Computational Synthesis of Artificial Neural Networks Based on Partial Magma Rings

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Abstract

A simple way to model the electrical properties of neurons consists of considering an electric circuit where batteries, capacitors and resistors represent, respectively, the difference in ion concentration inside and outside the cell, the charge storage capacity of cell membranes, and the ion channels within the cell membrane [4]. Further, the known multiplicative mechanisms existing within single neurons [5] make interesting the use of analog multipliers within such electric circuits. The structure constants of partial magma algebras have recently revealed [1] to play an important role in order to model the flow of electric current within electric circuits with all the mentioned components: batteries, capacitors, resistors and analog multipliers. This differs from the use of Boolean algebras by Shanon [6], which enable one to model the working of switches and relays within a switching circuit, but not the mentioned flow of electric current. Based on these facts, this work delves into the current literature concerning the modeling of different biologic and physical procedures by means of certain types of algebras as, for instance, the so-called evolution algebras [7], magnetic algebras [2] or electric algebras [3]. As an illustrative example, we make use of Computational Algebraic Geometry to model neural networks based on partial magma rings that have either a partial quasigroup or a Hadamard matrix as their Cayley table.

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