Digital Image Processing
Project part 2

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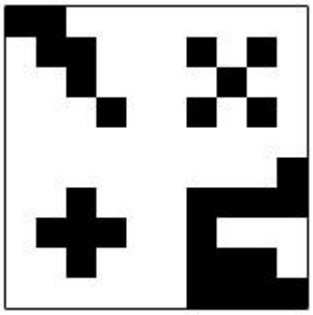
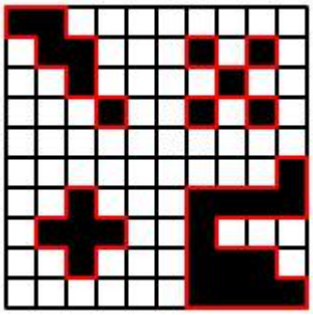
METHOD-1 Blob detection

In Image processing, blob detection refers to modules that are aimed at detecting points and/or regions in the image that differ in properties like brightness or color compared to the surrounding. The blob detection provides information about regions, which is not obtained from edge detectors or corner detectors. It is used to obtain regions of interest for further processing. These regions could signal the presence of objects or parts of objects in the image domain with application to object recognition and/or object tracking.



Original Image



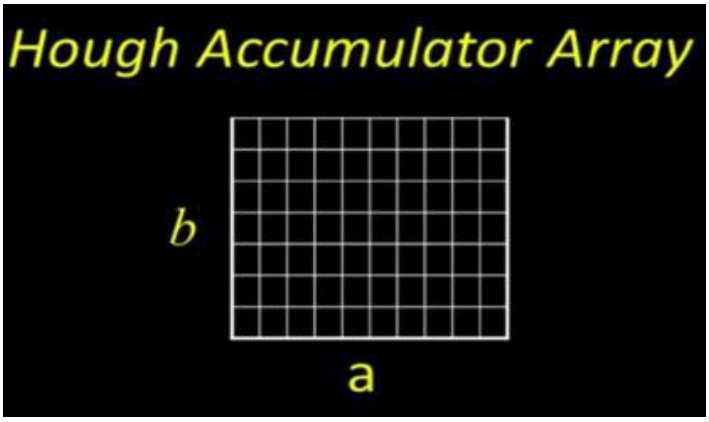
Blobs selected

METHOD 2 - Hough Transform:
Hough transform is a feature extraction technique which detects circles. The circle candidates are produced by "voting" in the Hough parameter space and then select the local maxima in a so-called accumulator matrix.

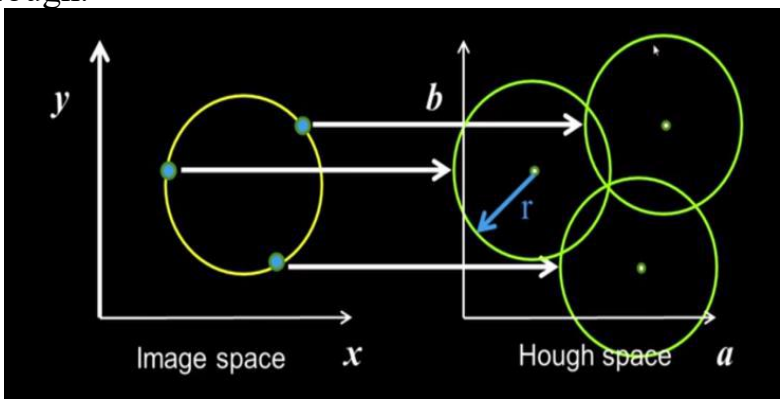
Voting:
Voting is a general technique where the features vote for all models that are compatible with it.

Image space and Hough (parameter) space:
Image space is a space where the circle is present. We still don"t know where the circle is, but the edge detection detects points on the circle. It satisfies the equation
Where ***a*** & ***b*** are the center and ***r*** is the radius.
Hough space is a space which is constructed using the center locations in ***x*** and ***y*** direction, which are ***a*** and ***b***.

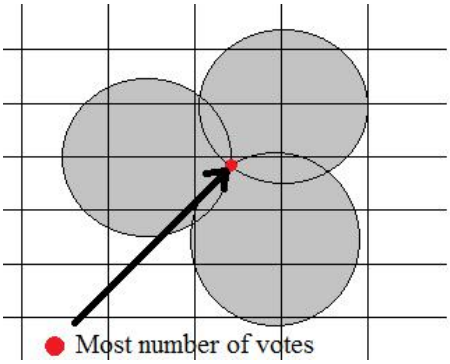
Accumulator matrix:
Accumulator matrix is used to find the intersection point in the parameter space. The Hough space is divided into equally sized „buckets" using grids. The element in the accumulator matrix denotes the number of "circles" in the parameter space that passing through the corresponding grid cell in the parameter space. The number is also called "voting number"



Working:
We know the radius of the circle. So each point detected on the image space, corresponds to a circle with that point as the center in Hough accumulator space. So, initially, every element in the accumulator matrix is zeros. Then for each "edge" point in the image space, we can formulate a circle in the Hough space and increase the voting number of the grid cell which the circle passing through.



The maximum voted circle of Accumulator gives the circle center from which the circle can be found.

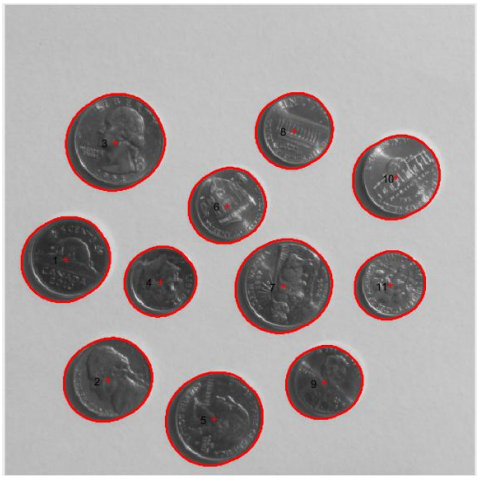


METHOD 3 – Cross Correlation
Cross-correlation is used to measure the similarity between 2 images. Normalized cross relation can be used to do template matching. It takes 2 images (the original image and the template) and gives the output. If the template matches perfectly, the output will have a really bright spot. This can be viewed properly by computing the peaks.
Example:

Image

Template

METHOD 1- BLOB DETECTION



Coin #1
Diameter = 94.7 pixels
Area = 7042 pixels

Coin #2
Diameter = 93.7 pixels
Area = 6896 pixels

Coin #3
Diameter = 106.3 pixels
Area = 8874 pixels

Coin #4
Diameter = 77.3 pixels
Area = 4689 pixels

Coin #5
Diameter = 103.8 pixels
Area = 8455 pixels

Coin #6
Diameter = 83.4 pixels
Area = 5457 pixels

Coin #7
Diameter = 103.6 pixels
Area = 8431 pixels

Coin #8
Diameter = 83.3 pixels
Area = 5448 pixels

Coin #9
Diameter = 81.6 pixels
Area = 5233 pixels

Coin #10
Diameter = 92.8 pixels
Area = 6770 pixels

Coin #11
Diameter = 75.9 pixels
Area = 4520 pixels

METHOD 2- HOUGH TRANSFORM

METHOD 3 - CROSS CORRELATION

The small blue squares insdie the coins are the center of the coins. By taking separate template for each coin we can find the center of the coins using cross correlation