HDR tone-mapping in VLC

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SDR reference

Source: Passengers (2016)

HDR input

With PQ curve applied

With simple tone mapping (Reinhard)

$$V_{\text{out}} = \frac{V_{\text{in}}}{V_{\text{in}} + 1}$$

SDR reference

With slightly better tone mapping (Hable)

With curve scaled to SEI peak (here: 1500 cd/m)

Overview of 2016

- May: **basic HDR support in mpv**
- May: static/simple tone mapping curves added
- June: "HLG", V-Log, S-Log etc. added
- June: parse HDR metadata from bitstream

No tone mapping (clipping)

No tone mapping (clipping highlighted)

No tone mapping (clipping)

"Colorimetric" tone mapping curve (mobius)

SDR reference

"Colorimetric" tone mapping curve (mobius)

Linear (luma-only) tone mapping

SDR reference

Linear tone mapping with Hable

Dynamic peak detection

SDR reference

Dynamic peak detection

Frame brightness compensation

SDR reference

Overview of 2017

- June: more colorimetrically accurate curve (mobius)
- June: support for OOTFs (e.g. HLG)
- June: **luma-only (linear) tone mapping**
- June: desaturation algorithm
- July: algorithm copied to lavf (vf_tonemap)
- July: **peak detection algorithm** created
- October: **libplacebo** created
- October: basic HDR support in VLC (via libplacebo for opengl)
- October: better peak detection, desaturation, everything
- October: **average brightness compensation**

Overview of 2018

- February: **scene change detection**
- February: HDR-in-SDR (HDR emulation)
- February: query target display's brightness (ICC profile)
- Feb-Aug: **libplacebo native renderer in VLC** (vulkan)
- June: algorithm copied to lavf again (vf_tonemap_opencl)

ACES reference

Source: ACES ODT test samples

ACES result

Source: ACES ODT test samples

ACES reference

Source: ACES ODT test samples

ACES result (mobius)

Source: ACES ODT test samples

Sony reference

Source: Sony HDR test clip

Sony result

Source: Sony HDR test clip

YouTube reference #1

Source: World in HDR (YouTube)

YouTube result #1

Source: World in HDR (YouTube)

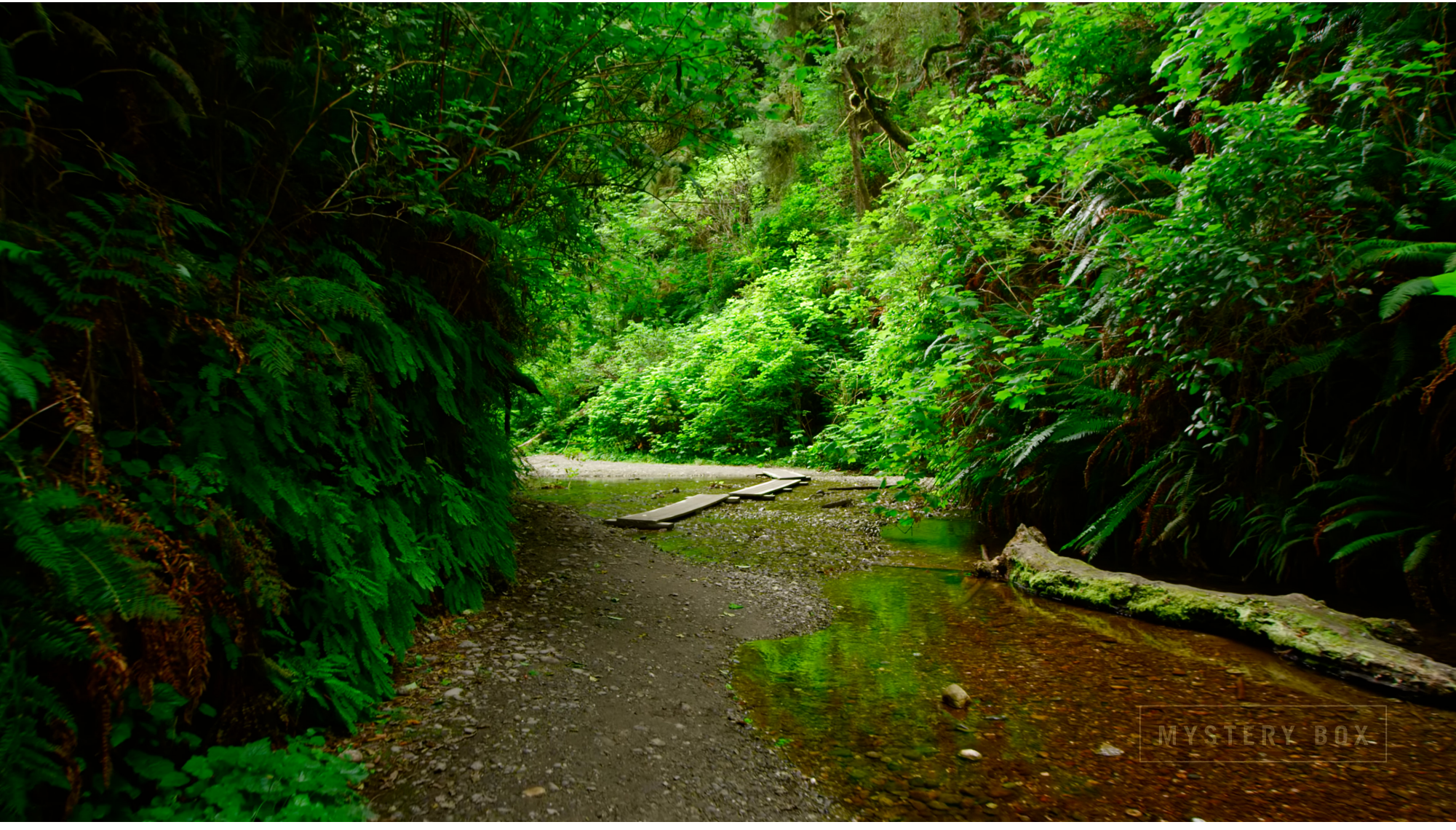
YouTube reference #2

YouTube result #2

YouTube reference #3

YouTube result #3

YouTube reference #4



YouTube result #4

YouTube reference #5

YouTube result #5

Current problems / improvement ideas

- Using a sliding average frame peak/avg sucks
- Scene change detection sucks
- Peak/Avg detection algorithm is delayed by a frame
- **Need static per-scene metadata for best results**

Appeal to Hollywood

- **HDR frame average = SDR frame average!**
- Don't exceed 100 cd/m (diffuse white) for large regions
- Stop pointing your cameras at the sun

References (ITU-R)

- Recommendation BT.2100 (defines PQ/HLG)
- **Report BT.2390 (explains HDR in general)**
- Report BT.2246 (explains Ultra-HD in general)

Contact / Links

- https://github.com/haasn/libplacebo
- Blog: https://haasn.xyz
- **Questions?**