

## 1 Overview

**1.1 Location** `$<AMDAPPSDKSamplesInstallPath>\samples\bolt\`

**1.2 How to Run** See the *Getting Started* guide for how to build samples. You must first compile the sample. Use the command line to change to the directory where the executable is located. The pre-compiled sample executable is at `$<AMDAPPSDKSamplesInstallPath>\samples\bolt\bin\x86\` for 32-bit builds, and `$<AMDAPPSDKSamplesInstallPath>\samples\bolt\bin\x86_64\` for 64-bit builds.

Type the following command(s).

1. `RgbToYuv`  
This runs the program with the default options; `s = (1024 * 768)`.
2. `RgbToYuv -h`  
This prints the help file.
3. `RgbToYuv_TBB -h`  
This command generates a build with the multiCoreCpu path (the Thread Building Block library), enabled.

**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.
	--device	Explicit device selection for Bolt [auto/openCL/multiCoreCpu/SerialCpu]
-q	--quiet	Quiet mode. Suppresses most text output.
-e	--verify	Verify results against reference implementation.
-t	--timing	Print timing related statistics.
-v	--version	Bolt and AMD APP SDK version string.
-x	--samples	Number of sample input values to be calculated.
-i	--iterations	Number of iterations.

**Note:** The `--device multiCoreCpu` option becomes available when the sample is compiled with `ENABLE_TBB` defined. Microsoft Visual Studio build configurations `Debug_TBB` and `Release_TBB` are created for this purpose. These configurations have `ENABLE_TBB` defined to enable the TBB path (multiCoreCpu) for all the AMD BOLT functions used in the sample.

## 2 Introduction

RGB to YUV conversion is a common preprocessing module used in video and image processing pipelines. The conversion modifies the color space of the image pixels, taking the human perception into account. This allows for transmission errors or compression artifacts to be concealed from human perception, as compared to the RGB color space.

## 3 RGB to YUV Conversion

RGB to YUV conversion is typically implemented as a 3x3 matrix multiplication of the input RGB data. The matrix that is applied for this sample is:

Equation 1

$$\begin{pmatrix} Y \\ U \\ V \end{pmatrix} = \begin{pmatrix} 0.257 & 0.504 & 0.098 \\ 0.439 & -0.368 & -0.071 \\ -0.148 & -0.291 & -0.439 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix} + \begin{pmatrix} 16 \\ 128 \\ 128 \end{pmatrix}$$

## 4 Implementation Details

This sample shows the usability of Bolt library's `transform()` as an alternative to `std::transform()` to perform RGB to YUV 4:4:4 color space conversion. Each iteration of the functor calculates the Y, U, and V values corresponding to the input R, G, and B values by applying the 3x3 conversion matrix, as shown above. The resultant YUV values then are clipped to a maximum of 255. This sample does not use `device_vectors` to allocate buffers on an available device. It is left as an exercise to the user to look at other Bolt samples and use `device_vectors` in this example and gain significant performance boost while running the sample using Bolt library.

The advantage of defining a Functor as a `BOLT_FUNCTOR` is that this code is usable by both `std::transform()` and `bolt::cl::transform()` without modification to user code elsewhere.

## 5 Recommended Input Option Settings

For the best performance, enter the following on the command line: `-x 786432 -i 100 -q -t`

## 6 References

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

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