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A HARDWARE ARCHITECTURE IMPLEMENTING THE SIGMOID FUNCTION FOR LSTM NEURONS

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Within the context of hardware prototyping aiming machine learning applications, the present work's goal is to develop an architecture that implements the structure of an LSTM-type neural network. In addition, it is planned to test the architecture using previously trained weights for forecasting the trend in the share price movement of the financial market and then understand whether such data can be useful in the context of speculative operations with Financial Options. We chose to model the behavior of the sigmoid function (which is a part of the LSTM neuron) through lookup tables and using variable precision i.e., in the output graph of the function in the regions of greater curvature, a greater precision was used whereas in the regions of more rectilinear behavior, less precision was used. The tools used for the implementation were the Quartus Prime alongside the verification tool ModelSim. To check the effectiveness of the project, the root mean squared error (RMSE) and the absolute error were calculated, whose values are respectively RMSE: 0.028292 and absolute error: 0.023396. By reference one of the consulted articles of the literature shows absolute errors in the area of 0.005, showing that our design still has room for improvement. The implemented module has obtained a frequency of 45.45 MHz consuming 4% of total logic elements of an FPGA board model Cyclone IV E.

Key-words: Long short-term memory; Sigmoid architecture; Field programmable gate array; SystemVerilog;