Application Development Tool
Intel Scientific Computers

ANNE
(Another Neural Network Emulator)
Neural Network Simulation System for the Intel iPSC™

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INTRODUCTION

The Department of Computer Science/Engineering at the Oregon Graduate Center (OGC) has developed an extensive system for the simulation of arbitrary neural network structures on the Intel iPSC hypercube. This system consists of a compiler that takes as input a Network Description Language (NDL) and generates:

- a well defined, low-level generic network specification, Beaverton Intermediate Form (BIF)
- a network partition utility (network node-to-iPSC processor mapper)
- an iPSC-based neural network emulator, ANNE (Another Neural Network Emulator).

USER INTERFACE

The user describes the structure of the network very quickly in NDL, which is based on Scheme (a lexically escaped version of Lisp). The user then deals with the components of the network as objects and combines them accordingly. Arbitrary, stochastic interconnectivity is possible. The functions of the particular nodes (and sites at the nodes) for computation and learning are specified by pointers to C procedures. Internal to these C functions, the user code accesses network parameters via standardized data structures and calls to ANNE. OGC will eventually provide a variety of standard functions for typical network architectures (back-propagation, adaptive-resonance, etc.), but the user can easily add his own.

MAPPING AND SIMULATION

The NDL source is compiled into BIF and run through the mapper which, using a PAD (Physical Architecture Descriptor) file that describes the user's machine, partitions the network among the iPSC processors. This mapped BIF is then read by ANNE.

The purpose of ANNE is to act as a testbed and debugger for the variety of neural network models describable by BIF. ANNE is not intended to model any particular architecture design on which these networks might be mapped but, rather, it is designed to run neural nets in an expedient manner in order to examine their operating characteristics.

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What ANNE provides the designer of experimental neural networks is a virtual machine over a distributed memory multiprocessor computer that is specifically designed for the characteristics of neural network models. As part of the complete design environment it supplies:

- a scanner/builder to construct a neural network from BIF
- a message passing mechanism for coordinating communication between network nodes on different iPSC processors
- a special timing and synchronization system (which is user controlled).

In addition, the user has the ability to examine, modify, or save pertinent data within the network, including the entire BIF description (plus network state) of the network at any point in the simulation.

ANNE reads the mapped BIF specification to construct the network under consideration. Included with the BIF specification are the C routines that specify the behavior of the network elements. Each network node may have its own user-defined function. The ANNE node image, including these functions, is loaded into each iPSC processor.

PERFORMING SIMULATIONS

Before starting a simulation, the user may provide certain parameters to control how the simulation is run (such as the degree of synchronization between processors), how messages are received at each node, and when to checkpoint (suspend) the simulation. The user is free to alter these parameters and data within the network at any time that the simulation is in suspension.

The user may also address some or all of the nodes in the network (along with their attendant sites and links) by the use of node maps that reside in the host software. These maps consist of named groups of nodes. For each node type there are maps constructed at the time the network is built. The user may also specify additional maps of arbitrary nodes and perform a variety of operations on the maps or between maps. The functions that can be applied to the nodes in node maps include: the printing of node fields, assignment of node fields, tracing of nodes, and the resetting of default values. Functions, such as *set operations*, can be performed over node maps.

The user's node function is at the core of the simulation of a neural network. These are called for each node on each iPSC processor at each local clock cycle. A variety of services for the node are provided by the simulation system through the use of procedure calls to ANNE. In this way, the user can design particular node functionality without needing knowledge of ANNE's internal data structuring or message passing mechanisms. Nor do they need to be concerned with how synchronization is maintained between the iPSC local and global simulation clocks.

AVAILABILITY

Available in Q4, 1987 in the iPSC Users' Group Library. For more information contact:

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