Mathematical Foundations of Computer Graphics & Vision

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Today!

1) Handout, exercise 1;
2) Next week – Handout, exercise 2
3) 14.03.2016 – Grading exercise 1

Reminder!

- 6 homework assignments (70% of the grade in total)
- Oral examination (30% of the grade)

Homeworks:

- Individual work!
- Normally you will have 2 weeks to solve each exercise.
- Programming in Matlab
- 3 minute demo sessions

Reminder!

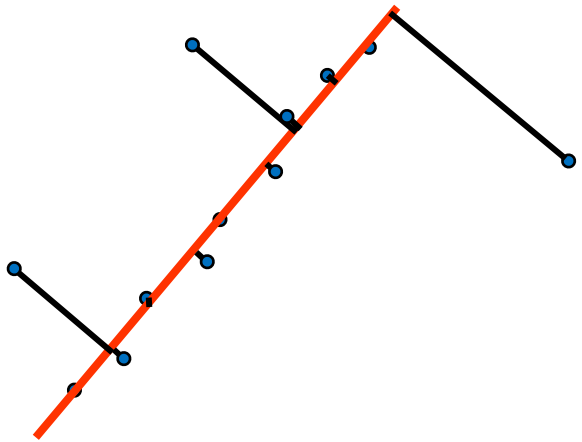
- Approximately 3 minutes to show your code and explain what you did or didn’t do.

- Prepare in advance to present your work. Present each exercise in order. Already have your computer turned on and ready to go on your turn.

- Presentations during the TA session. Random order, random examiner.

Task 1

- RANSAC

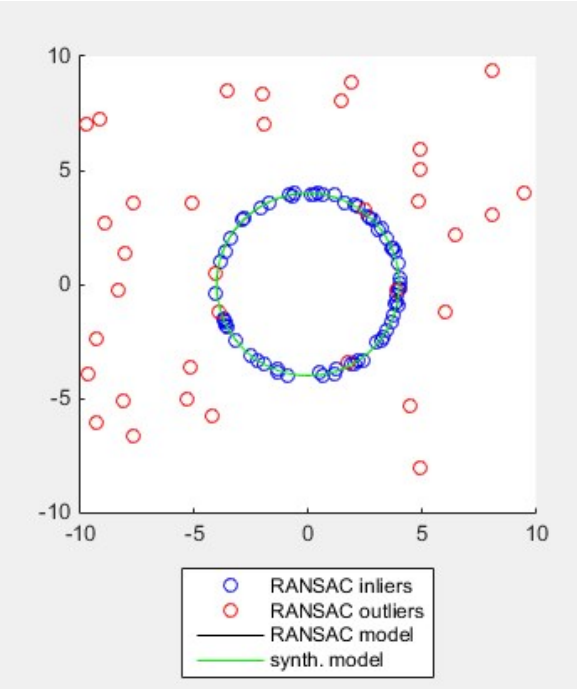


-Select 2 points
-Fit the line
-Compute the distances
-Count the nb of inliers
    -9 out of 13

Task 1

RANSAC to detect best circle fit.

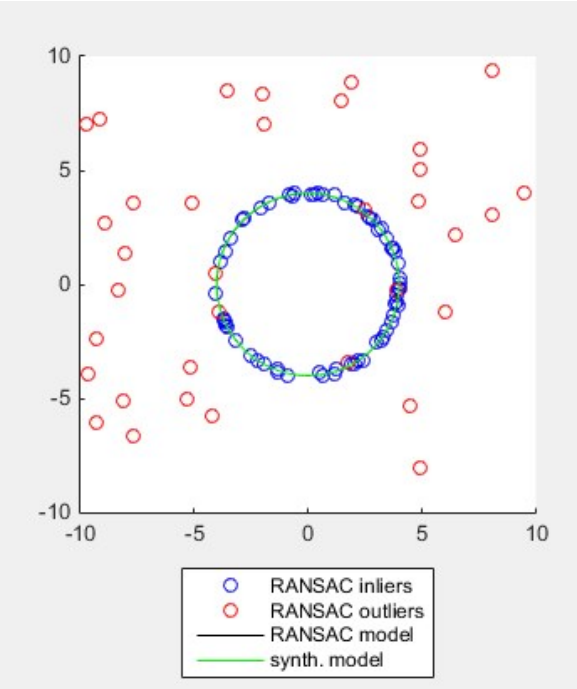
- Familiarize yourself with RANSAC;
- Apply RANSAC to detect inliers/outliers in a data set which can be approximated by a circle;
- Observe the efficiency of RANSAC on data sets of various qualities.



Task 1

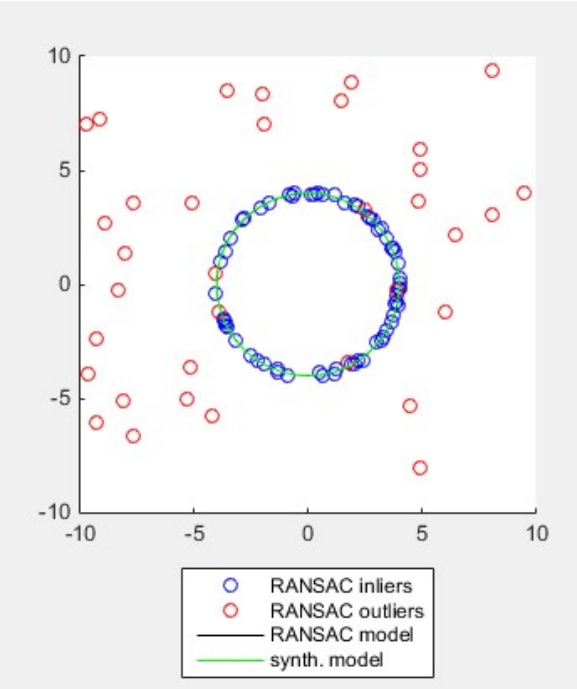
- Input:
  - Data set (N points in 2D)
  - Number of iterations *k*
  - Threshold value *t*

- Output:
  - Parameters *r, c* of the estimated circle
  - Inliers/Outliers



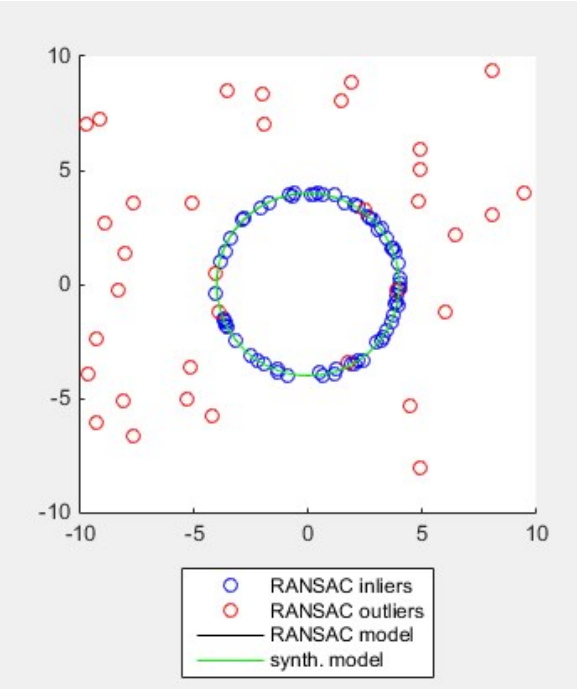
Task 1

- Synthetic data -> Ground truth solution exists!
- Choose *r, c* as you want
- Generate *N*=100 points in the domain [-10,10]x[-10,10]
- Some points are inliers, they are on the circle, but have noise
- Some points are outliers, they are not on the circle at all



Task 1

- Make sure that the synthesized inliers are indeed inliers and the synthesized outliers are indeed outliers and then verify the given outlier ratio *r*
- Total number of points is always N (N=100). So if the ratio of outliers is *r* = 10%, then 10 points are outliers and 90 points are inliers. If *r* = 30%, then 30 outliers and 70 inliers.



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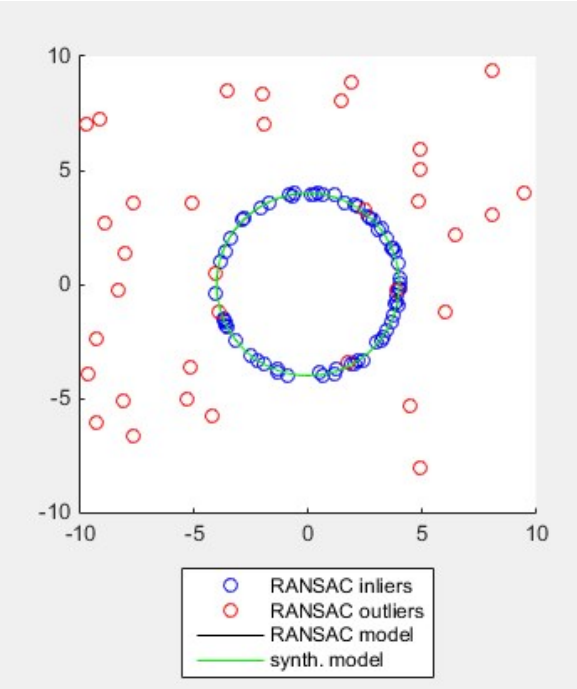
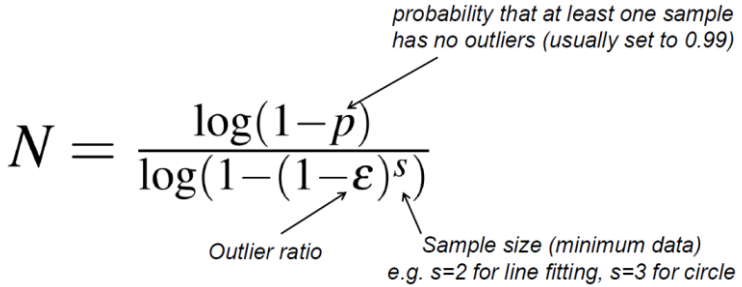


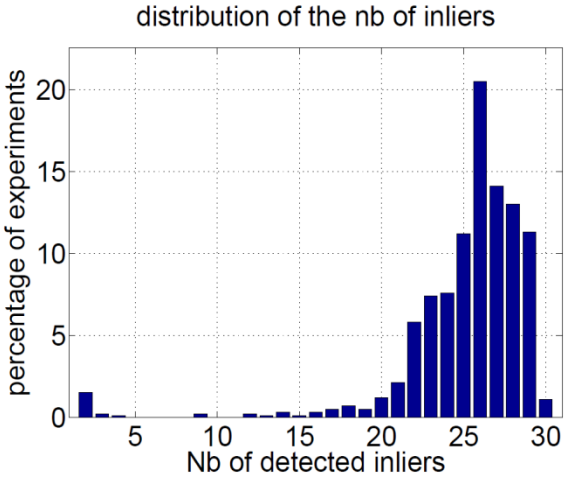
Task 1

- Automatically compute the number of RANSAC iterations



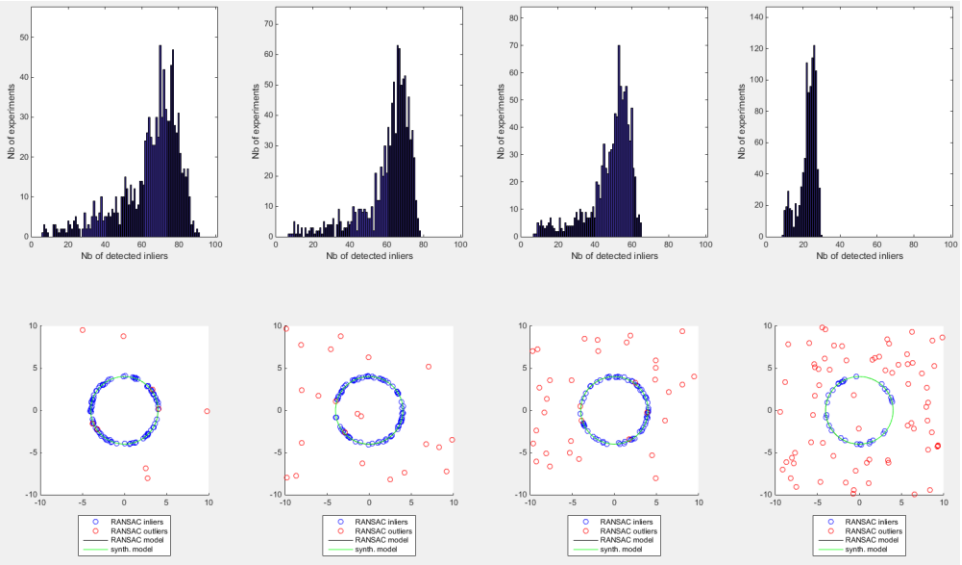
Task 1

- Plot results for data sets with *r*=5,20,30,70% of outliers
- Run RANSAC several times (1000) and plot the distribution of the best number of inliers for each run on a histogram



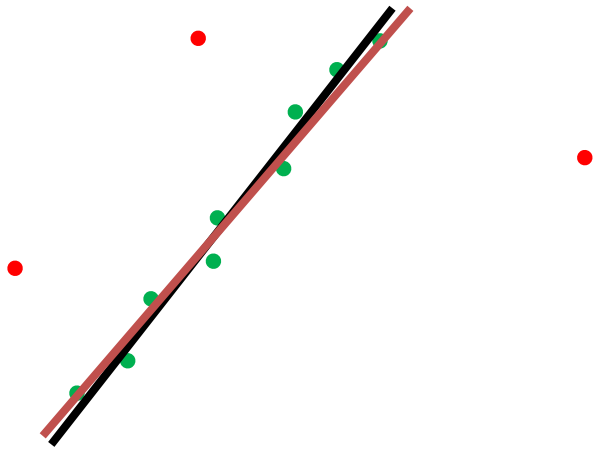
Task 1

- A successful task looks like this:



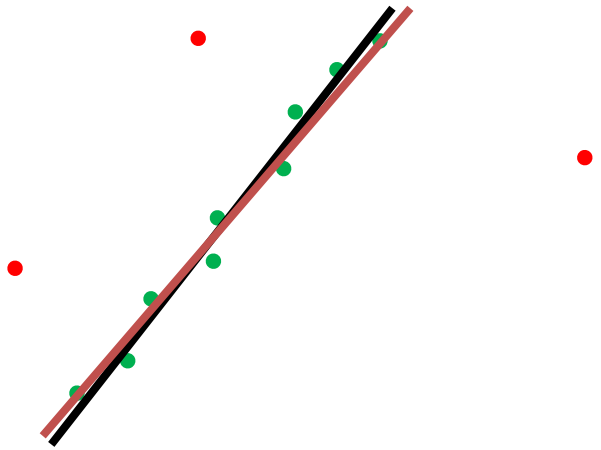
Task 2

- Line fitting



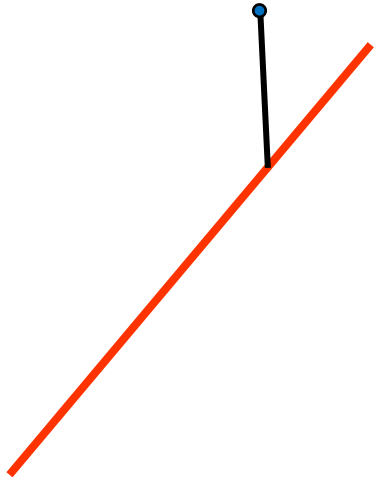
Task 2

- To generate data points on a line, follow a similar strategy to Part1.
- Add noise
- 0% (none) and 10% of outliers



Task 2

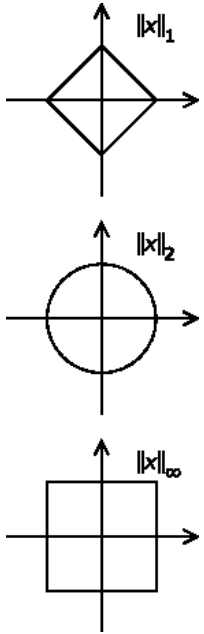
- Vertical cost: p = (px,py)
- d(f,p) = py – f(px)



Task 2

$$|x|_1 = \sum_{i=1}^{n} |x_i|$$

$$|x|_\infty = max_i |x_i|$$



Source - wikipedia

Task 2

- A successful result looks like this (LP with Linf norm, 10% outliers)