

Ask an Artificially Intelligent Question ...

BY ALAN CAMERON

EDITOR-IN-CHIEF

There was plenty for a philosophy major to sink his teeth into at ION's January workshop on Cognizant Autonomous Systems for Safety-Critical Applications (CASSCA).

What is knowledge? What is meaning? Understanding? Intelligence? Learning? What is thinking?

These questions excited Plato and Kant, Buddha and Descartes. Scientists now pose them anew. They say we cannot design driverless cars or pilotless plane-taxis for the coming autonomous, artificially intelligent environment without knowing more exactly what knowledge is, in our brave new world. Without thinking about what thinking may be, for a machine.

As positioning and navigation engage deeply with artificial intelligence (AI) and autonomy, these issues emerge from the landscape in which PNT solutions must verify and validate themselves.

Welcome to the future, it's yours.

CULTURE CLUB. Build-a-robot R&D projects transition into commercial partnerships, and added to the mix of technical challenge we suddenly have cultural challenges as well: institutional inertia, requirements changing on the fly, unanticipated expectations, magical thinking (empathetic attitudes towards robots), misplaced trust and misplaced distrust. This according to Signe Redfield of the U.S. Naval Research Laboratory.

Joao Hespanha, University of California, Santa Barbara, outlined three key concepts for AI: computation, perception and security. How much computing will be done onboard the platform, how much learning will be done onboard, and how much of each process will be distributed to offboard computation? Perception is closely bound in a feedback loop with control. The platform must gather data to make autonomous decisions (control), and those decisions must maximize the

gathering of information (perception).

Amply consider security. All safety-critical systems must provide for — and prevent where possible — decisions based on compromised measurements, which may stem from system or environmental noise, sensor faults, hacked sensors, or other corruptions.

SECOND WAVE. We are in the second wave of AI, according to Steven Rogers, Air Force Research Laboratory. In the first, complex algorithms, relatively low on data, drove new developments — but they hit real-world problems, hard. We're now in the "classify" stage with relatively simpler programs generating and consuming *lots* of data. Intense statistical learning will lead to the third wave: Explain. Contextual adaptation will give rise to "explainable" AI, capable of answering unexpected queries. It will have learned to teach itself.

Some of this stuff gets pretty scary.

THE MACHINE KNOWS. Most future knowledge will be machine-generated.

Let's run through that one more time.

"Most future knowledge on Earth will come from machines extracting it from the environment," said Rogers. "Machine generation of knowledge is key for autonomy."

"Current sensor solutions are not keeping pace, not growing as knowledge is growing," he asserted. And he challenged us with the questions posed at the head of this column.

David Corman, National Science Foundation, identified a looming explosion in AI, in which systems will interact, gather data, learn, improve and multiply. He suggested we browse "The Seven Deadly Sins of Predicting the Future of AI," an essay Rodney Brooks.

ION president John Raquet hopes we may see a fully fledged conference on this topic in the near future: CASSCA 2019, perhaps.

Agreed. We need to think more.

Don't look back, the machines may be gaining on us. 🌐

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