SoC Project

Convolution

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Brief:

In this project, we implemented a 2 convolution layer module having a Fifo between them. The FIFO stores the output from the first convolution layer and the second convolution layer uses what's inside the FIFO to perform its convolution operation as an input.

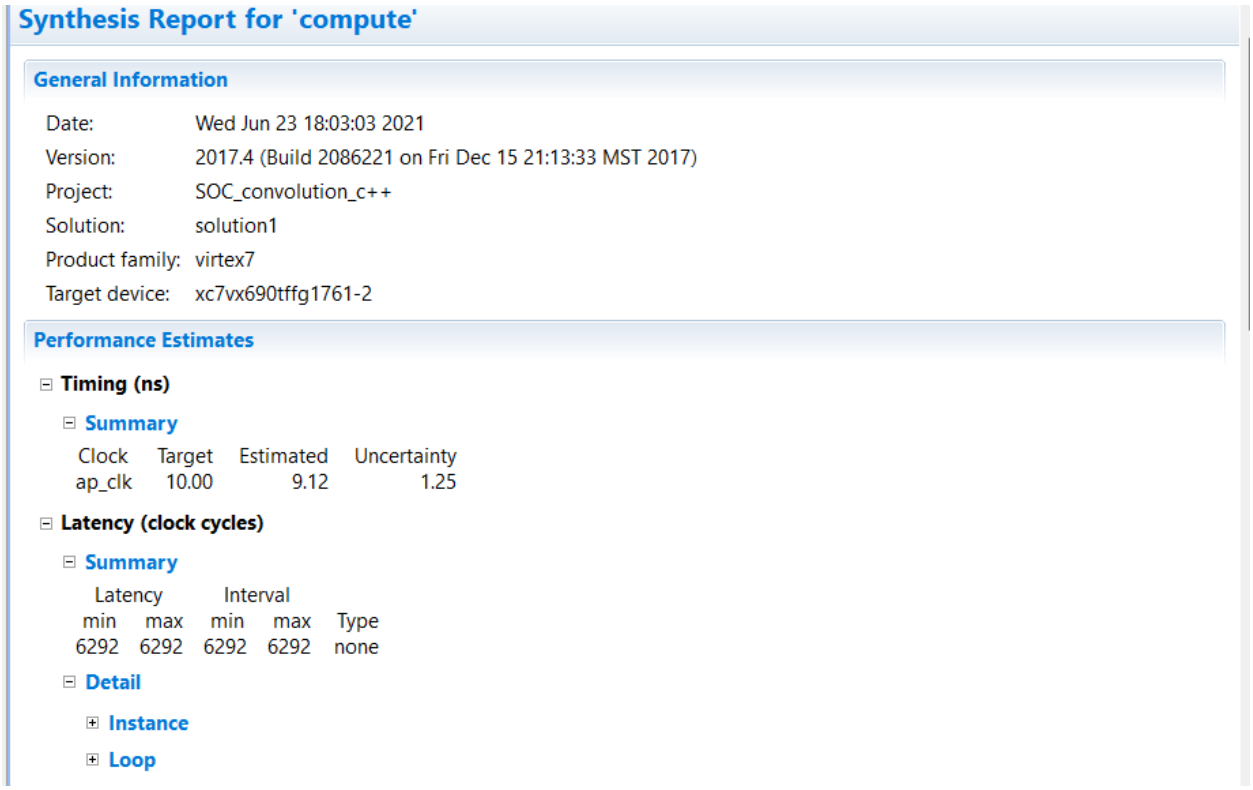
Convolution is an essential operation in the field of signal processing and image processing, playing a vital role across a range of applications. Its primary purpose is to extract valuable information from signals and images by performing a mathematical operation that combines input data with a filter or kernel. Convolution is extensively used in diverse domains, including computer vision, speech recognition, audio processing, and deep learning. For instance, in computer vision, convolutional neural networks (CNNs) leverage convolution to identify and extract distinctive features from images, facilitating tasks like recognizing objects and classifying images. Convolution also finds applications in audio processing, where it can be employed to create audio effects like reverberation or echo by convolving the audio signal with an impulse response. Moreover, convolution is widely used in fields such as seismic analysis, medical imaging, and communication systems to analyze data and enhance its quality. Overall, the broad utilization and effectiveness of convolution make it a valuable tool for extracting meaningful information and improving the understanding of various types of signals and images.

We implemented it using System-C once, and another using Cpp. The one using Cpp is synthesizable.

Results:

```
0 0 0 0 0 0 0
0 6.55308 7.31085 0 0 0 0
0 -9.83566 -2.30339 1.30231 2.21205 -0.573853 0
0 0 0 0 8.02752 -0.0652703 0
0 0 0 6.89543 -1.96541 0 0
0 0 -0.715398 5.57785 0.145988 0 0
0 0 -11.3116 -0.851598 0 0 0
```

Figure 1: Final Layer Output for both Modules



Synthesis Report for 'compute'

General Information

Date:	Wed Jun 23 18:03:03 2021
Version:	2017.4 (Build 2086221 on Fri Dec 15 21:13:33 MST 2017)
Project:	SOC_convolution_c++
Solution:	solution1
Product family:	virtex7
Target device:	xc7vx690tffg1761-2

Performance Estimates

Timing (ns)

Summary

Clock	Target	Estimated	Uncertainty
ap_clk	10.00	9.12	1.25

Latency (clock cycles)

Summary

Latency		Interval		
min	max	min	max	Type
6292	6292	6292	6292	none

Detail

Instance

Loop

Figure 2: Synthesis Result for CPP Code

The code is attached separately.