Centre is focal point for research

by Laurel Tokuda

On the northwesternmost tip of campus dwells a small robot, not as sophisticated as *Star Wars* R2D2 but twice as impressive because it is real.

A computer contained in a round metal box, a T.V. camera perched on top, a jointed mechanical arm, and wheels for feet are all that this robot is physically, but, despite these humble beginnings, it is fascinating.

This robot "learns" a two-dimensional picture and can pick out a copy of it, in another size or orientation, from a large group of other pictures it sees.

Dr. Terrence Caelli, creator of the robot, says, "There's nothing magic" about it. "All the movements and things are just standard." It is, in fact, "one of those stupid robots you buy for so-called mixing your drinks."

It seems like magic, however, when the robot walks over to the picture it has previously learned and points to exactly what it saw.

This somewhat magical chain of events was accomplished by cross-correlation, or matching. The computer learns the edges of a figure (prototype) "then goes around making edge versions of the world, then matches the edges of the prototype with the world." By doing this, it can distinguish between different shapes on pictures and pick out the shape it has learned.

Says Caelli, "We are interested in patterns and shape. What differentiates our group from other groups across Canada is that we really are concerned with pattern regulation."

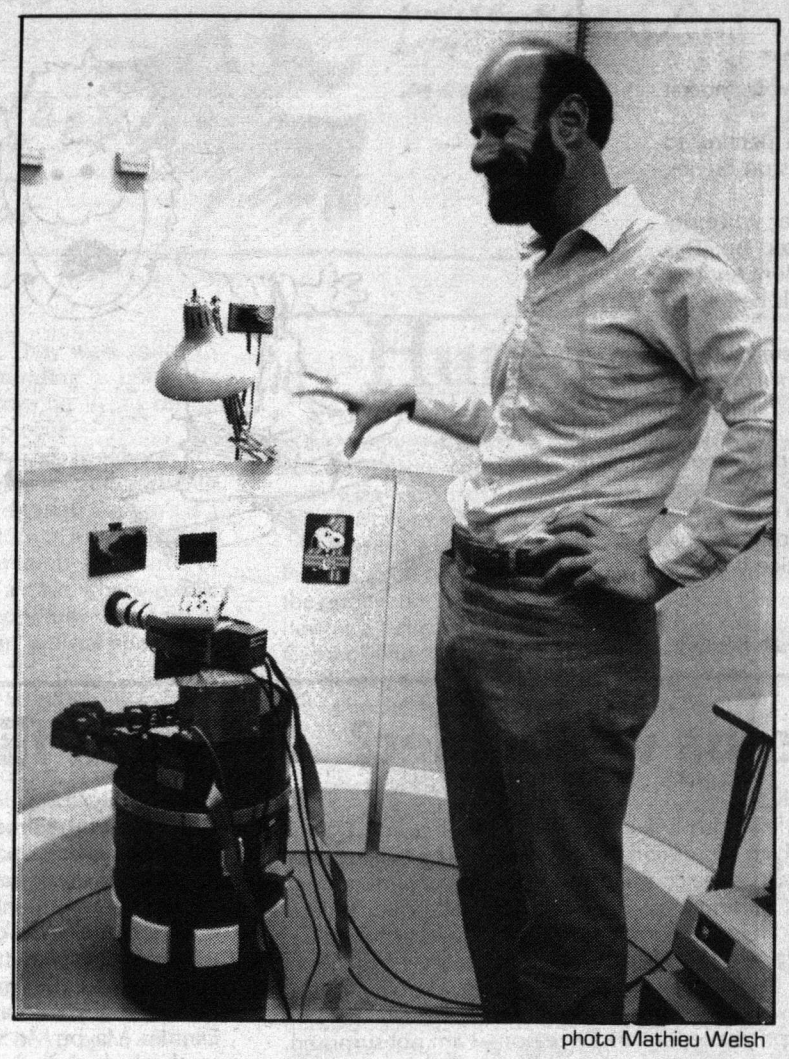

photo Mathieu Welsh

The group Caelli refers to is Computer Vision, "one group of four in what is now, officially on this university, The Alberta Centre for Machine Intelligence and Robotics" (ACMIR). ACMIR has people from a group of departments such as clinical engineering, electrical engineering, mechanical engineering, computer science, mathematics and psychology, who are actively involved in four areas of research. Computer Vision is one of these.

Other areas are expert systems, which "do what experts do, like finding oil or predicting stock-markets", robotics and control, which is "concerned with the control aspect of robots, for example, getting robots to pick things up", and integrated manufacturing, which is "very much a test bed group of all the other groups" and is concerned with the control of unmanned machines that can build things and repair themelves, etc., in industrial plants.

Caelli says that ACMIR has had some technical reports published in international journals. "This boost-up process makes us more well-known. It is good for the university, good for us, and good for the students."

Students from engineering, computer science, and psychology are supervised by Caelli. They benefit from ACMIR because, "they get this experience (of working together) that they wouldn't get just by staying in, for example, computer science, so it has an educational as well as a practical use."

ACMIR could also benefit the local industries in Alberta, because they "can use us as authorities. When you buy a high-tech device and you're in some industry that produces bolts and nuts or something, you don't know what's in that black box. You need people around you, who have some knowledge of these areas, to consult."

Caelli's little robot will hopefully benefit fields such as medicine and industry. He would like to "apply this technology to (the treatment of) breast cancer and to the classification of beef and pork."

"In the meat industry there is hardly any high technology of this nature so we've got to try these techniques and see how they can classify beef."

"In the breast cancer project, we're concerned with: Can we get the machine to automatically find tumors in the body?"

Although Caelli is very much involved with computer vision, he says that it "is a very small part of a very large overall plan."

ACMIR has only been formalized for the past four or five months, but things are rapidly expanding. Many students are interested in artificial intelligence and there is lots of employment in that field, so some of the best students from the different faculties involved want to join the research. They need a focal point to do it and ACMIR acts as one, Caelli said.

When asked if he would encourage students who are interested to speak with them, Caelli replied, "Absolutely, if they're interested in computers or artificial intelligence or anything like that, they should come and see us!"

Dr. Caelli's position at the U of A is purely a research one, called the Killam Memorial Professor of Science in the department of psychology. He teaches no classes, so most students would not know him. All other members of the Centre teach though, so if students are interested, the information about the Centre is available.

Caelli feels that "there should be some way that students can get an integrated view of everything (available to them) together" and be able to find out "how things apply to every other field." He hopes that ACMIR will enable students to gain knowledge about other areas of study that they would not normally gain by staying in one faculty.

Of his project in general, Caelli says, "It's fun. We have great fun! It's almost like playing! It's incredible when these programs work. Sometimes the thing goes crazy and walks around and hangs itself!"

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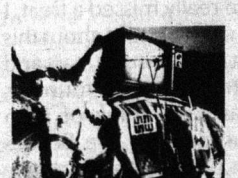

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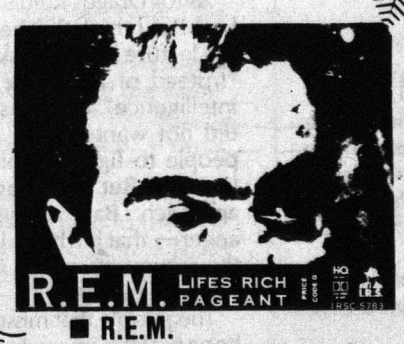

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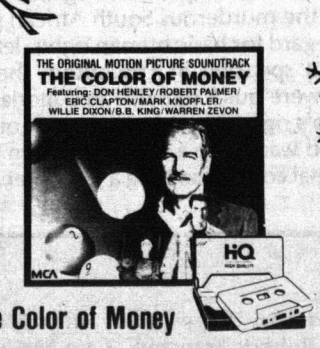

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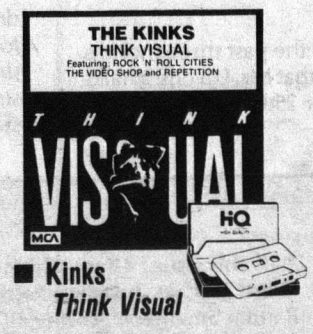

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