HDR Images via IIIF Image API

Use cases and further steps

Christian Mahnke, 14.11.2024

https://christianmahnke.de

Introduction: What is HDR?

Incomplete and greatly simplified

- ☞ HDR images using tone mapping are around since 3 decades
  - ☞ Composed of different exposure levels
  - ☞ Images for display still have 8 bit colors (colors are „warped“)
- ☞ We are talking about HDR display using a 10 bit color space
  - ☞ Tone mapping might be still applied
  - ☞ Generated either by HDR capable imaging sensors, composed or artificial.

Current and future developments

High level (user / consumer) view

- ☞ HDR video
  - ☞ Currently best known and supported in the browser - for example on YouTube
  - ☞ Supported by TV sets
  - ☞ Can be created by mobile phones
- ☞ HDR images
  - ☞ Can be created by modern mobile phones
  - ☞ Supported by some browsers
  - ☞ Different level of support by different formats
- ☞ HDR images as Textures (for 3D models)
  - ☞ Supported by modern game engines
  - ☞ Browser support experimental (Three.js)

Current limitations

Soft- and hardware (as of November 2024)

- ☞ You need a HDR-capable monitor / screen
- ☞ Operating system level support inconsistent
  - ☞ Mac OS is certainly best
  - ☞ Windows support need to be enabled explicitly (but it's solid enough for gaming)
  - ☞ Linux support currently experimental
- ☞ Browser support (~95% for HDR images)
  - ☞ Firefox only has partial support for HDR video
  - ☞ Chromium-based browsers might need additional flag for all features (see demo)
- ☞ OSS support in development / experimental
  - ☞ VIPS, ImageMagick etc.

Formats using gain maps

These formats offer a fallback by storing the lighting information separately

- ☞ Separation between SDR and HDR components
- ☞ Gain map holds „differences“ to create HDR image
- ☞ HDR gain map saved in image metadata
- ☞ Available for JPEG, AVIF, JXL and HEIF - specification (ISO 21496-1) currently settling, multiple vendors have implementations (November 2024)
- ☞ Benefits
  - ☞ Fallback for SDR-only soft- and hardware
  - ☞ Efficient storage by subsampled gain map

But why?

For those, not deceived by the looks: Use cases

- ☞ Presenting artifacts with enhanced colors
  - ☞ Immersive effects
- ☞ Image analysis
- ☞ Mixing different channels (wave lengths) in as gain maps
- ☞ Examples focused on presentation of cultural artifacts (from libraries and museums) for education and communication

Use cases II

Other ideas (for other communities)

- ☞ Scientific visualization
  - ☞ Like bioluminescence, multispectral / false-colour images etc.
- ☞ Highlighting / contrast enhancements (as optional image operations) in VREs
- ☞ Not necessarily limited to web browsers

Demo

Currently only working in Chromium-based browsers

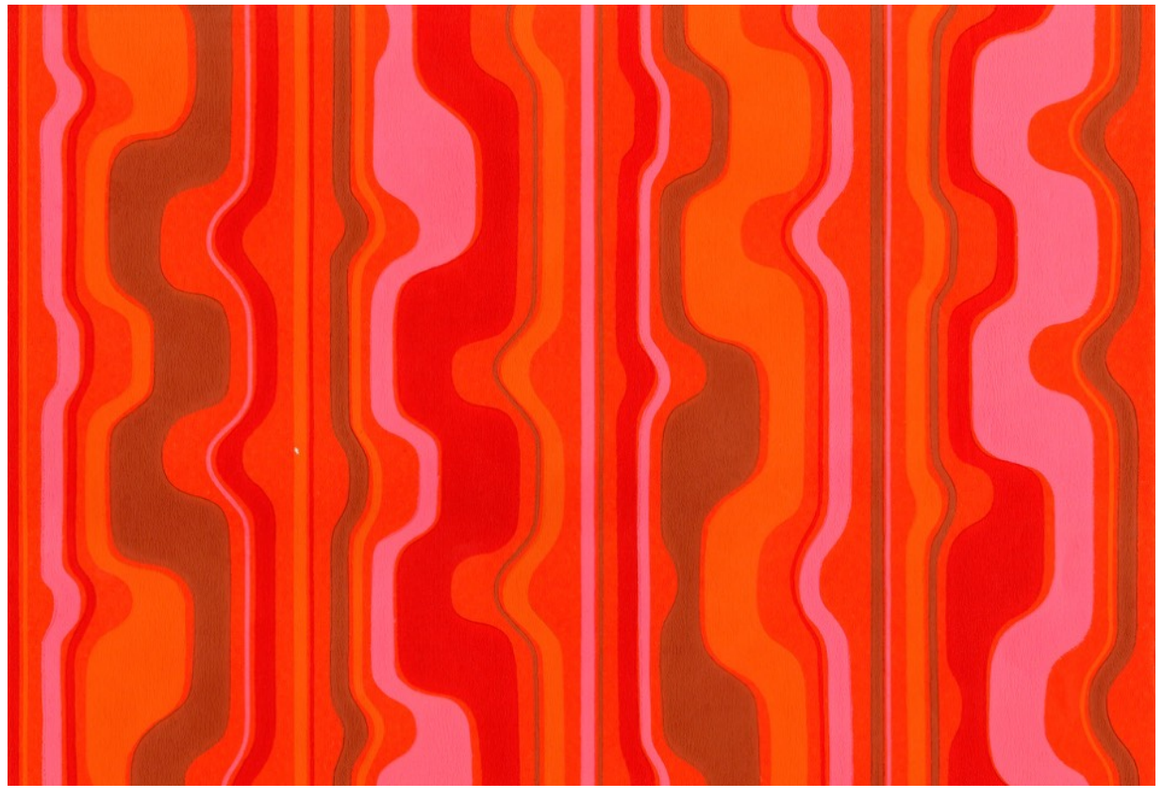
- ☞ The effect isn't really presentable yet - tone mapping will be applied automatically
- ☞ Besides from having the required hardware and a properly operating system you might need to configure your browser accordingly
- ☞ Chromium based browsers might need to have `enable-experimental-web-platform-features` enabled in `chrome://flags/`
- ☞ If your Setup supports the requirements , you might open the following URL in your browser:

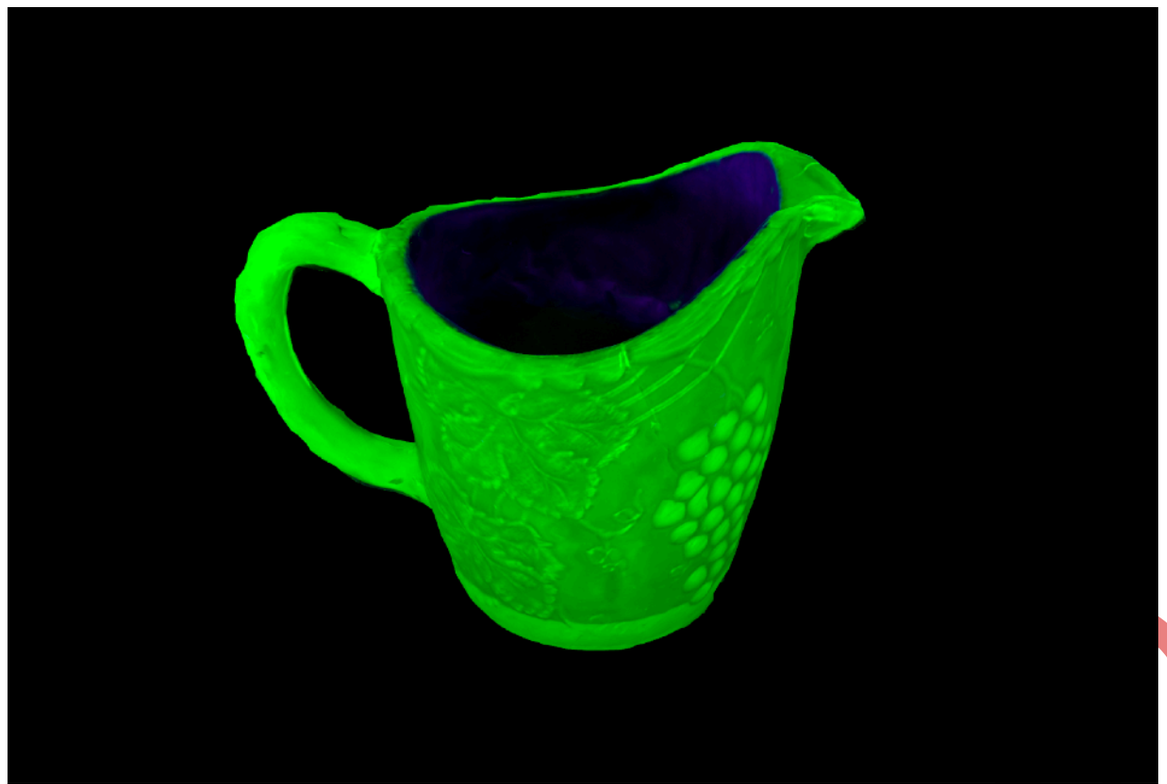
https://christianmahnke.de/en/post/iiif-online-meeting-2024-slides

Demo placeholder I

Images not in HDR due to technical limitations

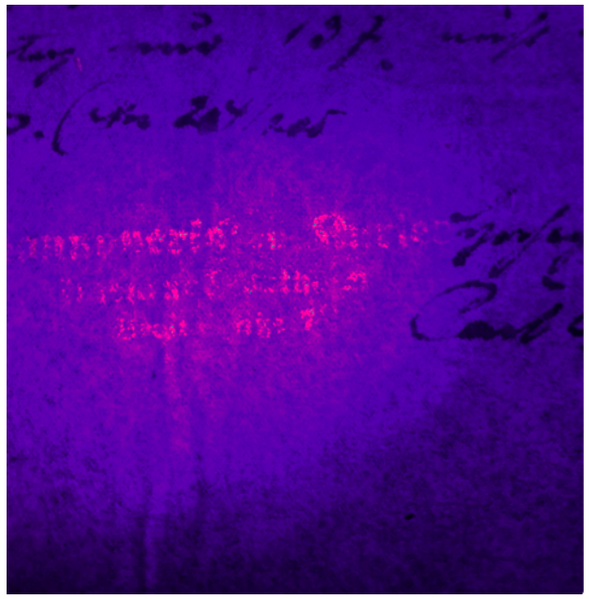
- This slide is just a placeholder for the demo
- The first image shows a HDR Image of a 70s wallpaper
- The second image shows a 3D model of a milk pourer made of uranium glas, digitized under UV light

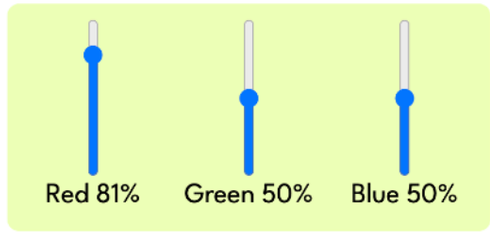




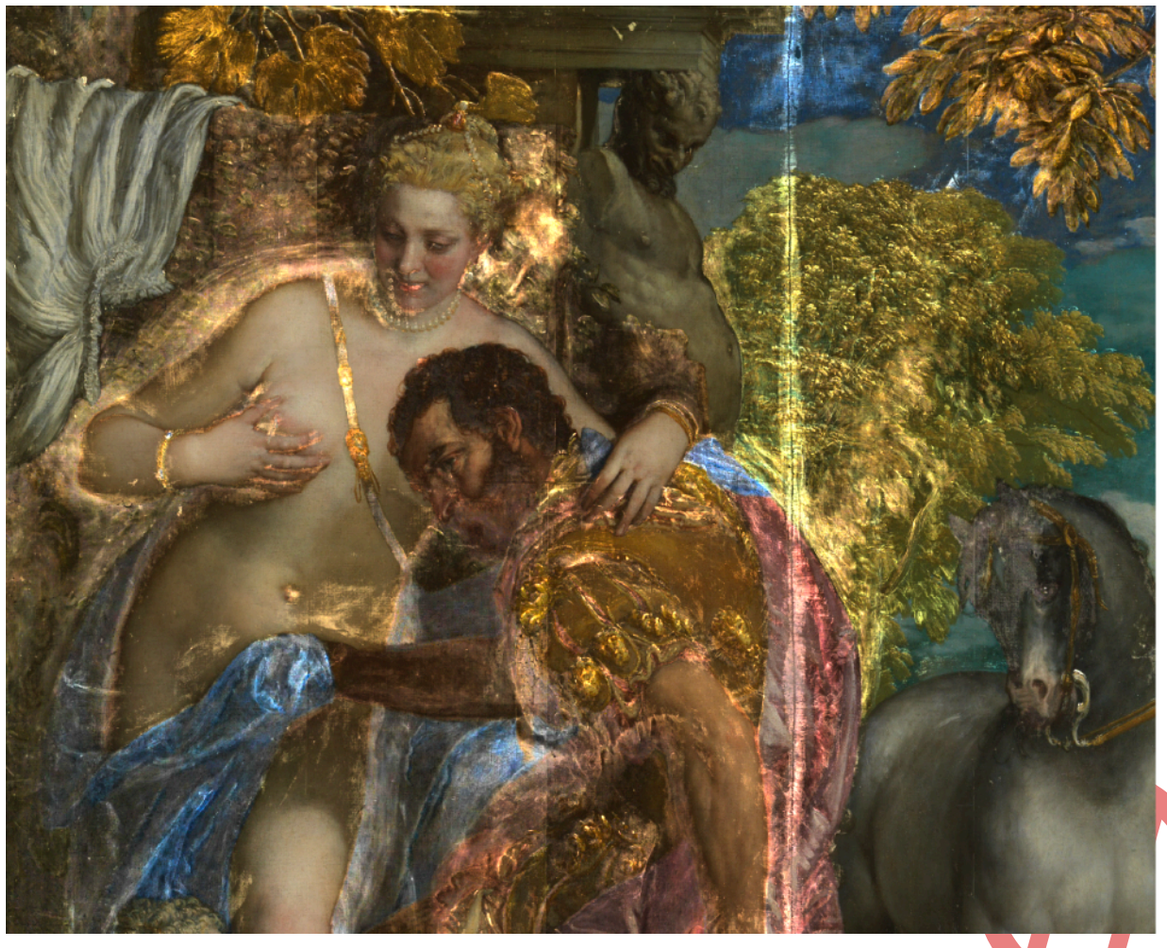
Demo placeholder II

Images not in HDR due to technical limitations





- This slide is just a placeholder for the demo
- The first image shows a image analysis color enhancement example
- The second image shows a painting with contrast enhanced by bright areas in a radiography of itself



Next steps

What should we do as a community?

- ☞ Standardization!
- ☞ Where? Image API, Presentation API? IIIF/api#2312
  - ☞ How generic should it be? 3D as well?
- ☞ Who will join?

Thanks for your time!

Any questions?

cmahnke@gmail.com

https://christianmahnke.de/en/