Analog Circuit Used for Sorting Neurons According to Calculated Distances to Pattern for the Application in Neural Networks Based on Neural Gas Learning Algorithm

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Abstract

The paper presents a new circuit that enables sorting analog signals representing distances of particular neurons in Artificial Neural Networks to input learning patterns. In the comparison to other circuits of this type, the proposed solution offers large versatility. The target application of the circuit is in Neural Gas (NG) learning algorithm used to train unsupervised neural networks (NNs) [1 -3]. However, the circuit can also be used in nonlinear processing of analog signals. It is capable of performing simultaneously several typical nonlinear operations that include Erosion, Dilatation and Median filtering. The circuit offers high accuracy, which is important in case if high precision is required. For example, the circuit it able to distinguish analog signals (currents) that differ by 10 nA if the assumed calculation time is larger than 1 us. The number of neurons in a typical NN exceeds 100-200. For this reason the circuit has been designed in such a way to be capable of sorting so many signals. At the output of the circuit we obtain the value of a given, min, max or median signal, as well as the information which input signal provided this value (address). This feature makes it suitable for the application in neural networks (address required) and non-linear filters (value required).

References

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