IEEE RAS Standards Strategy Update

By Craig Schlenoff

On 30 September 2018, the Industrial Activities Board (IAB) of the IEEE Robotics and Automation Society (RAS) organized a Standards Strategy Meeting in conjunction with the IEEE/Robotics Society of Japan Intelligent Robots and Systems Conference in Madrid, Spain. The purpose of the meeting was to review and refine an overall robotics standards landscape with the goal of determining areas in which the RAS should focus on robotics standards development and areas in which the Society should partner with other standards-development organizations. Attendees included many RAS working group chairs; representatives from the International Organization for Standardization, the Robotics Industries Association, and the American Society of Mechanical Engineers; and experts in various robotics fields, including autonomous vehicles and industrial robotics.

Multiple areas were proposed. The RAS has taken active steps to address three of them:

1) *Verification of autonomous systems*: This is a growing research area, especially in terms of its focus on systems that learn. The RAS could be a good home for standards and performance metrics to help verify autonomous-system performance.
2) *Robot agility performance metrics*: As robots need to adapt to ever-changing environments, metrics and test methods are necessary to assess their agility performance when confronted with unexpected situations.
3) *Harmonization of robot terminology*: In many cases, the same term is defined differently by the various standards organizations and even among different groups within the same organization.

How these areas are being addressed is described in the following sections.

Verification of Autonomous Systems Study Group

In December 2018, the IAB approved a proposal to form the Verification of Autonomous Systems Study Group. This body, led by Signe Redfield from the Naval Research Laboratory, Washington, D.C., will develop a set of IEEE guidelines formulating a standard for the verification of autonomous systems. This includes identification of existing best practices and development of new guidelines that will include instruction sets to define valid verification processes for a range of autonomous-system configurations. The guidelines are intended to include both robots and immobots, singly and in groups, and to focus primarily on systems that can operate autonomously rather than on automated and supervised robots.

In particular, this group is interested in providing best practices across all levels of abstraction within a given system, from the lowest-level components and software to the highest-level learning and decision-making elements (specifically including verification of the inputs to any learning algorithms, such as training data). The group also intends to provide a list of the types of tools that should be part of any autonomous-system verification toolbox, encompassing tools that can be used for behavior design and verification processes (such as those that quantify the completeness of coverage-guided test suites) and including both theoretical and software tools.

For more information about the group or to get involved, please contact Signe Redfield at signe@ieee.org.

Robot Agility Standards Study Group

Also in December 2018, the IAB approved a proposal to form the Robot Agility Standards Study Group. This group, led by Anthony Downs from the National Institute of Standards and Technology, Gaithersburg, Maryland, will work toward developing test methods and metrics as standards for measuring robot agility. In this context, *agility* is defined as including the following:

- *failure identification and recovery*: a robot's ability to detect and automatically recover from failures, focusing first on manufacturing and industrial scenarios
- *automated planning*: minimizing (or eliminating) the up-front robot-programming time when a new procedure or task is introduced
- *fixtureless parts sensing*: robots sensing their environment and performing tasks using parts that are not in predefined locations.

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This study group will work to develop a set of test methods that can be employed by end users to assess the kind of robotic system that will best meet their particular needs. For more information about the group or to get involved, please contact Anthony Downs at anthony.downs@nist.gov.

Harmonization of Robot Terminology

As a direct result of the September Madrid meeting, the IAB organized a follow-on assembly in conjunction with the IEEE International Conference on Robotics and Automation in Montréal on 19 May 2019. The meeting focused on the harmonization of robot terminology among the various standards organizations. Specific goals include

1) determining the best mechanism(s) for the various standards organizations to work together to address this issue
2) deciding on the best approach to address the harmonization issue, whether it be a mapping between terms, a common ontology, or something else
3) working through a small set of terms/concepts that are common among the various standards to narrow the problem to a manageable scope.

All of the standards organizations represented at Madrid are expected to be represented at this meeting, along with the American Society for Testing and Materials and the Object Management Group.

The RAS has recently focused on formal robot terminology standards, including IEEE 1872 (*Core Ontologies for Robotics and Automation*) and IEEE 1873 (*Standard for Robot Map Data Representation for Navigation*). In addition, numerous working groups are specializing and extending these standards and also exploring whether these standards, or others, are sufficient to provide a basis for robot-terminology harmonization among the standards organizations.

For more information about the group or to get involved, please contact Craig Schlenoff at craig@schlenoff.com.

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need more attention in future years if social robots are to be integrated in our daily lives.

This special issue of *IEEE Robotics and Automation Magazine* covers a plethora of challenges faced when socially assistive robots interact with vulnerable populations and illustrates the potential benefits of using assistive robots to help meet current societal needs.

Adriana Tapus is a full professor in the Autonomous Systems and Robotics Lab of the Computer Science and System Engineering Department at ENSTA-ParisTech, France. Her research interests include long-term learning (i.e., in interactions with humans), human modeling, and online robot behavior adaptation to external environmental factors, and she has more than 150 research publications. Further details about her research and activities can be found at http://www.ensta-paristech.fr/~tapus. Email: adriana.tapus@ensta-paristech.fr.

Ayanna Howard is the Linda J. and Mark C. Smith Professor and chair of the School of Interactive Computing at the Georgia Institute of Technology, Atlanta. Her research focuses on intelligent technologies that must adapt to and function within a human-centered world and encompasses advancements in artificial intelligence, assistive technologies, and robotics, resulting in over 200 peer-reviewed publications. Email: ayanna.howard@ece.gatech.edu.

Isamu Kajitani is a senior researcher on the Service Robotics Research Team of the Robot Innovation Research Center at the National Institute of Advanced Industrial Science and Technology, Japan. His research interests include assistive products, prosthetic hands, service robots, and the social acceptance of such products as well as applied behavior analysis. Further details about his research and activities can be found at https://orcid.org/0000-0002-3178-9388. Email: isamu.kajitani@aist.go.jp.

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which we know is rather straightforward. This would allow you to ease students into the more difficult concepts of robotics without overburdening them at the beginning of the course.

Finally, it is important to know where our students are going after they graduate. The surveys conducted by Data USA [1] show that most undergraduates never pursue a graduate-level degree. This means that most students taking our robotics courses will not take an advanced robotics course—an important consideration when developing the goals and objectives of the course. An education in robotics has much more to offer an undergraduate than knowledge about robot systems. Through a robotics course, students can hone their problem-solving, algorithm design, programming, and mathematics skill sets.

Reference

[1] Data USA. 2018. [Online]. Available: https://datausa.io/profile/cip/110701/