Goal: Estimate high dynamic range lighting conditions and camera parameters from a single outdoor low dynamic range image.

Solution: fit low-dimensional parametric sky model (Hošek-Wilkie) on the SUN360 dataset.

High Dynamic Range 360° panoramas properly capture omnidirectional lighting. Unfortunately, no such dataset currently exists to train a deep neural network.

Impact of the turbidity (t) on sky appearance and renders

For more

CNN architecture and training

The ELU activation function and batch normalization are used at every layer.

Training using stochastic gradient descent with Adam with an initial learning rate of 0.01.

7 crops were taken for each of the 38,814 panoramas of SUN360 and then split into (261,288 / 1,751 / 8,659) subsets for (train / validation / test). Extra care was taken to ensure no panorama overlap between those subsets.

Virtual object insertion

Virtual object insertion on HDR validation set

Quantitative performance

Comparison with the method of Lalonde et al. showing the cumulative sun azimuth estimation error on a 176-image subset from the SUN360 test set, and (b) their original dataset.

Percentiles

Percentiles

Percentiles

Percentiles

Results

Relighting on SUN360

Quantitative relighting comparison with the ground truth lighting parameters on the SUN360 dataset (bottom left) / RMSE (top right) Scale-invariant RMSE and bottom right per-channel scale invariant.