Reconfigurable Computing

Tutorial 3 - LSTM Network (Precision)

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1 Introduction

Fixed-point arithmetic requires less area and has lower latency than floating-point. Moreover, FPGAs can more efficiently perform low-precision calculations than processors and graphics processing units. This tutorial has the following goals:

- Gain experience in converting floating-point designs to fixed-point.

- Quantify the performance advantages of fixed-point over floating point for our long short-term memory (LSTM) example.

2 Laboratory Questions

Your answers to this laboratory should be in the form of a simple report. For each question below, provide a listing of the changes to the original code as well as the speedup compared with the baseline design generated in the previous tutorial in your report.

2.1 (50%) Fixed-point C Implementation

Use the Vivado HLS ap_fixed type to make a C implementation which uses ap_fixed<12,4,AP_TRN,AP_WRAP> . What is the maximum percentage error of this implementation compared to the original single precision implementation?

2.2 (50%) RTL Simulation

Synthesise the design using HLS. Run the C simulation to verify the output is correct. Moreover, run an RTL simulation to check that the HLS output is correct.