

TITLE OF DATASET

Fifty hyperspectral reflectance images of outdoor scenes

GENERAL DESCRIPTION OF DATASET

This set of 50 hyperspectral reflectance images of outdoor scenes was drawn from the main land-cover classes, either predominantly vegetated, containing woodland, shrubland, herbaceous vegetation (e.g. grasses, ferns, flowers), and cultivated land (fields), or predominantly non-vegetated, containing barren land (e.g. rock), urban development (residential and commercial buildings), as well as farm outbuildings, and painted or treated surfaces. Images were spatially downsampled and spectrally smoothed to reduce non-imaging noise in the unaveraged source data. For details see <https://dx.doi.org/10.1098/rspb.2021.2483>.

The effect of different global illuminants on a scene can be simulated by multiplying the reflectance image by an illuminant spectrum. Three daylight illuminant spectra are provided representing light from the setting sun, average daylight, and the north or polar sky.

The approximations involved in representing a radiance image as a product of a reflectance image and an illuminant spectrum are considered in <https://dx.doi.org/10.1098/rspb.2021.2483> and its Supplementary Material and in <https://doi.org/10.1364/JOSAA.36.000606>, which also gives details of usage.

FILES AND FORMAT

There are 55 files in all (including this README file).

The 50 zipped files hsi_1.zip, ..., hsi_50.zip each contain a hyperspectral reflectance image of an outdoor scene, in Matlab MAT format, of size $\sim 256 \times 336 \times 33$. The first two coordinates are pixel indices, and the third coordinate is the wavelength index, corresponding to 400, 410, ..., 720 nm.

The three zipped illuminant files illum_4000.zip, illum_6500.zip, and illum_25000.zip contain daylight spectra in Matlab MAT format, each of size 33×1 , drawn from CIE daylight spectral distributions with correlated colour temperatures of 4000 K, 6500 K, and 25000K (<https://doi.org/10.25039/TR.015.2018>).

The file Scenes_and_Names_Key.pdf contains a key for relating image label, e.g. hsi_1, to scene name and image appearance. Each image was obtained as the product of the reflectance image with a daylight illuminant of correlated colour temperature 6500 K and then rendered as sRGB. These images are for illustration only.

The MAT files were created Nov-Dec 2021 under Matlab R2021a (win64), Mathworks Inc.

USAGE

To simulate the effect of different illuminants on a scene in a Matlab environment, proceed as follows:

```
>> load illum_4000.mat           % load an illuminant spectrum, e.g. illum_4000
```

```
>> load hsi_1.mat; % load a reflectance image, e.g. hsi_1
>> [nr,nc,nw] = size(hsi); % get size of image
>> ref = reshape(hsi,nr*nc,nw); % reshape for multiplication and rename
>> rad = ref.*illum_4000'; % make radiance array from reflectance
>> rad = reshape(rad,nr,nc,nw); % reshape as radiance image
```

The procedure is the same with the other illuminants, illum_6500.mat and illum_25000.mat.

DATA ACQUISITION AND PROCESSING DETAILS

For more information on data acquisition and processing, including calibration and downsampling, see the Methods section of <https://doi.org/10.1098/rspb.2021.2483>.

CITATION OF DATA

Foster, David; Amano, Kinjiro; Nascimento, Sérgio (2022): Fifty hyperspectral reflectance images of outdoor scenes used in Foster DH, Reeves A. 2022, Colour constancy failures expected in colourful environments. Proc. R. Soc. B 20212483 (<https://doi.org/10.1098/rspb.2021.2483>). Dataset <https://doi.org/10.48420/14877285.v1>

PUBLISHED RESEARCH DERIVED FROM DATA

Foster, David H; Reeves, Adam (2022), Colour constancy failures expected in colourful environments, Proc. R. Soc. B 20212483. <https://doi.org/10.1098/rspb.2021.2483>

GEOGRAPHIC LOCATIONS AND DATE OF DATA COLLECTION

Minho region of Portugal, 2002-2003

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