Workshop proposal for SIGCSE 2008

Title: Computer vision and image processing: accessible resources for robotics and CS curricula.

Presenters:

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(cochair) Lisa Meeden, CS department, Swarthmore College; meeden@cs.swarthmore.edu
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Abstract:

Interested in making image processing, vision, and/or robotics part of your CS curriculum? This workshop presents these topics at several curricular levels:

- for CS 0/1/2: using IPRE's Myro, atop existing media-themed approaches to early CS
- for robot-themed courses: with vision-enabled Create, PowerWheels, and TeRK platforms
- for electives: via traditional and emerging software resources – Matlab, OpenCV, Tekkotsu

Instructors at all experience levels - including none - are welcome. The second half is hands-on: participants will be able to explore those resources from the above list that best fit their interests.

Presenters' Biographies:

Zach Dodds has taught at Harvey Mudd College for the past eight years. He has used a variety of educational robots through six offerings of an undergrad-only CS elective on robotics and another on computer vision. Zach co-organized 2004 and 2007 AAAI spring symposia on Accessible, Hands-on AI and Robotics Education and is currently using vision-enabled iRobot Create and PowerWheels vehicles to offer educators the power of research-caliber platforms at the cost of Lego-based kits.

Doug Blank is an associate professor at Bryn Mawr College. He was a co-PI and principal developer of the NSF-funded Pyro (Python Robotics) project, and is now a co-PI in the Institute for Personal Robots in Education (IPRE), a joint partnership between Georgia Institute of Technology, Bryn Mawr College, and Microsoft Research. IPRE was designed to create pedagogically scalable software frameworks allowing and encouraging students of all experience levels and abilities to learn computing skills via robots. Doug's work on Pyro gave rise to IPRE's Myro platform.

Bob Avanzato teaches computer engineering, information sciences, and freshman engineering design courses at Penn State Abington. Bob pioneered the use of inexpensive PowerWheels vehicles as autonomous robots – platforms which depend heavily on realtime visual processing. Bob created the annual Mini Grand Challenge, an accessible undergraduate-level robot competition whose computational demands are as compelling as DARPA's grand challenges.

Bruce Maxwell is Colby College's Chair of Computer Science. He holds a B.A. and B.S. from Swarthmore College and a Ph.D. from CMU's Robotics Institute. His research interests include computer vision, robotics, computer graphics; Bruce has developed undergraduate curricula and resources for each of these topics. His NSF-sponsored *Computer Vision Education Resource* provides a widely accessible starting point for comparing texts, software resources, syllabi, and assignments relating to computer vision.

Lisa Meeden is an associate professor at Swarthmore College. A co-PI on the NSF-funded project *Beyond LEGOs: Hardware, Software, and Curriculum for the Next Generation Robot Laboratory*, Lisa has developed a variety of computer- and cognitive-science courses involving robotics and vision. Lisa's

curricula successfully bridge her research in developmental robotics with innovative assignments using machine-learning and vision in early CS/CogSci courses.

David Touretzky is a research professor in the CS department at Carnegie Mellon University. With Ethan Tira-Thompson, he has developed the Tekkotsu software platform, a powerful and popular open-source framework for high-level interaction with robotic and computer vision hardware. Originally designed around the Sony AIBO, Tekkotsu has expanded (since last year's successful SIGCSE workshop) to support several accessible hardware platforms, including stand-alone webcameras, CMU's Qwerkbot, and iRobot's Create.

Schedule, Intended audience, and numbers:

Based on feedback from previous SIGCSE workshops by members of this group, our schedule will limit presentations to 90 minutes total. These will comprise the first half of the workshop, with the speakers presenting short (~15 minute) introductions on how computer vision contributes to their courses. The built-in break halfway through the evening offers a natural transition to the hands-on portion, during which participants will be able to choose an exploration from several options:

- Vision tasks suitable for a CS 0/1/2 course, using IPRE's Myro platform.
- Vision-enhanced robotics on inexpensive indoor platforms, i.e., the Create, NXT, or CMU's TeRK.
- Vision-based robotics on inexpensive outdoor platforms, i.e., PowerWheels vehicles (here, indoors)
- Software access to vision for use across the CS curriculum: via Matlab, OpenCV, or CMU's Tekkotsu.

This is a large set of options for a three-hour workshop. Yet, we anticipate that participants will come to this topic with a variety of motivations. Some will be most interested in augmenting their curricula in early-CS courses; others will have experience teaching computer vision and/or robotics and will want to explore one or more of the emerging educational resources in those areas. With our presenters spanning this range, we feel that we can provide hands-on options to engage all our participants.

To help ensure this, however, we do request limiting the number of this workshop's attendees slightly, as we did in '06 and '07, to ***24 participants*.**

Materials provided, AV and computer requirements:

We will provide a packet of materials detailing the software, hardware, curriculum, and web-based resources highlighted in each of the presentations. This will include

- the classroom-tested Myro curriculum for CS 1, along with software support
- a hardware and software guide to the iRobot Create and PowerWheels vehicles
- the documentation and curricula developed for the CMU Tekkotsu and CMU TeRK projects

Because the presenters will provide hardware for participant experimentation, we suggest that this workshop be designated as **Laptop Recommended**. There are no unusual audio-visual or space requirements for this project. Because there will be some hands-on robotics, a largish room would be ideal.

Additional context:

Although we are leveraging prior experience in this event's deisgn, we note that this proposal's focus on vision differs significantly from the robotics-per-se themes of the '06 and '07 workshops. Their titles were "Emerging Robotics Resources in Undergraduate CS" and "A Hands-on Exploration of Educational Robotics", respectively. Even attendees of one or both of those workshops will find this workshop's material almost entirely new.