

Machines that Learn and Mimic the Brain

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Machine Learning. Machine Learning is the attempt to give computers the ability to adapt to their environment and improve with experience. Such a learning ability has always been viewed as an essential, defining characteristic of intelligence. Most of us would not consider a machine to be "intelligent" if it repeated the same mistake over and over. But this is exactly what current AI systems are likely to do when they encounter an unanticipated situation. One of the aims of machine learning is to make building and correcting of AI systems easier and faster. Ideally, such systems would be able to extend their knowledge autonomously, correcting their mistakes and adding to their knowledge through experience.

Machine learning draws on statistics, pattern recognition, and control theory, while taking inspiration from psychology and the neurosciences. Although machine learning may seem a distant goal, learning systems are already in use in a variety of commercial applications. For example, they have been used to identify the optimal conditions for casting automobile-engine-block components, to estimate credit risks, and to adapt synthetic-aperture radar processing.

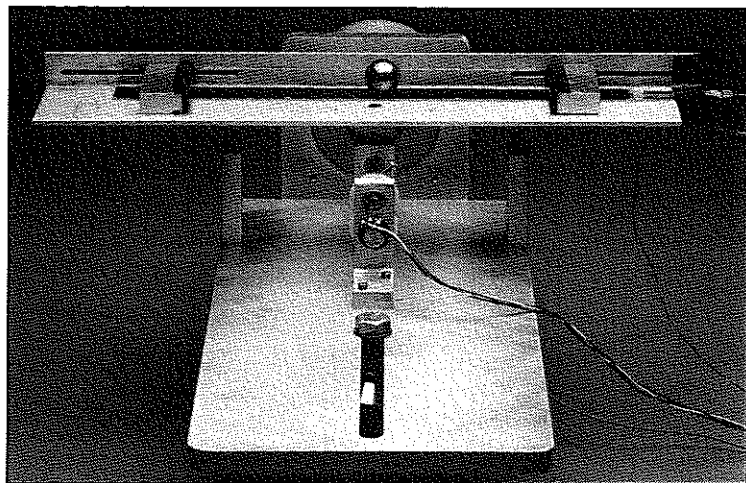
Machine learning is likely to play a significant role in GTE's future. In a competitive environment, GTE must operate ever larger and more complex telecommunications networks with fewer employees-per-customer. Constant changes and inherent uncertainties, particularly in mobile networks, demand frequent tuning of the network to match actual traffic levels. Because it is not practical to have human experts for all functions of a large, changing network, much of the adaptation must be autonomous, without human intervention. Machine learning is viewed as a key technology for managing such change, complexity, and uncertainty.

"Brain-Style" Learning. Neural Networks is a popular new approach to machine learning inspired by the structure and operation of the human brain. The learning system is conceived as a large network of simple, interacting processors analogous to nerve cells. While the analogy with the brain is only a loose one (the workings of the brain are still largely unknown), neural networks are similar to biological ner-

vous systems in emphasizing parallel processing, distributed control, rapid decision making, and associative memory.

Special purpose computers and Very Large Scale Integration (VLSI) chips have been fabricated to take advantage of the special features of neural network architectures. In contrast to other approaches to AI, neural networks emphasize low-level capabilities like perception and the control of movement, rather than high-level capabilities like cognition and problem-solving.

For example, while other AI systems attempt to mimic the performance of human experts such as medical doctors, neural networks attempt to mimic everyday human performance such as recognizing speech, faces, or handwriting, or such as walking across a room without falling down. (See photo of ball balancing on the beam for another example). Research and development at GTE Laboratories spans the full spectrum of machine learning research.



A NEURAL NETWORK AT GTE LABORATORIES LEARNS TO BALANCE A BALL ON A BEAM BY TRIAL-AND-ERROR IN REAL-TIME.