Soliloquy for a computer's ear

"Too bee, oar knot two B." As written, this phrase doesn't make any sense, but to human ears, its sound summons up the image of a melancholy, pensive Dane. A computer "listening" to such a speech, however, would have difficulty deciding how to spell out Hamlet's question.

This is one of many problems that automatic speech recognition systems ought to be able to solve but usually stumble over (SN: 11/16/85, p. 313). So far, most such systems recognize only a few words, spoken one at a time, often make mistakes or take an unreasonably long time to translate an incoming acoustic signal into a suitable written form.

Recently Dragon Systems, Inc., a small research and development company in Newton, Mass., demonstrated a prototype system that may bring speech recognition closer to everyday use. "It's a significant departure from anything done before," says Janet M. Baker, Dragon Systems president.

What makes the Dragon technology remarkable is the large vocabulary that it can handle — about 2,000 words — with an average response time of less than a second. Yet, combined with a simple microphone and some electronics to convert the analog acoustic signal into digits, the system runs on a personal computer. Unlike other experimental systems, which often include special electronic filters and other custom-built hardware, this system does all of its speech processing in the software.

Last year, IBM Corp. in Yorktown Heights, N.Y., was the first company to demonstrate a speech recognition system able to handle sentences composed from a large vocabulary. IBM's experimental system works with 5,000 words commonly used in business. In contrast to the Dragon system, however, the computations require computer equipment worth close to $1 million. With improved hardware, IBM is now developing a 20,000-word speech recognizer.

Both the Dragon and IBM systems use "stochastic modeling." This statistical technique, for instance, allows the computer to distinguish between words that sound alike by examining the context in which they appear. By looking at surrounding words, these systems can usually handle sets of words like "to," "too" and "two."

Neither system is based on rules, which present a sequence of choices requiring yes or no answers, and neither tries to imitate the way people recognize speech. "We don't insist that certain features or characteristics of the signal must be there," says Baker. Instead, the computer estimates the probability that observed features match known language and acoustic patterns.

"Traditionally, this kind of modeling has consumed incredible amounts of computation and memory," says Baker. Dragon Systems has concentrated on finding efficient algorithms, making it possible to run such speech recognition programs on small computers.

A person using the Dragon speech recognizer first "trains" the computer to recognize his or her speech patterns. By analyzing selected printed material, the computer also automatically builds up a model of how language is used in, say, a particular business, medical or engineering specialty.

Typically a user would speak slowly, pausing briefly between each word. The computer responds by flashing the appropriate word on a monitor, in some cases offering a menu of as many as five possibilities for anything that sounds ambiguous.

"People have responded quite favorably toward getting immediate feedback and knowing exactly what the system is doing," says Baker. By using a smaller vocabulary or a computer with a faster microprocessor, the average response time can be cut to as little as 250 milliseconds.

— I. Peterson

A one-two punch for cancer

A two-step immune-stimulating strategy can prompt the body to fight cancer growth, Steven A. Rosenberg and his colleagues at the National Cancer Institute in Bethesda, Md., have found.

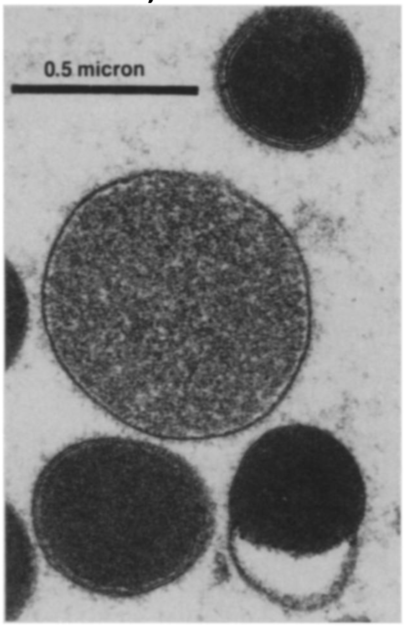
In what they term a "preliminary" report in the Dec. 5 NEW ENGLAND JOURNAL OF MEDICINE, the researchers describe transfusing cancer patients with the immune system stimulator interleukin-2 along with the patients' own, previously collected white blood cells.

They tried the process on 25 patients with untreatable, advanced cancers of various types. One patient was cancer-free 10 months after therapy, in 11 patients the tumors shrank by more than 50 percent, and 10 patients had a partial response.

Interleukin-2 can induce white blood cells to develop in lymphokine-activated killer (LAK) cells, which kill cancer cells but not normal cells. Neither LAK cells alone nor interleukin-2 given at anything but near-toxic doses limit cancer growth.

While the researchers note that the findings represent "a possible new approach to the treatment of cancer, with potential applicability to a wide variety of tumors," they caution that the study involved a small number of patients and that the safety of the procedure remains to be determined. According to a National Institutes of Health spokesperson, the same sort of immune stimulation has been tried on an AIDS patient, but it is too early to tell if it worked. □

Fake cells, real benefits?



Hunt/Science

Artificial red blood cells, which could reduce blood transfusion risks such as infection and immune reactions, have been successfully created by packaging the oxygen-carrying protein hemoglobin in bubbles of fat, according to a report in the Dec. 6 SCIENCE from researchers at the University of California at San Francisco. The cells, called neohemocytes, also represent "one step along the road of constructing biological systems from scratch," co-researcher C. Anthony Hunt told SCIENCE NEWS.

The process encapsulates hemoglobin from outdated donor blood in bilayer membranes of lipids (see thin-section electron micrograph above). One-twelfth the size of real human red blood cells, the artificial cells could be used to oxygenate poorly vascularized tissues, such as tumors and the brain, to facilitate treatment. Studies suggest that, although these cells are cleared from the bloodstream more rapidly than are real cells, their lack of blood group antigens and their shelf life of six months make them a viable choice in the treatment of trauma patients, as a temporary substitute for real red cells and for tissue irrigation during surgery.

The next step, Hunt says, is the difficult "scale-up" process to produce enough material for clinical trials in humans. He estimates the final product will cost two to five times as much as real blood. The artificial red cells, however, are not expected to fulfill all the needs now satisfied by whole blood or packed red blood cells. Other researchers are studying chemically treated free hemoglobin and an entirely synthetic perfluorocarbon oil emulsion (SN: 8/28/82, p. 137) as possible oxygen carriers. — D.D. Edwards

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