LUT Generator

For Loadable Image Sensors

Users Guide

RHMG Software Tools Library

8/8/2011

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Document ID: 3000-002
Revision: v1.0.0
Publication Date: August 8,2011
Publication Status: Final

1.0   Introduction:

This application provides the means to generate look up tables or LUTs for a variety of image sensors that have the ability to have their default LUT's changed. A LUT in the image sensor context is a data translation interface between the output of an image sensor and the input to the image processor hardware. It's main metric is pixel depth. Most common is 8bits/pixel but can be higher to 12bits/pixel for high performance image sensors. LUTs are generally used as gamma compensation in video applications. A sensors light dynamics will typically be matched to the end application.

Another way to look at LUTs is that they provide a programmable 'weighting' factor on a pixel by pixel basis producing unique output responses depending light values seen by the input to the sensor surface. Low light conditions for example can have the LUT output higher or lower values than would be usual or expected with a linear one to one setting. Darks and highlights in an image can be compressed or made non linear to soften, highlight or enhance image contents. Digital imagers in film capture applications use a different gamma setting than do video applications for example.

2.0   Installation:

Installation of this application is quite straight forward.

If you wish to just use the **Setup.exe** file on its own as the install program, you must have (dot)NET Framework 4.0 already installed on your computer. **Setup** will seek out and install the Framework from Microsoft if it is not on your computer.   It is highly recommended to use the **Setup** and folder arrangement we have provided to do a successful install.

Once installed, the **RHMG LUT Generator.EXE** file will show up in the startup menu as "*RHMG LUT Generator*" with a default icon. You are ready to use.

This program was written in C# using in MS Studio 2010 and is a 32bit native application.

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3.0 Interface Description and Use

The **LUT Generator** program makes use of sophisticated spline algorithms to create smooth curves at the key points even where high degree transitions occur, called '*breakpoints*'. There are two basic breakpoints, one at the top end of the curve and one at the bottom. Each breakpoint has an *x and y* co-ordinate and are smoothed out to ensure uneven step functions will not occur in the final generated output regardless of the slope setting.

Any generated curve that is plotted is based on a start origin of 0.0 and 0,0, the two breakpoints with associated slope (BottomX,Y and TopX,Y indicated by green diamonds) and the end point of 1.0 and 1.0. There are limits to curve generation due to containment in the one quadrant. However, the curve can be inversed to start at 1.0, 0.0 and end up at 0.0, 1.0 with all of the programmable features available. A linear line is plotted as reference to accentuate design curve differences.

There will be output results that will clearly be incorrect by just looking at them. All results must start from X = 0, Y = 0 and go to X = 1.0, Y = 1.0 to be considered a valid LUT table.

The LUT can be programmed for 4-bits to 16-bits per pixel, selectable in 1 bit increments. Output can be written as a text file in comma delimited form. The file can be easily read and input to a LUT friendly image sensor.
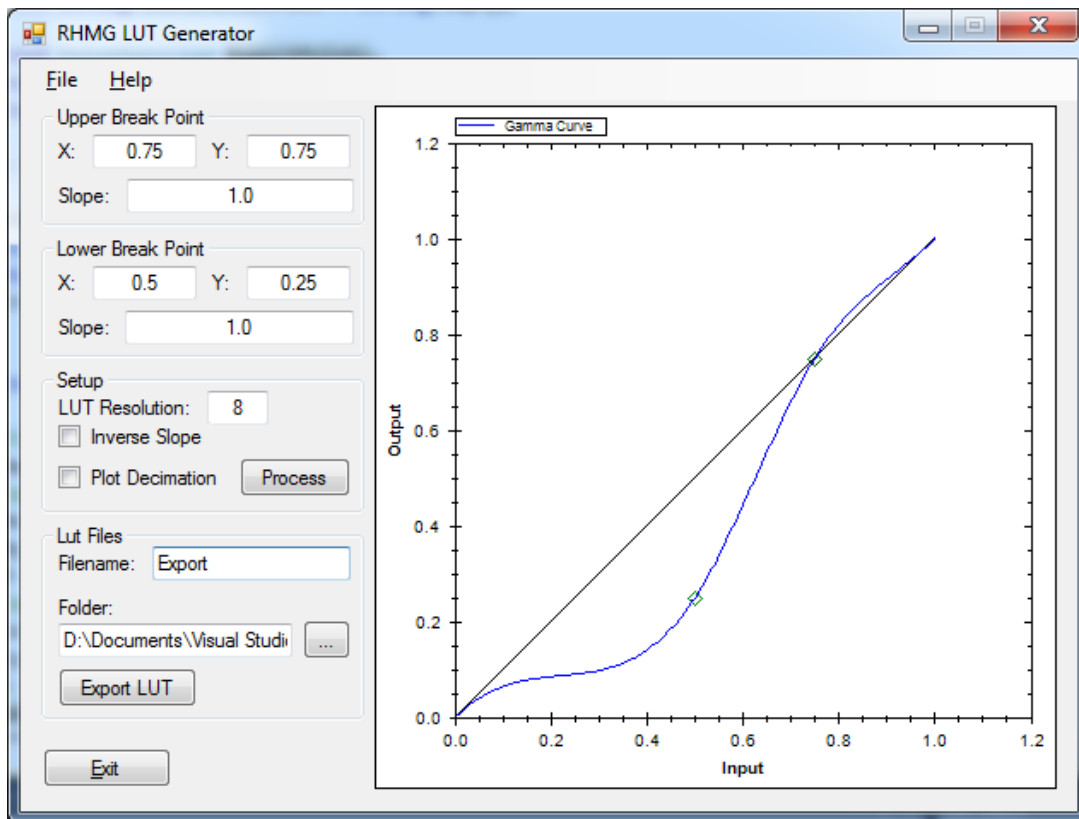

Figure 1.0   LUT User Interface

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Using **Figure 1.0** as reference, the upper or top breakpoint section is where you define the upper control point and the lower or bottom breakpoint section is where you define the lower control point. You cannot have the upper and lower control point values the same in either X or Y. The control points are displayed as green diamonds on the graph.

The limits are that X and Y (top or bottom) are limited between 0.0 and 1.0. While M or slope is limited between 0.0 and + infinity in both top and bottom cases. The number of decimal places per input is unlimited, but in practical terms 2 to 3 decimal places for most LUTs will suffice. Keep in mind higher resolution LUTs like 16 bit may require more decimal places.

The GUI *Setup* Section configures the way the LUT will operate. LUT resolution only accepts numbers from 4 to 16. This is the number of bits/pixel or pixel depth to create. LUT bit resolutions of 4, 5, and 6 will show distinct the plot points on the graph, filled in by the plot routine just to connect the points – the intra data here is not real. Higher LUT bit resolutions will be plotted with all calculated results, except when *Decimation* is selected (full 16bit LUT values will just congest the plot output).

Choosing *Inverse* slope will flip the data on the X axis, where 0.0 becomes 1.0 and 1.0 becomes 0.0. Plot *Decimation* when checked reduces the number of points displayed on the graph by 2^n, where n is the decimation factor. The *Process* Button processes the data and updates the graph with your settings.

In the *LUT Files* section shows the LUT table export area. The Filename field is for naming your export file. You do not need to worry about file extensions as it is automatically made as a text file. You can set the directory it is exported to by clicking on the classic button style with the 3 dots. The Export LUT button exports the data to the export file and location defined by the user. To use the Export properly you must process the data first before exporting it. If you export before Process, the file will still be generated but with previous or false information. The exported file outputs in whole numbers in a comma delimited x,y, pairing (x first, comma, associate y) using Unicode character set.

To operate the program, you merely input data into the Upper and Lower breakpoint edit boxes along with the associated slope and choose from several other operational options and then press *Process*. Review results and repeat until desired results. Save the final version to a text file of your choosing for later upload into your sensor by using the *Export* button. You will have to write a code snippet unique to your sensor to upload the LUT table into your sensor.

4.0   Specifications

LUT Resolution	(bits/pixel) 4 to 16bits in 1 bit increments
Export File format	Text file, ASCII comma delimited UNICODE
Plot co-ordinates	normalized to 1.0 in both x and y
X input range	0 to 1.000 3 or more decimals
Y input range	0 to 1.000 3 or more decimals
Slope Range	0 to + infinity The closer to 1.0 the more stable the LUT curve
Plot Decimation factor	2^n where n is the decimation factor for output plot only

5.0   Minimum System Requirements

Windows XP pro 32bit, Vista, Windows 7 (32bit or 64bit)
(dot)NET Framework 4.0 installed
CPU: single core Pentium 4
RAM: 512MB
VC 2010 distributable.

6.0   Recommended System Requirements

CPU: Core 2 Duo
2.4GHZ or higher
RAM: 1024MB

7.0   Support and Contact

No technical support will be available for this product at this time. The supplied documentation will describe as much detail as needed for a great percentage of users.

8.0   License

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