HYPERBOLIC TANGENT ACTIVATION FUNCTION INTEGRATED CIRCUIT DESIGN

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ABSTRACT

Activation function is a mathematical function implemented used in neural network to limit the output signal. The objective of this project is design a hyperbolic tangent (TANH) activation function on digital design implementation for integrated circuit (IC). This thesis compares the performances of area, speed and power between ring and tree architecture of activation function. Multiplier, adder and subtraction are designed as submodules in the TANH activation function structure. TANH activation function is approximated up to three orders terms in Taylor series expansion since direct instantiation code is not possible. The project scope is to approach the digital design with hardware description language (HDL) and functioned simulation. The design is synthesized to produce the gate netlist allowing layout implementation process. The activation function successfully performed the TANH mathematical operation with ±0.02 percent accuracy. Tree architecture performs better than ring architecture in terms of speed since it have lower propagation delay by 22 percent and use less hardware by 23.34 percent in the design. Ring architecture has low power dissipation than tree architecture only by 0.005 percent.

Keyword- Hyperbolic tangent; activation function; neuron; neural network; integrated circuit

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Now days, neural network have applicability to real world business problems. It makes the neural network already been successfully applied in many industries. Neural network are best at identifying patterns or trends in data, so it suited for prediction and data validation. A neural network is a data-modeling tool that is able to capture and represent complex input to output relationships [1]. The development of neural network technology were invented from an idea of artificial system that could perform "intelligent" tasks similar to those performed by the human brain. The human brain can interpret the action to be taken when something happened. Humans have five types of sensory vision, hearing, taste, smell and touch controlled by human brain. The newborn human has a brain that cannot interpret what was felt by the senses. The longer the brain is more able to interpret or discern what is felt by the senses. Human brain controlled by 100 billion of neuron connected with each other [2].