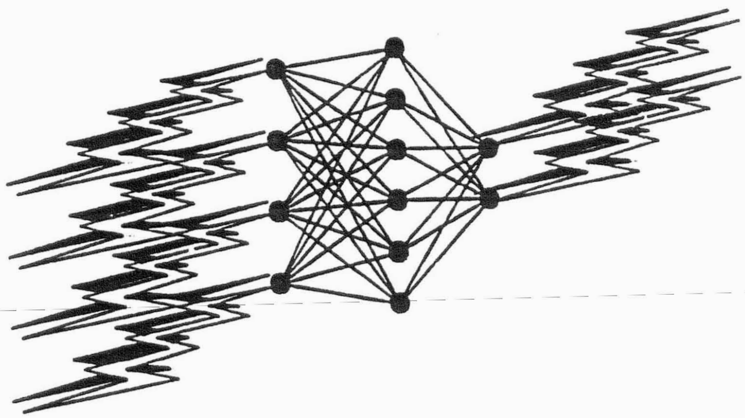
PROCEEDINGS OF THE FIRST INTERNATIONAL FORUM ON

APPLICATIONS OF NEURAL NETWORKS TO POWER SYSTEMS



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PREFACE

Neural networks (NN's) have been studied for many years with the hope of understanding and artificially achieving human-like computational performance. There has been a recent resurgence in the field of NN's due to the introduction of new network topologies, training algorithms and VLSI implementation techniques. Appealing benefits of NN's, including massive parallelism, architectural modularity, fast speed, high fault tolerance and adaptive capability, have lured researchers from other fields such as controls, robotics and energy systems, to seek NN solutions to some of their more complicated or unsolved problems.

An artificial neural network can be defined as a loosely connected array of elementary processors or neurons. Algorithms are then crafted about this architecture. Neurons are linked with interconnects analogous to the biological synapse. This highly connected array of elementary processors defines the system hardware. Specification of weights to perform a desired operation can be viewed as the net's software. Commonly used neural networks, such as the layered perceptron, are said to be trained rather than programmed in the conventional sense.

Computationally, neurally networks have the advantage of massive parallelism and are not restricted in speed by the von Neumann bottle neck characteristic of conventional computation. Neural networks are characterized by high parallelism and, in most cases, are significantly fault tolerant.

At this writing, the layered perceptron is receiving the most attention as a viable candidate for application to power systems. The layered perceptron is taught by example, as opposed, for instance, to an expert system, which is taught by rules. The preponderance of data typically available from the power industry, coupled with the ability of the layered perceptron to learn significantly nonlinear relationships, reveals it as a viable candidate in the available plethora of solutions for solving significant power systems engineering problems. Hopfield neural networks have also been proposed for application to combinatorial search problems.

A number of superb books have recently been published which present the foundations of NN's quite nicely [1-3]. An overview of neural networks and their applications to power systems is contained in a chapter of Leondes' book [4]. For monitoring more recent developments in the field, the reader is referred to the *IEEE Transaction on Neural Networks* which is currently the most widely circulated of archival journals dedicated solely to NN's.