NAME

hdrcvt - convert between HDR and LDR formats with optional transformation

SYNOPSIS

hdrcvt [**-verbose**][**−output CS**][**−quality Q**][**−tmo alg**][**options**] **input.img output.img**

DESCRIPTION

Hdrcvt reads a single input image and produces a single output file, which will be overwritten if it exists. Input and output format are determined by file suffixes, which may be taken from the following list:

tif,tiff	- Tagged Image File Format, LDR or HDR
jpg,jpeg	- JPEG format, LDR or HDR
hdr,hsr	- Radiance RGBE, XYZE, or spectral format
exr	- ILM OpenEXR format (HDR)
mtx	- Radiance float matrix format
dpt	- Radiance 16-bit depth map
bmp	- Windows BMP format (input only)
raw	- RAW data format (see below)

The TIFF, JPEG, OpenEXR, and BMP formats are well-known standards with easy-to-find library support.

The Radiance matrix format contains uncompressed float, double, or ASCII data with a human-readable metadata header with parameters for the number of components, primaries, calibration, byte ordering and image dimensions. (See *getinfo(1)* regarding Radiance information headers.)

The Radiance depth map format is an uncompressed 16-bit/pixel encoding of depth values used by some rendering tools and post-processors. It's header is also readable using *getinfo*.

The RAW format is uncompressed data with an unknown header, whose size and format must be specified on input. Specifically, the RAW data type and color space are given with a *−input* option, which takes the same argument(s) as the *−output* format, described below. (This should not be confused with Camera RAW, which includes any number of proprietary formats defined by individual camera manufacturers, with custom data compression and encoding.) A *−swap* option says input (and/or output) byte order is reversed in the RAW file. Color data must be interleaved in standard image ordering, i.e., "RGBRGBRGB...," starting from the upper-left of the image and proceding to the upper-right before continuing on the next scanline from the left.

Most of the listed formats may be read or written, with the exception of the Windows BMP format, which is read-only due to its limited metadata support. And while the HSR (hyper-spectral radiance) format is supported on input, a crude conversion to RGB is performed during load and the spectral data is lost, so it is not supported on output.

The default output color space will be float in CCIR709 (RGB) primaries, regardless of the input type. If one wishes the input color space be reproduced on output, specify *−output in* on the command line. Otherwise, there are a few standard options provided, and the output specification may be mixed by separating parts with a plus ('+') symbol or using multiple *−output* settings. As with many *hdrcvt* options, shorter forms are accepted, thus *-o in* is the same as *-output input ,* but beware of name collisions.

Below is a list of *−output* options:

sRGB	- Standard 24-bit/pixel RGB
AdobeRGB	- Adobe 1998 RGB primaries
P3	- P3 gamut RGB primaries
XYZ	- CIE XYZ primaries
gray	- grayscale (Y)
float	- floating-point (HDR)
short	- unsigned short (16-bit)
byte	- unsigned byte (8-bit)
gamma=VAL	- set output gamma value
linear	- synonym for "gamma=1"
R=x,y	- set red chromaticity

G=x,y - set green chromaticity
B=x,y - set blue chromaticity
W=x,y - set white chromaticity

Note that setting a type (float, short, or byte), a gamma value, and either "gray" or R, G, B, and W chromaticities gives the caller full control of the output color space. For instance, the shorthand *−o sRGB* is equivalent to:

-output byte+gamma=2.2+R=.64,.33+G=.3,.6+B=.15,.06+W=.3127,.329

When applying a tone-mapping operation to an HDR input, the sRGB color space is the default output type. The following tone-mappings are supported by the *−tmo* option:

histogram - global histogram adjustment
photographic - global photographic TMO
gamma - global gamma curve
map - global curve from stdin
bilateral - bilateral filter TMO
multiscale - multiscale local TMO

The local bilateral and multiscale TMO may be combined with global base operators, e.g, "bilateral+histogram" or "photo+multis". The modifier "human" may be applied as well, e.g. "human+histo". Like the other options, these may be abbreviated by their unique starting letters, such as "mu+hi" for "multiscale+histogram".

Note that the *−tmo map* specification is not an operator, but expects to read a global input-to-output mapping on the standard input. This is given as an ordered set of input and output value pairs. The input is absolute luminance, and the output is proportional to the final pixel brightness, such as the map obtained via the *pcond(1) −x* option.

If an HDR to LDR conversion is requested via the *−output* option without a *−tmo* selection, then a straight linear operator is applied. This may be adjusted using any of the exposure settings, such as the *−expose, −calibrate,* and *−limit* options, described with the other image transformations after the next section.

The output image type is controlled by the *−output* setting and the selected file format. This may be adjusted in some cases by the *−quality* setting, which defaults to 90 out of 100, where higher is lower compression and better quality. The following data types are supported by each format:

TIFF - any type, RGB or grayscale, -q 100 is uncompressed
JPEG - LDR or HDR color or grayscale
HDR - HDR color, -q 100 is uncompressed
EXR - HDR color or grayscale, -q 100 is uncompressed
MTX - float color or grayscale, always uncompressed
DPT - grayscale, positive values only
RAW - any type, uncompressed without a header

The *−verbose* option will provide details on input and output along with other operations performed in between.

Additional image transforms are applied as requested using the following options:

−expose *E* Alter image exposure by the factor *E*. If preceded by a plus ('+') or minus ('-') sign, this is taken as an exposure value, which means two to the specified power.

−calibrate *L*
Adjust output levels such that a value of 1.0 corresponds to the given luminance in candelas/meter^2. Any *−expose* setting will be applied on top of the computed factor. If the input calibration is unknown, as in LDR or HDR formats that do not specify a sample-to-nits or exposure value, the given *L* argument will be set as the luminance corresponding to 1.0 or its equivalent (e.g., 255 for a byte encoding).

−limit *P* Adjust the default exposure to allow the given percentage of pixels to exceed the 0-1 output range. (E.g., a *P* setting of 0 will ensure the brightest pixel is 1.0 in the output.) This option is

incompatible with and overrides any previous *−calibrate* setting. As with the *−calibrate* option, the *−expose* setting is applied after this initial adjustment.

−scale *SF* Scale image size by the decimal factor *SF*. A non-unity scale factor greater than 0.62 will employ bicubic sampling, which includes image magnification. Anything less than 0.62 will apply Gaussian downsampling, which may involve some degree of resolution loss. The output dimensions will always be adjusted to produce "square" pixels, even if the input pixels are not, so the same scale factor may not be applied to both dimensions in such cases. The default scale factor is 1.0, which means no resampling for pixels that are already square. Alternatively, the options below may be used to control the final image dimensions.

−dim *xdim ydim*
Fit the output image into a frame that is at most *xres* by *yres* pixels. The largest scale factor is selected such that neither of these dimensions is exceeded, while maintaining square pixels.

−xres *xdim*
Adjust the scale factor such that the output X-dimension does not exceed *xdim*. The X-dimension will exactly equal *xdim* if no other dimensioning option is specified.

−yres *ydim*
Similar to the above option, but for the Y-dimension. Specifying both *−xres* and *−yres* options is the same as giving these dimensions in a single *−dim* option.

−rotate *{0|90|180|270}[hv]*
Rotate the image clockwise by the given number of degrees (multiples of 90, only). A 0 argument is usually but not always the same as no rotation, as it will reorient images that have non-standard starting ordering. If followed by an 'h' or 'v' character, the rotation will be followed by a horizontal or vertical flip.

−blur *R* Blur the image by the given decimal radius in output pixels.

−dilate *R* Dilate the image using the given decimal radius, which spreads maximum values in each channel. A negative radius applies an erosion operator, which may also be specified by the next option. Dilation and erosion are applied prior to any blurring operation.

−erode *R* Erode the image using the given decimal radius, which spreads minimum values in each channel. A negative radius applies a dilation operator, which may also be specified using the previous option. Erosion and dilation are applied prior to any blurring operation.

−flare Remove flare from an HDR (or 16-bit) input image. This is the same as applying the *−f* option in *hdrgen(1)*. The algorithm attempts to determine the point spread function corresponding the the captured image flare and remove it without otherwise affecting the image. The result should be improved contrast over the whole image, and better clarity near light sources.

−match *ref.img*
Attempt to match the output image histogram to that of the specified reference image.

−comment *COMMENT*
Add the given comment to the output file. If the comment contains spaces or special characters, it must be quoted on the command line. Multiple comments may be given with multiple options.

−parameter *param*
A parameter is similar to a comment, but takes the form "variable=value", and any number of parameters may be given either in separate options or using a colon (':') separator, e.g., "var1=val1:var2=val2". Some parameters will affect the output, such as the "REFDEPTH" for setting the reference depth in a Radiance DPT output file.

EXAMPLES

To convert and tone-map and HDR image using the histogram operator, writing as a TIFF image using P3 color primaries:

hdrcvt -tmo histo -out P3 input.hdr output.tif

To convert HDR to LDR, but using a linear operator that produces an sRGB JPEG with 2% over-exposed pixels:

hdrcvt -limit 2 -out sRGB input.hdr output.jpg

To rotate an image by 90 degrees then flip horizontally and blur, writing at a quality/compression setting of 70:

hdrcvt -rotate 90h -blur 1.5 -qual 70 input.jpg output.jpg

To downsample a square LDR image to raw gray short values:

hdrcvt -output short+gray -dim 128 128 input.bmp grayshort128x128.raw

To take the resulting RAW image back to an equivalent TIFF file:

hdrcvt -input short+gray -dim 128 128 -out in grayshort128x128.raw check.tif

As described earlier, the input type and size must be specified for RAW files.

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SEE ALSO

bitmapop(1), expose2range(1), getinfo(1), hdrgen(1), pcomb(1), pcond(1), PQconvert(1), rcomb(1), rmtxop(1), warpimage(1)