rather than based on variables such as a driver's age or location. "The question is, with the regulatory hurdles and the acceptance hurdles, are we going to be willing to turn our cars over [to robots], where we don't do anything?"

That's why most lawyers interviewed for this article agree that in the near term, liability and insurance structures are going to move very slowly in addressing the new wave of autonomous technologies, simply because there is little legal precedent for these systems. Further, organizations that are currently deploying robots declined to participate in this article, perhaps wanting to avoid boxing themselves into any specific legal corner if a problem were to arise.

Open Source Opens a Host of Questions

While most of the robotic technology in use today is based on closed, proprietary technology, robots are starting to be developed using open source software. As a result, liability might not be assigned to the developers of that software if something goes wrong, since the software itself is designed to be modified. As such, it is harder to quantify what types of functionality or uses could be considered "off–label" or unauthorized, or even ill-advised, based on an open source platform.

"Liability can be addressed currently with closed robotics, because they have restricted functionality," says Diana Cooper, Articling Associate, LaBarge Weinstein LLP, and author of a paper entitled "A Licensing Approach to Regulation of Open Robotics," which was presented at the We Robot Conference at Stanford Law School in April. Cooper notes the very nature of open source robotics is that the functionality is not predefined, and there are no restrictions in place governing what actions the robot can or cannot carry out. This is creating a considerable amount of confusion for robotics developers who are worried about liability, from the components used in robots to fully completed products.

"The problem is, how will the upstream parties that create certain components that are built into these end products be sheltered from liability from any downstream modifications that might be harmful?," Cooper asks. "That is a whole different ball game, because we cannot provide warnings to the market, since we do not know what that end product will be, and we cannot rely on the defense of product misuse since open robots are intended for modification."

Legal scholars such as Cooper and Ryan Calo of the Center for Internet and Society have brought up the idea of creating a licensing system, similar to an end-user license agreement found on productivity software. In essence, the license of the robot or robotic component would stipulate that the robot or robotic component would not be used for certain actions (such as creating a weapon, or otherwise harming people, animals, or property), and would indemnify the developer and/or manufacturer of the robot or component against any claims resulting from a robot or component being used in violation of the terms of the license.

Cooper, for one, says the only way open source robotics will see support from manufacturers is if they develop some sort of framework to codify acceptable robot behavior, and create a method for indemnifying upstream suppliers of hardware and software from potential liabilities.

Says Cooper: "Hardcore open-source advocates don't really want any restrictions on the use, but now that we're inputting the software into hardware components that have actuators and a physical presence that interacts with people, I think that perhaps we should be looking at imposing some tailored restrictions." C

Further Reading

Patrick Lin, Keith Abney, and George A. Bekey (eds.)
Robot Ethics: The Ethical and Social Implications of Robotics, MIT Press, 2012, 386pp., http://ndpr.nd.edu/news/31199-robot-ethics-the-ethical-and-social-implications-of-robotics/

Richards, Neil M. and Smart, William
How Should the Law Think About Robots? (May 10, 2013). Available at SSRN: http://ssrn.com/abstract=2263363 or http://dx.doi.org/10.2139/ssrn.2263363

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ACM Member News

Wenwu Zhu's research on multimedia cloud computing is both topical and groundbreaking; he is exploring how a cloud can perform distributed multimedia processing and storage, and provide quality of service provisioning for multimedia applications and services.

This research also focuses on how to allocate computing and communications resources between the cloud and clients, which includes mobile phones for multimedia applications, and services for good Quality of Experience.

Zhu was recruited to his post in the Computer Science Department of Tsinghua University under China's "1,000 People Plan" to enlist top academics and researchers; he previously was senior researcher/research manager at Microsoft Research Asia. Zhu is the inventor or co-inventor of more than 40 patents, and has published more than 200 refereed papers on multimedia communications and networking, and wireless communications and networking.

He says he is interested in "how to use social information to reduce the intention gap in the multimedia search and how to use social information to predict emotion for the individual person."

Zhu was part of a group of Chinese computer scientists and academicians awarded the ACM SIGMM award for Best Technical Paper in 2012, for the paper "Propagation-based social-aware replication for social video contents."

"I see a convergence of cloud media, social media, and mobile multimedia," Zhu says. "Cloud can help with mobile phones, which have very limited computing and storage capabilities. The cloud can become a 'base' and a 'powerhouse' to provide content and user information for mobile phone applications and services."

—Laura Didio