and designing body, brain, and mind will be held.

SuT9: Micro Aerial Vehicles from Technologies to Commercialization: Ready or not ready?

Organizer: Samir Bouabdallah*, Kimon Valavanis

The field of Micro Aerial Vehicles is gaining an important interest from the scientific, industrial and hobbyist communities. These flying systems can be of high value in surveillance, search, rescue and many other missions. The multidisciplinary nature of MAVs makes it challenging for a research group to master the numerous related scientific problems. Therefore, workshops which regroup scientists from different disciplines of aerial vehicles represent an excellent opportunity to exchange ideas and discuss progress and challenges. The proposed workshop is such an opportunity. It will focus on several research questions on fixed-wing, rotary-wing and other types of MAVs, especially identifying mature and promising technologies that will bridge the gap between research and market-ready MAVs. The workshop shall also help to identify current and future challenges and review future research directions. This event will be the meeting place for aerial-robotic researchers who are interested in theoretical and practical problems of MAVs.

SuT10: Autonomous Mental Development for Intelligent Robots and Systems

Organizer: Danil Prokhorov*

What is autonomous mental development (AMD)? It is a process in which a natural or artificial embodied system controlled by its internal developmental program develops mental capabilities through autonomous real-time interactions with its environments including its own internal environment by using its own sensors and effectors. The mental capabilities include perceptual, cognitive, behavioral, emotional, and all other mental capabilities that are exhibited by humans, higher animals, and advanced artificial systems.

Recent advances in computational intelligence, cognitive science, neuroscience, and robotics have stimulated the birth and rapid growth of the AMD. New cross-disciplinary conference series, International Conference on Developmental Learning (ICDL), has been initiated and going strong for several years. The new IEEE Transaction on Autonomous Mental Development was established in 2008 to help bring together different communities of researchers to advance the AMD field.

SuT11: Exploring New Horizons in Evolutionary Design of Robots

Organizer: Stéphane Doncieux*, Nicolas Bredeche, Jean-Baptiste Mouret

Robot design usually follows a reductionist approach where mechanics, electronics, control loops and software are designed in sequential order, without much “feedback” from higher level components. While impressive results have been achieved with this methodology, and it is arguably the best suited to human engineers, it neglects numerous situations in which, for instance, a minor change in mechanics can substantially simplify software and/or electronics. Conversely, evolution allows living organisms to take full advantage of interactions across levels, because it provides a automatic and integrated design process that relies only on the effectiveness of its results as a whole.

Loosely inspired by nature, Evolutionary Algorithms (EAs) now provide mature optimization tools that have successfully been applied to the design of many artifacts, from antennas to complete robots. In robotics, it has culminated in the Evolutionary Robotics research field. Modular robotics, swarm robotics or any robot with non-conventional mechanics (high redundancy, dynamic motion, multi-modality) are challenging robotics applications for which such an integrated approach could prove useful.

The workshop will present the most recent fundamental developments of ER, including some not yet transferred to real robotics applications. It also aims at facilitating discussions on ER applications between researchers of the field and potential users. Compared to the main conference, the emphasis will be on fundamental issues rather than on practical implementations.

ThT1: Robots, Games, and Research: Success stories in USARSim

Organizer: Stephen Balakirsky, Stefano Carpin*, Michael Lewis

Since its genesis in 2003, USARSim has evolved into a full-blown robot simulator whose components have been downloaded more than 40,000 times. The spectrum of envisioned applications has grown far beyond the initially envisioned search and rescue applications, and now encompasses a huge variety of robots, sensors and actuators. Examples of successful and effortless migrations of code from simulation to real robots abound; a clear indication of its value as a tool to ease the development and debugging of robot control software targeted for running on real robots. An active community of developers has contributed back a variety of additions to the open source project, and a fruitful exchange of ideas and tools has been established. This workshop aims to bring together researchers and educators using this software in order to promote and exchange of ideas, results, and software components. This timely event will coincide with the release of the new version of the simulator that will offer many renewed opportunities to current and new users.

ThT2: Semantic Perception for Mobile Manipulation

Organizer: Radu Bogdan Rusu*, Gary Bradski, Kurt Konolige, Michael Beetz

As autonomous mobile manipulation will soon move away from individually set up manipulation experiments and begin to tackle real-world everyday manipulation tasks, such as setting the table or cleaning up, the perception capabilities of the robots must become much more powerful. For example, if the robot is asked to bring a glass it must not bring a dirty one or one that is intended for the use of somebody else. More generally, perception for mobile manipulation must become a resource for the robot, which informs the robot with respect to what to do to which object and in which way. This is the main issue of semantic perception for mobile manipulation.

In this full-day workshop we will try to analyze the requirements of such a perception system, and discuss alternatives for achieving this goal, by bringing together researchers from the Computer Vision, 3D Mapping, and Mobile Manipulation and Grasping areas. As an immediate course of action, we plan to make available during the workshop a complete database of 3D object models and scenes for mobile manipulation scenarios.

ThT3: International Workshop on Evolutionary and Reinforcement Learning for Autonomous Robot Systems (ERLARS)

Organizer: Nils T Siebel*, Josef Pauli

Evolutionary and Reinforcement Learning methods are important learning approaches for neural networks and other knowledge representations. They are inspired by nature and known to be used extensively in biological systems. However, so far their use in artificial cognitive systems, e.g. autonomous robot systems, is limited. This is mainly due to the large number of necessary robot actions and/or learning cycles before an acceptable mapping from perceptions to actions is found. Autonomous robots are becoming more and more common even in non-industrial settings, an example area being toys like Sony's Aibo robotic dog and the new Pleo toy dinosaur. However, they tend to have very limited learning capabilities. These are usually restricted to adjusting a few parameters in an otherwise fixed control strategy that determines how the robot interacts with the environment.

In recent years, fast computers have made evolutionary and reinforcement learning more feasible from a computational point of view. Therefore research in these areas has attracted more attention. A number of new and efficient algorithms have shown promising results, albeit many of these still rely on training in simulated environments or in combinations of offline and online learning.

The main goal of this workshop is to bring together researchers and promote work on evolutionary and reinforcement learning methods with a focus on their (future) application in

autonomous robot systems. We believe that in order to achieve this a great deal of fundamental research, e.g. on the efficiency of algorithms, is just as important as their practical applications. Therefore contributions are invited both on theoretical and practical results in this area.

ThT4: Performance Evaluation and Benchmarking for Next Intelligent Robots and Systems

Organizer: Angel P. del Pobil, Raj Madhavan, Fabio Paolo Bonsignorio*

High-level cognitive competencies encompassing knowledge representation, perception, control, and learning are considered essential elements that will allow robots to perform complex tasks within highly uncertain environments with an appropriate level of autonomy in various domains (service, manufacturing, and search and rescue). As the complexity and variety of required tasks and of the targeted environments increase exploring new application capabilities and domains, it becomes necessary to develop well principled procedures that allow quantitative comparison of the solutions provided by robotics research thereby facilitating exchanges of methods and solutions between different research groups and assessment of the state of the art.

New more successful implementations of concepts already presented in literature, but not implemented with exhaustive experimental methodology, run the risk of being ignored, if appropriate benchmarking procedures allowing to compare the actual practical results with reference to standard accepted procedures, are not in place.

The emphasis of the workshop will be on principles, methods, and applications expanding beyond the current limit of robotics applications in terms of cognitive capabilities and autonomy. Another key issue will be a capability-led understanding of cognitive robots: how to define shared ontologies or dictionaries to discuss robotic cognitive systems in terms of their performance, relationships between different cognitive robotics capabilities, requirements, theories, architectures, models and methods that can be applied across multiple engineering and application domains, detailing and understanding better the requirements for robots in terms of performance, the approaches to meeting these requirements and the trade-offs in terms of performance.

The proper definition of benchmarking is related to the problem of measuring capabilities of robots in a context in which, in many cases, the 'robotics experiments' themselves are difficult to 'replicate'.

ThT5: Critical Impediments and Future Challenges for Multi-Modal Robotic Locomotion

Organizer: Ravi Vaidyanathan*, Roger, D. Quinn, K. H. Low, Xinyan Deng, Jorge Solis

ThT6: IEEE TC-Soft Workshop on Event-based Systems in Robotics (EBS-RO)

Organizer: Sebastian Wrede*, Ingo Lütkebohle, Davide Brugali

ThT7: Network Robot Systems: Network Robot Services for the Elderly

Organizer: Norihiro Hagita, Alberto Sanfeliu, Hiroshi Ishiguro, Takayuki Kanda*

In previous workshops in this series, we have invited key persons from various regions to discuss its current status and future direction of "network robot systems". This has enabled us to clarify the fundamental research areas pertaining to network robot systems. The first objective is the continuation of this effort of community building by bringing together key people.

In addition to community building, this proposed workshop will place special emphasis on the exchange of ideas about "network robot services for the elderly". As aging of the population is a serious social problem in several countries, attempts have been made to apply robotics to physical support for the elderly. Moreover, "networked" robots have great potential in their ability to connect people in remote places; that is, network robot systems allow us to consider applications for the elderly involving social human-robot interaction, such as providing encouragement to communicate more with others and participate in communities. On the other hand, such networked systems raise potential concerns about security and privacy. We will discuss the appropriate use of technology to meet the needs of the elderly with current technical limitations.

In conjunction with these efforts, the research community should contribute its significant knowledge base towards technical standardization and legal guidelines, which are always needed in industry. Reflecting the growth of this research community, this direction of research is now supported by many governments, and several initial "network robot systems" have been built in Japan, Europe, and Korea; questions have now begun to arise about legal, safety, and responsibility concerns. By involving lawyers, we will start to share this society-level concern internationally in order to think about a global standard about legal and safety criteria in the workshop at ICRA2009. We will continue this discussion with more emphasis on applications for the elderly.

IROS 2009 Exhibitors



ABB



Barrett Technology Inc.



Willow Garage



Robotis



Vortex CM Labs



Skybotix



Mobilerobots Inc.



Butterfly Haptics LLC



SimLab Co., Ltd.



Springer Science+Business Media



Ascending Technologies GmbH



Hokuyo Automatic Co., Ltd



SCHUNK Inc



JETRO Chicago



RoadNarrows LLC



Aldebaran Robotics



KIST-TAMUCC

General Information

Conference Date and Venue

Date: 12 - 14 October 2009 (Technical sessions)

11, 15 October 2009 (Workshops)

Venue: Hyatt Regency St. Louis Riverfront, St. Louis, Missouri, USA

Registration Desk

11 October 2009: 8:00 am – 6:00 pm. Location: Coatroom at 4th floor
(opposite to Grand A room)

12 October 2009: 7:30 am – 6:00 pm. Location: Coatroom at 4th floor

13 October 2009: 7:30 am – 6:30 pm. Location: Coatroom at 4th floor

14 October 2009: 7:30 am – 6:00 pm. Location: Coatroom at 4th floor

Conference Events

11 October, 2009:

- Welcome Reception: 6:00 pm – 8:00 pm
Location: Grand D and E

12 October, 2009:

- Gold Lunch: 12:40 pm – 2:00 pm
Location: Grand D and E
(first come first serve basis with limit supplies)
- Botanical Garden Dinner Tour: 6:00 pm – 9:20 pm
Location: Botanical Garden
(Shuttle buses begin leaving hotel from 6:00 pm.)

13 October, 2009:

- Lunch Discussion: Government Panel on Robotic Research and Funding: 12:30 pm – 2:00 pm
Location: Grand D and E
(first come first serve basis with limit supplies)
- Conference Banquet: 6:30 pm – 9:00 pm
Location: Grand D and E

14 October, 2009:

- Award Lunch: 12:30 pm – 2:00 pm
Location: Grand D and E
- Farewell Reception: 6:00 pm – 8:00 pm
Location: Grand D and E

For welcome reception and farewell reception, all registered conference participants are welcome. For conference banquet and Botanical Garden dinner

tour, all regular registered participants are welcome. Additional tickets can be purchased at the registration desk for their guests. All lunches are first come first serve basis with limit supplies.

RAS Gold Lunch (Graduates of the Last Decade)

Date: Monday October 12, 2009

Time: 12:40-14:00 (during lunch break)

Place: Grand Hall: D and E

Free box lunch is available on a first-come, first-served basis to the first 200 attendees who have graduated from any institution in the past 10 years (generally those under 40). Ken Goldberg, Vice-President of Technical Activities, and other Society officers will highlight recent developments and describe the RAS 23 Technical Committees (TCs) and also our Distinguished Lecturer (DL) Program. Attendees will have the opportunity to ask questions, talk with TC chairs, sign up to join TCs, and meet fellow young professionals in our Society.

Botanical Garden Dinner Tour

Date: Monday October 12, 2009

Time: 18:00-21:20

(Shuttle buses begin leaving hotel from 6:00 pm.)

Founded in 1859, the [Missouri Botanical Garden](#) is the nation's oldest botanical garden in continuous operation and a National Historic Landmark.

The Garden is a center for botanical research and science education, as well as an oasis in the city of St. Louis. The Garden offers 79 acres of beautiful horticultural display, including a 14-acre Japanese strolling garden, Henry Shaw's original 1850 estate home, and one of the world's largest collections of rare and endangered orchids.

The year 2009 marks the Garden's sesquicentennial anniversary. For over 150 years, the Garden has been an oasis in the city, a place of beauty and family fun—and also a center for education, science, and conservation.

A full conference registration includes the ticket for the Botanical Garden Dinner Tour. Extra ticket can be purchased separately.

Lunch Discussion: Government Panel on Robotic Research and Funding

Date: Tuesday October 13, 2009

Time: 12:30-14:00 (during lunch break)

Place: Grand Hall: D and E

The panelists include robotics program managers from National Science Foundation, DARPA, Army Research Office, and European Union. They will first

present the overview of their programs and followed by questions and answers session.

Box lunch will be provided on a first-come, first-served basis with limit supplies.

Award Lunch

Date: Wednesday October 14, 2009

Time: 12:30-14:00 (during lunch break)

Place: Grand Hall: D and E

At the Award Lunch, the finalists and the winners of the following IROS 2009 best-paper awards will be announced.

NTF Award for Entertainment Robots and Systems

JTCF Novel Technology Paper Award for Amusement Culture

Robo Cup Best Paper Award

ICROS Conference Best Application Paper Award

IROS 2009 Best Paper Award

In addition, we will announce the winner of 2009 IROS Harashima Award for Innovative Technologies.

Meeting with National Science Foundation, Robust Intelligence (Robotics) Program Director, Dr. Paul Y. Oh

Date: Thursday October 15, 2009

Time: 9:00-17:00

Place: Mills 8

Dr. Oh will first give a presentation on NSF robotics programs. Following the presentation, one-to-one private meeting with Dr. Oh will be arranged. All participants are welcome to sign up the one-to-one meeting at the registration desk before Oct 15.

Official Language

The official language of the conference is English.

All presentation including discussion and submissions shall be made in English.

Conference Auxiliary Facilities

At each oral presentation room, one set of LCD projector will be provided. The presenters should prepare and use their own computers.

Internet

Wireless internet is provided in the exhibition area and the poster session room.

Transportation

Metrolink

A light rail train system connecting the main and east terminals of Lambert International Airport to the downtown area. Hyatt Regency St. Louis Riverfront guests can exit at 8th and Pine Street (hotel is at 4th and Pine St.) just minutes from the hotel. Total travel time is approximately 27-30 minutes. The trains run approximately every 30 minutes from 5:02 a.m. to 12:48 a.m. Cost: \$3.50 to / from airport. Not recommended for people with heavy or large amounts of luggage as there is a short walk to the hotel. *All other rides on the METROLINK are \$2.00 each way. Metrolink tickets are sold at each stop.

Trans Express

For reservations call 314-427-3311: \$15 per person one way, \$25 per person round trip. 5:50 a.m. - 10:00 p.m. runs every 25 minutes. Reservations are required after 6:10 p.m. (White vans with black lettering that reads TRANS EXPRESS). *Major credit cards accepted to downtown.

Taxi

For wheelchair guests, contact Richardson Transportation at 314-725-9111 (prefer 24- hour notice) Or Harris Cab (some extra charges may apply) at 314-535-5087 or 314-371-7111. Taxi is approximately \$45.00, each way.

Amtrak

8 blocks from hotel--taxi is approx \$8.
550 S 16th St., St Louis – 314-331-3309

Local Bus

Bi-State Transit runs. Cost is \$1.75.
Megabus Stop for service between St. Louis and Chicago, call 877-GO2-MEGA (877-462-6342) or go to www.megabus.com for information!

About St. Louis, MO, USA

St. Louis is known as the "Gateway City", as it is seen as the Eastern/Western US dividing mark. It's also called "Gateway to the West" on behalf of the many people who migrated west through St. Louis via the Missouri River. The city is also well known for its contribution to Blues, Ragtime, Jazz and Theatre. The St. Louis Cardinals, one of the most successful Major League Baseball teams, make their home at Busch Stadium, other teams include the St. Louis Rams (football) and St. Louis Blues (hockey). A diversity of successful sports franchises has led to St. Louis being called "North America's Best Sports City".

Climate

St. Louis lies on the border between humid continental climate and humid subtropical climate, and has neither large mountains nor large bodies of water to moderate its temperature. Both cold Arctic air and hot, humid tropical air from the

Gulf of Mexico affect the region. The city has four distinct seasons. The average low temperature in October is 49 °F (9 °C) and the average high temperature in October is 69 °F (21 °C).

What to Wear

Proper attire is recommended during the conference; e.g. casual attire at welcome and farewell receptions, suit or white shirt with neck-tie at all technical sessions and banquet.

Business Hours

Most offices open from 9:00 am - 5:00 pm, Monday to Friday, except on public holidays.

Local Time

GMT -6 hours (and daylight saving time)

Electricity

The electric system is 120 volt AC (60 Hz).

Troubles in USA

Regular Police: Tel: 911

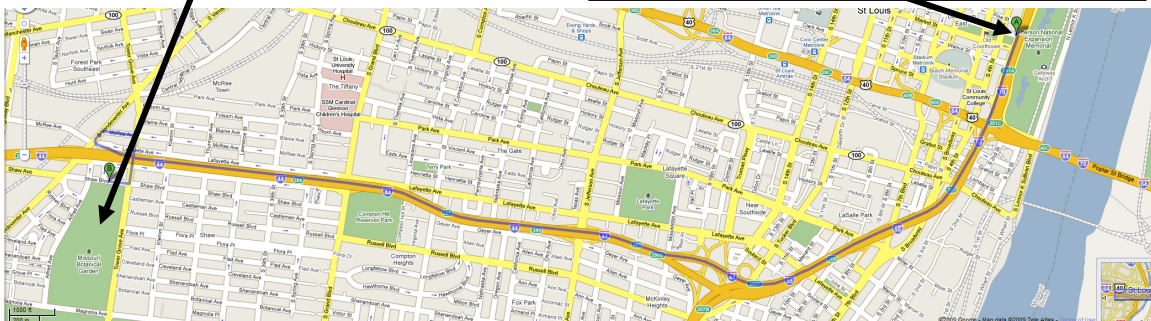
Hotel Exterior Map



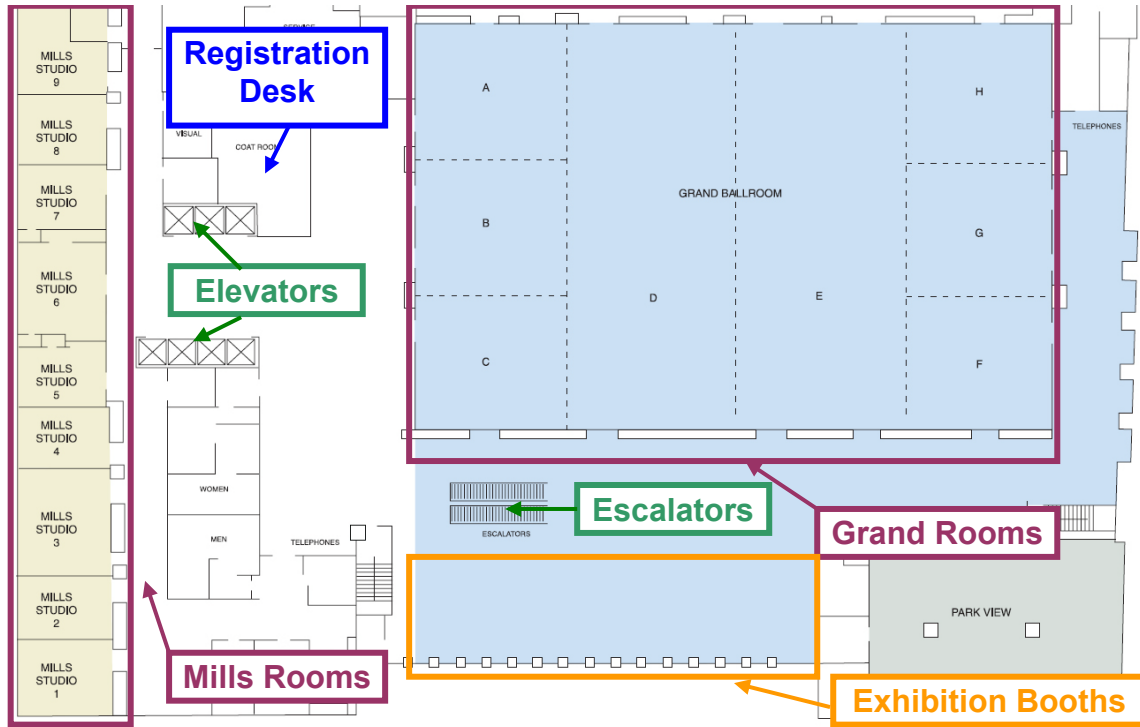
Location of Dinner Tour on Oct. 12

Botanical Garden

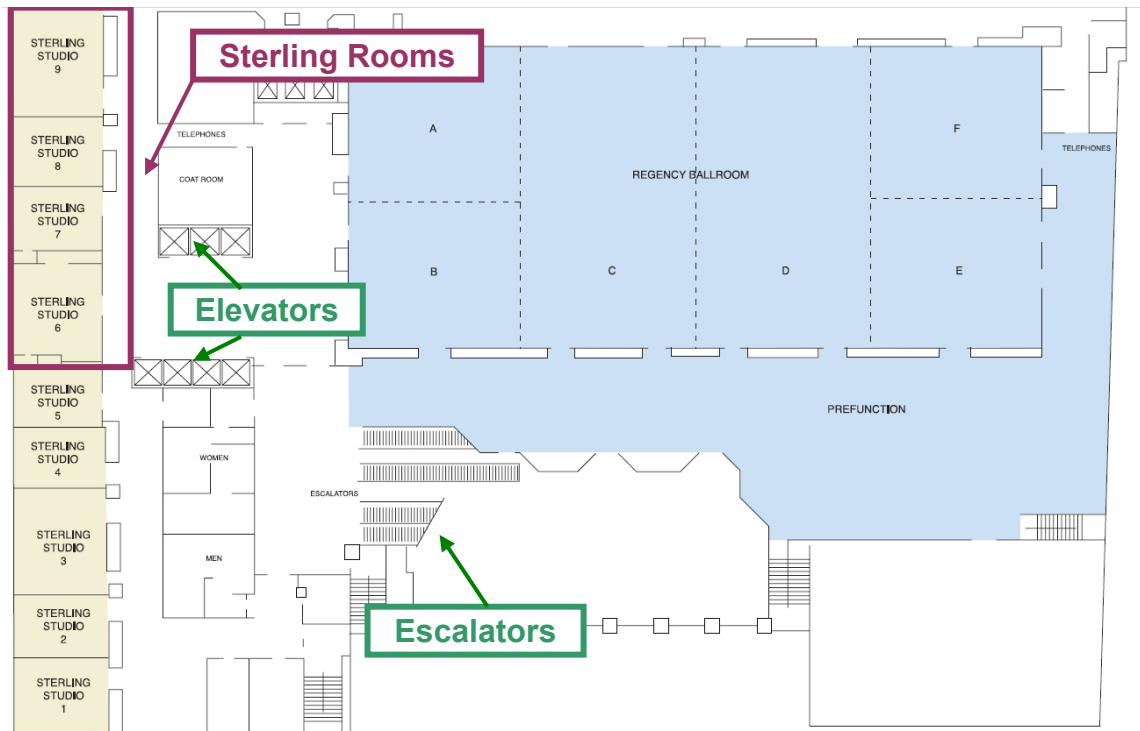
Hyatt Regency St. Louis Riverfront



Conference Rooms: Hyatt Regency St. Louis Riverfront

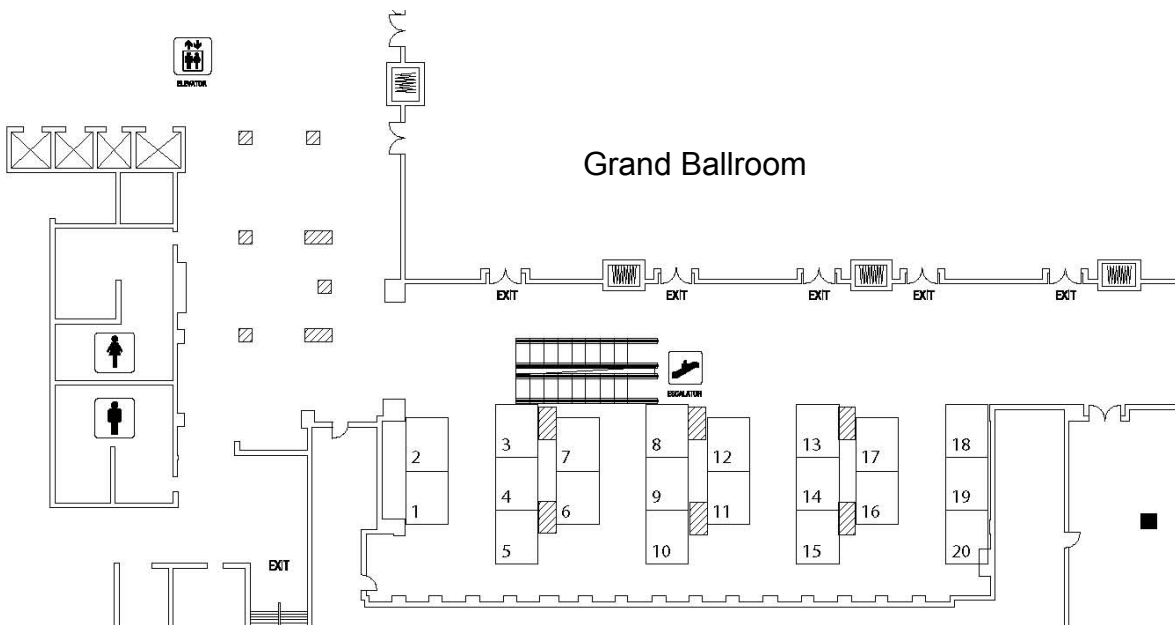


4th floor: Grand Rooms, Mills Rooms and Registration Desk



2nd floor: Sterling Rooms

Exhibition Booths: 4th floor



Booth #1 & #2	Mobilerobots Inc.
Booth #3	Springer
Booth #4	SimLab Co., Ltd
Booth #5	Aldebaran Robotics
Booth #6 & #7	RoadNarrows LLC
Booth #8	SCHUNK Inc.
Booth #9	JETRO Chicago (Japan External Trade Organization)
Booth #10	KIST-TAMUCC
Booth #11	Hokuyo Automatic Co., Ltd
Booth #12	ABB
Booth #13	Barrett Technology Inc.
Booth #14	Butterfly Haptics LLC
Booth #15	Skybotix
Booth #16	Ascending Technologies GmbH
Booth #17	Robotis
Booth #18 & 19	Willow Garage
Booth #20	IEEE