

Research in Progress

Research at Fairchild

Ronald Brachman

*Fairchild Laboratory for Artificial Intelligence Research
Fairchild Advanced Research and Development
4001 Miranda Avenue
Palo Alto, California 94304*

THE FAIRCHILD LABORATORY for Artificial Intelligence Research (FLAIR) was inaugurated in October, 1980, with the purposes of introducing AI technology into Fairchild Camera and Instrument Corporation, and of broadening the AI base of its parent company, Schlumberger Ltd. The charter of the laboratory includes basic and applied research in all AI disciplines. Currently, we have significant efforts underway in several areas of computational perception, knowledge representation and reasoning, and AI-related architectures. We also engage in various tool-building activities to support our research program. The current computational environment includes several large mainframes dedicated to AI research, a number of high-performance personal scientific machines, and extensive graphics capabilities.

Speech—Contact: Richard F. Lyon

We expect to see a widespread ability for people to interact with their machines by voice communication within the next ten years. We are addressing the research issues involved in two main areas. First, we are investigating robust sound analysis algorithms based on models of human hearing; these algorithms will enable the computer to deal with complexes of sounds, such as speech plus typewriters plus air conditioners, which are common in any real-life environment.

A second project involves the development of a rule-based sound interpretation system which looks at features

extracted from the output of the sound analyzer stage and tries to interpret them as meaningful speech information, applying many of the sources of knowledge that expert human spectrogram readers use. We expect these efforts to lead to a next-generation speech recognition system, implemented partly in specialized hardware.

Vision—Contact: Jay M. Tenenbaum

An ambitious program of research is underway in computer vision. The program has three objectives: first, to do fundamental research on the computational principles of vision, leading to powerful general-purpose vision systems; second, to investigate image processing applications (particularly within Fairchild and Schlumberger,) where tasks are too complex for current commercial systems; and third, to investigate ways of implementing complex real-time vision algorithms cost-effectively in VLSI.

In terms of basic research, our current focus is the development of broadly applicable techniques for description and matching of structure in sensory data. Such techniques appear to underlie virtually every aspect of early and intermediate vision, such as edge and region finding, perceptual organization and grouping, and the recovery of 3-D shape from contour, texture, stereo and motion. They appear to be equally important in other sensory domains, such as auditor (e.g., for describing the structure in spectrograms.)

We are also investigating practical visual inspection problems whose solutions require techniques beyond those of existing commercial approaches. In particular, we are dealing with the problem of grey-level inspection, and are constructing a vision workbench to allow rapid experimentation with alternative techniques

Finally, we are examining a variety of special-purpose architectures for image processing. These range from a SUN (MC68000-based) workstation, augmented with high-speed pipelined VLSI components, to a massively parallel architecture involving a thousand processors and a novel interconnection network.

Knowledge Representation

Contact: Ronald J. Brachman

Having had experience with knowledge representation systems designed to support "common sense" reasoning, we are developing and implementing a new framework for representation and reasoning in areas requiring "expertise." Our framework partitions the competence of a knowledge representation system into a terminological part, responsible for maintaining and understanding the technical terms in an expert domain, and an assertional part, responsible for maintaining beliefs about the world and their implications. We are actively investigating the utility of this framework in the areas of intelligent information retrieval and man-machine communication.

In addition, we are examining specific methods for representing and reasoning about the structure and function of digital systems. The emphasis here is upon the validation of designs, but the work touches upon optimization, test generation, and diagnosis. We are also constructing a rule-based simulator that uses hierarchical design descriptions to manage the simulation of extremely complex systems.

AI Architectures—Contact: Alan L. Davis

The AI Architectures project provides the architectural support for research in speech and vision, but also includes other novel activities supporting wider, more symbolic, AI applications. The central theme is the exploitation of the massive concurrency promised by VLSI, in a way that meshes synergistically with our other AI projects, and leads to the development of interesting silicon chips.

We are also building a VLSI design aid called ELECTRIC which integrates several electrical design tools. Among its more notable features is the ability to handle multiple technologies simultaneously, perform cell stretching properly and permit top-down design. It is a workbench for many AI/VLSI algorithms, an exploration of control issues for VLSI tools, and a uniform interface to all aspects of circuit design.

NASA Ames Research Center
Moffett Field, CA 94035

MAN-COMPUTER INTERACTION SCIENTIST

Ames Research Center is seeking a human factors engineer or engineering psychologist to conduct research in the application of artificial intelligence (AI) techniques to airborne systems. Responsibilities will include participating in the conduct of laboratory, simulation, and flight research; monitoring of contracts and grants required to support in-house programs; and establishing/maintaining interaction with the aviation, scientific, and technical communities. The increase in computational capability of digital computers has made it feasible to consider the application of AI techniques to aircraft control or aircrew monitoring systems. Preliminary research is required to improve understanding of human-computer interaction before such systems can be successfully implemented. Poorly understood issues include: the ability of the crew to perceive and comprehend system operation, capability, complexity, and reliability; and their abilities to recognize operational anomalies, diagnose failures, and take appropriate corrective action in real time.

Specified qualifications include: 1) knowledge of AI and computer science; 2) knowledge of cognitive psychology; 3) ability to plan, conduct, and report on human behavioral research, and 4) ability to work as a member of a team. U.S. citizenship is required. Permanent position in federal service. Salary ranges between \$24,508 and \$29,374, commensurate with experience/education. For further details regarding requirements and application procedures, write LM-7-83 at above address or phone (415)965-5084. Formal applications must be filed by April 15, 1983. AN EQUAL OPPORTUNITY EMPLOYER