

# **Object-Background Image Database Using a Calibrated Camera**

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## **What is the purpose of this database?**

This image database is intended for use by those who study natural image statistics, those who use natural images for psychophysical stimuli, those who use natural images to develop and test computer vision algorithms, or anyone else who is interested in the properties of natural images.

This database is special, in that, it was developed using a calibrated camera

## **Why is it important to use a calibrated camera?**

Image properties are a product of the 3D scene being photographed and the characteristics of the camera itself. A confound is generated by this dual source of image properties. Generally, one is more interested in the natural image properties, and not so interested the camera properties. We have calibrated our camera so that camera and scene properties can be considered separately.

## **Where can I get detailed information regarding the camera calibration procedures used?**

See the paper on camera calibration, also posted on this website.

## **What else is special about this database?**

Unlike most images available on the web, these images are high resolution and high dynamic range. They were prepared specifically for research purposes.

## **What's in the pictures?**

There are two object image sets and two background sets. One object set consists of natural objects. The other object set consists of artificial objects. The Cottage Grove Minnesota background set was shot so that the angle of illumination matches the objects. This allows the objects to be pasted into these backgrounds in a meaningful way. The Cottage Grove backgrounds are natural and artificial ground planes.

The Ruffner Mountain Alabama backgrounds are shot under different illumination conditions than the objects. They consist of various forest floor scenes.

## **Why are the image sets available in various formats?**

Actually, these subsets represent different stages of image processing to remove or isolate camera artifacts. The stage you use depends on what you want to do.

## **RAW images**

Files ending in CRW are Canon raw images. This doesn't mean that the images are not compressed. They are compressed, but all compression is lossless. "Raw" also does not mean that the files lack a header or other accessory information. In fact, there is a lot of accessory information.

What "raw" *does* mean is that many camera settings and in-camera processing options are changeable post-photographically, using an application such as Photoshop CS. Each image

has 3 million pixels and 16 bits per color channel (~10 bits of actual dynamic range) in each pixel, for a total of 48 bits per pixel.

If you are doing photography for natural image studies, the raw image format is the best way to go.

## **Corrected images**

These images were created by correcting for vignetting and optical distortions in the raw images. The image format is uncompressed tiff. These are also 16 bit per color channel. This file format can be read by Matlab, using the *imread* function.

## **Segmented object images**

These images are created from the corrected images. They contain objects and the backgrounds have been removed. Removed backgrounds are replaced with blue, which can act as a key color.

## **Luminance object images**

These images are created from the segmented object images. The color object pixels are replaced by the human luminance equivalent. These images retain three color channels to accommodate the blue background, but two of these channels are redundant in the object regions.

## **Luminance background images**

These are similar to the luminance object images, except that there is no blue. Also, since color is not needed, there is only one 16 bit channel.

## **Why do the luminance images look so strange?**

Most cameras output a non-linear function of scene luminance, which is designed to enhance the appearance of displays and printed output. We are not really interested in this function. We would prefer that the camera act like an imaging photometer. Our calibration procedure results in an output where each pixel value is proportional to the scene luminance. Actual luminance can be calculated for these pixels as well. See the camera calibration paper for procedures.

### **Who can use these images?**

These images are copyrighted, but they can be used for research purposes. The source should be cited in any publication.

### **Questions**

Send any questions, comments or suggestions to [mark.brady@ndsu.nodak.edu](mailto:mark.brady@ndsu.nodak.edu)