

### Overview

Image processing is a broad term describing most operations that you can apply to image data which may be in the form of a 2D, 3D or 4D waves. Image processing may sometimes provide the appropriate analysis tools even if the data have nothing to do with imaging. In Chapter II-16, **Image Plots**, we described operations relating to the display of images. Here we concentrate on transformations, analysis operations and special utility tools that are available for working with images.

You can use the IP Tutorial experiment (inside the Learning Aids folder in your Igor Pro 7 folder) in parallel with this chapter. The experiment contains, in addition to some introductory material, the sample images and most of the commands that appear in this chapter. To execute the commands you can select them in the Image Processing help file and press Control-Enter.

For a listing of all image analysis operations, see **Image Analysis** on page V-4.

### Image Transforms

The two basic classes of image transforms are color transforms and grayscale/value transforms. Color transforms involve conversion of color information from one color space to another, conversions from color images to grayscale, and representing grayscale images with false color. Grayscale value transforms include, for example, pixel level mapping, mathematical and morphological operations.

### Color Transforms

There are many standard file formats for color images. When a color image is stored as a 2D wave, it has an associated or implied colormap and the RGB value of every pixel is obtained by mapping values in the 2D wave into the colormap.

When the image is a 3D wave, each image plane corresponds to an individual red, green, or blue color component. If the image wave is of type unsigned byte (/B/U), values in each plane are in the range [0,255]. Otherwise, the range of values is [0,65535].

There are two other types of 3D image waves. The first consists of 4 layers corresponding to RGBA where the 'A' represents the alpha (transparency) channel. The second contains more than three planes in which case the planes are grayscale images that can be displayed using the command:

```
ModifyImage imageName plane=n
```

Multiple color images can be stored in a single 4D wave where each chunk corresponds to a separate RGB image.

You can find most of the tools for converting between different types of images in the **ImageTransform** operation. For example, you can convert a 2D image wave that has a colormap to a 3D RGB image wave. Here we create a 3-layer 3D wave named M\_RGBOut from the 2D image named 'Red Rock' using RGB values from the colormap wave named 'Red RockCMap':

```
ImageTransform /C='Red RockCMap' cmap2rgb 'Red Rock'  
NewImage M_RGBOut // Resulting 3D wave is M_RGBOut
```

**Note:** The images in the IP Tutorial experiment are not stored in the root data folder, so many of the commands in the tutorial experiment include data folder paths. Here the data folder paths have been removed for easier reading. If you want to execute the commands you see here, use the commands in the "IP Tutorial Help" window. See Chapter II-8, **Data Folders**, for more information about data folders.

In many situations it is necessary to dispose of color information and convert the image into grayscale. This usually happens when the original color image is to be processed or analyzed using grayscale operations. Here is an example using the RGB image which we have just generated:

```
ImageTransform rgb2gray M_RGBOut  
NewImage M_RGB2Gray // Display the grayscale image
```