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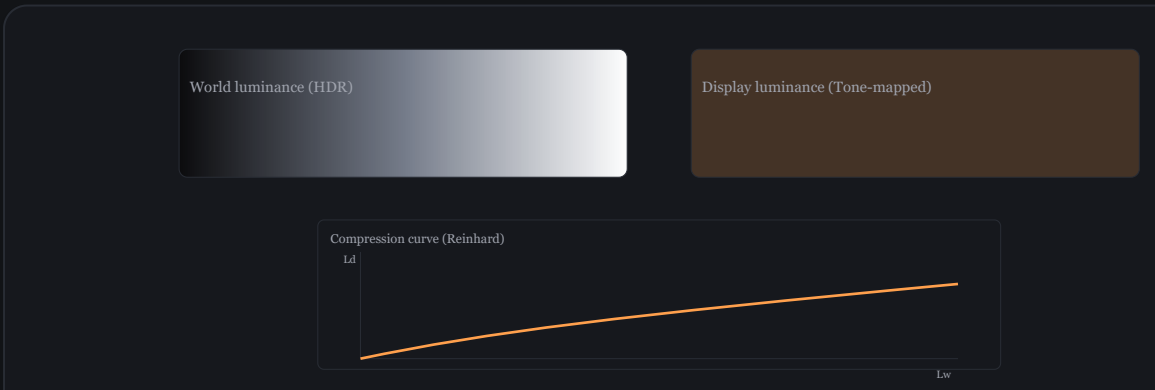
HDR

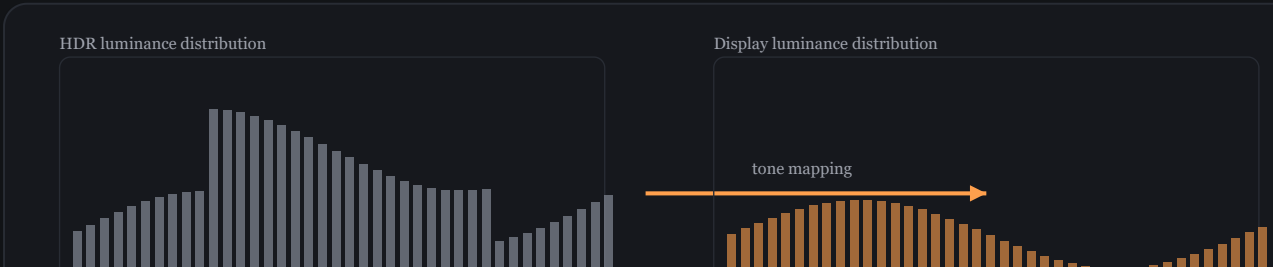
HDR Tone Mapping

$$L_d(x,y) = \frac{L_w(x,y)}{1 + L_w(x,y)}$$

Comprehensive guide to High Dynamic Range tone mapping operators and luminance compression



HDR input (left) compressed to display range (right) via an S-shaped Reinhard curve.



Histogram view: wide HDR distribution compressed into a denser, display-friendly range after tone mapping.

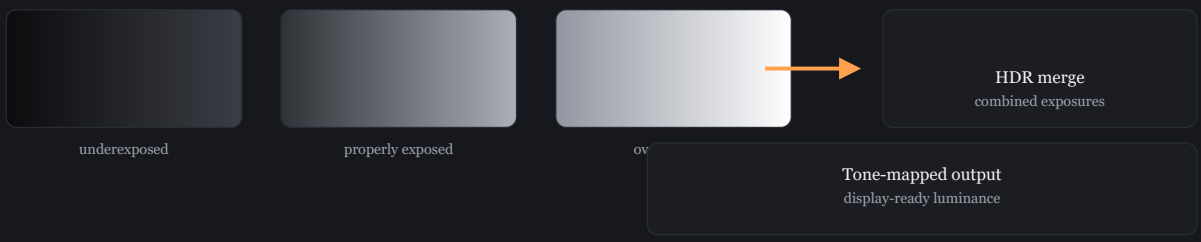
HDR Tone Mapping

`definition` algorithm **Required**

Process of mapping high dynamic range luminance values to display-compatible range while preserving visual appearance and detail.

$$L_d(x,y) = \frac{L_w(x,y)}{1 + L_w(x,y)}$$

Reinhard tone mapping operator - simple global compression



Multiple exposures are merged into HDR, then tone mapped to fit the display range.

Formula Parameters

$L_d(x,y)$ float **Output**

Display luminance at pixel coordinates (x,y). Range: [0,1] representing displayable brightness values.

$L_w(x,y)$ float **Input**

World luminance at pixel coordinates (x,y). Range: [0,∞] representing real-world brightness

values in cd/m².

Tone Mapping Operators

Reinhard **Drago** **Durand** **Fattal** **Mantiuk** **Photographic** **Adaptive** **Local** **Global**

› Properties of `reinhard_operator`

Advanced Operators

`extended_reinhard` algorithm **Enhanced**

Extended Reinhard operator with white point control: $L_d = \frac{L_w/a \cdot (1+L_w/L_{white}^2)}{1+L_w/a}$

$$L_d(x,y) = \frac{\frac{L_w(x,y)}{a} \cdot \left(1 + \frac{L_w(x,y)}{L_{white}^2}\right)}{1 + \frac{L_w(x,y)}{a}}$$

Where a is the key value and L_{white} is the smallest luminance that will be mapped to white

Implementation Types

global operator **local operator** **bilateral filter** **gradient domain** **frequency domain** **perceptual** **exposure fusion** **adaptive logarithmic** **histogram adjustment**

› Properties of `hdr_processing`