Beyond the Pixel:

a Photometrically Calibrated HDR Dataset for Luminance and Color Prediction

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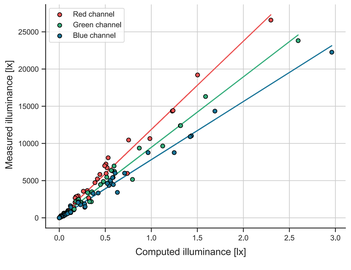
MOTIVATION: We live in a light field, that impacts our biology and the way we interact with our environment. However, most computer vision tasks treat pixels without considering the physical light. To measure absolute light quantities, expensive specialized hardware is required. Can we develop methods that consider the physical light that **lies beyond the pixel?**

CONTRIBUTIONS: We present the Laval Photometric HDR Dataset, the first large scale photometric dataset. We also present three novel deep learning tasks aiming to explore the effect of various inputs on the predictions.

METHOD

I. **Laval HDR Dataset:** We calibrate this dataset, which contains over 2300 indoor HDR panoramas up to scale.
II. **Setup:** The Canon 5D captures a HDR bracket and the CL-200a measures the absolute illuminance
III. **HDR illuminance:** The HDR image is integrated to compute the scene illuminance. This value can be compared to the chroma meter measurement.
IV. **Comparison HDR—Chroma meter:** Repeating this process for over 120 scenes, a linear relation arises between the HDR and true illuminance. The slope of the regression for each channel is applied to the original dataset to obtain photometric HDR values.



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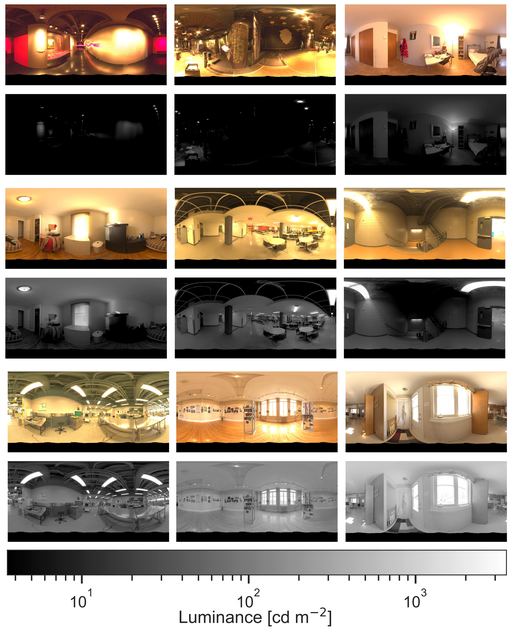
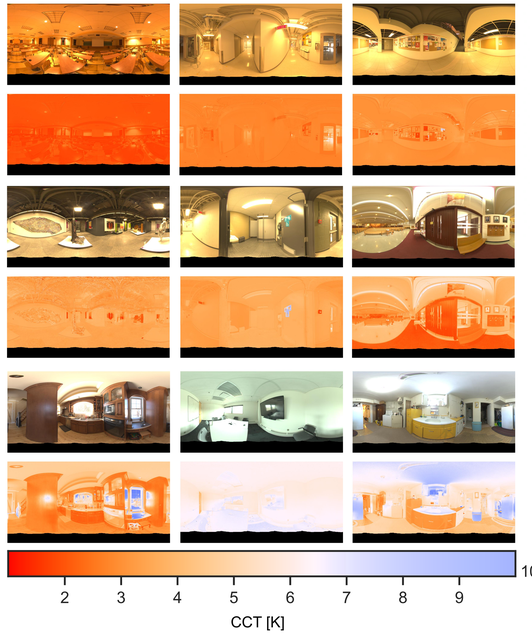
Photometrically Calibrated HDR Panorama Dataset for Data-driven Photometric Computer Vision.

2300 HDR 360º panoramas with absolute luminance and color values!

Luminance



Color



Photometric tasks

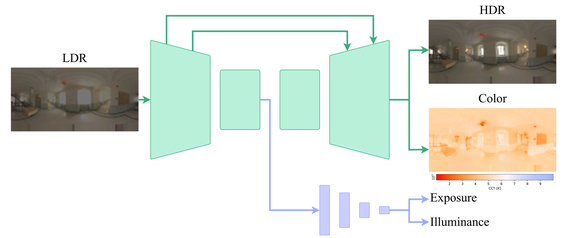
New photometric vision tasks!

Per-pixel luminance

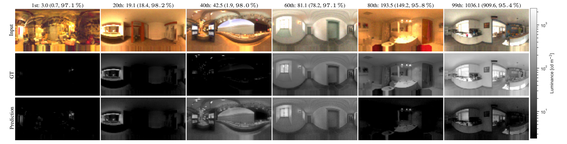
Per-pixel color

Illuminance

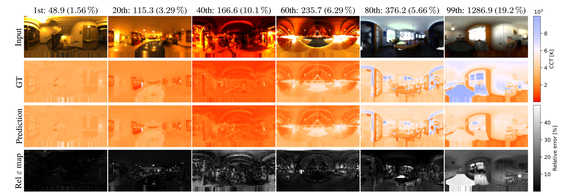
Architecture



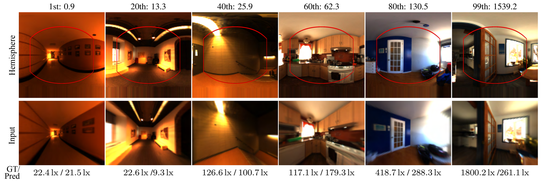
Per-pixel luminance

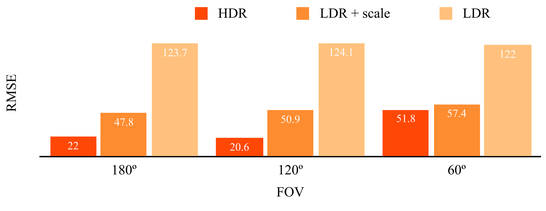


Per-pixel color



Illuminance





Generalization

Theta Z1

	Luminance			Color		Illuminance	
Input	RMSE$_\downarrow$	siRMSE$_\downarrow$	HV3$_\uparrow$	RMSE$_\downarrow$	rel $\varepsilon_\downarrow$	RMSE$_\downarrow$	$R^2{}_\uparrow$
PT LDR	130.6	86.9	95.5	334.0	11.97	153.2	0.469
PT Jpeg	170.0	100.6	90.3	676.4	25.06	141.9	0.314
FT Jpeg	156.7	96.4	91.4	177.9	5.52	143.3	0.385