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FUZZY LOGIC AND NEURAL NETWORK INTEREST GROUP

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Artificial Life

A review of Dr. Healy's presentation of artificial life will appear in the next edition of the newsletter due to some technical problems. Watch for it.

Neural Network Implementation

Dr. Hammerstrom is the founder of Adaptive Solutions, Inc. of Beaverton, Oregon. The mission of Adaptive Solutions is to provide the latest technology for high speed parallel applications, especially the human computational forms of speech recognition, vision and pattern recognition. Fast computation is typically traded for flexibility, but Adaptive Solutions has attempted to produce a computer which has a large degree of both.

The computer is an all digital implementation using a two metal CMOS process. A direct data input feature allows higher data bandwidths and numbers are stored as 16-bit fixed point number, more than adequate for neural network applications. The CNAPS system consists of processing chips with arrays of processing nodes. Redundancy in the design produces reliable systems with high yield. The chip is large, having 106 pins, 60 of which are inputs, and draws four to five watts of power. The chip uses a single instruction stream and multiple data streams (SIMD) which is ideal for vector and neural network applications.

Adaptive Solutions currently produces a VME bus card with one, two or four chips (up to 256 nodes) with a larger board in the works with perhaps eight chips or 512 nodes. A PC bus card is also being designed but the number of chips is currently limited by the power supply used in most PCs. The PC card is expected to put super computer performance on the desk top.

The performance of the CNAPS system is impressive. Using an eight chip card operating at 25 MHz, the board makes 2380 million connection updates per second while a Cray only makes seven million. A common bench mark is NetTalk, where a neural network is trained to convert text to phonemes. It takes approximately 10 to 45 minutes to train the network on a SPARC 10, but only seven seconds using the CNAPS architecture.

Along with the impressive hardware, Adaptive Solutions provides software tools to make programming of the CNAPS system relatively easy. A compiler, an ANSI C subset, and a debugger are provided for Unix platforms with an NT version due out soon. Other visual tools are also available.

The CNAPS system has been but to use in several applications to date, including Japanese Optical Character Recognition by Mitsubishi and Sharp. With the impressive performance and the numerous applications already making use of the CNAPS system by Adaptive Solutions, the power of neural networks should soon be on our desks at a reasonable cost.

The Next Meeting

Some Control Challenges for Fuzzy Logic

Speaker: Professor Juris Vagners
University of Washington
Date: Thursday, March 10, 1994
Time: 7:00 p.m. Social Time
7:30 p.m. Presentation
Place: Puget Power Auditorium
10608 NE 4th St.
Bellevue

Fuzzy logic seems to offer the potential of solving some difficult nonlinear control problems. Numerous papers have been published that discuss the application of fuzzy logic to control problems and quite a few practical applications have been reported as well. Some of the literature reports integration of fuzzy logic with artificial neural networks (ANN) for nonlinear control. In this talk we will review some of the issues in applied nonlinear control as well as some of the hardware implementation concerns that determine real control systems performance. We will give an overview of the developments in the UW Control Systems Laboratory experience with ANN and fuzzy logic controllers to date as well as a preview of planned studies.

Dr. Vagners is currently a Professor of Aeronautics and Astronautics and an Adjunct Professor of Electrical Engineering at the University of Washington. He received his PhD from Stanford University and has been on the faculty at the UW since 1967. His teaching and research interests are in dynamics and control with particular focus on the behavior of nonlinear systems. For the last six years he has been coordinating the development of the control systems curriculum in the College of Engineering. As part of this effort a cross-departmental Control Systems Laboratory has been developed for use in undergraduate and graduate courses as well as research. The focus of the curriculum development efforts has been to bring hardware-in-the-loop experience into the education and training of control systems engineers.

Fuzzy Announcement

EE400: Introduction to Fuzzy Systems
(The Course Will Be offered on TIE)

Prof. Robert J. Marks II
Three Credits
Spring quarter, 1994; 8:30 to 10:00 Tues/Thurs.

Prerequisite: EE370, STAT390 or permission of the instructor.

* Texts:
- G.J. Klir and T.A. Folger, Fuzzy Sets, Uncertainty and Information, Prentice Hall, 1988.
- T. Terano, K. Asai & M.Sugeno, Fuzzy Systems Theory and Its Applications, Academic Press, 1992

* Reference:
- R.J. Marks II, Editor, Fuzzy Logic Technology and Applications I, (IEEE Technical Activities Board, Piscataway, 1994).
- J.C. Bezdek & S.K. Pal, Fuzzy Models for Pattern Recognition, IEEE Press, 1992.
- Proceedings of FUZZ*IEEE
- IEEE Transactions on Fuzzy Systems

* Course Outline
    - Crisp sets and fuzzy sets.
    - Operations on Fuzzy sets
    - Fuzzy relations.
    - Fuzzy measures.
    - Adaptive Fuzzy Processing.
    - Uncertainty and information.
    - Applications.

ABSTRACT:
Fuzzy theory, in part, seeks to provide an accurate and useful model of uncertainty. Fuzzy modeling, based on relative membership of elements in sets, has a firm axiomatic base from which advance concepts are developed. These concepts are then applied to such problems as fuzzy inferencing, fuzzy control and fuzzy pattern recognition. Prerequisites include a firm working knowledge of both conventional (crisp) set theory and probability.

* Students will perform a course project.

Engineering science: 2 credits
Engineering design: 1 credits