



ATI STREAM COMPUTING SAMPLE

Simple Convolution

1 Overview

1.1 Location `$(ATISTREAMSDKSAMPLESROOT)\samples\opencl\cl\app`

1.2 How to Run See the *Getting Started* guide for how to build samples. You first must compile the sample.

Use the command line to change to the directory where the executable is located. The pre-compiled sample executable is at `$(ATISTREAMSDKSAMPLESROOT)\samples\opencl\bin\x86\` for 32-bit builds, and `$(ATISTREAMSDKSAMPLESROOT)\samples\opencl\bin\x86_64\` for 64-bit builds.

Type the following command(s).

1. `SimpleConvolution`
Performs convolution of a 64x64 image with a blur mask of 3x3.
2. `SimpleConvolution -h`
This prints the help file.

1.3 Command Line Options Table 1 lists, and briefly describes, the command line options.

Table 1 Command Line Options

Short Form	Long Form	Description
-h	--help	Shows all command options and their respective meaning.
-q	--quiet	Quiet mode. Suppresses all text output.
-e	--verify	Verify results against reference implementation.
-v	--verbose	Verbose output.
-t	--timing	Print timing.
-x	--width	Width of problem domain.
-y	--height	Height of problem domain.
-z	--depth	Depth of problem domain.
-mx	--maskWidth	Size of the mask matrix (square).
	--device	Devices on which the program is to be run. Acceptable values are <code>cpu</code> or <code>gpu</code> .

2 Introduction

Convolution filtering is widely used in image processing applications such as blur, smooth effects, or edge detection. This sample, shows naïve convolution using OpenCL.

3 Implementation Details

The overlap between two functions can be quantized using convolution. In image processing, if a small *mask* matrix (say 3x3) can represent an edge, and this is convolved with the image, the resultant image shows all the edges detected.

A convolution filter is just a scalar product of the filter weights with the input pixels within a window surrounding each of the output pixels.

Equation 1
$$(s * k)(i, j) = \sum_m \sum_n s(i-n, j-m)k(n, m)$$

where *k* is a matrix of size *n* x *m*.

A more detailed explanation of convolution can be found at [1]. It is also a heavily data parallel algorithm because the output at a pixel just depends on the input pixels surrounding it.

4 References

1. <http://en.wikipedia.org/wiki/Convolution>

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