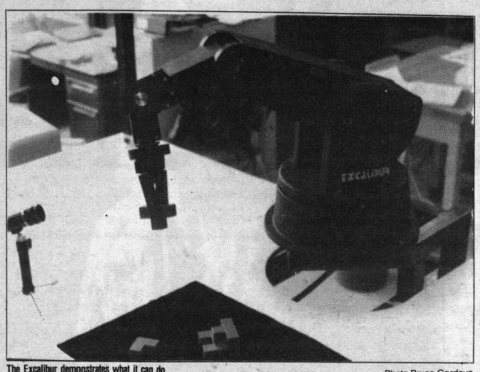
Computer robotics at University of Alberta trying h

Hidden away in the General Services Building is a small office. The plaque on the door reads "Alberta Centre for Machine Intelligence and Robotics."

This office is an attempt by the University of Alberta to try to keep up with the rapid pace of technological change in the fields of machine intelligence, robotics and control. ACMIR is actually a loose coalition of four interest groups in various fields on campus. In April 1986 they were brought together under the umbrella of ACMIR to keep each other informed about the latest research, and to improve their chances of receiving funding from the provincial government and other sources for their work.

The Centre consists of three groups working with various aspects of robotics and machine intelligence — a computer vision group, an intelligent systems group, and a robotics and control group. The fourth group is working towards setting up an integrated production facility where industrial applications of the research could be tested and demonstrated. This group, however, has not yet received any funding.

The goals of ACMIR are to promote the application of new computer technology, and to further the interdisciplinary research that would help develop new technology. One of its ultimate aims is to help diversify the economy of Alberta by establishing a strong industrial base. Here, however, the lack of money is impeding their progress. The projects currently being worked on are funded independently, as no provincial money has been given to the Centre as a whole.



The Excalibur demonstrates what it can do. Photo Bruce Gardave

Computer Vision

The computer vision group, says Dr. Terry Caelli of Psychology, is concerned with "developing computer software that has the ability to understand images." Or, as his coworker Dr. Walter Bischof puts it, to teach the computer to "interpret images in terms of a three-dimensional world."

Teaching a computer to recognize images is much more difficult than it seems to humans, who are born knowing how to see. Humans have a built-in program that tells us how to interpret the patterns of light and dark spots that appear on our retinas. We merely take the information available to us and use our program to figure out what we are actually looking at. A computer, on the other hand, must be taught these things.

Theories of perception, or how we see the world, have suggested that object recognition consists of several subprocesses. It is these subprocesses, which include breaking an image into component parts, discovering the relationship of parts to each other, and identifying the object, that are programmed into a computer to enable it to 'see' and 'understand'.

> "The vision group is confident that their findings will have many uses."

This can be done with computers for objects with varying complexity. However, a specific program will usually only let a computer recognize a specific class of objects. If the object is altered substantially, the program will not always work. The key to computer vision systems is to teach the computer the general rules of pattern recognition, similar to the way the human brain "knows the general ways to find the solution," says Caelli.

The vision group is confident that their findings will have many uses. They are already working with the Faculty of Medicine to investigate the possibility of using computers to scan mammograms for the detection of breast cancers.

Bischof, who is working on this process with Dr. W. Castor from the Cross Cancer Institute, notes that radiologists who can detect tumors on mammograms describe the features they look for in a general way. These general descriptions are then broken down into combinations of simple features such as color, brightness, area, etc. Once the computer can look for these generalized features, it can scan the large number of images, and indicate which images have a possible tumor site. The radiologist is thus saved from spending time scanning healthy images and can concentrate on deciphering possibly abnormal mammograms.

Another application of computer vision is in the area of industrial inspection. "You can develop machines to replace humans," says Caelli, who will be heading to Queen's University in Ontario in July to work further in the field. On the inspection line "the needs are more constrained; you know in advance what the machine should be looking for. When vision systems understand the general rules, they have become "trainable". Once they have been taught to recognize defects in products, "they can use similar programs to recognize pizza or screws, with certain constraints," says Bischof.

Robotics and Control

The Robotics and Control group has members from the Departments of Mechanical, Chemical and Electrical Engineering, and Computing Science. One of its goals is to establish the credibility of its work with the public, and a $90,000 funding request for the group is being submitted to the University administration. If this money becomes available, says Dr. V.G. Gourishankar of Electrical Engineering, "we will immediately set up a robotics laboratory with an industrial robot and a computer work station that will enable all members of the group to use the equipment."

One of the areas that Gourishankar, his colleague Dr. Rink and their graduate students are presently working on is the control of flexible robot manipulators. Gourishankar notes that "in industries for consumer items, robots can be used for accuracy and efficiency, but in many applications the robot arm must be slender and flexible," and therefore prone to oscillation. "Research will help us come up with better ways of controlling these robots with better efficiency and less oscillation." Other projects underway in the department include robotics for the disabled.

The equipment the Robotics and Control group is working with is extremely limited. "There is not a single industrial robot on the U of A campus," notes a funding proposal from the Robotics and Control Group of ACMIR. Researchers are limited to small 'hobby' robots that are operated from microcomputers. The more advanced aspects of robotics have therefore been limited to computer simulations. Gourishankar, however, sees his work as one that the university should be concerned about. "The University has a responsibility to bring engineering education in the field of robotics to the 1980's."