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Development of Neural Network Microelectronics in Europe

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ABSTRACT:

VLSI systems for information processing by artificial neural networks range from digital neural signal processors like the MA16, L-Neuro2 or GENESIS IV over analog vision chips to neuro-biology inspired circuits for pulse-train processing. In contrast to the early days of neuro-technology, the needs of an application under consideration are found to determine whether the analog or digital design style is used.

Further development of neural VLSI systems depends to very much extent on progress in neurodynamics. Neural models based on relaxation equations for the neuron signals are, on the one hand, optimally suited for neural systems that use weights to fit a set of learning patterns. On the other hand, VLSI implementation of relaxation networks is hindered by the huge amount of on-chip memory for storage of intermediate data produced by the learning algorithms. In contrast, oscillatory neuron models make use of a causal modelling of the dynamics of neural signal processing and, hence, do not suffer from a on-chip memory problem. Although there is great evidence on the side of neuro-biology that the oscillatory signal representation is bearing an information processing quality of its own, research in applicational areas like image or speech understanding has not yet brought to light the universal applicability of oscillatory neural networks. In any case, oscillatory neurons are best implemented by the analog design style; even the technological design of special neural devices may become necessary.

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