

BENCHMARKS

SOFTWARE

Genius Minus Perspiration

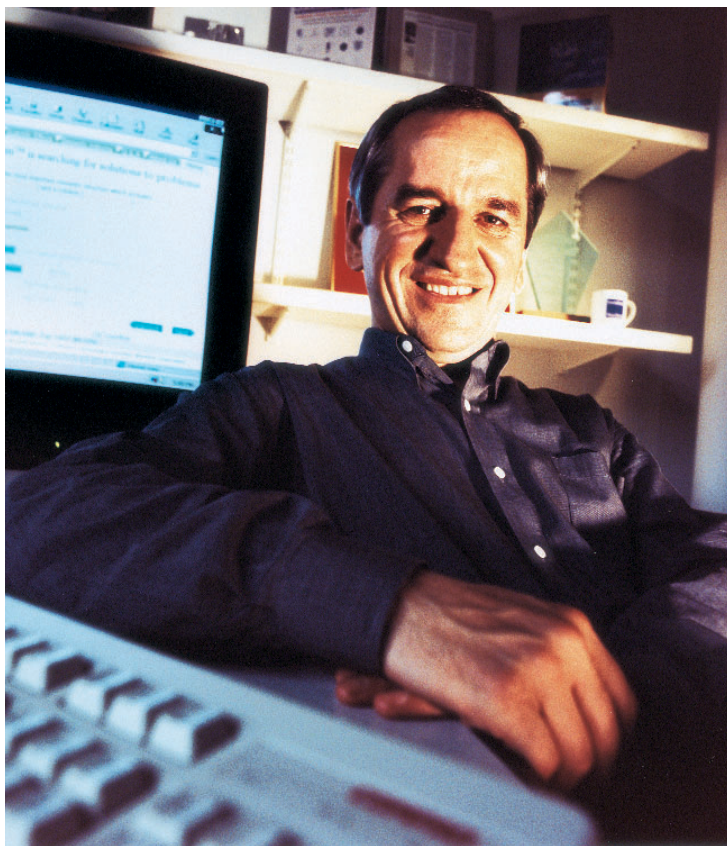
A Boston company aims to make invention automatic

THOMAS EDISON CALLED genius “one percent inspiration, 99 percent perspiration.” Now Valery Tsourikov, a Russian-born entrepreneur, believes he has found a way to package the 99 percent and sell it as software.

Tsourikov’s Boston-based company, aptly named “Invention Machine,” has created and patented a program to speed the process of coming up with new technologies. “We understand how people invent,” Tsourikov claims. “It’s cause-effect analysis, backward reasoning and forward reasoning.” The magic of genius, he says, comes from having a large knowledge base and knowing how to apply it.

To capture that magic in software, Tsourikov’s program comes with more than 6,000 “cause and effect” processes and techniques, gathered from different fields of engineering. Each effect is integrated into a semantic network so that the computer knows when it can be applied and what it does. Much of the database stems from U.S. patents that have been painstakingly categorized. The company’s newest program, called CoBrain, automates this data-gathering process as well. As a result, Tsourikov says, when companies buy Invention Machine, they can easily add their own proprietary processes and techniques to the database.

“It’s much more than a really good encyclopedia,” says Tom Carlisle, director of new technology at Phillips Petroleum. “It retrieves information in context.”



Your next bright idea could come from a computer program, says Valery Tsourikov.

Carlisle’s group is using Invention Machine to figure out ways of eliminating microscopic amounts of oxygen in natural-gas collection systems, which cause the equipment to corrode. “The problem-analysis section [of the software] has helped us clarify what the problem really is.”

Tsourikov and four colleagues were granted a United States patent on Invention Machine’s technology in May, but the seeds of the idea go back more than two decades. In 1975, Tsourikov was finishing a master’s degree in computer science in Minsk. “AI [artificial intelligence] was very big at that time, but MIT, Stanford and CMU [Carnegie Mellon University] had already taken all of the good topics,” he recalls. So, Tsourikov decided to create “a computer [program] that was

able to invent things.” Tsourikov worked nights on the IBM 360 computer at the Moscow Electrical Communications University, ultimately producing a program that could invent and test novel mathematical algorithms. In 1983 he contributed his software to the university’s part of the international SETI (Search for Extraterrestrial Intelligence) project. Tsourikov’s donation: 20,000 algorithms—invented by the computer—for distinguishing intelligents from background noise.

As any inventor knows, the key to success is being in the right place at the right time. Taking advantage of Gorbachev’s economic reforms, which were opening Soviet markets in the early 1990s, Tsourikov started his own company in 1991 in Minsk to commercialize the technology. “In two years we had 800 major companies in Soviet industry running our program,” says Tsourikov. In one notable success, engineers at an oil company were looking for a way to make oil flow faster through pipelines. Using Invention Machine’s software, an engineer learned that he could decrease the viscosity of the oil by adding trace amounts of a polymer to the crude, the same way adding a polymer to blood can help it flow through constricted arteries.

Getting the business established in the United States proved to be a bigger challenge. In late 1991, Tsourikov flew to New York with five floppy disks in his briefcase.

“Every inventor in Russia knew that if you showed up with an invention in the U.S., you would be handed a blank check,” he recalls sardonically. Unfortunately, such a check is only as good as the people writing it, and Tsourikov’s dreams were delayed several years after he signed an exclusive license with a group of financially strapped investors.

Today, things are back on track:

Invention Machine has 140 employees in Russia and 80 in the United States and Europe, with annual sales of more than \$10 million. Whether Edison would be proud is a different question. “I love what they are doing,” says Jane Linder, associate director of Andersen Consulting’s Institute for Strategic Change. But Linder says some engineers, especially older ones, are less enthusiastic. She recalls one

company where the engineers were hostile to Invention Machine’s presentation. “These were leading, very creative people, who saw the potential of the technology to put into the hands of ordinary engineers, or younger ones who hadn’t made their reputations, the ability to do things that would surpass these folks—and they didn’t want it.”

—Simson Garfinkel

RESTORATIONS

Virtual Archaeology

A good archaeologist needs brawn as well as brains to reconstruct a fragmented relic—pieces of objects such as stone statues can be heavy and must be manipulated carefully, since each move risks damage. Sometimes restorers even build external frames to hold fragments in position while other pieces are fitted, and there’s always concern when the time comes to glue parts together that each is in the right place.

But computer-based imaging is changing how archaeology is done—possibly eliminating much of the heavy lifting.

Researchers at the Museum of Terra Cotta Warriors and Horses in Xi’an, China, want to eliminate muscle and mishap from the restoration process by handling fragments in virtual space. There, the pieces could be endlessly arranged and rearranged and imperfections smoothed over. The team has an army of artifacts to work with: The scientists have been experimenting with ways to reconstruct digitally some of the 3,000 famous life-size terra cotta statues uncovered at the museum’s site.

Virtual assembly of relic fragments is among the most recent installments in the application of ever-increasing computing power to archaeology. Says Alan Kalvin, research scientist at IBM’s T.J. Watson Research Center in Yorktown Heights, N.Y., “Originally the computer applications were more statistical, but with computer prices coming down and performance improving, particularly in graphics, it’s opened up the field for a lot of people.” Jim Wiseman, director of the center for archaeology studies at Boston University, agrees that this is the next logical step: “This is just the kind of thing that would be useful for reconstruction of individual pieces.”

To scan statue fragments into the computer, the Xi’an researchers use a laser range finder—a standard tool normally used for precisely measuring objects as diverse as manufactured parts or human bodies for clothing design—reconfigured to be

portable and compact enough for an archaeological dig site. Equipped with a digital video camera and a laser, the device records each fragment’s shape, surface colors and textures.

Far more challenging than getting the fragments into the virtual world, however, is manipulating them once they’re there, says team leader Jiang Yu Zheng, associate professor of computer science and systems engineering at the Kyushu Institute of Technology in Fukuoka, Japan. The images contain so much data, according to Zheng, that the computer can only move them very slowly through virtual space. “If I reduce the data resolution,” says



Three views of a virtually reconstructed terra cotta warrior.

Zheng, “the pieces will lose their value as art” and be more difficult to fit together accurately. Zheng and his team predict that further work on data handling, as well as faster computers, will speed the process up considerably.

Once archaeologists figure out how the virtual fragments of a relic fit together, they could use that information as a blueprint to reconstruct the object in actual space. But the ultimate value of such a system might be simply to leave the artifacts resting in peace. With an estimated 5,000 more statues still underground at the Xi’an site, museum staff imagine it may be enough to do the restorations virtually, without ever disturbing the remains.

—Deborah Kreuze

JIANG YU ZHENG/KYUSHU INSTITUTE OF TECHNOLOGY



JAMES STEINBERG

INTERNET

Taking Back the Web

Are new services ways to share ideas, or graffiti?

WHEN YOU'RE TRAIPSING THROUGH endless corporate-image home pages, it's hard to remember that the folks who invented the Web wanted a tool to foster collaboration and community. Now a pair of free Web services, Third Voice and Gooley, are trying to restore that spirit to the medium. But the Web seems to be resisting this re-direction—in fact, these services have caused an uproar.

It doesn't take long to understand the controversy raised by Redwood City, Calif.-based Third Voice. Users of the company's software can treat the Web like a giant graffiti board. When they visit any site, they can post messages that appear to every visitor to the page using Third Voice. Some have taken to Third Voice like a graffiti artist to spray paint, and high-profile pages like Microsoft.com have become particularly easy targets.

Third Voice founder Eng-Siong Tan says, "The point of the Web is discussion and sharing of ideas." Third Voice, he adds, lets readers "take back a little bit of the Web."

But the people who own the sites where these notes appear aren't very enthusiastic. Third Voice represents an intrusion into a site owner's right to control content, says Char M. Green, director of legal research for a coalition of site owners called Say No To Third Voice. Green complains that Third Voice allows anyone

to change the apparent content of the page. "It's vandalism," she says. Actually, the postings are stored on Third Voice's servers and overlaid on the target Web page—but Green dismisses this as a "technicality."

This summer, while the furor over Third Voice was raging, an Israeli company called Hypernix introduced Gooley—a Web-based chat service that seems to provide the open communication promised by Third Voice without invoking such

angst. Gooley attempts to turn the Web into a gigantic party in which people exchange real-time messages with others visiting the same site at the same time. Each time you surf to a new site, you automatically join a new group of people who presumably share common interests. Hypernix posts a continuously updated list of the sites where Gooley users are congregating (in the early days of the service, however, the most active Gooley chat was at portal sites—not the sort of interest-sharing community that Gooley is designed to foster). About 46,000 people registered for Gooley in the first month after its launch, according to Hypernix CEO Shai Adler, who says that at any given time about 1,600 Gooley users are online.

Gooley has kicked up less of a ruckus than Third Voice. One reason: Gooley chat evaporates from a site once the users log off. Also, unlike Third Voice notes, Gooley chat occupies a separate, unobtrusive window. Moreover, real-time chat is becoming increasingly popular, and Gooley makes chat easily accessible at every Web site. Linking chat to a Web page that contains honest-to-goodness content may yield online exchanges with more depth than the inanity of many chat rooms.

Millions of Internet users have come to expect the Internet to serve up information. Now we will see if these legions of mouse potatoes are ready to turn the World Wide Brochure into a salon.

—Herb Brody

PLANT BIOTECH

40 Acres and an Antibody

A handful of companies have begun human tests of medicines grown in genetically engineered corn, potatoes, and even tobacco plants. Promising prospects include antibodies to fight cancer or infection. Antibodies can be grown in animals or cell culture, but "plantibodies" are cheaper, and don't risk spreading animal diseases to humans.

COMPANY	LOCATION	PLANT	PRODUCT	STATUS
Axis Genetics	Cambridge, UK	Potato	Edible hepatitis-B and diarrhea vaccines	phase I
Biosource Technologies	Vacaville, Calif.	Tobacco	Antibody vaccine for non-Hodgkin's B-cell lymphoma	preclinical
EPIcyte (with ReProtect)	San Diego, Calif.	Corn	Antibodies to prevent sexually transmitted diseases	preclinical
Planet Biotechnology	Mountain View, Calif.	Tobacco	Antibody to fight cavity-causing bacteria	phase II
ProdiGene	College Station, Texas	Corn	Hepatitis B vaccine	preclinical

SPACE EXPLORATION

E.T.—Don't Call Home

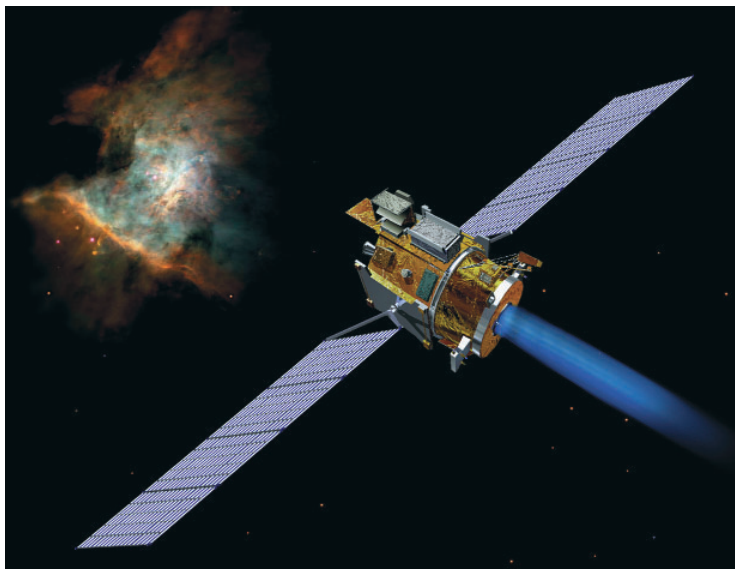
A spacecraft thinks for itself

NASA'S FLEET OF ROBOTIC SPACECRAFT has generated volumes of data about the solar system over the past 40 years. Yet, for all the insights these unmanned missions have provided, the spacecrafts are pretty dumb. A recent experiment, though, could make the next generation of planetary explorers smarter, more versatile and less expensive.

Unmanned spacecraft typically require significant handholding from mission control. A series of detailed, low-level commands are created on the ground and sent to the craft, telling it precisely what to do and when to do it. Most spacecraft also have a limited ability to deal with problems; when computers notice a problem with a key system, they shut down non-essential systems and wait for instructions from Earth.

For 35 hours over the course of one week in May, however, NASA's Jet Propulsion Laboratory (JPL) handed over control of its Deep Space 1 spacecraft to

Remote Agent, an onboard software package that uses artificial intelligence to control the spacecraft with little input from ground controllers. The Remote Agent requires only high-level commands, such as "take an image of this asteroid." The



NASA's Deep Space 1 used artificial intelligence to run part of its mission.

software takes these commands and generates a timeline of events necessary to complete them. That timeline is passed on to the "Smart Executive," which fleshes out the timeline with detailed commands, which are passed on to various subsys-

tems. A third portion of Remote Agent, "Livingstone," monitors the health of the spacecraft; when it detects a problem with a spacecraft system, it works to fix the problem or work around it. Only if those efforts fail does the spacecraft call home.

During the May test, Remote Agent was given a number of high-level tasks. Ground controllers also simulated problems ranging from a balky camera to a broken thruster. In each case the software handled matters on its own, despite a minor problem with the Remote Agent software that was solved within several days.

The quick fix showed Remote Agent's versatility. "If it hadn't been for Remote Agent's ability to do onboard planning, we would not have been able to complete the tests so quickly," says Pandu Nayak, deputy manager of the project.

The success is leading NASA to consider using software like Remote Agent on future missions, according to Doug Bernard, Remote Agent manager at JPL. "This technology will allow us to pursue solar system exploration missions that would have been considered too elaborate, too costly, or too dependent on teams of Earth-bound controllers," he says.

—Jeff Foust

INTELLECTUAL PROPERTY

States Get an Edge in Patent Fights

State universities are big players in technology who often aggressively license research breakthroughs in fields such as biotechnology to companies, sometimes reaping millions in royalties. This complex intersection of public and private interests is rife with disputes over patent rights and inventions. And experts argue that a June ruling by the U.S. Supreme Court that citizens and companies can't sue states in federal court over intellectual property could give the universities a decided edge in such legal battles.

The decision has already had an impact on at least one high-profile patent dispute. According to Martin Simpson, counsel for the University of California (UC), the ruling "obliterated" a lawsuit against the school by Genentech, a San Francisco biotech company. Genentech had been trying to void a UC patent the university

says covers recombinant human growth hormone, a drug that racked up \$214 million in sales for Genentech last year. John Kidd, Genentech's lead litigator and a partner in the New York law firm of Rogers & Wells, says firms who want to sue a state will now have to take their case to state court, where there's no established forum for patent law. "I've got no place to sue," laments Kidd.

Companies say that's unfair because the Supreme Court decision leaves states free to sue them in federal court. In the Genentech/UC litigation, the university is countersuing Genentech for \$1.2 billion, claiming the company stole key DNA code from a university lab. That case is unaffected by the Supreme Court decision. Given the court's ruling, it would seem that state universities can continue to dish out lawsuits, but no longer have to take them.

—Antonio Regalado



PUBLISHING

A New Openness

IT'S A PROBLEM MANY INTERNET USERS share: How do you allow successive modifications of online materials without losing the credibility of the original?

A Brigham Young University grad student thinks he has a solution. David Wiley modeled his open publication license (OPL) on the agreements that allow open-source programmers to constantly and collectively improve free software. (In fact, open-source software gurus Richard Stallman and Eric Raymond helped him draft the license.) The OPL grants anybody permission to modify and redistribute the materials, provided changes are marked and the resultant work is also put out under the license. Wiley set up a repository for all OPL works at the OpenContent Web site (www.opencontent.org).

As of July, the repository contained about 90 registered works, ranging from experimental art to university course materials. Wiley is working on a new OPL with an optional clause prohibiting commercial paper publication without the author's consent. This way, a work could benefit from online peer-review and peer-improvement while a hard-copy version's publisher would be protected from its competitors.

Mark Stone, an editor at O'Reilly & Associates, a California firm that is one of the leading publishers of material on programming and open-source software, says such crossover from the free-content community to the for-profit realm would be most valuable when the ideas are new and changing fast. Or, as Stone puts it: "where mindshare is more important than marketshare."

—Brad Stenger