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
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 shapes 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

$T_{round} = 2$

$T_{round} = 3$

$T_{round} = 5$
Noise

- Noise is a problem of the clustering algorithm
- **After the clustering there is no noise**
Noise – Another Example
Summary

• 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 kinds of symmetric shapes
  – The edge is very thin

• Disadvantages
  – Needs the edge to be seen
  – Depending on the clustering, especially with noise