# Circles Finding

*with*

# Clustering Method

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# *Introduction – Other Methods*

- *One way to find circle is using the Hough transform.*
- *This method have some problems:*
  - *It's based on gradient edge detector*
  - *gradient edge detector is sensitive to noise*
  - *the angles the edge can have are discrete*

# *Introduction – My Idea*

- *What if we don't have to find the edge angle?*
- *What if we already have the shape center, and we just need to check if it a circle?*
- *The new problem: how to find the shapes centers?*

# Brief Description of the Algorithm

*The 5 steps of the algorithm:*

- *Finding the clusters in the picture*
- *Creating the edge map*
- *Finding the clusters' centers*
- *Finding the symmetric shapes*
- *Finding the circles*

# Clustering – What Can It Do?

- Clustering is a way to find all the points that are "close" to each other, and define them as a cluster.
- "close" is a matter of definition:
  - for points in space it can be the Euclidian distance.
  - For pictures it can be the Euclidian distance in pixels and the distance in the color/intensity between the two pixels.

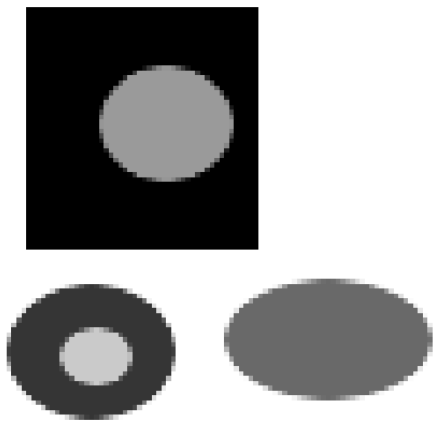
# Clustering – What Can It Do?

- So, we can find all the "close" pixels in the picture, and define them as a cluster.
- One of the first assumptions was that all the pixels of one REAL object have "close" parameters.
- Therefore, each cluster represent one REAL object.

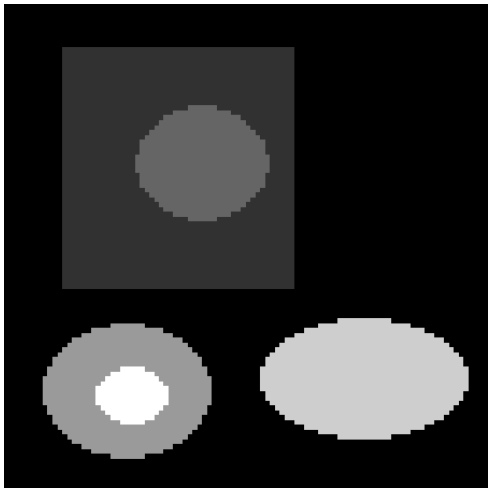
# Finding the Cluster

Each cluster has its own label

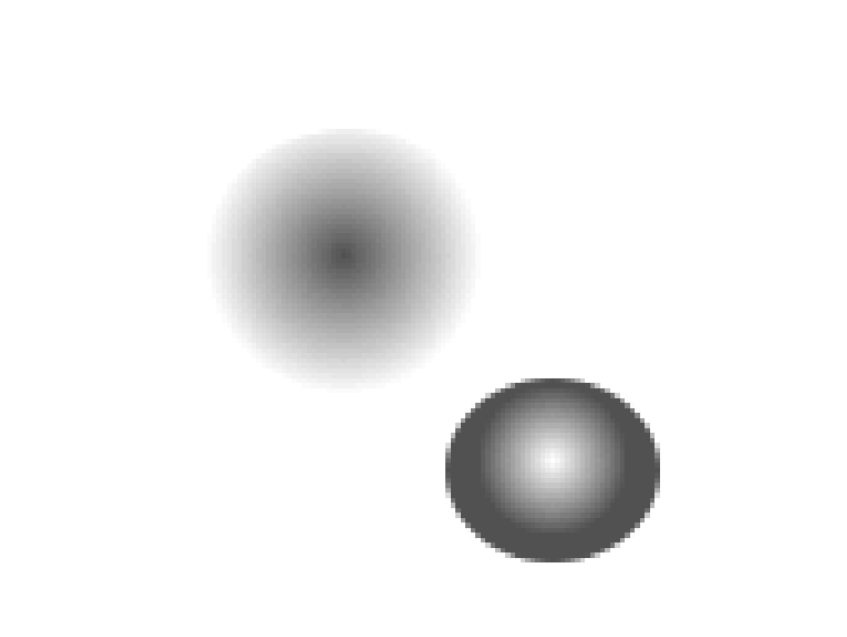
Original picture

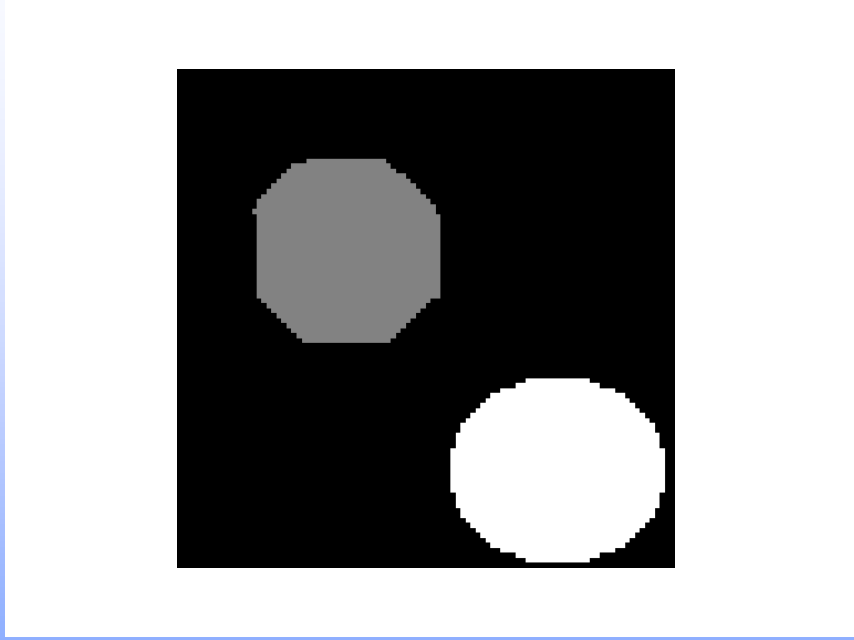


Clusters picture



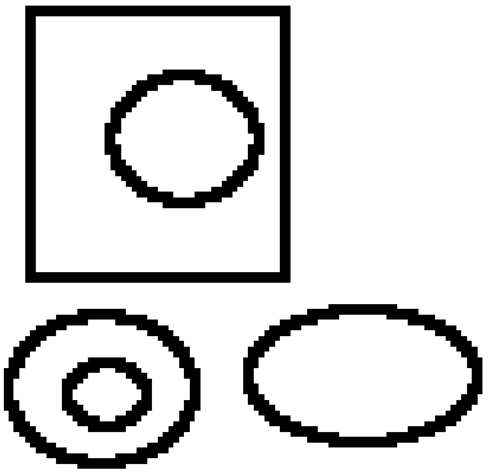
# *Another Example*

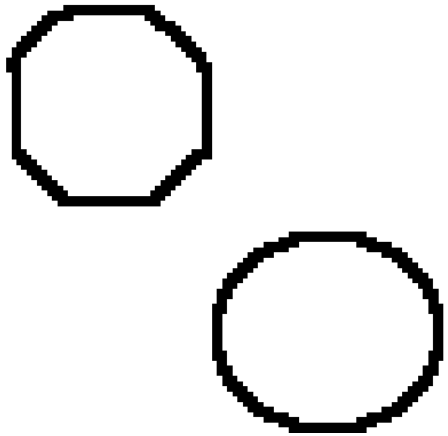




# Creating the Edge Map

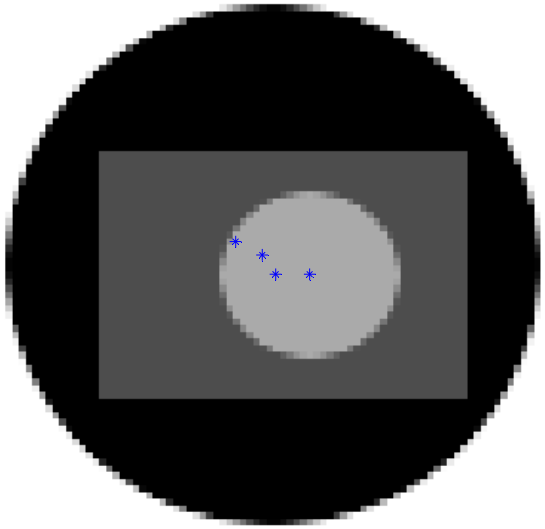
*After I have the cluster, it easy to find the edges*





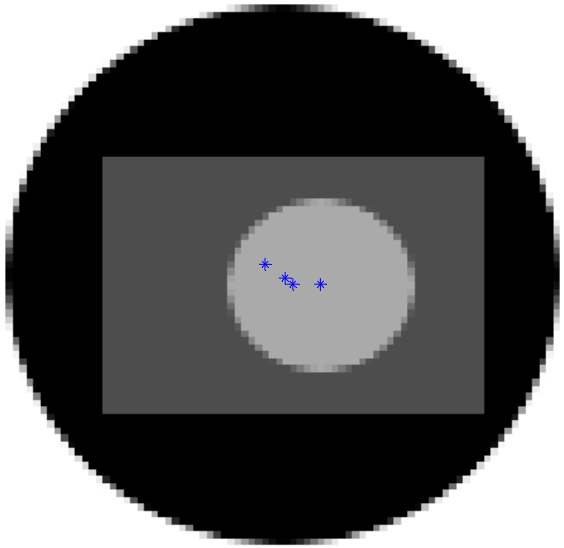
# Finding the Centers

The mean value of the pixels with the same label is the shape's center



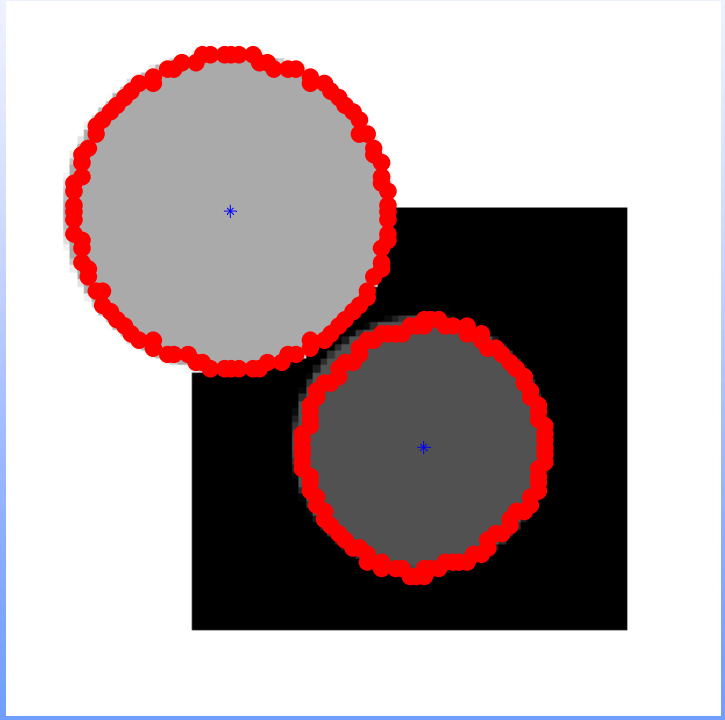
# *Finding the Center – Continue*

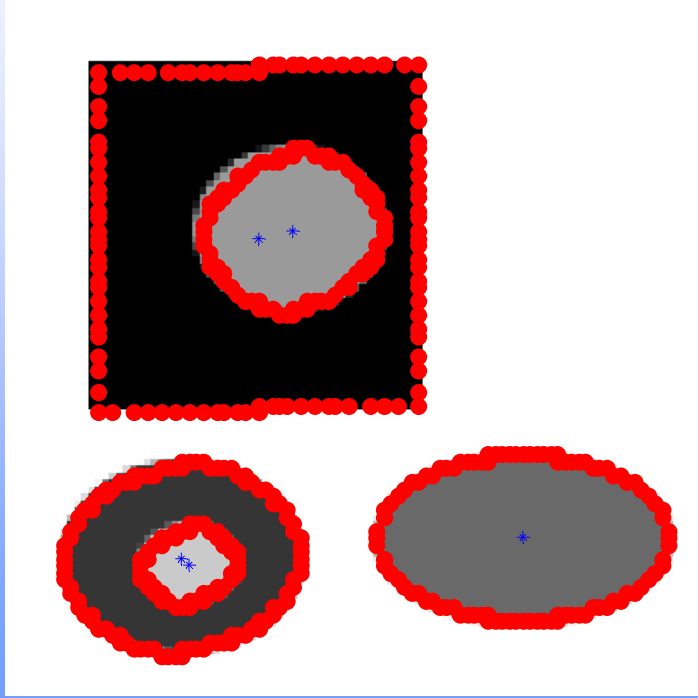
- *In the last picture there are shape on top of the other*
- *I need to consider that in the mean value calculation*



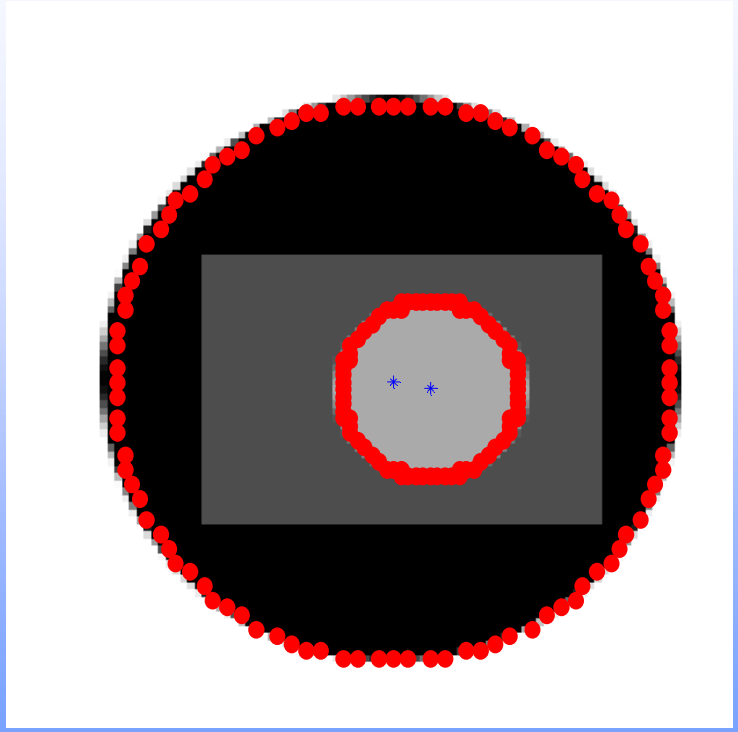
# Finding the Symmetric Shapes

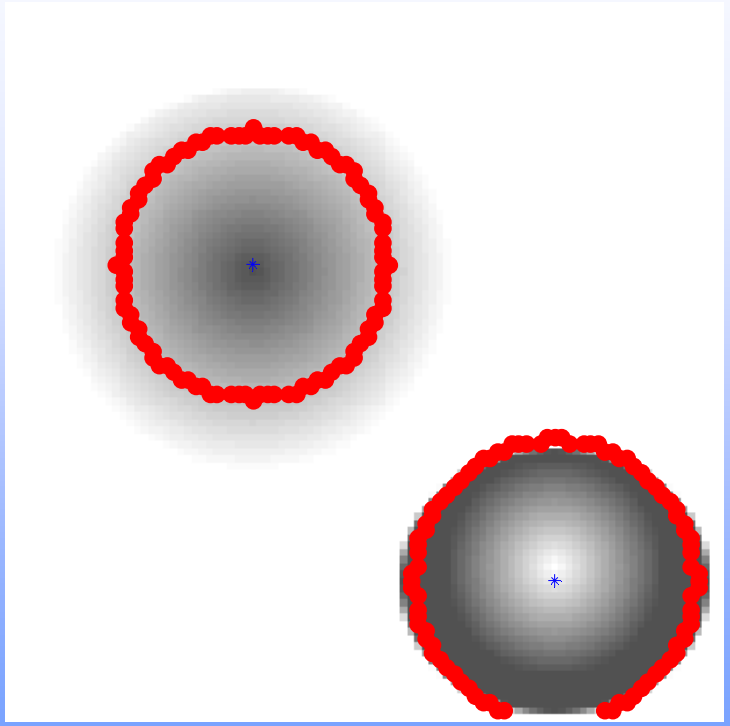
*The results after finding the symmetric shapes*





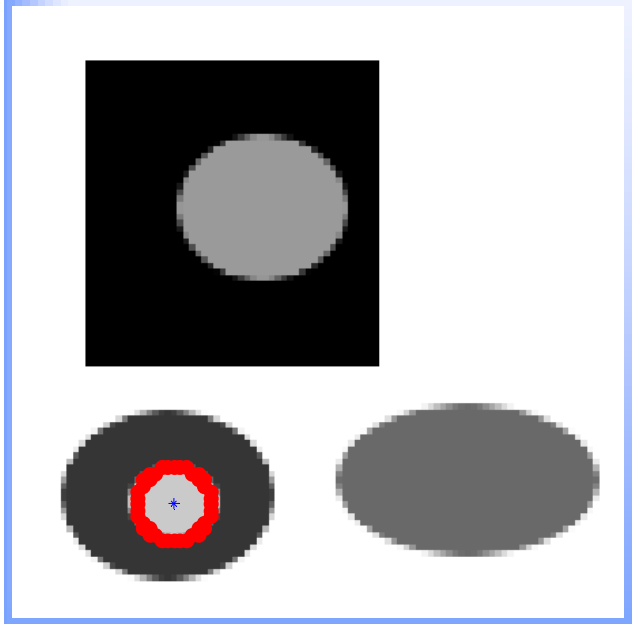
# And for last – the Circles



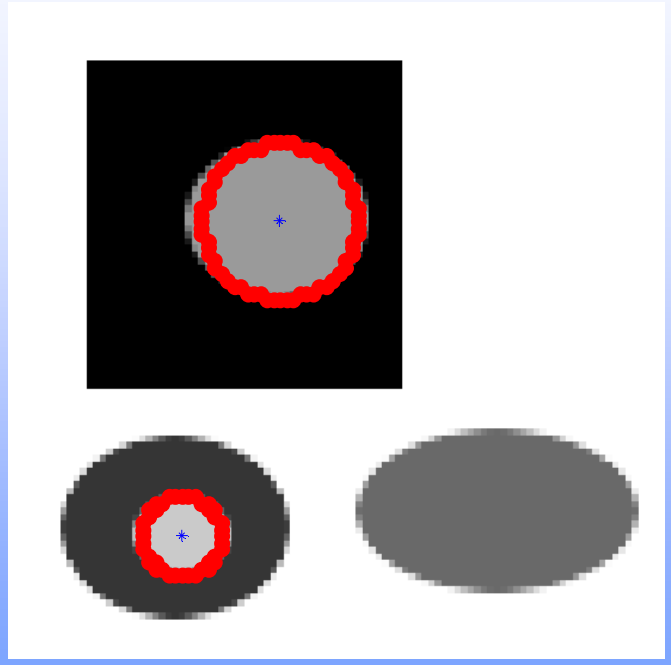


# Circles Vs. Ellipses

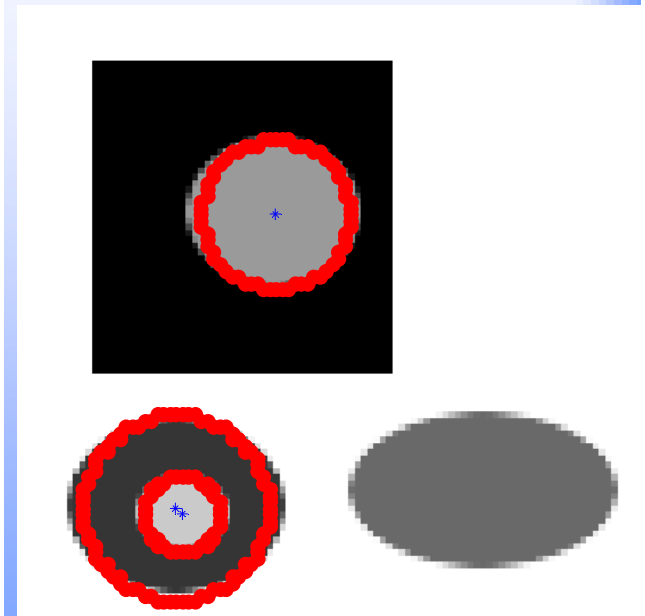
*Tround = 2*



*Tround = 3*



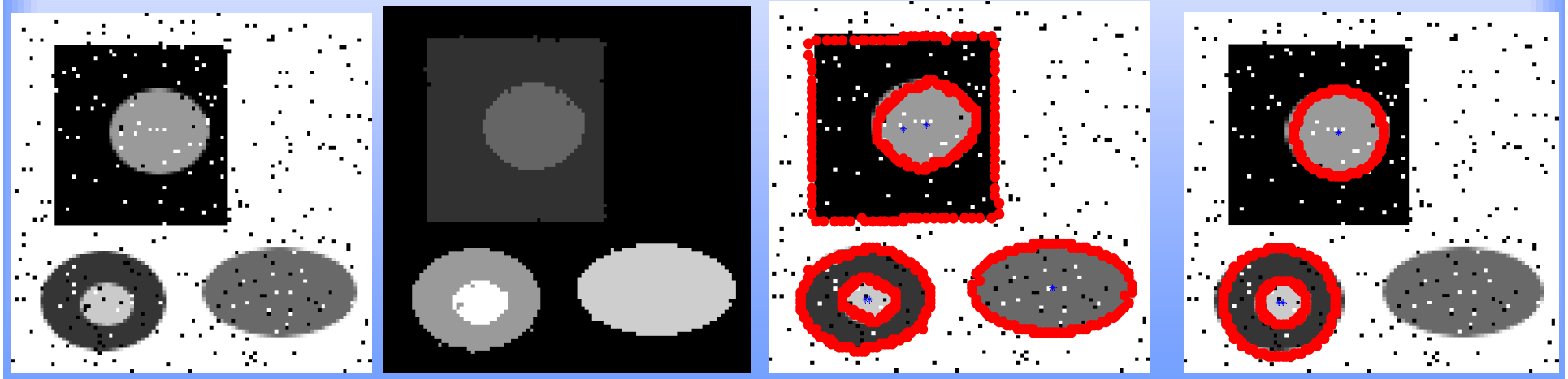
*Tround = 5*



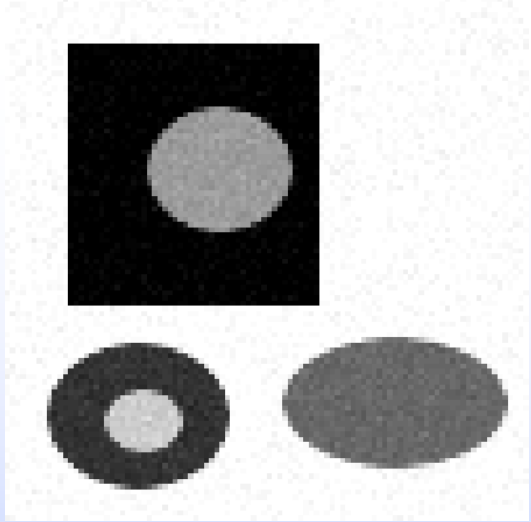
# Noise

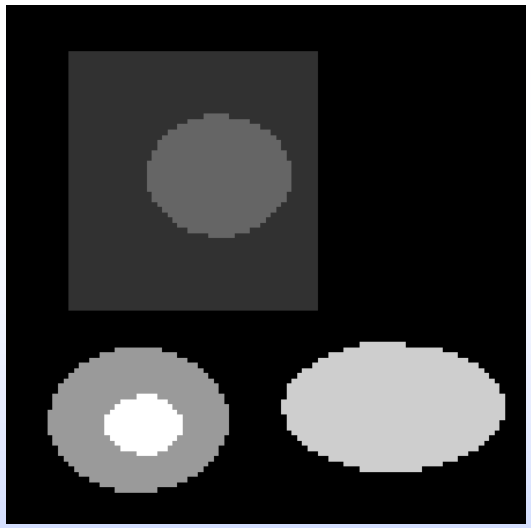
- *Noise is a problem of the clustering algorithm*
- ***After the clustering there is no noise***

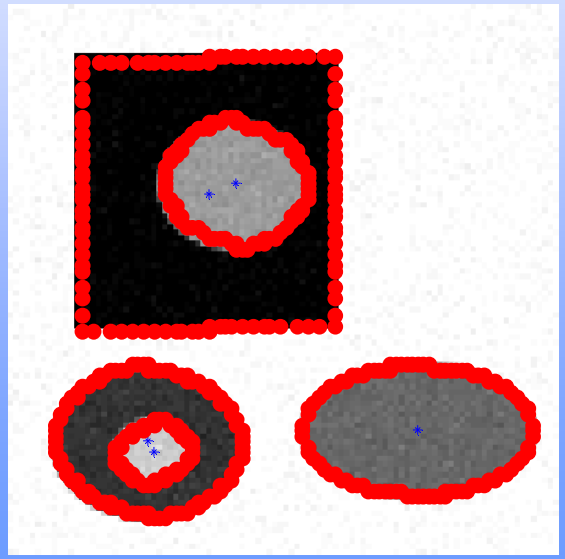
*Original picture* *After clustering* *Symmetric shapes* *circles*

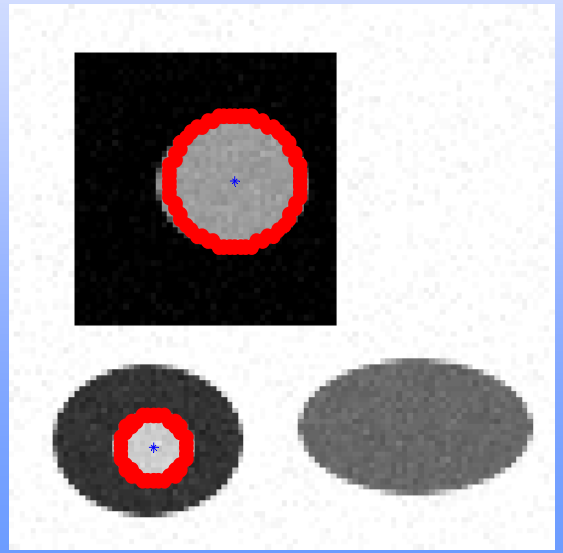


# Noise – Another Example









# Summery

- This algorithm can find circles
- It has one exception: if part of the edge of the circle is hidden.
- On the other hand, it will be a circle only if it is one object, and not several object that look like a circle.

# Advantages & Disadvantages

- Advantages
  - The algorithm can find all king of symmetric shapes
  - The edge is very thin
- Disadvantages
  - Needs the edge to be seen
  - Depending on the clustering, especially with noise