NAME

      mtf_generate_rectangle − generate images containing edges with known MTF50 values

SYNOPSIS

      mtf_generate_rectangle [--b16] [-l] [-c *<factor>* **] [--adc-depth** *<bits>* **] [--adc-gain** *<electrons>* **] [--pattern-noise** *<fraction>* **] [--read-noise** *<std. dev>* **] [-x** *<pixels>* **] [-y** *<pixels>* **] [-d** *<pixels>* **] [-b** *<std. dev>* **] [-m** *<mtf50>* **] [-n** *<std. dev>* **] [-s** *<seed>* **] [-r** *<ratio>* **] [-a** *<angle (degrees)>* **] [-o** *<file-name>* **]**

DESCRIPTION

      mtf_generate_rectangle renders an image (default rect.png) containing a rectangle rotated through the specified angle. The edges are blurred with a Gaussian with the specified standard deviation, and Gaussian noise is added. The program reports the MTF50 value of the rendered edges. **mtf_generate_rectangle** can be used to evaluate the accuracy of the **mtf_mapper**(1) tool.

OPTIONS

      --b16   Render output image as a 16-bit grayscale image (default is 8 bits gamma corrected)

      -l   Render output image as a linear grayscale image (default is sRGB gamma)

      --adc-depth <bits>

            Number of bits used in full noise model ADC. This parameter effectively scales photon shot noise. Recommended value is 12.

      --adc-gain <electrons>

            Number of electrons per DN, i.e., the ADC gain of the full noise model. Recommended value is 2.64.

      --pattern-noise <fraction>

            Magnitude of Pixel Response Non-Uniformity (PRNU) component of full noise model. Recommended value is 0.0085.

      --read-noise <std. dev>

            Standard deviation of read noise component of full noise model, in electrons. Recommended value is 3.7.

      -d <pixels>

            Dimension of the long edge of the rectangle, in pixels. Please note that MTF Mapper may produce inaccurate results if this parameter is below 35 pixels.

      -x <pixels>

            Sub-pixel offset applied to rendered rectangle, x-axis direction.

      -y <pixels>

            Sub-pixel offset applied to rendered rectangle, y-axis direction.

      -c <factor>

            Reduce edge contrast by <factor>, i.e., if <factor> is 0.3, then the edge contrast is 1 - 0.3 = 0.7.

      -b <std. dev>

            Specify the standard deviation of the Gaussian point spread function (PSF) with which the edges are sampled. This parameter effectively controls the resulting MTF50 value of the edges. Mutually exclusive with **-m.**

      -m <mtf50>

            Directly specify the desired MTF50 value. This indirectly controls the Gaussian PSF standard deviation. Mutually exclusive with **-b.**

      -n <std. dev>

            Specify the noise standard deviation [0-1) of the Gaussian noise that is added to the image. This invokes the simplified noise model, which produces noise that is independent of signal level. A more accurate sensor noise model can be obtained with the full sensor noise model. See examples

below.

-s <seed

       Specify the random seed for the RNG used to generate the additive Gaussian noise.

-a <angle>

       Specify the angle (in degrees) at which the rectangle is generated. Useful for characterising MTF measurement accuracy as a function of edge orientation

-r <ratio>

       Specify the aspect ratio of the rectangle in the range [0,1]. Ratios above 1.0 are clipped. The aspect ratio is adjusted so that the rectangle is at least one pixel wide. Very thin rectangles (< 25 pixels wide) are not ideal for use with MTF Mapper.

-o <filename>

       Specify the name of the output file

-h   Displays usage information

EXAMPLES AND NOTES

This utility supports both a simple Gaussian noise model, and a signal-dependent noise model that models sensor noise more accurately. If you just need *some* noise, then the simple model (specified with the **-n** parameter) will be sufficient. This method can also be used to generate noise-free images.

Noise free images

       mtf_generate_rectangle -n 0 ...

Simple noise model

       mtf_generate_rectangle -n 0.01 ...
       #Additive Gaussian white noise with a standard deviation of 1%. This is the default option.

Full noise model

       mtf_generate_rectangle --pattern-noise 0.0085 --read-noise 3.7 --adc-gain 2.64 --adc-depth 12 -c 0.2
       #Realistic simulation of Nikon D7000 noise.

Dynamic range and headroom

       The default **-c** parameter setting (0.1) will cause the edge to span the range [0.05, 0.95], leaving some dynamic range for subsequent processing steps. For example, the additive noise will be clipped if there is no headroom for the outer tails of the noise distribution. The headroom is also criticial for other types of image processing, e.g., sharpening or resizing. When in doubt, rather specify some extra headroom (**-c** 0.2), especially if you push the noise levels higher.

Linear vs. Gamma corrected values

       By default, mtf_generate_rectangle will generate output files with linear intensities only when 16-bit output is specified (**--b16**). This implies that if no parameters are specified, then *mtf_generate_rectangle will generate 8-bit files in the SRGB space, i.e., intensities will be gamma corrected.* You can override this behaviour with the **-l** switch, which will force linear 8-bit values. It is crucial that you keep track of whether you are dealing with gamma-corrected intensities or not. For example, **mtf_mapper** will not measure correct MTF values if there is a gamma mismatch (i.e., generated with linear 8-bit intensities but processed as if images were gamma corrected). Please use the **-l** switch with **mtf_mapper** if you generated your test images with the **-l** switch of **mtf_generate_rectangle.**
       Better yet, always use 16-bit images, since all the MTF Mapper tools assume they are linear.

BUGS

Currently, the image is generated by brute-force sampling of the PSF. For a strict Gaussian, it would probably be more efficient to compute the definite integral directly.

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SEE ALSO
      mtf_mapper(1), **mtf_generate_test_chart**(1),