Crossroads
The ACM Student Magazine

Introduction

by ***Frank Klassner***

In the summer of 1956, a group of researchers met at Dartmouth College to explore ``...the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.'' It was in the grant proposal for this two-month-long conference that the term ``Artificial Intelligence'' (AI) first appeared, and it was at the conference that many of the earliest leaders in AI, including **John McCarthy**, **Marvin Minsky**, Allen Newell, and **Herbert Simon**, first met. For these reasons, the 1956 Dartmouth Conference is considered the foundation of AI as a formal field. On the 40th anniversary of AI's foundation, this issue of Crossroads presents a snapshot of the field's development, its current research, and its future.

Over the last forty years the field's scope and its ``precise description'' of intelligence have expanded as new insights were gained into the nature of intelligence. From the beginning there has been a research track that concentrates on getting computers to ``reason'' like humans. Intelligent behaviors are modelled as the result of a system searching through a set of states, or descriptions of itself and its environment, until it finds a state that solves the problem at hand. Within the *reasoning* research track much progress has been made in planning, knowledge representation, theorem proving, game playing, expert systems, resource management, scheduling, and machine learning.

Beginning in the early sixties a new general research area, the intelligent *interface* track, emerged. Research in this area emphasizes reproducing the aspects of intelligence that humans recognize in interactions with each other. It asserts that if people are to perceive AI systems as intelligent, then these systems' interfaces must interact intelligently with humans. The track started with work on foreign language translation, then expanded to include work on natural language processing and generation, storytelling, commonsense reasoning, user modelling, fuzzy logic, and tutoring systems.

The early seventies saw the start of a third research area within AI, the *perception* track, which emphasizes reproduction of the aspects of intelligence that allow a system to perceive and manipulate its environment. Work in this area began by building on earlier research in pattern recognition, control theory, and human and animal physiology. The goal of many projects in this area is to design systems that do not just numerically process a sensory signal but also apply high-level knowledge about the environment to constrain the identification or manipulation of the objects generating the signal. Topics within this track include computer vision, speech recognition, auditory scene analysis, robotic path-planning and kinematics, and robot design.

Although, in the past, researchers from each area did not usually discuss questions of how to integrate their work into a single system, that intellectual isolation is disappearing as more researchers embrace the ``intelligent agent'' design concept. This paradigm views intelligence as the result of a (machine or human) agent's efforts to control itself and its environment in the face of incomplete knowledge about the environment. An agent is a collection of cooperating mechanisms for receiving stimuli from an environment and for performing goal-achieving actions. Examples of such agents include softbots for exploring the World Wide Web, robots, and personal assistant software.

This issue of Crossroads presents articles on topics from each of the three general areas. In Joshua Grass's article, we learn about work being done in the reasoning track on ``anytime'' algorithms, a technique for building agents that can trade off how completely they perform a task for how quickly they can perform the task -- an important aspect of intelligent behavior that must handle real-time deadlines. Lynellen Perry's article explores questions in the intelligent interface track on how to use knowledge about human emotions in systems that must interact with people. Far from being a mere interface decoration, simulated emotions in an agent might prove

necessary if the system must support commonsense reasoning about the emotional concerns of human clients. The article by Joseph Beck, Mia Stern, and Erik Haugsjaa discusses how various efforts in the intelligent interface research area address the problem of integrating components to build robust, adaptive tutoring agents. Christopher Jaynes' article shows us one example from the perceptual research track of how high-level reasoning components in an intelligent agent might exercise control over the agent's visual signal processing components.

No overview of AI would be complete without reporting on at least one senior practitioner's views on the field. We are pleased to offer Kentaro Toyama's interview with Drew McDermott, a researcher whose work spans several fields within AI and whose candor balances the hype that unfortunately sometimes appears in assessments by AI researchers of their own work.

During the last 40 years, theoretical AI research efforts as well as commercial AI applications have had their share of illuminating successes and disheartening failures. Brittle rule-based expert systems, machine translation systems, and LISP machines are AI applications that ultimately disappointed their creators and buyers, while classification-learning systems, speech recognition software packages, image analysis software, neural-net control systems, and tutor systems are examples of AI applications that have provided their purchasers with moderate to high success in reducing costs or saving or improving lives. As AI enters into its fifth decade on this balanced track record, we wish it and its researchers well.