Preface

I originally wrote this book in the 1980s as a companion to software I wrote, *The Brain Simulator*, which simulated an array of 1,200 neurons on a PC. Many of the ideas in this book were mere speculations at the time but are facts now. In a nutshell, the software was released but the book wasn't.

In 2003, I updated the text as a companion to the software I wrote called *Synthetic Intelligence* (SI) which included larger functional modules. Instead of individual brain cells, the SI software allowed the creation of arbitrarily complex modules such as video edge detection, various speech-process modules, etc. and was used in AI (Artificial Intelligence) classes. A unique capability of the system was that various modules (and multiple instances of the modules) could run simultaneously on different networked computers. Once again, the software gained traction while the book wasn't completed.

This time, I decided to finish the book first.

I have had a variety of professional experiences which have contributed to my ability to write this book. Primary among them were several years writing software for neurological test equipment. In writing most of the software for one of the first paperless EEG (brainwave monitoring) systems, I became familiar with brains and the kinds of normal characteristics and malfunctions they exhibit. My subsequent work on software for NCV/EMG/EP (Nerve Conduction Velocity/Electromyography/Evoked Potential—all of which measure signals in neurons) helped me gain insight into the capabilities and limitations of the biological neuron as a computational device.

Along the way, I earned degrees in Electrical Engineering and Computer Science, founded companies, and managed software projects. I worked in the semiconductor industry and participated in the development of an early microprocessor, giving me insight into the capabilities and limitations of integrated circuits, how these have evolved over past decades, and what the future will hold.

I've always been interested in intelligence and the possibilities of mimicking human intelligent behavior in computers. At the first

company I founded which did automated printed circuit design, we wrote algorithms which attempted to fit patterns to the problem of routing circuit boards. In this way, the software mimicked the way we observed human designers solving the same problem.

These experiences combined to create the model of intelligence detailed in Section II of this book. Based on this model of intelligence, we can make reasonable predictions of what the behavior, capabilities, and limitations of future thinking machines will be.

The question remains as to how much computer horsepower will be required to implement a system along the lines I will describe in this book. This is an open question, primarily because we can't predict how software efficiency will be able to short-cut the need for brute-force computing. If we need machines which equal (or exceed) the computational power of the human brain, these are still decades away. If, as I contend, we'll be able to devise algorithms which are orders of magnitude more efficient than the human brain (which evolved to make use of the neuron as its building block), this is a project which, if started today, will be complete in five to ten years. That's five years to develop the system/software and five years to train it and create any custom hardware which will make it fast enough to be useful.

I believe that for each of us, intelligence and insight are based on our experiences. Because I have had a unique set of experiences, this book contains some unique ideas and a singular point of view on intelligence and our ability to replicate it in machines.

As a future of thinking machines will be sooner than most people think, **the time to start getting prepared is *NOW!***