Automatic Segmentation and Yield Measurement of Fruit using Shape Analysis

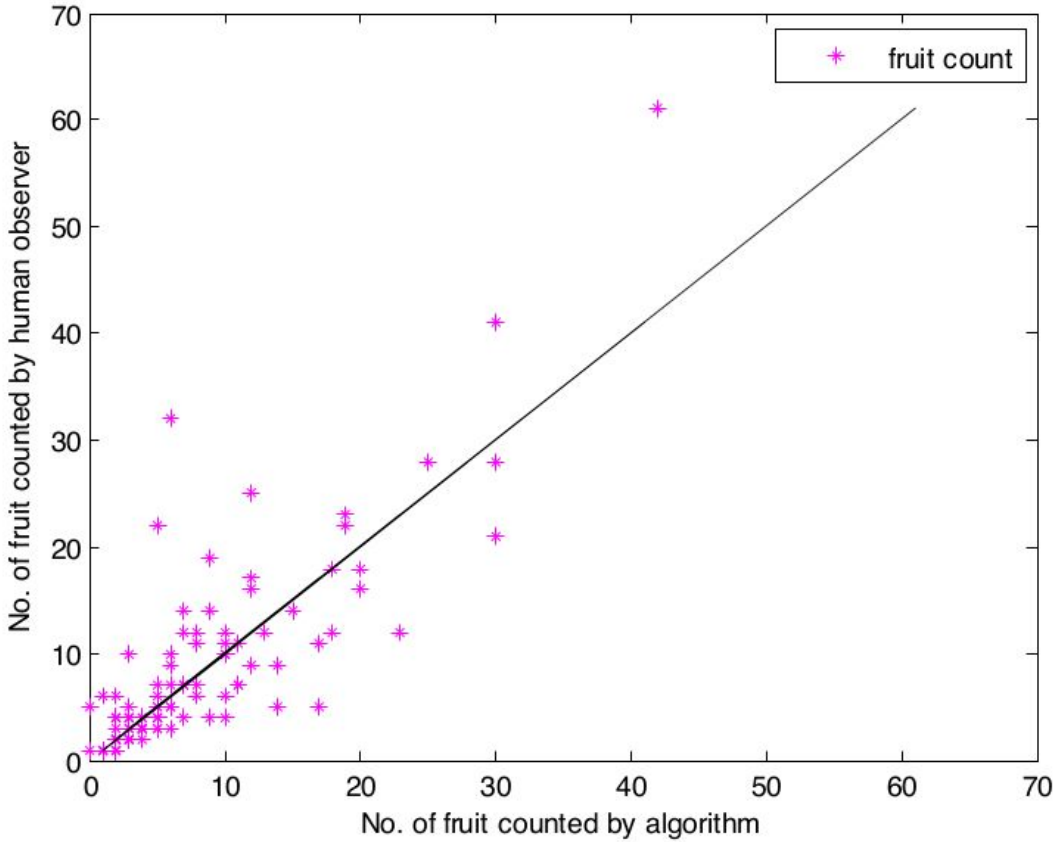
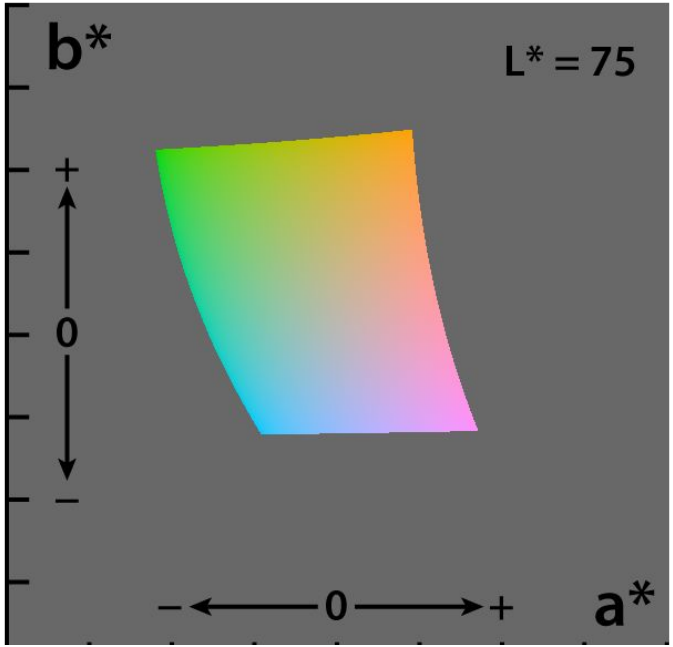
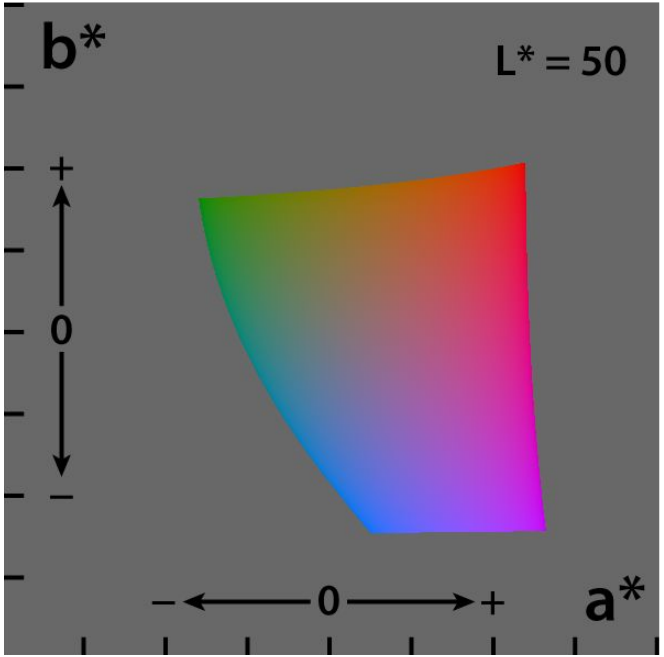


Fig 13: Plot of manual fruit count versus fruit count by an algorithm

CIELab





Total no. of Fruits are 2

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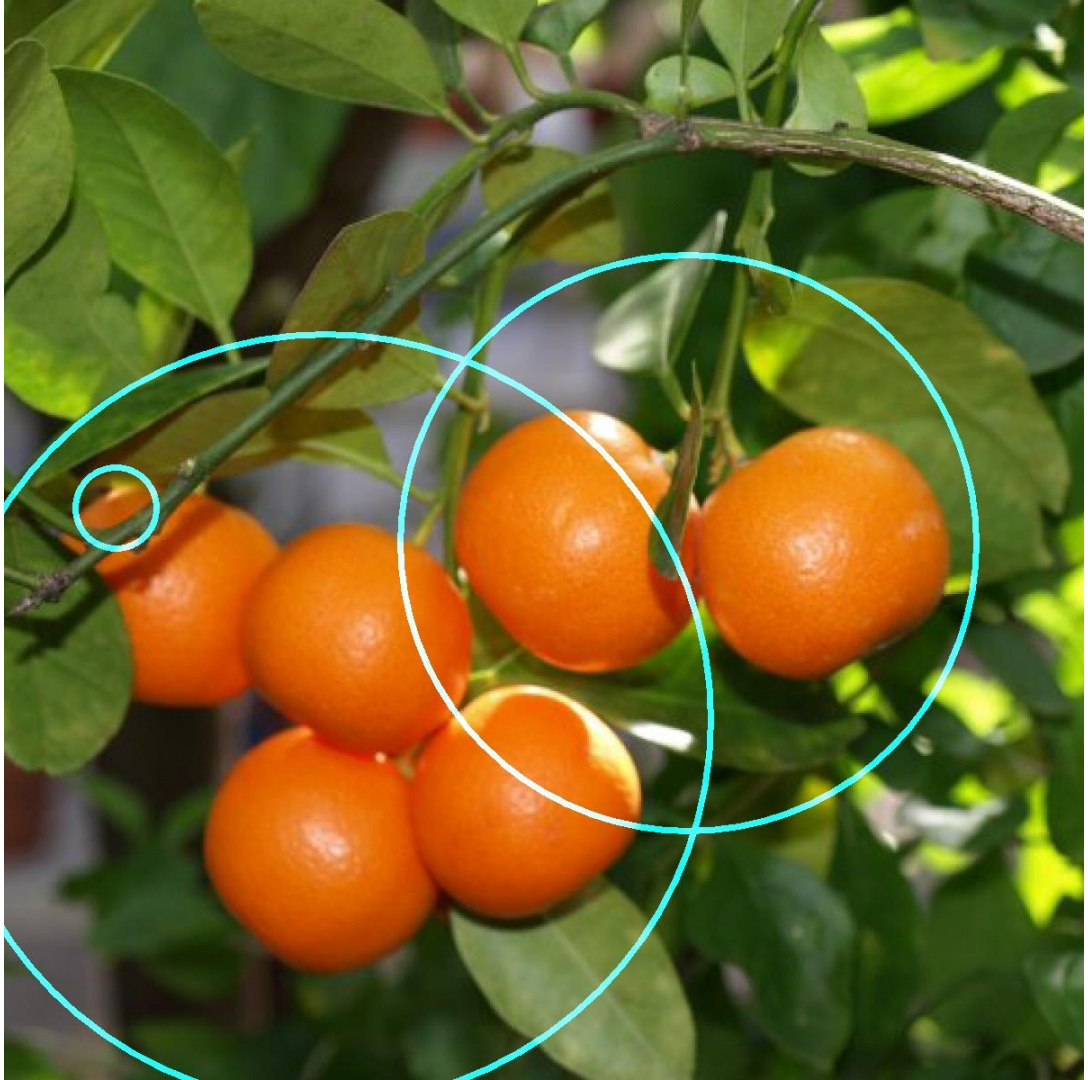
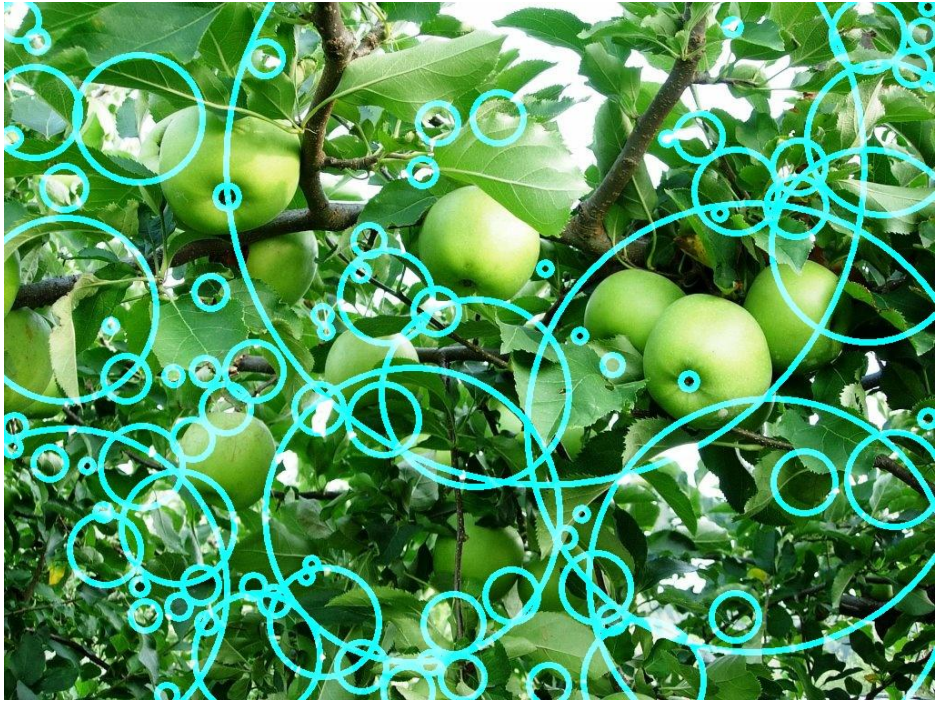
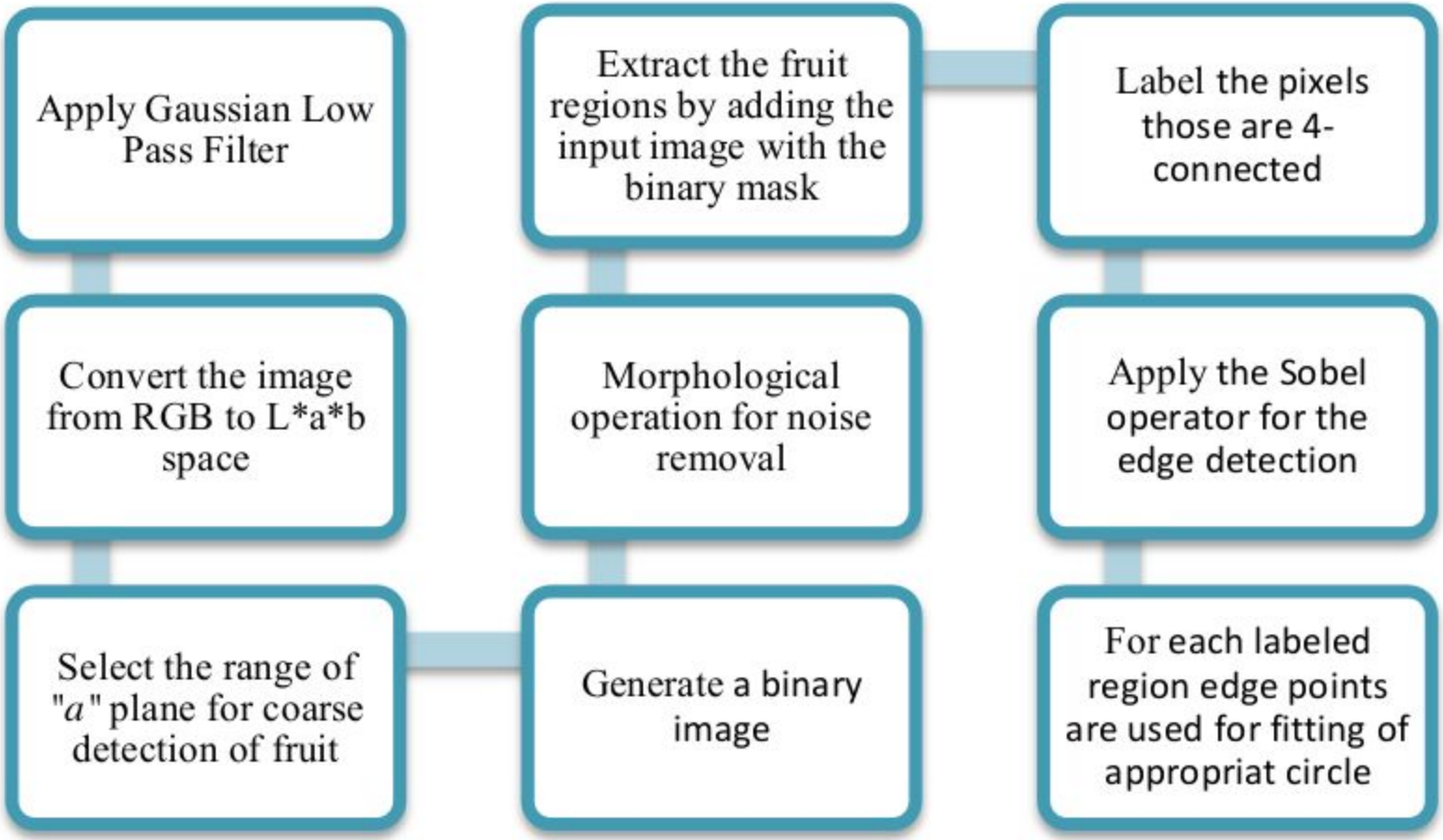
Fig 12: Effect of different lighting conditions and clustered background.





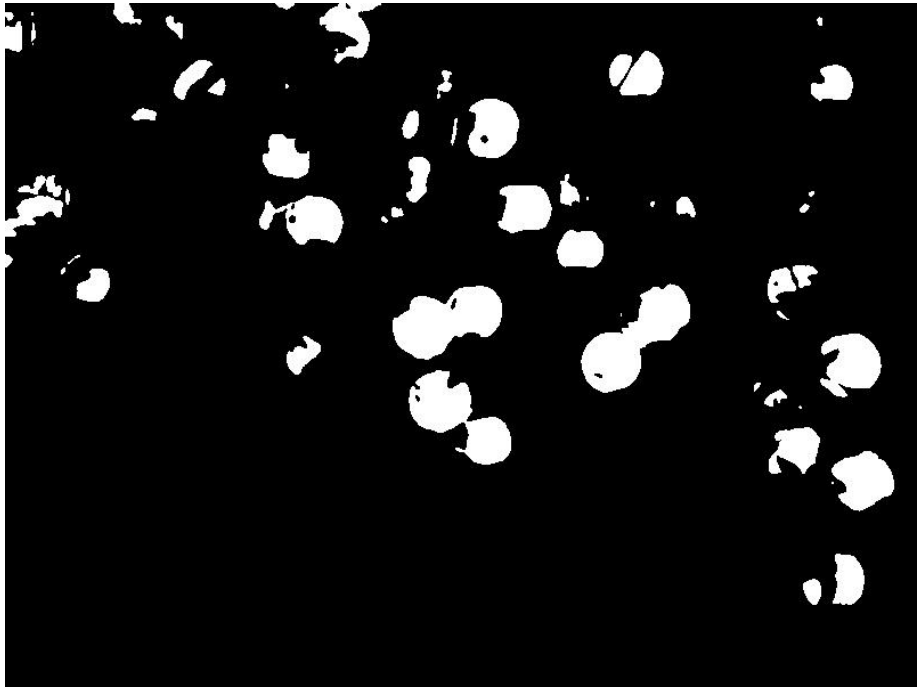

Apply Gaussian Low Pass Filter
Convert the image from RGB to L*a*b space
Select the range of "a" plane for coarse detection of fruit
Generate a binary image
Morphological operation for noise removal
Extract the fruit regions by adding the input image with the binary mask
Label the pixels those are 4-connected
Apply the Sobel operator for the edge detection
For each labeled region edge points are used for fitting of appropriat circle

Original image

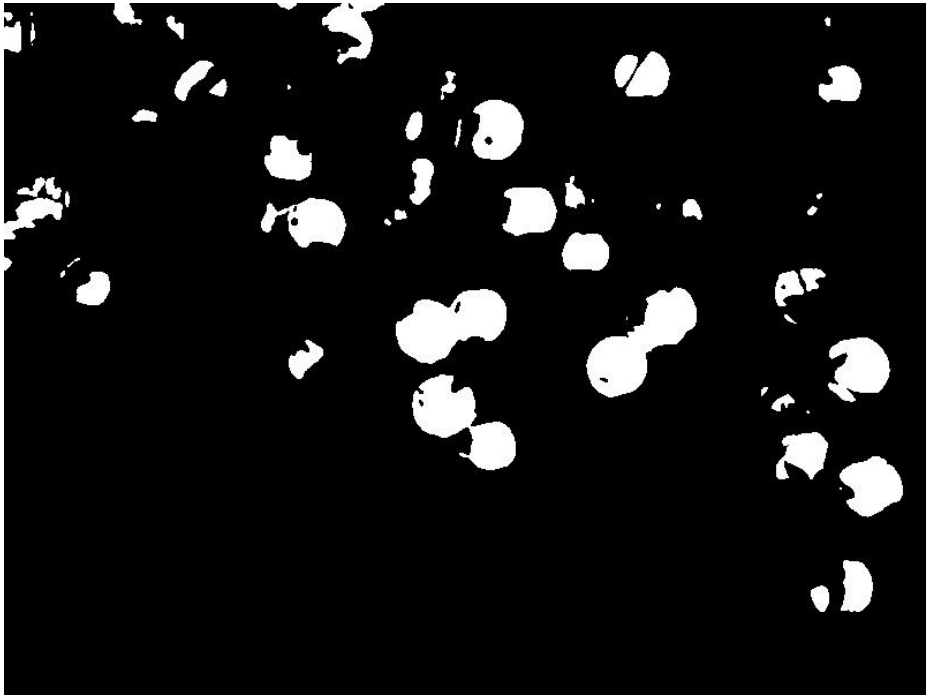
Blur

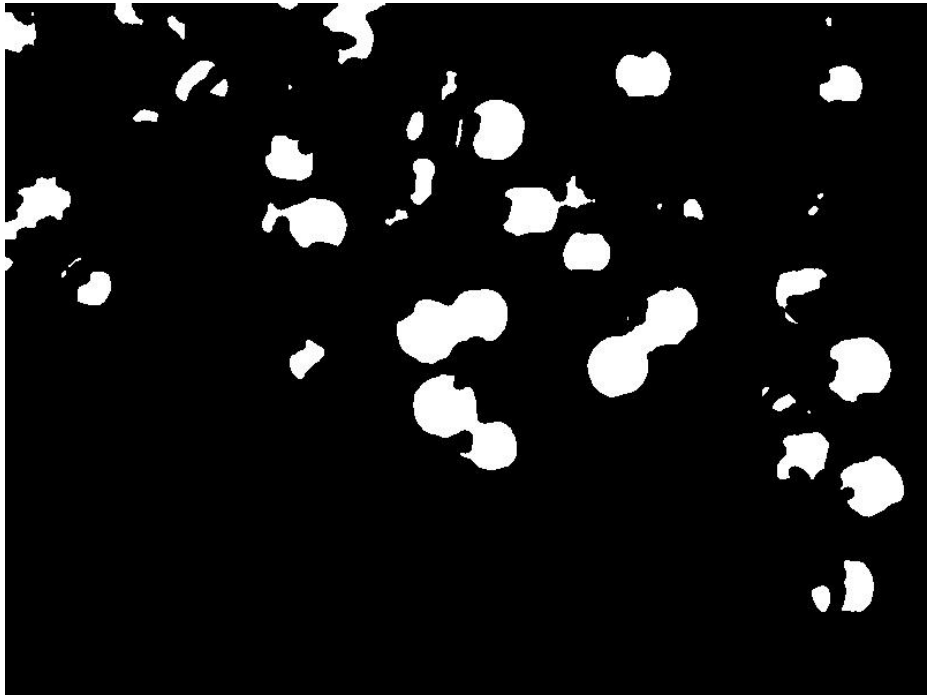
L*a*b, only `a` axis [0..255]

Binarization, threshold = 150

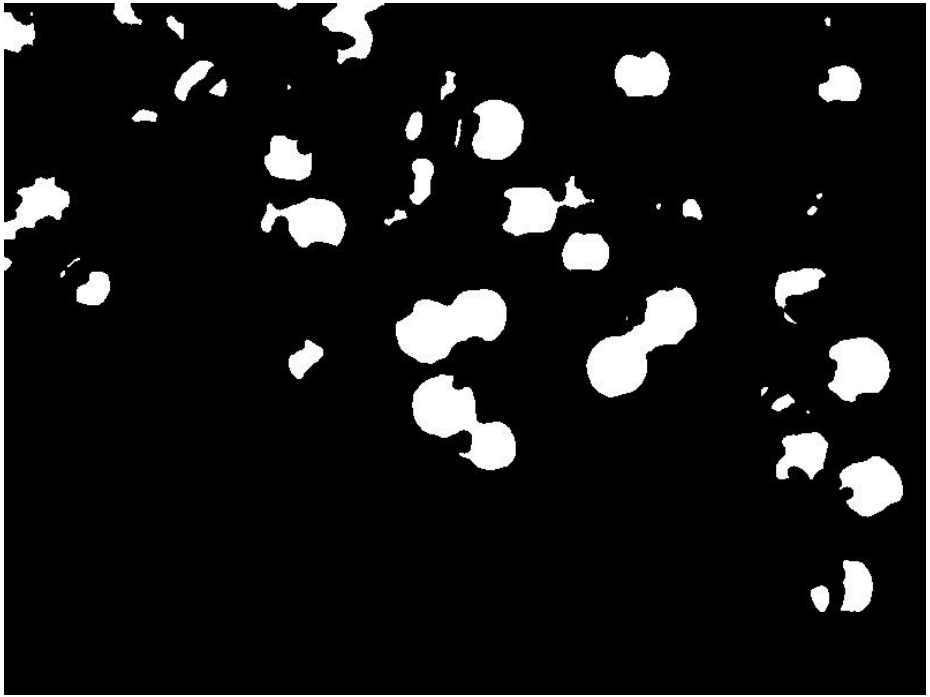


Morphological operations. close. 5 * 5





Morphological operations. open. 5 * 5

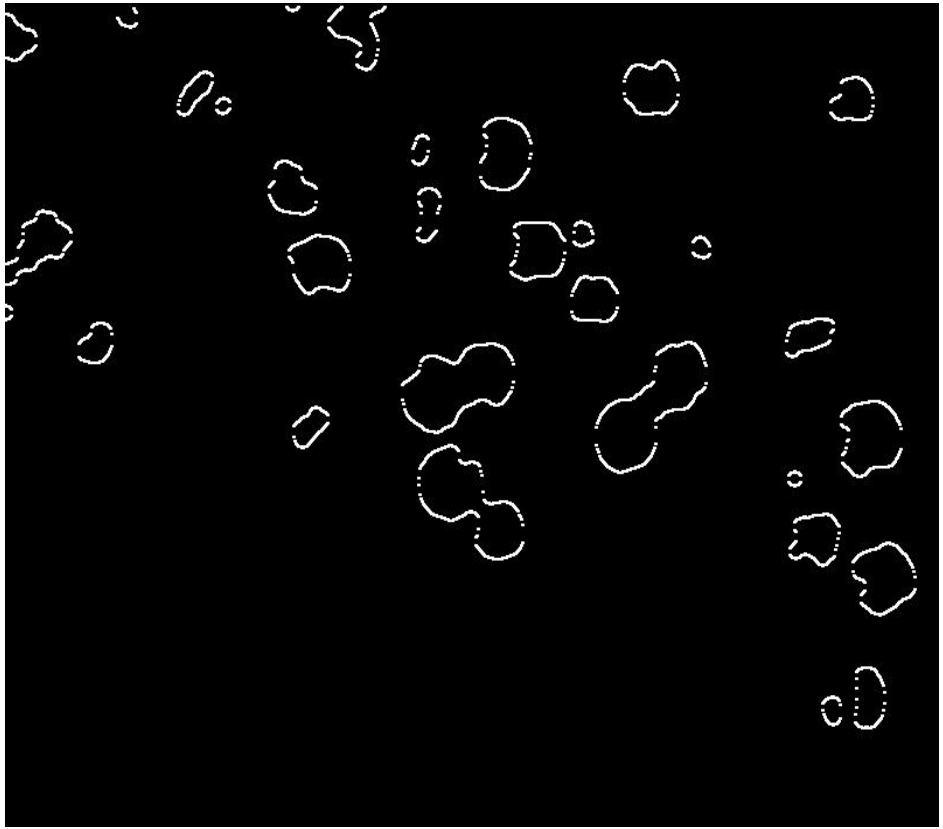


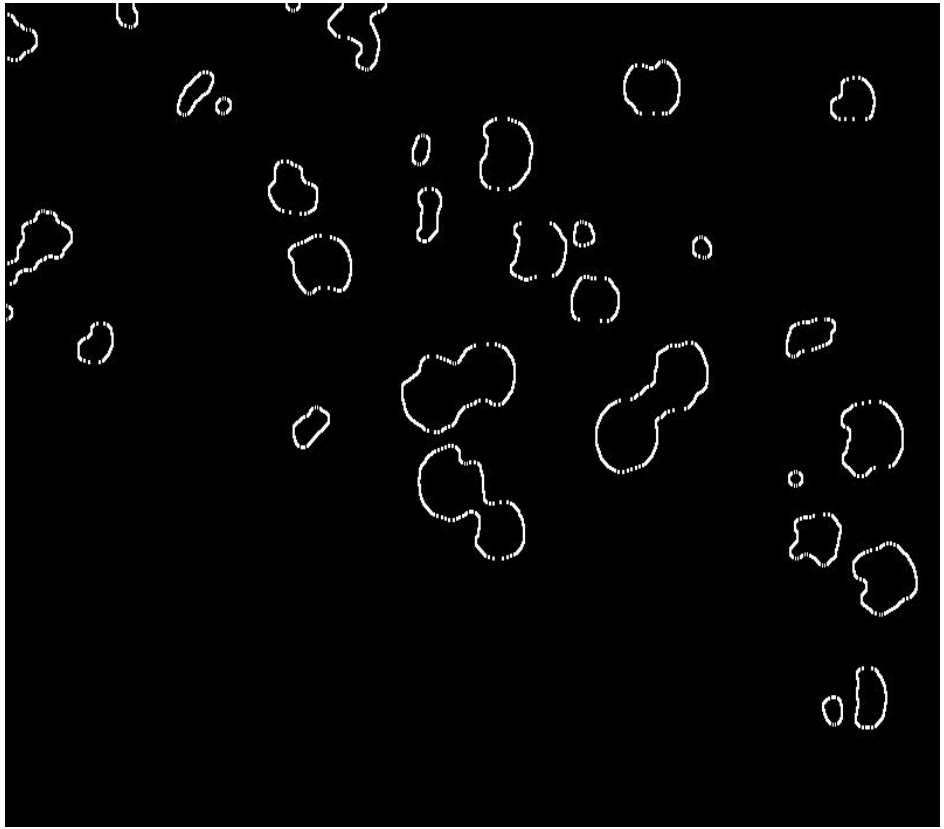
Sobel x, y

$$Sx = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}$$

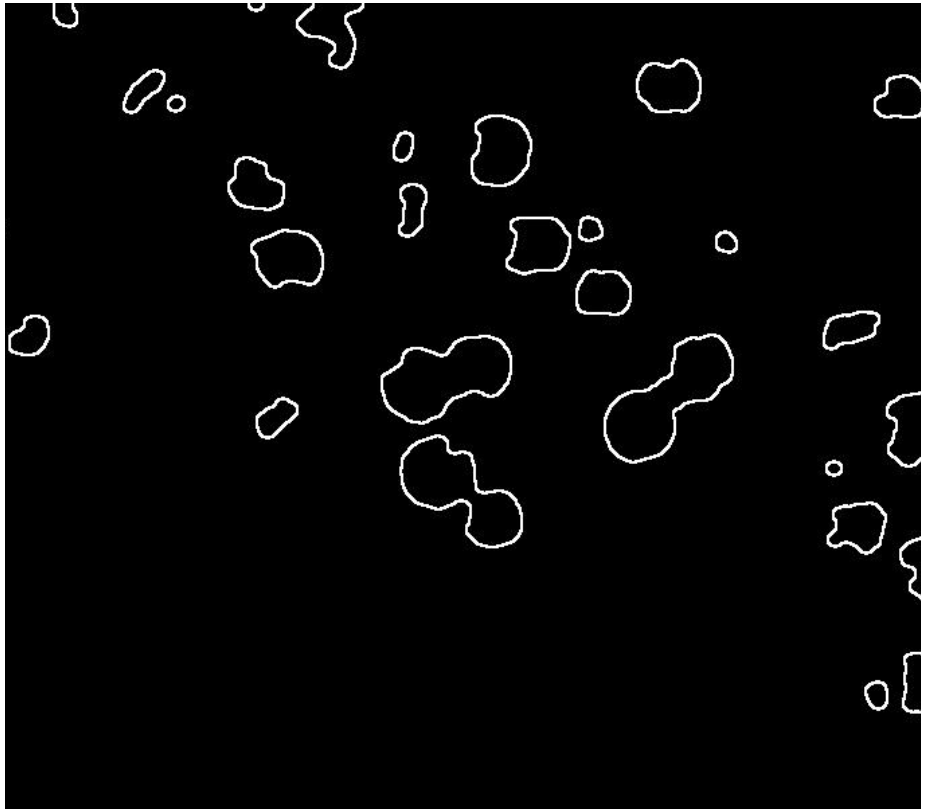
$$Sy = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix}$$

Sobel x, y





|| Sobel || & binarization



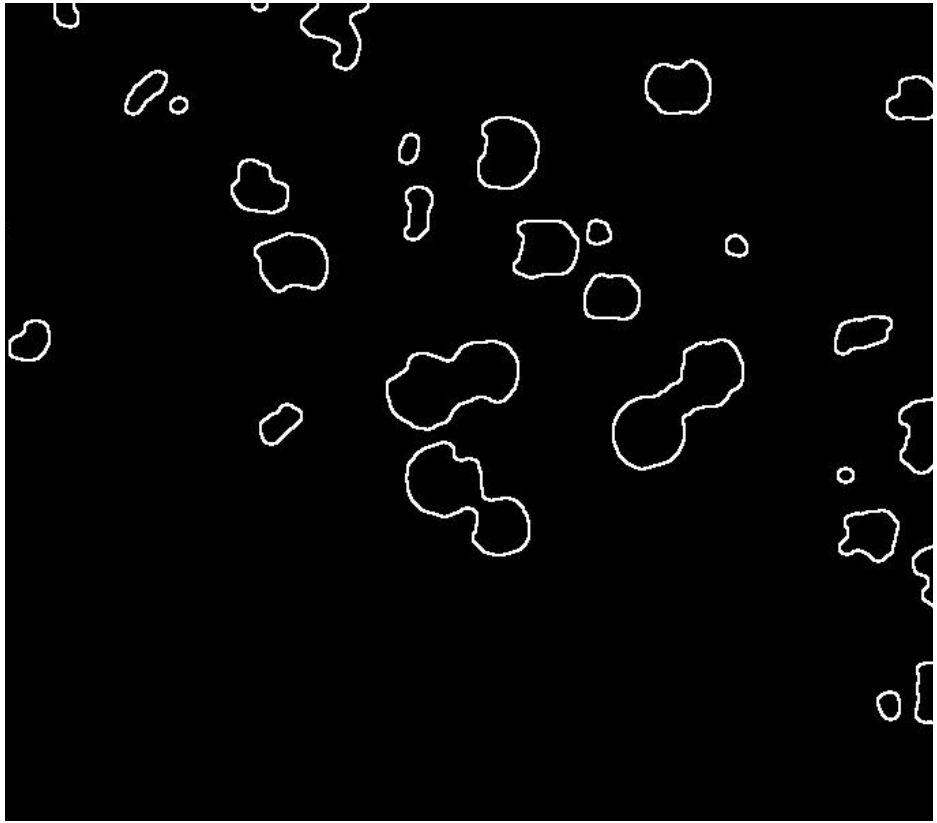
Fitting circle to the pixel data:

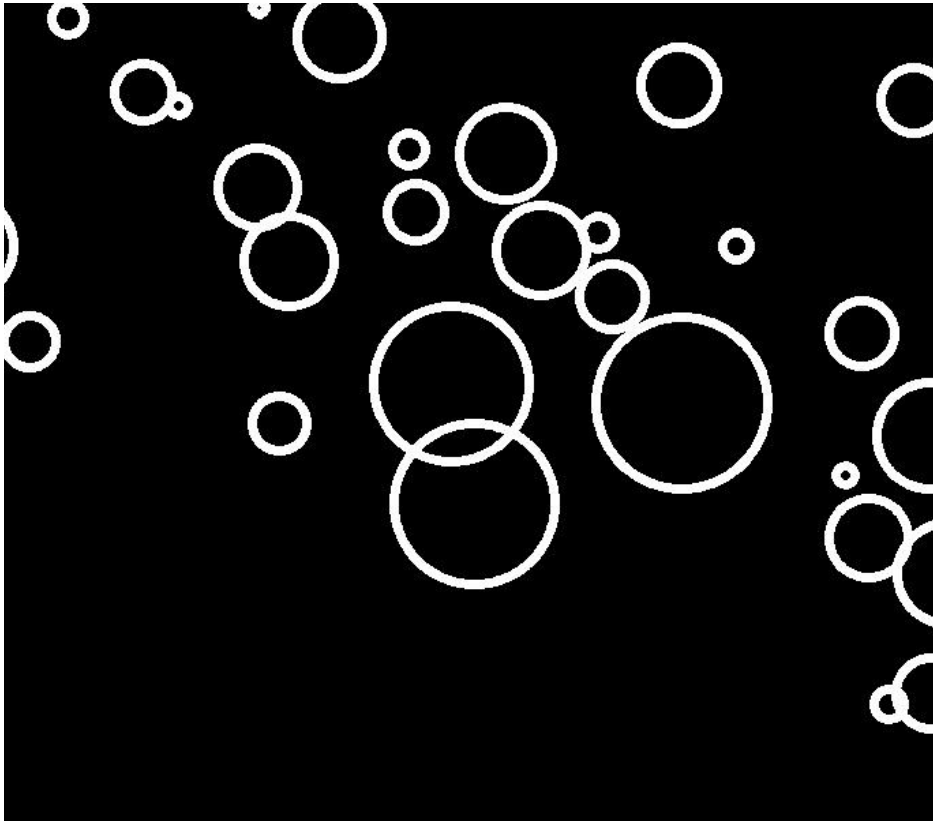
$$\mathcal{F}(a,b,R) = \sum_{i=1}^{n} \left[\sqrt{(x_i - a)^2 + (y_i - b)^2} - R\right]^2$$

An algorithm to fit a circle into scattered pixel data.

1. Find the co-ordinates of the edge pixels.
2. Calculate the mean of pixels.
3. Find the center of the clusters using the mean computed.
4. Compute the coefficients of the characteristics polynomial:$A(x^2 + y^2) + Dx + Ey + F$.
5. Apply Newton's method [20] for fitting the approximate circle into the known data set.
6. Compute the circle parameters (centre and radius).
7. Plot the probable fitted circle on an input image.

Median x, y of each component, and max rad.

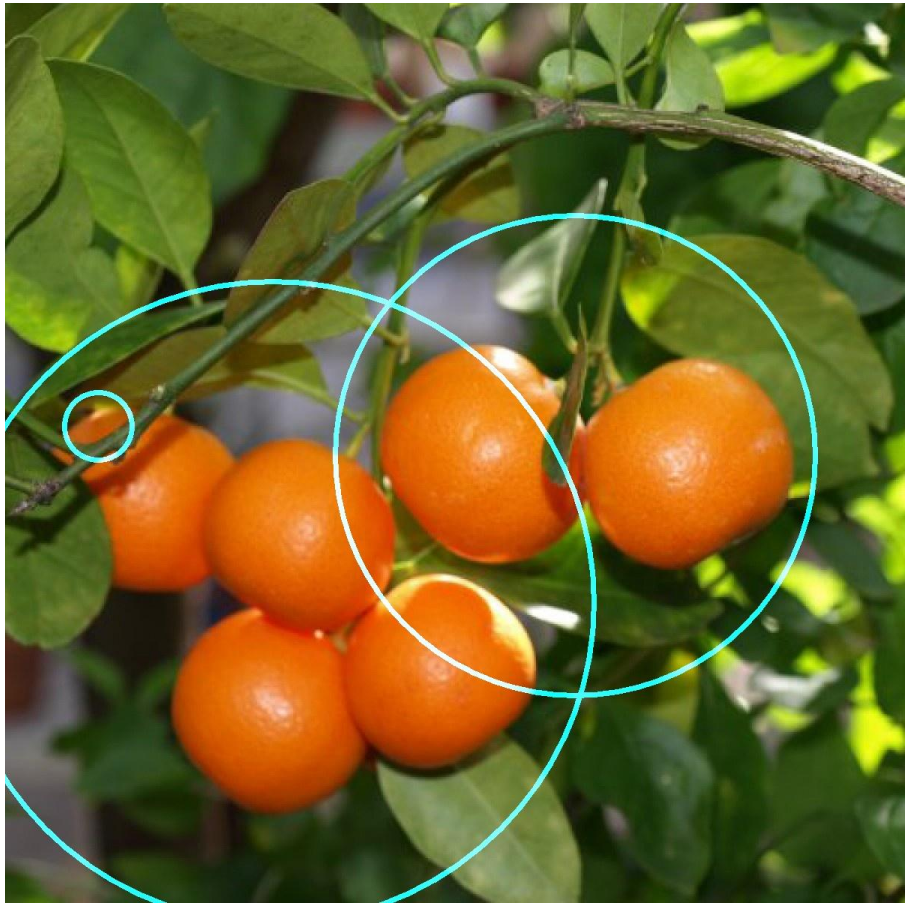


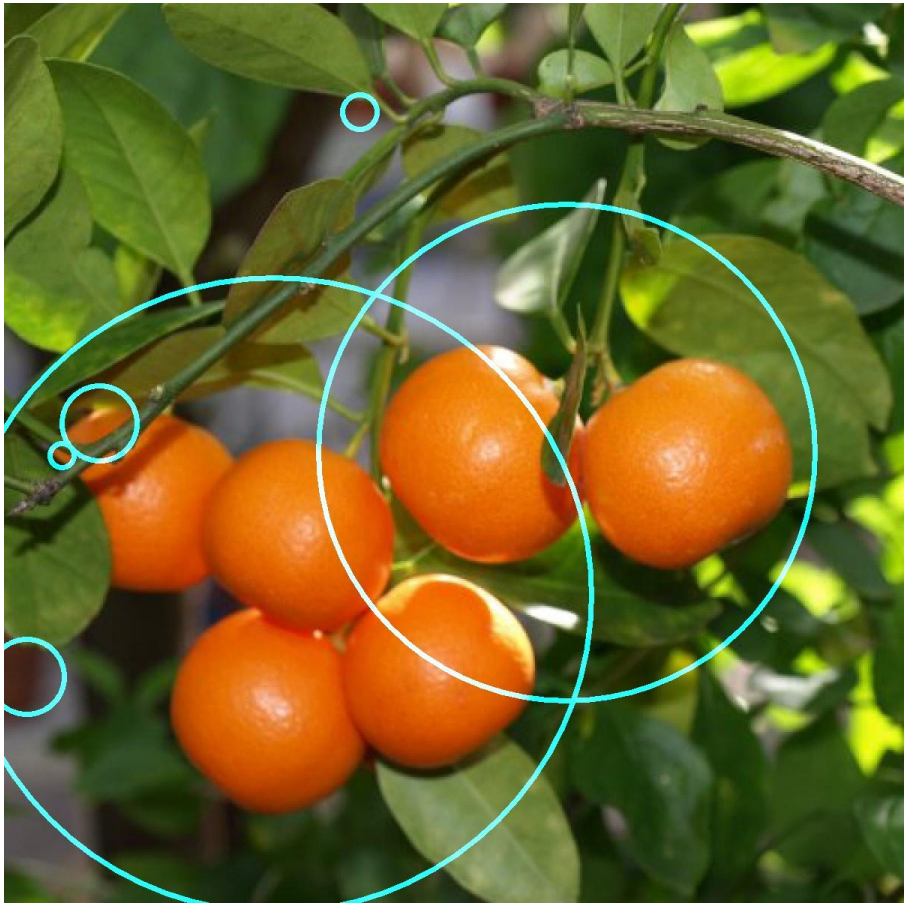


31, 35 vs 43

22, 18 vs ?

3, 6 vs 6





вопросы?

спасибо за внимание

http://www.ijcaonline.org/archives/volume45/number7/6792-9119