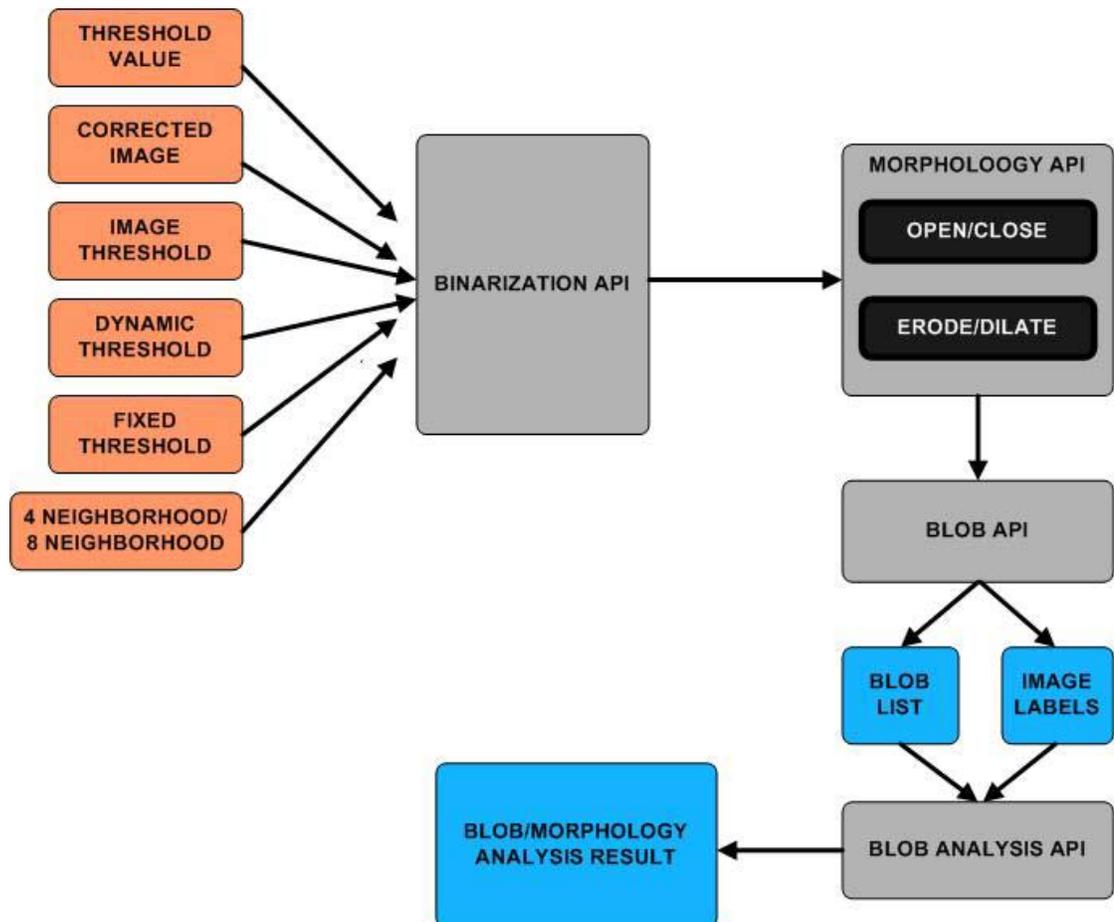




## Morphology (BLOBS)

Morphology operations generally follow the following steps

- Image Conditioning
- Binarization
- Binary Image Conditioning
- Labeling
- Feature Extraction





# Morphology (BLOBS)

## *Image Conditioning*

This step falls outside the morphology library, but provides for the improvement of the quality of the image filtering. Linear and nonlinear filtering is done to improve the quality of the binarization.

## **Binarization**

### ■ **Fixed Threshold**

Fixed threshold binarization converts the gray scale image to a binary image by comparing the input image to a PAIR of thresholds.

### ■ **Dynamic Threshold**

A dynamic threshold replaces the two threshold numbers with two images.

## *Binary Image Conditioning*

### *Structuring Elements:*

*Structuring elements are small binary templates that are used to define the other morphology operations.*

### ■ **Erosion**

This operation does the following at each pixel location in the image. The selected template is centered at the pixel location. At each location where the template is 1, the input image pixel must be one. If this is true the output pixel is 1, if it is false the output pixel is zero.

### ■ **Dilation**

This operation does the following at each pixel location in the input image. The selected template is centered at the pixel location. At each location where the template is 1, if any input image pixel is on then the output pixel is one, otherwise it is zero. Intuitively this will add to the edges of regions. Dilation is complementary to Erosion, Dilation is an OR function Erosion is an AND function.

### ■ **Open**

Open is an erosion followed by dilation. Normally the function also carries a repetition factor, Open N times.

### ■ **Close**

Close is dilation followed by erosion. Normally the function also carries a repetition factor, Close N times.

## **Labeling BLOBS**

Binary Large Objects are extracted from the processed image by a labeling step. This step is performed by labeling each pixel, in the image, with an integer, so each pixel that 'touches' another pixel, has the same label value. When a labeling operation runs out of values the function call fails. Each region of the image that has the same label value is called a BLOB. The output of the labeling operation is two tables, one the same shape as the image, but each pixel is its label value, is a vector of vectors, which contain the c, y coordinates of each BLOB.

### **Feature Extraction**

After the labeling operation is complete, the various 'features' are extracted from the label. The features take forms, unary features, that is the feature of one 'BLOB', and binary features, that is relationships between blobs. Feature operations can be performed on a single BLOB, or on all BLOBS in the label table.

