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2008 Robot Workshop and Exhibition Backgrounder

July 14-16, 2008
Hyatt Regency McCormick Place, Chicago, Illinois
Second Level, Hyatt Regency Conference Center, CC23
In conjunction with the AAAI-08 Conference

This year AAAI is sponsoring two Robot Workshops and Exhibitions – one on **Robots and Creativity** (pages 1-9) and one on **Mobility and Manipulation** (pages 10-14). Below are schedules, descriptions of the robots to be presented, and brief biographies of the researchers involved. Exhibits will be showcased on July 15 and 16. This gives audiences opportunities to see and experience what was discussed in the Workshop.

Workshop on Robotics and Creativity
July 14, 2008, 8:20a.m.-12:30 p.m.

This workshop explores the roles that creativity plays in robotics. This includes research where robots employ cognitive models and computation to display creativity. Also explored are partnerships among artists, scientists and engineers to generate a creative synergy and stimulate breakthroughs.

Format

A distinguished panel will kick off the workshop by providing a broad overview of the area, emerging paradigms and exciting opportunities. Those invited to exhibit at AAAI, will give short 10-minute briefs. These talks provide examples and personal thoughts of creativity and robotics. The workshop concludes with a 60-min Discussion Forum to capture thoughts and generate research roadmaps.

Schedule

Time			
08:20	Youngmoo Kim	Drexel University and Workshop Chair	Creative Expression through Humanoid Robotics and Dance
08:30	Amy Baylor	National Science Foundation	CISE -- Creative IT Program
09:00	Ruzena Bajcsy, Lisa Wymore, Klara Nahrstedt, Renata Sheppard, and Olivier Kreylos	UC Berkeley, UIUC, and UC Davis	Digital Choreography - The Road to IT Creativity
09:30	Stellan Ohlsson	University of Illinois Chicago	A Processing Mechanism that Can Produce Insights
10:00	Gil Weinberg	Georgia Tech	Extending the Musical Experience - from the Physical to the Digital... and Back
10:30	Coffee break		
10:45	Reid Simmons and Marek Michalowski	CMU	Keepon
10:50	Jeff Lieberman	MIT	Absolut Quartet
10:55	Debra Burhans	Canisius College	The Great Wumpus Hunt
11:00	Zachary Dodds	Harvey Mudd College	Accessible Robotics Algorithms
11:05	Andrea Thomaz and Maya Cakmak	Georgia Tech	Learning about Objects with a Human Teacher
11:10	Todd Murphey	University of Colorado Boulder	The Automated Marionette Project
11:15	Richard Margolin	Hanson Robotics	Zeno
11:20	All Participants	Discussion Forum	Research Roadmaps: Near-term and Grand Challenges
12:30	Adjourn		

Abstracts and Biographies

Youngmoo Kim
Creative Expression through Humanoid Robotics and Dance
Abstract
Enabling a humanoid robot to dance in response to live music is a complex task requiring contributions from multiple disciplines. A vocabulary of intricate limb motions must be designed to be stable and subsequently coordinated to be complementary. In order to produce these movements in coordination with music, the robot must be able to detect the appropriate beats within audio, which is also a non-trivial problem. We have implemented a system based on a perceptual model of hearing that accurately determines beat locations, even for music without strong rhythmic content. This information is then combined with the motion vocabulary, allowing the robot to dance in real-time. Our system uses the *RoboNova*, a small humanoid robot about one foot high. Because of the limited processing capabilities of the unit, the motions require a high degree of optimization. We also present a simplified user interface that allows a user to experiment with both choreographed movement sequences as well as simple generative behavior.
Bio
Youngmoo Kim is an Assistant Professor of Electrical and Computer Engineering at Drexel University. He received his Ph.D. in Media Arts and Sciences from MIT and also holds Master's degrees in Electrical Engineering and Music (Vocal Performance Practice) from Stanford University. He is director of the Music and Entertainment Technology Laboratory (MET-lab), which pursues research in technologies for creativity and entertainment, including machine listening, music information retrieval, and human-computer interaction.

Amy Baylor
CISE -- Creative IT Program
Bio
Amy L. Baylor joined the National Science Foundation in September 2006 as a Program Director the Human Centered Computing Cluster in CISE/IIS (Division of Information and Intelligent Systems.) She on leave from Florida State University where she is an Associate Professor, jointly appointed in Instructional Systems and Information Technology. She also is the Director and Founder for the Center for Research of Innovative Technologies for Learning (RITL), http://ritl.fsu.edu. Dr. Baylor received her B.A. from Stanford University and her PhD from the University of South Carolina, both in the area of cognitive science. Her research interests include social and affective computing, virtual humans, anthropomorphic and multi-modal interfaces, metacognitive and creativity support tools, and advanced technologies for learning and motivation.

Ruzena Bajcsy
Digital Choreography - The Road to IT Creativity
Abstract
Creating a new dance requires choreographer/dancers to engage with inner motivations to express feelings as well as to dialogue with the external environment, whether that be visual, aural, tactile, or kinesthetic environmental stimulus on a stage or in a laboratory.

The choreographer devises body movements using internal and external cues to express feelings and concepts, from the most abstract ideas to very concrete human situations in a highly creative manner, wherein a body or bodies in time and space are the central tools of this choreographic process. Choreography is simultaneously deeply abstract and physical. Imagine a moment when a dancer enters into a 3D tele-immersive (3DTI) room surrounded by multiple 3D digital cameras and displays, where internal and external cues for creative movements come not only from physical objects in the 3DTI room, but also from a remote dancer who is placed in geographically-remote 3DTI room and appears in a joint virtual space with our dancer.

Bio

Dr. Ruzena Bajcsy is a professor of EECS at the University of California, Berkeley and director emeritus of CITRIS. Prior to coming to Berkeley, she was Assistant Director of the Computer Information Science and Engineering Directorate (CISE) between December 1, 1998 and September 1, 2001. She came to the NSF from the University of Pennsylvania where she was a professor of computer science and engineering and Director of the University of Pennsylvania's General Robotics and Active Sensory Perception (GRASP) Laboratory, which she founded in 1978. Dr. Bajcsy received her master's and Ph.D. degrees in electrical engineering from Slovak Technical University in 1957 and 1967, respectively. She received a Ph.D. in computer science in 1972 from Stanford University. Prior to her work at the University of Pennsylvania, she taught during the 1950s and 1960s as an instructor and assistant professor in the Department of Mathematics and Department of Computer Science at Slovak Technical University in Bratislava. In 2001 she received an honorary doctorate from University of Ljubljana in Slovenia. In 2001 she became a recipient of the ACM A. Newell award.

Stellan Ohlsson

A Processing Mechanism That Can Produce Insights

Abstract

The purpose of this presentation is to lay out some principles which, in conjunction, enable an information processing system to generate novelty. A precise set of quantitative processing principles for how to manipulate the activation values of representations within computational systems that can produce novelty will be specified. These rules identify the emergence of a novel idea in consciousness as a threshold phenomenon. No unique 'creative process' kicks in at the moment of insight. Instead, the creative insight is a side effect of processing as usual.

Bio

Stellan Ohlsson is Professor of Psychology and Adjunct Professor of Computer Science at the University of Illinois at Chicago (UIC). He received his Ph.D. at the University of Stockholm in 1980. He was Senior Scientist at the Learning Research and Development Center (LRDC) in Pittsburgh 1990-1995. He has published extensively on computational models of cognitive change. Dr. Ohlsson is currently completing a book length integration of his research in the areas of creativity, skill acquisition and conceptual change, to be published by Cambridge University Press under the title Deep Learning: How the Mind Overrides Experience.

Gil Weinberg

Haile – the first improvisational percussionist robot

Extending the Musical Experience - from the Physical to the Digital... and Back

Abstract

In the last decade we have explored a number of research directions in which digital technology bears the promise of revolutionizing the musical experience. The research directions identified – gestural expression, collaborative networks, and constructionist learning – can lead to musical experiences that cannot be facilitated by traditional means. While facilitating novel musical experiences, the digital nature of these research directions often led to flat and inanimate speaker-generated sound, hampering the physical richness and visual expression of acoustic music. In our current work, we attempt to combine the benefits of digital computation and acoustic richness, by exploring the concept of "robotic musicianship." We define this concept as a combination of algorithmic modeling of musical, perceptual, and social skills with the capacity to produce rich acoustic responses in a physical and visual manner. The robotic musicianship project aims to combine human creativity, emotion, and aesthetic judgment with algorithmic computational capabilities, allowing human and robotic players to cooperate and build off one another's ideas. A perceptual and improvisatory robot can best facilitate such interactions by bringing the computer into the physical world both acoustically and visually.

Haile, the first perceptual robotic percussionist, was designed to explore these concepts. The robot can listen to live players, analyze their music in real-time, and use the product of this analysis to play back in an improvisational manner. It is designed to combine the benefits of computational power and algorithmic music with the richness, visual interactivity, and expression of acoustic playing. When collaborating with live players, Haile is designed to inspire players to interact with it in novel manners that combine human expression and robotic algorithms. The project has been recently supported by an NSF grant aiming at extending the current rhythmic perceptual and improvisatory abilities to melody and harmony. The new perceptual marimba-playing robot will complete our music journey from the physical to the digital... and back.

Bio

Gil Weinberg is the Director of Music Technology at Georgia Institute of Technology, where he founded the Master of Science in Music Technology program and the Georgia Tech Music Technology Research Center. He holds professorship positions both the Music Department and the College of Computation. Dr. Weinberg received his M.S. and Ph.D. degrees in Media Arts and Sciences from Massachusetts Institute of Technology, after co-founding and holding a number of positions in music and media software industry in his home country of Israel. His music has been featured in festivals and concerts such as Ars Electronica, SIGGRAPH, ICMC, and NIME, and with orchestras such as Deutsches Symphonie-Orchester Berlin, the National Irish Symphony Orchestra, and the Scottish BBC Symphony. His interactive musical installations, notably the Beatbugs and the Musical Playpen, have been presented in museums such as the Smithsonian Museum, Cooper-Hewitt Museum, and Boston Children's Museum. With his perceptual robotic percussionist, Haile, he has traveled around the world, featuring dozens ten concerts in Asia, Europe, and North America.

Reid Simmons

Keepon

YouTube video of Keepon http://www.youtube.com/watch?v=nPdP1jBfxzo including Keepon dancing with other small lab robots towards the end of the video.

Abstract
Keepon is a small, nonverbal, creature-like robot designed for interaction with children through the communication of attentive and emotive movements. It has four degrees of freedom, cameras in its eyes, and a microphone in its nose. We have used Keepon in natural playroom settings to study social development and to develop tools for therapeutic practice for social developmental disorders such as autism. Recently, we have been studying the role of rhythm and synchrony in establishing engagement, through the use of sound, video, and accelerometer-equipped toys. This research has made Keepon popular on the internet as a dancer in a series of videos.
Bio
Reid Gordon Simmons is a Research Professor in the School of Computer Science at Carnegie Mellon University. He earned his B.A. degree in 1979 in Computer Science from SUNY at Buffalo, and his M.S. and Ph.D. degrees from MIT in 1983 and 1988, respectively, in the field of Artificial Intelligence. His thesis work focused on the combination of associational and causal reasoning for planning and interpretation tasks. The research analyzed the relationships between different aspects of expertise and developed a domain-independent theory of debugging faulty plans. Since coming to Carnegie Mellon in 1988, Dr. Simmons' research has focused on developing self-reliant robots that can autonomously operate over extended periods of time in unknown, unstructured environments. This work involves issues of robot control architectures that combine deliberative and reactive control, probabilistic planning and reasoning, monitoring and fault detection, and robust indoor and outdoor navigation. More recently, Dr. Simmons has focused on the areas of coordination of multiple heterogeneous robots, human-robot social interaction (including the robots Grace and the Roboceptionist), and formal verification of autonomous systems. Over the years, he has been involved in the development of over a dozen autonomous robots.

Jeff Lieberman
Absolut Quartet
See YouTube video http://www.youtube.com/watch?v=1e9AJVtuCKc
Abstract
Absolut Quartet is a music making machine like no other, where the audience becomes part of the performance. The visitor enters a 5 second theme, and the machine generates, in real-time, a unique musical piece based on the input melody you have provided. This melody is played by three instruments. The main instrument is a ballistic marimba, which launches rubber balls roughly 2m into the air, precisely aimed to bounce off of 42 chromatic wooden keys. The second instrument is an array of 35 custom-tuned wine glasses, played by robotic fingers. An array of 9 percussion instruments rounds out the ensemble.
Bio
Jeff attended MIT for 10 years, accumulating BS degrees in Math and Physics, and Master's degrees in Mechanical Engineering as well as Media arts and Sciences. He is currently finishing his fifth degree, a PhD in the Robotic Life group at the MIT Media Lab, exploring ways art and science can be combined, to bring people together in fundamentally new ways. His first major exhibition was at the Cooper-Hewitt Smithsonian National Design triennial, where he designed the CyberFlora installation, a robotic flower garden that interacts with viewers. He has patents in robotics applications

for motor learning and physical rehabilitation. His research has appeared in numerous international journals, and he has shown work in many shows around the world.

Jeff hosts a prime time TV show on The Discovery Channel, entitled 'Time Warp,' about using technologies such as high speed photography to teach people fundamentally new things about science.

Debra Burhans

The Great Wumpus Hunt

Abstract

The Wumpus World is a well known agent environment consisting of a grid whose cells might contain gold, pits, or a deadly wumpus. A wumpus hunter is an intelligent agent who enters the grid, avoids pits, collects gold, and kills the wumpus. We present a wumpus hunter embodied in a physical robot, moving and sensing in the real world, and, most importantly having the cognitive ability to consciously represent and reason about itself, the environment, and its actions. Our system is implemented using the snarpy architecture which links the SNePS knowledge representation, reasoning, and acting system to the Pyro Robotics framework.

Bio

Debra Burhans is an Associate Professor of Computer Science and Director of the Bioinformatics Program at Canisius College in Buffalo, NY. She received a B.S. in Mathematics from the University of Michigan and M.S. and Ph.D. in Computer Science from the State University of New York at Buffalo. Her research interests include genomics, cognitive robotics, computer science education, linguistics, and logic. She served as chair of the AAAI Robot Exhibition event in 2006. Debra is currently the Chair of the Mathematics and Computer Science Division for the Council on Undergraduate Research. She can be contacted at burhansd@canisius.edu.

Zachary Dodds

Accessible Robotics Algorithms

Abstract

This project provides portable modules allowing instructors or students alone to investigate and extend spatial reasoning algorithms with inexpensive robotic platforms. These materials can be used for short demonstrations, to scaffold week-long AI and robotics assignments, or as a foundation for larger - but still easily and broadly accessible - student-designed projects.

Bio

Zachary Dodds teaches computer science at Harvey Mudd College. His interests are in AI and robotics education, particularly toward broadening the audience and impact of those fields through the use of inexpensive, but very capable, classroom robots.

Andrea Thomaz and Maya Cakmak

Learning about Objects with a Human Teacher

Abstract

In building robots that assist people in human environments, it will not be feasible to pre-program them with every skill needed, learning will often be required. We believe robots should learn on their own, but they will also need to learn from everyday people. These "modes" of social and non-social learning are not mutually exclusive, but provide different learning opportunities for the robot.

We use a small upper-torso humanoid to study social and non-social learning about objects, and to understand how people scaffold a robot's learning. Preliminary observations point to important differences. A teacher helps the robot quickly collect positive examples, and self-learning allows the robot to explore the negative space of the problem.

Bio

Maya Cakmak has received a B.Sc. degree in Electrical and Electronics Engineering, a minor degree in Mechatronics and an M.Sc. degree in Computer Engineering from the Middle East Technical University, Turkey. She worked at the KOVAN Research Lab for two years. She is now pursuing a Ph.D. in Robotics at the College of Computing, Georgia Institute of Technology. She's working in the Socially Intelligent Machines Lab. Andrea Thomaz is an Assistant Professor of Interactive Computing at the Georgia Institute of Technology. She directs the Socially Intelligent Machines lab which is part of the Robotics and Intelligent Machines (RIM) Center and the Graphics Visualization and Usability (GVU) Center. Thomaz earned a B.S.E.E. from UT-Austin, and Sc.M. and Ph.D. degrees from MIT. She has published in the areas of Artificial Intelligence, Robotics, and Human-Robot Interaction.

Todd Murphey

The Automated Marionette Project

Abstract

Marionettes are complex constrained mechanical systems, often involving over fifty degrees of freedom and very nonlinear dynamics. Puppeteers have a very formal approach to managing this complexity that is reflected both in how they learn to manipulate marionettes as well as in the choreography they use to describe puppet plays. This project is aimed at encoding this choreographic language as a computer language appropriate for embedded systems. The end goal is to have a choreographic language that can be automatically "compiled" into a a play enacted by mechanically articulated marionettes.

Bio

Todd Murphey received his undergraduate degree in mathematics from the University of Arizona and a Ph.D. in Control and Dynamical Systems from the California Institute of Technology. He was a postdoctoral scholar at Northwestern University for a year, after which he worked for the Aerospace Corporation in the Electro-Mechanical Control Department. He has been an Assistant Professor at the University of Colorado at Boulder since Autumn of 2004.

Richard Margolin

Zeno

Abstract

Zeno is a conversational social robot who talks about AI and robotics issues, he makes eye contact with people and understands speech with NLP (neuro-linguistic processing), he displays feelings with extremely lifelike facial expressions, and can actually walk around, running on batteries. This is a platform for cognitive A.I. development, interfacing with Open Cog and other robot architectures.

Workshop on Mobility and Manipulation
July 14, 2008, 1:50 - 6:00p.m.

This workshop explores advanced perception and cognition that significantly advances and/or speeds robot mobility and/or manipulation. Exhibits will be showcased on July 15 and 16. This gives audiences opportunities to see and experience what was discussed in the Workshop.

Format

A distinguished panel will kick off the workshop by providing a broad overview of the area, emerging paradigms and exciting opportunities. Presentations will be 20-22 minutes not including time for questions. Those invited to exhibit at AAAI, will give short 10-minute briefs. These talks provide examples and personal thoughts of mobility and manipulation. The workshop concludes with a 60-min Discussion Forum to capture thoughts and generate research roadmaps.

Schedule

Time			
1:50	Monica Anderson	Drexel University and Workshop Chair	Opening Remarks
2:00	Robert Mandelbaum	DARPA	IPTO Programs
2:25	Stewart Tansley	Microsoft Research	Robotics Research
2:50	Oliver Brock	University of Massachusetts, Amherst	Results of 2005 NASA/NSF Workshop on Mobile Manipulation
3:15	Ron Provine	Boeing Phantom Works	AI Robotics
3:30	TBD		
4:00	Coffee Break		
4:25	Howie Choset	CMU	Snake Robots
4:30	Andrew Ng	Stanford	STAIR: Stanford AI Robot platform
4:35	Jerry Weinberg	Southern Illinois University	Formations and Legged Robots
4:45	David Touretzky	CMU	Hexapods
4:50	David Gustafson	Kansas State University	Semantic Vision
4:55	Jianna Zhang	Western Washington University	Robot Vision
5:00	All Participants	Discussion Forum	Research Roadmaps: Near-term and Grand Challenges
6:00	Adjourn		

Abstracts and Biographies

Robert Mandelbaum
Challenges in Mobile Manipulation
Abstract
The success of tele-operated robots in defusing explosives in Iraq has heightened interest in imbuing mobile robots with even greater dexterity and with capabilities to manipulate their environments in a more autonomous way. However, integrating and controlling multiple manipulators on mobile platforms presents numerous simultaneous challenges in the areas of perception, manipulator design, grasp planning, pose planning, and closed-loop control. In this talk, I present several challenge problems which DARPA is interested in addressing.
Bio
Dr. Mandelbaum is a Program Manager at DARPA in robotics. He currently manages the BigDog and Learning Locomotion programs. Dr. Mandelbaum was previously the Director of the Automotive Business Unit for Sarnoff Corporation. As Founder of Sarnoff's Robot and Automotive Vision Group he developed and applied perception technologies to Unmanned Ground Vehicles, and the commercial automotive industry. Dr. Mandelbaum has a Ph.D. in Computer and Information Science from U. Penn. He is a faculty member at Drexel University, and has taught a graduate course on "Computer Vision for Robots". He has published numerous technical papers in robotics, vision, and perception.

Stewart Tansley
Bio
Stewart is responsible for academic partnerships in Robotics research and Sensor Networks research as part of External Research & Programs in Microsoft Research. Before joining Microsoft in 2001, he spent 13 years in the telecommunications industry in software research and development, focusing on technology transfer. Stewart has a PhD in Artificial Intelligence applied to Engineering from Loughborough University, UK. He has published a variety of papers on robotics for education, artificial intelligence and network management, several patents, and has co-authored a book on software engineering for artificial intelligence applications (so long ago that he should really write a new one).

Oliver Brock
Autonomous Manipulation in Unstructured Environments
Abstract
Autonomous manipulation in unstructured environments is a prerequisite for many important applications, ranging from household robotics to urban search and rescue efforts. We demonstrate autonomous manipulation of unknown objects in the context of a specific task. Examples of such tasks could include the opening of doors, hatches, and lids, or the use of tools such as pliers, wire cutters, or scissors. The first demonstration is a method for extracting the kinematic structure of unknown objects to enable manipulation. The second demonstration is a skill for visual segmentation and tracking of objects, again as a prerequisite for autonomous manipulation. The resulting manipulation capabilities are highly robust. We therefore argue that our approach to manipulation is well-suited for real-world mobile autonomous manipulation.

Bio

Oliver Brock is an Assistant Professor of Computer Science at the University of Massachusetts Amherst. He received his Computer Science Diploma in 1993 from the Technical University of Berlin and his Masters and Ph.D. in Computer Science from Stanford University in 1994 and 2000, respectively. He was a co-founder and CTO of an Internet startup called AllAdvantage.com. He also held post-doc positions at Rice University and Stanford University. At the University of Massachusetts Amherst, Oliver is affiliated with the Robotics and Biology Laboratory and the Computational Biology Laboratory. His research focuses on Autonomous Mobile Manipulation and the application of robotic algorithms to problems in Structural Molecular Biology.

Ron Provine
AI Robotics
Boeing Phantom Works

Howie Choset
Snake Robots
Carnegie Mellon University

Andrew Ng
STAIR: Learning to Open New Doors

Abstract

We consider robots operating in novel, uncertain home and office environments. In these environments, they should be able to open doors and elevators to navigate to new spaces. This, however, remains a challenging problem because a robot will likely encounter doors it has never seen before. We present a vision-based learning algorithm that finds door handles and elevator buttons, and also infers a strategy to open them. This enables our robot to navigate anywhere in a new building by opening doors and elevators, even ones it has not seen before. We also present our learning algorithms that enable our robots to grasp novel objects.

Bio

Andrew Y. Ng received his B.Sc. from Carnegie Mellon University, his M.Sc. from the Massachusetts Institute of Technology, and his Ph.D. from the University of California, Berkeley. He is an Assistant Professor of Computer Science at Stanford University, and his research interests include machine learning, robotic perception and control, and broad competence AI. His group has won best paper/best student paper awards at ACL, CEAS and 3DRR. He is also a recipient of the Alfred P. Sloan Fellowship.

Jerry Weinberg
SkewlZone: A Brain and Sensor Pack for Advancing Research and Education in Legged Robot Mobility

Abstract

Legged robots with sufficient on-board processing power for real-time sensing and control are not currently available on the market. SkewlZone is a generalized system that provides perception and cognitive ability to off-the-shelf legged robots such as the Kondo KHR-2HV. Specialized haptic foot sensors, hand sensors, and inner-ear balance (3-axis inertial measurement unit) are integrated with an on-board embedded XScale Linux board using a standard I^2C interface. The software architecture allows real-time

sensing and control on-board. Applications can be quickly developed using the open interface, which provides a layer of abstraction away from the details of the mechanical control.

Road Runner: The Smart Cart

Abstract

The Mini Grand Challenge competition held at Penn State Abington is scaled to demonstrate autonomous vehicle technologies on low-cost platforms. Thus far entries have been too small to transport a person. Our single-person golf cart entry, Road Runner, allows a passenger to ride comfortably and interact via a laptop interface. We leverage Google Earth as a means to specify waypoints. As the robot traverses these waypoints, it provides information regarding known landmarks. The Road Runner provides a platform to test autonomous vehicle interfaces and gain insight into the ways that humans will interact with the automobile of the future.

A Distributed Control Algorithm for Robots in Grid Formations

Abstract

Coordinating a group of robots to work in formation has been suggested for a number of tasks. Our approach to formation control treats each robot as a cell in a cellular automaton. A robot's behavior is governed by a set of rules for changing its state with respect to its neighbors. Using only local communication and sensor readings, robots calculate and correct for discrepancies between desired and actual relationships, producing movements that result in the emergent organization of the desired global structure. This work extends on our previous work by considering grid formations, such as square and hexagonal lattices.

Robotic Limb Calibration: Accelerometer Based Discovery of Kinematic Constants

Abstract

Limbed robots carry inherent difficulties not found in wheeled or tracked robots. Robots with linkages typically require the use of careful measurements and complex kinematic equations for set-up and calibration. In our research we aim to automate this process through the use of feedback from a 3-axis accelerometer and algorithms that solve for the linkage lengths. The calibration involves the structured movement of the limb(s) and data collection from the highly sensitive accelerometer as well as calculation of the kinematic equations. Benefits of this research include simple set-up, constant feedback and interesting possibilities in self-discovery.

Bio

Jerry B. Weinberg is a Professor in the Computer Science Department at Southern Illinois University Edwardsville. He teaches courses and conducts research in Artificial Intelligence, Robotics, and Human-Computer Interaction. In 1999, Dr. Weinberg formed the Robotics Project Group that has introduced robotics projects in various computer science and engineering courses, and has initiated various robotics outreach programs. He was the Principal Investigator on the NSF funded projects "An Undergraduate Robotics Course Emphasizing Integrated System Design and Multidisciplinary Team Work" and "The Effects of Robotics Projects on Girls' Perceptions of Achievement in Science, Technology, Engineering, and Mathematics".

David Touretzky
A New Hexapod Robot for Robotics Education
Abstract
Since Sony discontinued the AIBO in 2006, there has been no comparable platform for robotics education. We are developing a hexapod robot that retains many of the AIBO's best features: a powerful onboard computer, built-in video camera, servos with position and force feedback, and wireless Ethernet for remote monitoring and tele-operation. Our platform surpasses the AIBO in two ways. With six legs instead of four, the robot's walk is statically stable. And the 6DOF arm allows it to grasp and manipulate objects. The robot is programmed using our Tekkotsu open source software framework. Anticipated cost is $2500.
Bio
David S. Touretzky is Research Professor of Computer Science and co-director of the graduate training program of the Center for the Neural Basis of Cognition at Carnegie Mellon University. His current research efforts aim to change the way undergraduate CS majors are introduced to robotics, by providing high level primitives for perception, manipulation, and control in the Tekkotsu programming framework. Dr. Touretzky's other major research area is computational neuroscience, focusing particularly on spatial representations in the rodent hippocampus and related structures. He received his Ph.D. from Carnegie Mellon in 1984.

David Gustafson
Semantic Vision
Abstract
The semantic vision challenge in 2007 inspired our robotics team to include more intelligence in our robotic system. Instead of building intelligence into the controller software, our team has been investigating ways to use information from the internet to build internal models that allow the robot to make better sense of the assigned tasks and improve object recognition.
Bio
David Gustafson is a Professor at Kansas State University in the Computing and Information Sciences. He earned his PhD from the University of Wisconsin - Madison. His research interests include robotics, vision, biometrics, software engineering, software metrics and software testing. His teams have participated in many AAAI Robotics competitions since 1995.

Jianna Zhang
A Seeing-Eye Guide Robot Prototype Using NXT
Abstract
Service animals undergo rigorous, lengthy training to fill many difficult roles for the benefit of their owners. A subset of these roles that depend on the ability to learn and intelligently respond to a variety of external stimuli can also be filled by robots with less training time and maintenance cost. This paper explores such an approach with a "Seeing-eye Guide Robot" that is trained by feedback from both humans and the environments using parallel learning models. These models will allow the robot to selectively obey human commands depending on its understanding of the safety. The prototype of seeing-eye guide robot is made of NXT Lego Mindstorms robot kit. We

expect the learning results satisfy our goals before implementing a more sophisticated model.

Bio

Dr. Jianna Zhang is an associate professor at Computer Science Department, Western Washington University. Her research interests falls in machine learning, robotics, natural language processing, and Web design. Dr. Zhang is the president of Bellingham AI and Robotics Society, the supervisor of Western Student Robot Club, and the creator and project supervisor of ML and Robotics Lab at Computer Science Department of Western Washington University.