

Innovators of Intelligence Look to Past

By John Markoff

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SEATTLE — Inside the Allen Institute for Artificial Intelligence, known as AI2, everything is a gleaming architectural white. The walls are white, the furniture is white, the counters are white. It might as well have been a set for the space station in “2001: A Space Odyssey.”

“The brilliant white was a conscious choice meant to evoke experimental science — think ‘white lab coat,’ ” said Oren Etzioni, a computer scientist and director of the new institute, which the Microsoft co-founder Paul Allen launched this year as a sibling of the Allen Institute for Brain Science, his effort to map the human brain.

Yet for the 30 (soon to be 50) artificial-intelligence researchers who can look out on a striking view of downtown Seattle, the futuristic surroundings offer a paradoxical note: AI2 is an effort to advance artificial intelligence while simultaneously reaching back into the field’s past.

While Silicon Valley looks to fashionable techniques like neural networks and machine learning that have rapidly advanced the state of the art, Dr. Etzioni remains a practitioner of a modern version of what used to be known as Gofai, for good old-fashioned artificial intelligence.

The reference goes back to the earliest days of the field in the 1950s and ’60s, when artificial-intelligence researchers were confident they could model human intelligence using symbolic systems — logic embedded in software programs, running on powerful computers.

Then in the late 1980s, an early wave of commercial artificial-intelligence companies failed, bringing on what became known as the “A.I. winter.” The field was seen as a failure and went into eclipse.

In recent years, however, A.I. has come roaring back as speech recognition, machine vision and self-driving cars have made progress with powerful computers, cheap sensors and machine-learning techniques. That has started a Silicon Valley gold rush led by Google, Facebook and Apple, drawing outsiders like Alibaba and Baidu in China, all caught up in a frantic race to hire the world’s best machine-learning talent.

But the debate over how to reach genuine artificial intelligence has not ended, and Dr. Etzioni and Mr. Allen are betting that their path is more pragmatic. The power of the new techniques is not disputed, but there is a growing debate over whether they can take the field to human-level

capabilities by themselves.

“Think of it as Sherlock Holmes versus Spider-Man,” said Jerry Kaplan, a visiting lecturer at Stanford who teaches a course on the history and philosophy of artificial intelligence, comparing Holmes’s deductive powers with the irrational “spider sense” that tingles at the base of Spider-Man’s skull and alerts him to danger.

Mr. Allen, who noted that he came from a family of librarians, said his decision to fund an artificial-intelligence research lab was inspired by the question of how books and other knowledge might be encoded to become the basis for computer interactions in which human questions might be answered more fully.

“AI2 was born from a desire to create a system that could truly reason about knowledge, rather than just offer up what had been written on a subject before,” he wrote in an email interview.

Dr. Etzioni says that the artificial-intelligence field has made incremental advances in areas like vision and speech, but that we have gotten no closer to the larger goal of true human-level systems.

“Driverless cars are a great thing,” he said, but added that the field had given rise to “bad A.I., like the N.S.A. is using it or Facebook is using it to track you.”

“We want to be the good guys,” he went on, “and it’s up to us to deliver on that.”

Moreover, he says, both he and Mr. Allen believe that technology cannot be separated from its social and economic consequences. They have added a social mission to the project that they call “artificial intelligence for the common good.”

The success or failure of the project, however, will ultimately hinge on whether Dr. Etzioni can create a new synthesis of artificial intelligence, weaving together powerful machine-learning tools with traditional logic-oriented software.

The current fad for big data, of which machine learning is a major component, has significant limits. “If you step back a little and say we want to do A.I., then you will realize that A.I. needs knowledge, reasoning and explanation,” he said. “My argument is that big data has made great progress in limited areas.”

Even Watson, the brainy IBM computer whose intelligence the company wants to apply in complex applications like medical diagnoses and automated call centers with interactive speech recognition, will soon reach fundamental limits, he argues.

“I really don’t want a system that can’t explain itself to be my doctor,” he said. “I can just imagine sitting there with Dr. Watson and the program saying, ‘Well, we need to remove a kidney, Mr. Etzioni,’ and I’m like, ‘What?!’ and they respond, ‘Well, we have a lot of variables and a lot of data, and that’s just what the model says.’ ”

Dr. Etzioni, 50, was already known for innovative web projects, including MetaCrawler, an early search engine, and an array of successful start-up companies; one of them, Farecast, was acquired by Microsoft and became the basis for its Bing Travel service. (The first student to major in computer science at Harvard, he is a son of the well-known sociologist Amitai Etzioni.)

At AI2 he is motivated by Mr. Allen’s view that “in order to be truly intelligent, computers must understand — that is probably the critical word,” as the Microsoft co-founder put it in a 1977 interview.

Some technology experts argue that self-aware computing machines are now on the horizon. “As for A.I. progress, we’re mostly haggling about a few decades,” said Hans Moravec, a leading roboticist who is the chief scientist of Seegrid Corporation, a maker of autonomous vehicles for warehouse applications. “I’m content to simply watch it play out, trying to do my part. I do want fully autonomous robots as soon as possible, to begin visiting the rest of the universe.”

Mr. Allen and Dr. Etzioni are not so optimistic. Both are skeptical of claims that we may be only years away from machines that think in any human sense.

“Full A.I., in the sense of something like HAL in ‘2001,’ ” Mr. Allen wrote in an email interview, “is probably a hundred years away (or more). In reality, we are only beginning to grasp how deep intelligence works.”

Dr. Etzioni wants AI2 to set measurable goals to help get a new class of learning systems off the ground. During its first year, the researchers have focused on three projects — one in computer vision (in which computers learn to recognize images), one to build a reasoning system capable of taking standardized school tests, and a third to help scholars deal with the fire hose of information that is inundating every scientific field.

The school-test effort, Project Aristo, seeks to create a learning program that can collect and organize a wide range of information, and then use that database to reason and to answer questions, even discussing and explaining its answers with human users.

To chart Aristo’s progress, researchers plan to test it on increasingly difficult standardized science exams, moving from the fourth grade through the 12th.

“We’re not planning on putting 10th graders out of work,” Dr. Etzioni said. But he does believe that a program that can converse with humans and answer questions would serve as a foundation for many other achievements, going far beyond the most powerful search engines and systems like Watson.

In September, the researchers celebrated their first milestone — 60 percent correct answers in the language portion of New York State’s fourth-grade science test. Many of the questions in the actual test include diagrams and illustrations, which will ultimately require advances in computer vision.

That challenge is considered far more difficult than recognizing human speech. It calls for a computer system with “scene understanding,” the human ability to extract meaning from animate and inanimate objects that interact.

Whether AI2’s research leads to a new generation of thinking machine or just more incremental advances, the project is a clear indication that artificial intelligence has once again become the defining force in the software world.

“The narrative has changed,” said Peter Norvig, Google’s director of research. “It has switched from, ‘Isn’t it terrible that artificial intelligence is a failure?’ to ‘Isn’t it terrible that A.I. is a success?’ ”

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