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Microprocessors and the Emulation Approach to Machine Intelligence

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Those who view microprocessors as small, inexpensive computers are perhaps correct in a technical sense, but I'd like to suggest that this is an inhibiting view. While there are clearly many applications where it is appropriate to define the microprocessor as a type of computer, more revolutionary opportunities materialize if we accept the following premise:

A microprocessor is a universal active device having a transfer function which can be almost arbitrarily defined.

In particular, appropriate software will permit a microprocessor to provide complex analog transfer functions. Thus, even though internal processing is digital, the externally observed function of the chip would be that of an analog n-port.

The concept is not unlike one exploited by the nervous system. Analog signals flow within the nervous system as digital pulse trains propagated via active transmission lines, i.e., the axons, where the pulse rate reflects the analog level. The active digital lines are apparently a convenient mechanism for getting data from one place to another without suffering the losses that would be encountered in a passive wire of the same diameter. In the same sense, the microprocessor is a convenience; it permits realization of analog functions in quantities that were previously impractical.

When one contemplates microprocessors from this alternate perspective, it becomes evident that most existing applications do not contribute significantly to the evolution toward such an analog function scenario. Lacking sufficient motivation, such an evolution is not likely to occur.

The motivation, however, does exist and is the rationale for most machine intelligence and pattern analysis research funding. Unfortunately, that research has been under the hypnotic influence of the large-scale digital computer for a number of years now. For example, a participant at a recent workshop observed that the various machine intelligence approaches reflect the enthusiasm of "computer buffs"—those who use and are mainly interested in large systems. But to what extent do such enthusiasms and the convenient availability of large computers inhibit initiation of more promising microprocessor-related machine intelligence research?

Merely asking such a question, of course, indicates that there may be a more promising path for such research to follow. Instead of continually ignoring the best existing example of an intelligent machine, let us launch a serious attempt to emulate the nervous system.

We can argue that the nervous system is a network which compares and inter-
the power of CTA applied to a radar processing problem.  

And these are indeed relevant approaches. We can show, for example, how an image processing synthetic nerve network based on such concepts could have neurons which behave like the line-sensing cells in a cat's visual cortex.

In summary, microprocessors can become the practical implementation technology for machine intelligence. Microprocessor cost and production trends permit contemplation of networks containing thousands of such devices. Because each is potentially capable of emulating the functional behavior of neuron arrays within the nervous system, a powerful means for modeling biological signal processes now appears feasible. A new class of computing machines can be created, with operations consisting of comparative transient analyses. Such machines could be implemented via thousands of microprocessor n-port modules with analog transfer functions.

The technology is here, and the concepts have been here for some time. We need only step out of the shadow of the big computer and give comparative transient analysis a serious evaluation.