

ABSTRACT

Machado, Tarso Mesquita. *Dedicated Project for Neural Networks Based on Multi-valued Probabilistic Logic Node*. 2017. 156f. Dissertação (Mestrado em Engenharia Eletrônica) – Faculdade de Engenharia, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, 2017.

Artificial Neural Networks (ANN) are computational models that are mirrored in the arrangement and architecture of the human brain. For the case of conventional ANNs, the information is propagated between neurons and is weighted by the synaptic weights between them, which are adjusted during the training phase and reflect the knowledge acquired by the network regarding the problem to be solved. The problem related to the conventional ANN model lies on the fact that the learning of the network is performed by successive sums and multiplications. This causes such ANN model to require large computational power to be implemented, and causes the learning of the network to be too slow. On the other hand, in the Weightless Neural Networks (WNN), the information learned by the network is stored in the RAM memories of each of the neurons, and the training process of the network usually consists of performing read and write operations. Therefore, WNNs have simpler and faster training than conventional ANNs. However, the vast majority of discussions about ANNs are relative to those with synaptic weights between neurons. Thus, there is little information about the implementations of WNNs, especially WNNs with probabilistic elements. The present work aims to analyze the impact of the project parameters of a WNN based on Multi-valued Probabilistic Logic Neurons (MPLN), in order to establish design project for the same. The solution is obtained through the implementation of several WNN architectures of the MPLN type for two applications, namely the recognition of handwritten numbers and the classification of the parity bit. Each of the implemented architectures had one of the parameters varied while the others were kept constant, in order to observe the impact of such parameter on the classification accuracy, training epochs necessary to train the network and processing time. The present work further proposes a modification in the MPLN network for multi-class problems, defines as the Mod-MPLN network. The Mod-MPLN network is defined by a change in the network training algorithm and by the inclusion of a specific discriminator at the network output, without changing the intrinsic characteristics of the MPLN topology. In order to establish the design guidelines for an MPLN WNN and to validate the effectiveness of the Mod-MPLN network, ten WNN architectures were developed for the handwritten number identification problem and ten architectures for the parity bit problem, which are evaluated by means of simulations performed in MATLAB[®]. From the results of the simulations, recommendations are proposed for the choice of project parameters of the network.

Keywords: Weightless Neural Network; Artificial Intelligence; Probabilistic Logic Node; Image Recognition.