Variable V_flag is set to 1 if the top graph contained draw objects in the correct layer and 0 if not. If 0 then the M_ROIMask wave was not generated.

Examples

```
Make/O/N=(200,400) jack=x*y; NewImage jack; ShowTools
SetDrawLayer ProgFront
SetDrawEnv linefgc=(65535,65535,0),fillpat=0,xcoord=top,ycoord=left,save
DrawRect 63.5,79.5,140.5,191.5
DrawRRect 61.5,206.5,141.5,280.5
SetDrawEnv fillpat= -1
DrawOval 80.5,169.5,126.5,226.5
ImageGenerateROIMask jack
NewImage M_ROIMask
AutoPositionWindow/E
```

See Also

For another example see **Generating ROI Masks** on page III-378.

ImageGLCM

ImageGLCM [*flags*] *srcWave*

The ImageGLCM operation calculates the gray-level co-occurrence matrix for an 8-bit grayscale image and optionally evaluates Haralick's texture parameters.

The ImageGLCM operation was added in Igor Pro 7.00.

Flags

/D=*distance* Sets the offset in pixels for which the co-occurrence matrix is calculated. The default value is 1.

/DEST=*destGLCM* Specifies the wave to hold the co-occurrence matrix. If you omit /DEST the operation stores the matrix in the wave M_GLCM in the current data folder.

/DETP=*destParamWave*

Specifies the wave to hold the computed texture parameters. If you omit /DETP the operation stores the texture parameters in the wave W_TextureParams in the current data folder.

If the destination wave already exists it is overwritten. Note that you must specify the /HTFP flag to compute the texture parameters.

/E=*structureBits* *structureBits* is a bitwise setting that lets you control the combination of co-occurrences that you want to compute.

Consider a wave displayed in a table and a pixel at position x

0	3	5
1	*x*	6
2	4	7

The *structureBits* corresponding to co-occurrence between x and any direction is simply 2^direction. By default the operation computes all combinations. This is equivalent to *structureBits*=255.

Note that the *structureBits* only define directions. The combination of the distance (/D) and the *structureBits* define the full co-occurrence calculation.

See **Setting Bit Parameters** on page IV-12 for details about bit settings.

/FREE — Creates output waves as free waves.

/FREE is permitted in user-defined functions only, not from the command line or in macros.

If you use /FREE then *destGLCM* and *destParamWave* must be simple names, not paths.

See **Free Waves** on page IV-91 for details on free waves.

/HTFP — Computes Haralick's texture parameters. See the discussion in the Details section below for more information about the texture parameters.

/P=plane — If the image consists of more than one plane you can use this flag to determine which plane in srcWave is analysed. By default it is plane zero.

/Z — No error reporting.

Details

ImageGLCM computes the co-occurrence matrix for the image in *srcWave* and optionally evaluates Haralick's texture parameters. The operation supports 8-bit grayscale images and generates a 256x256 single-precision floating point co-occurrence matrix.

The elements of the matrix P[i][j] are defined as the normalized number of pixels that have a spatial relationship defined by the distance (/D) and the structure (/E) such that the first pixel has gray-level i and the second pixel has gray-level j. The matrix is normalized so that the sum of all its elements is 1.

If you specify the /HTFP flag the operation computes the 13 Haralick texture parameters and stores them sequentially in the destination wave (see /DETP). The wave is saved with dimension labels defining each element. The expressions for the texture parameters are:

$$f_1 = \sum_i \sum_j \left(p[i][j]\right)^2,$$

$$f_2 = \sum_{n=0}^{254} n^2 \left\{ \sum_{i=0}^{255} \sum_{\substack{j=0 \\ |i-j|=n}}^{255} p[i][j] \right\},$$

$$f_3 = \sum_i \sum_j \frac{(i-\mu_x)(j-\mu_y)p[i][j]}{\sigma_x \sigma_y},$$

$$f_4 = \sum_i \sum_j (i-\mu)^2 p[i][j],$$

$$f_5 = \sum_i \sum_j \frac{1}{1+(i-j)^2} p[i][j],$$

$$f_6 = \sum_i i p_{x+y}(i),$$

$$f_7 = \sum_i (i - f_6)^2 p_{x+y}(i),$$

$$f_8 = -\sum_i p_{x+y}(i) \log\left(p_{x+y}(i)\right),$$

$$f_{10} = Variance\left(p_{x-y}\right),$$

$$f_9 = -\sum_i \sum_j p[i][j] \log\left(p[i][j]\right),$$

$$f_{10} = Variance\left(p_{x-y}\right),$$

$$f_{11} = \sum_i p_{x-y}(i) \log\left(p_{x-y}(i)\right),$$

$$f_{12} = \frac{f_9 - HXY1}{\max\left(HX, HY\right)},$$

$$f_{13} = \sqrt{1 - \exp\left(-2\left(HXY2 - f9\right)\right)}.$$

Here

$$p_x(i) = \sum_j p[i][j], \quad p_y(j) = \sum_i p[i][j],$$

$$\mu_x = \sum_i i p_x(i), \quad \mu_y = \sum_i i p_y(i), \quad \mu = (\mu_x + \mu_y)/2.$$

$$\sigma_x = \sqrt{\sum_i \left(1 - \mu_x\right)^2 p_x(i)}, \qquad \sigma_y = \sqrt{\sum_i \left(1 - \mu_y\right)^2 p_y(i)},$$

$$p_{x+y}(k) = \sum_i \sum_{\substack{j \\ i+j=k}} p[i][j],$$

$$p_{x-y}(k) = \sum_i \sum_{\substack{j \\ |i-j|=k}} p[i][j],$$