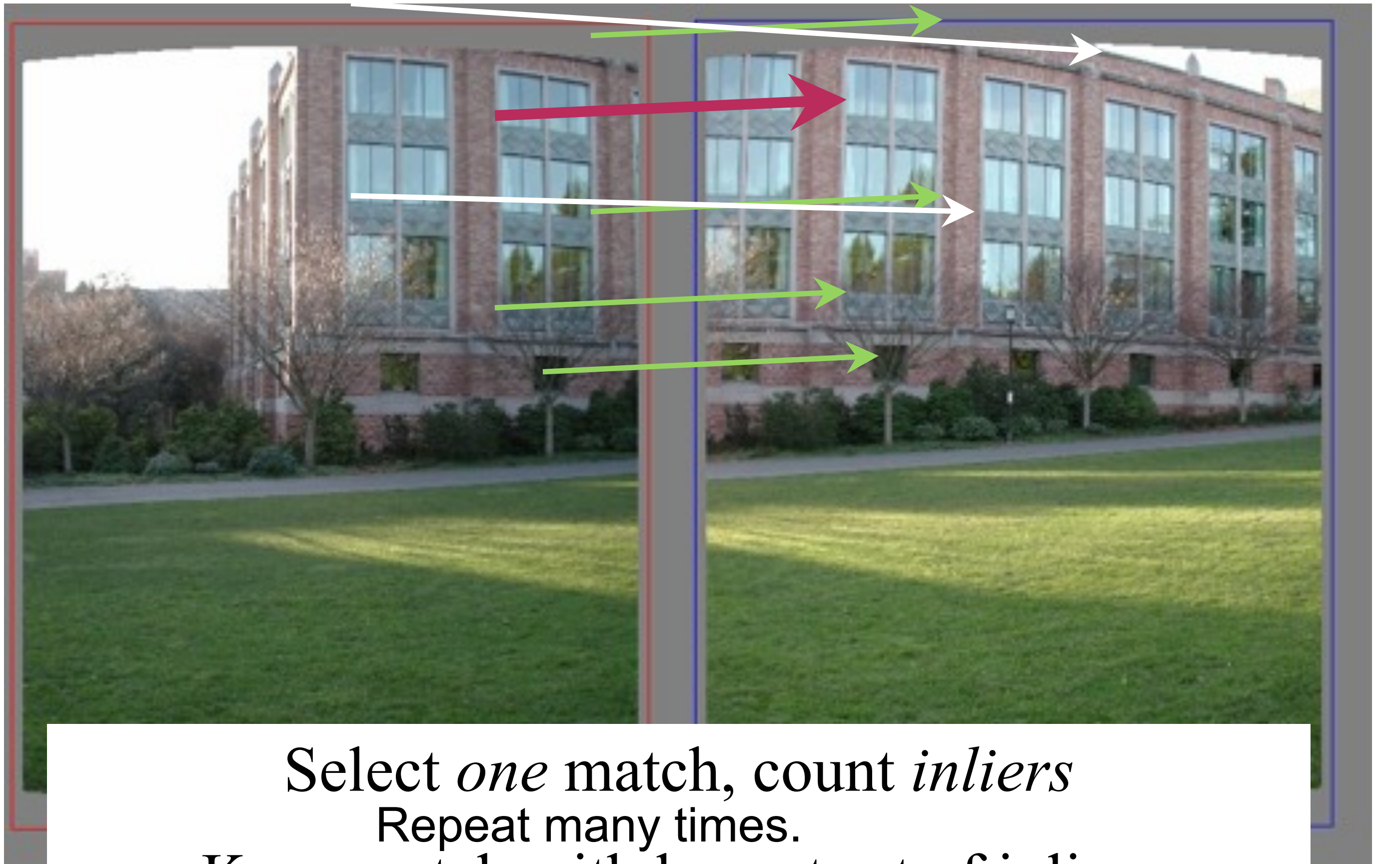
M. A. Fischler, R. C. Bolles. Random Sample Consensus:
A Paradigm for Model Fitting with Applications to Image Analysis
and Automated Cartography. Comm. of the ACM, Vol 24, pp 381-395, 1981.

RANdom SAmple Consensus



Select *one* match, count *inliers*

Repeat many times.

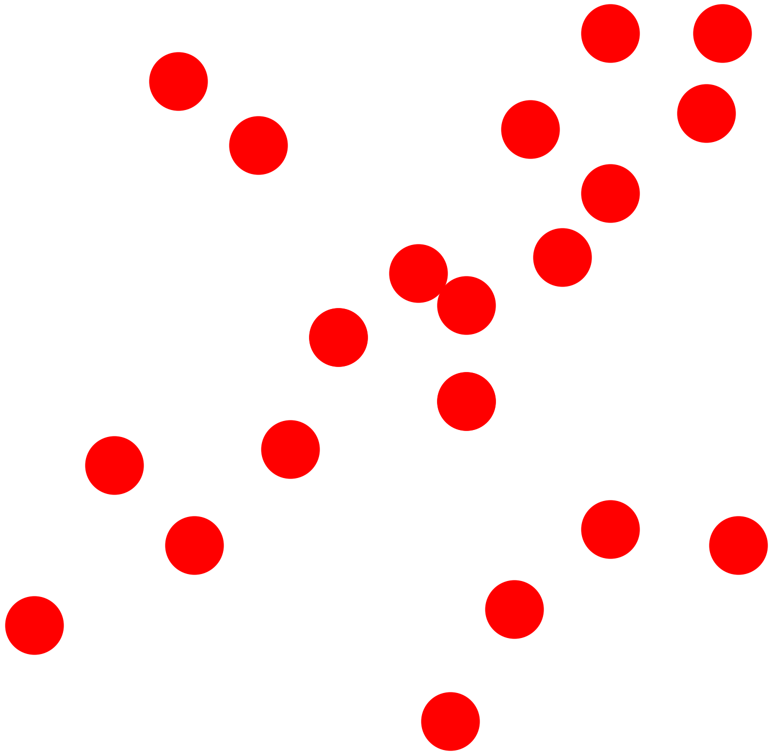
Keep match with largest set of inliers

Basic Philosophy
(voting scheme)

- Elemental subset (minimum number of points) randomly picked up for each hyphotesis.
- The standard deviation of the inlier noise has to be given before by the user!

- Assumption1: Outlier features will not vote consistently for any single model.
- Assumption 2: There are enough features to agree on a good model.

RANSAC



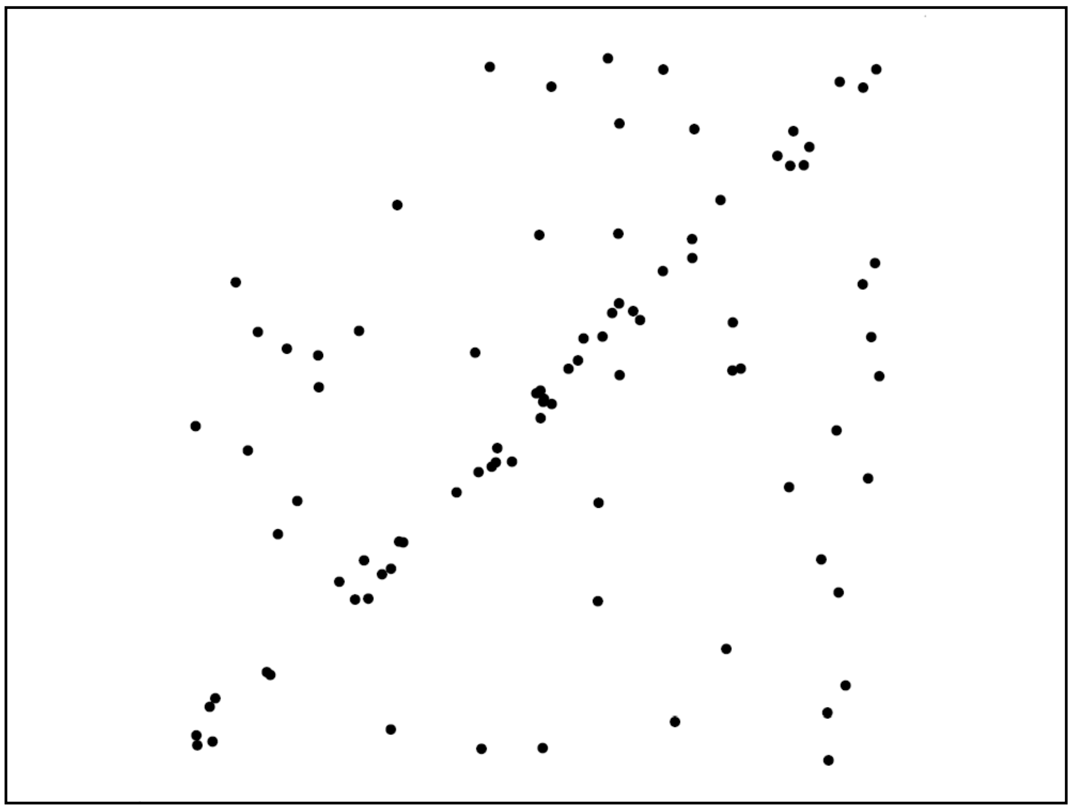
Sample set = set of points in 2D

Algorithm:

1. Select random sample of minimum required size to fit model
2. Compute a putative model from sample set
3. Compute the set of inliers to this model from whole data set

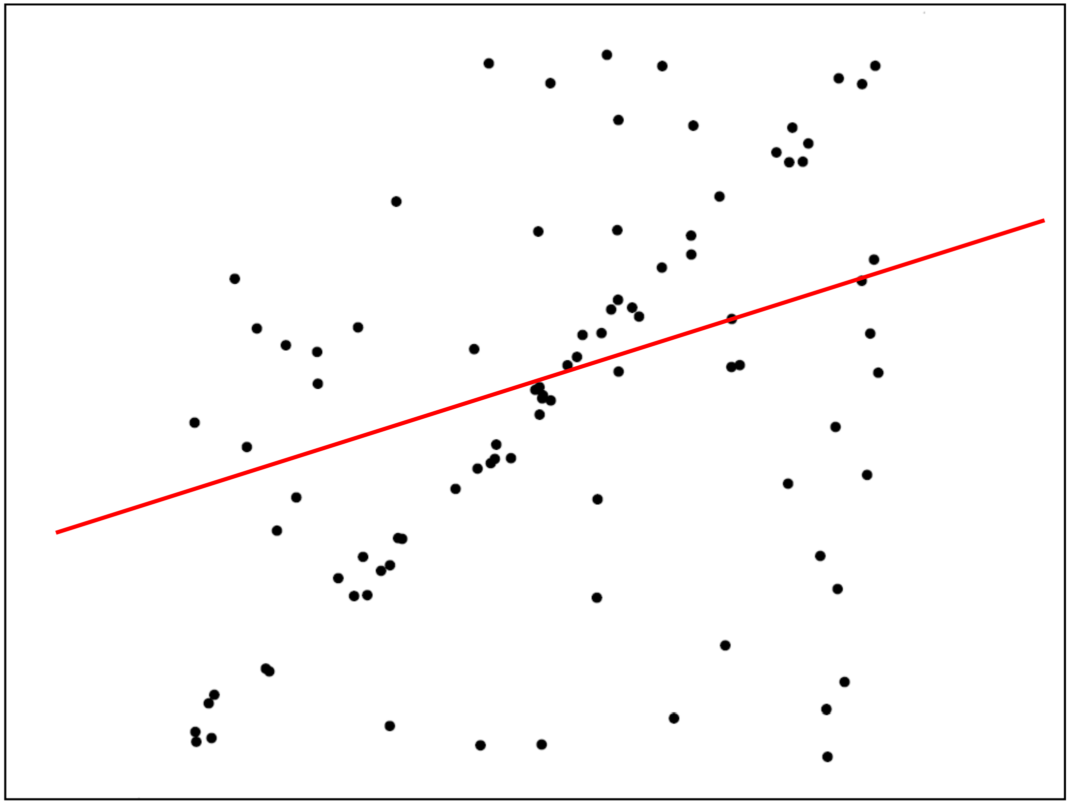
Repeat 1-3 until model with the most inliers over all samples is found

RANSAC for line fitting example



Source: R. Raguram

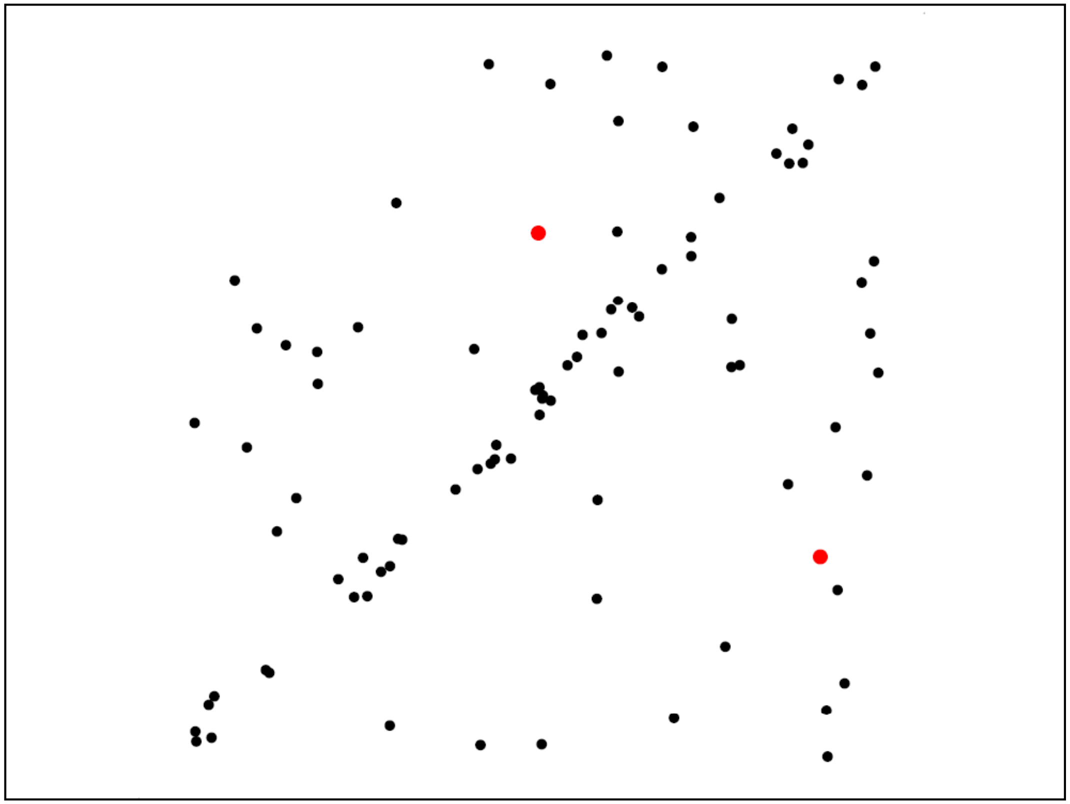
RANSAC for line fitting example



Least-squares fit

Source: R. Raguram

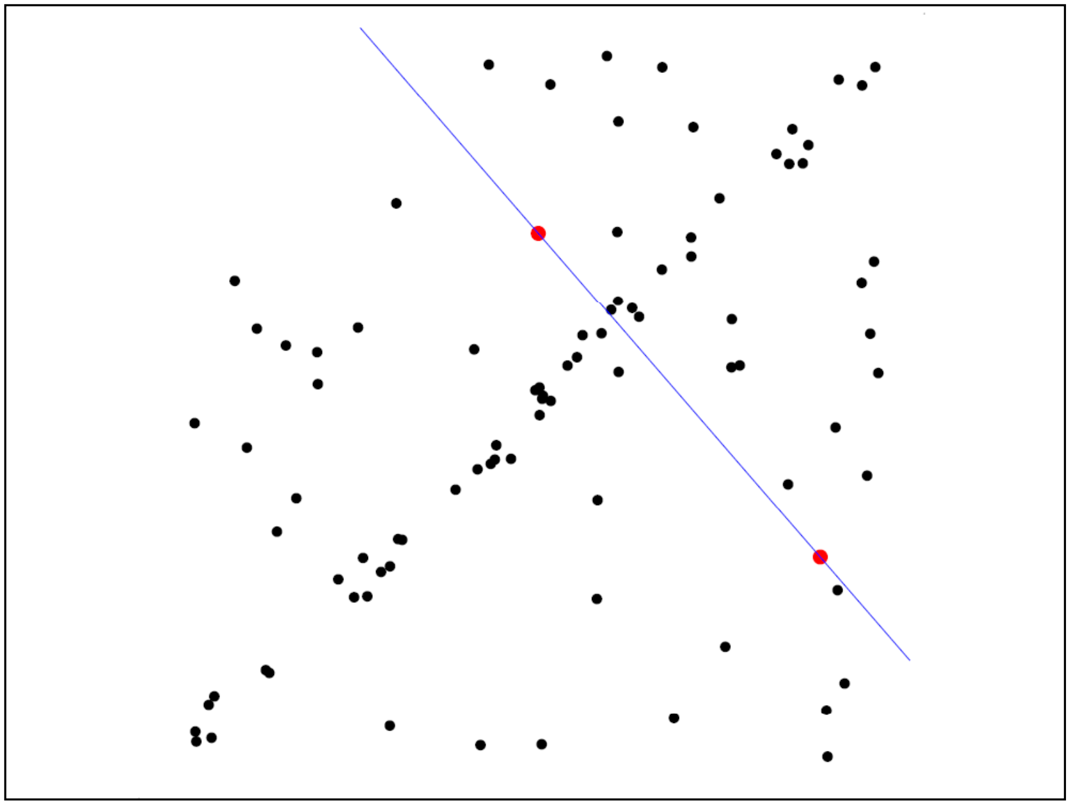
RANSAC for line fitting example



1. Randomly select minimal subset of points

Source: R. Raguram

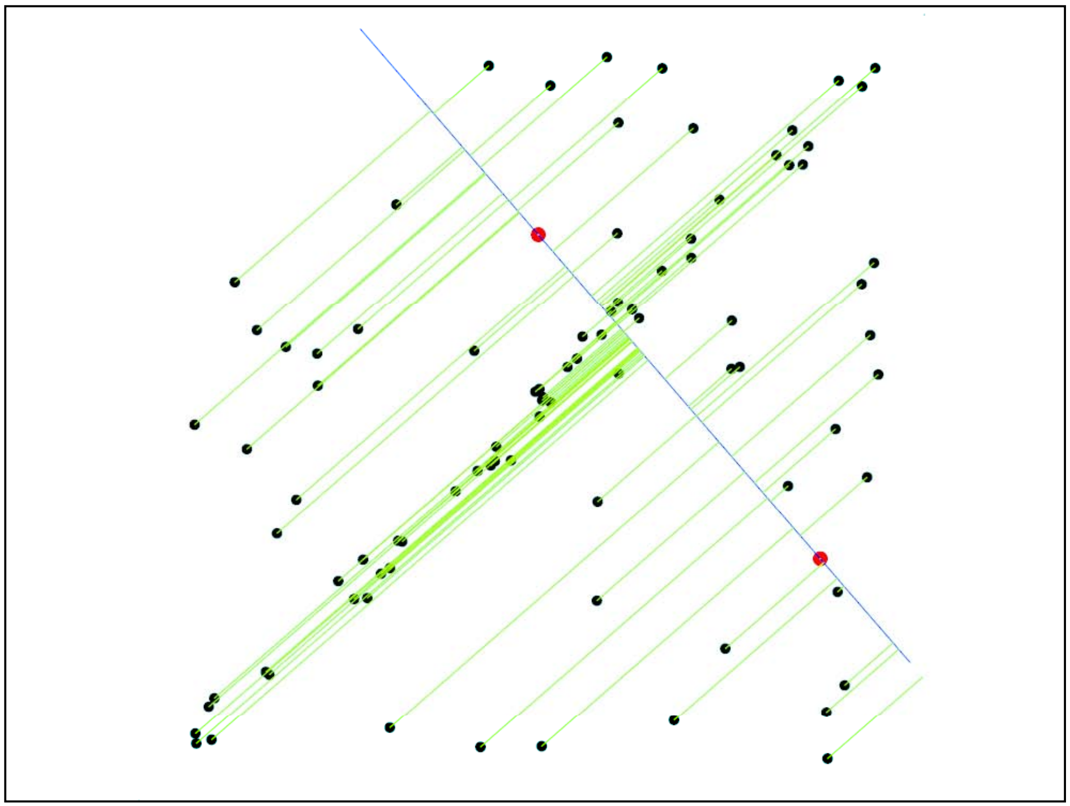
RANSAC for line fitting example



1. Randomly select minimal subset of points
2. Hypothesize a model

Source: R. Raguram

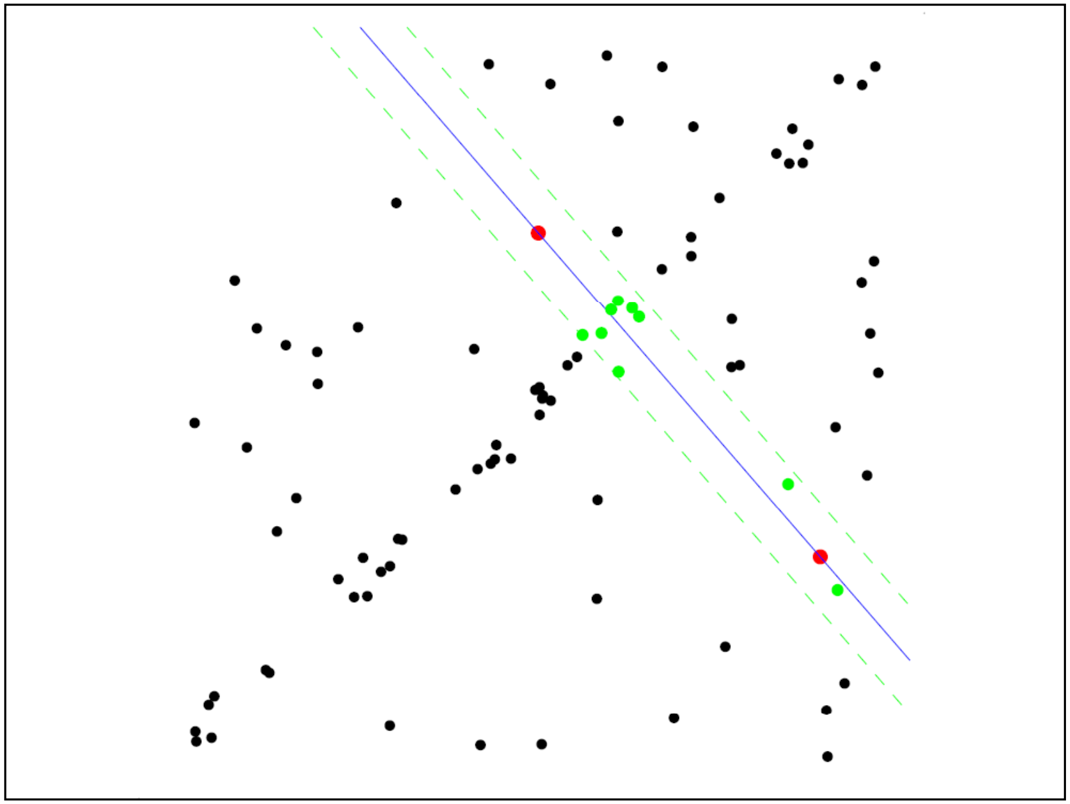
RANSAC for line fitting example



1. Randomly select minimal subset of points
2. Hypothesize a model
3. Compute error function

Source: R. Raguram

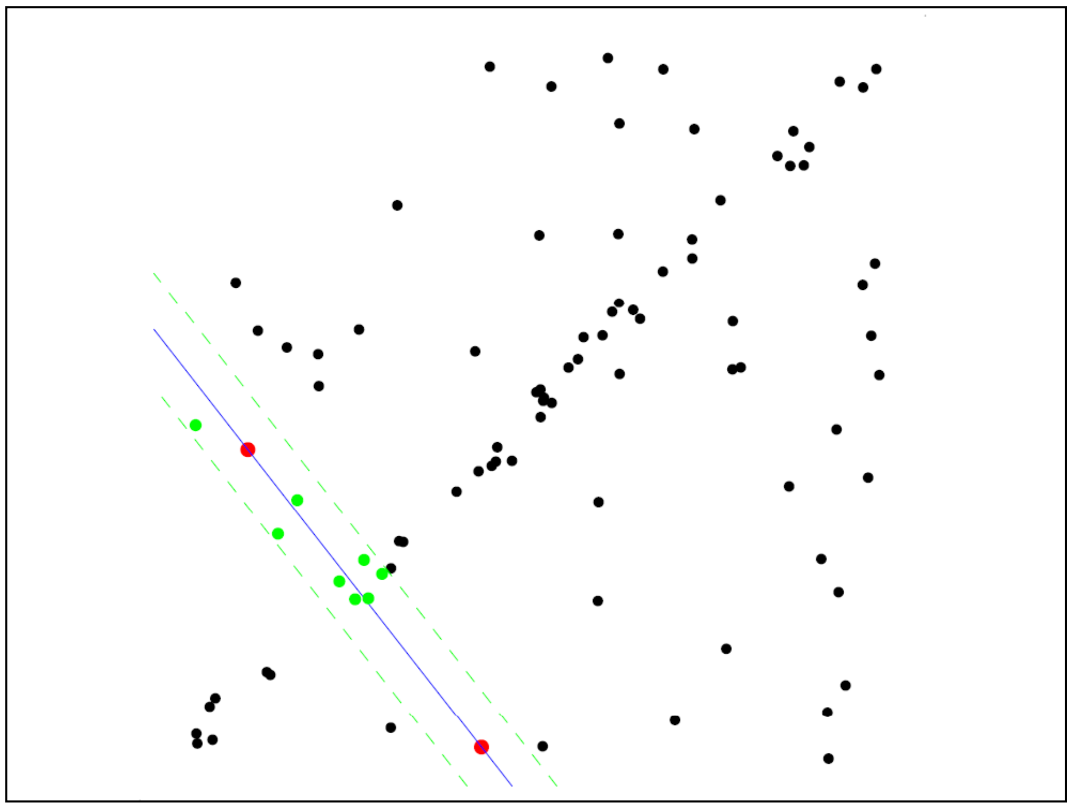
RANSAC for line fitting example



1. Randomly select minimal subset of points
2. Hypothesize a model
3. Compute error function
4. Select points consistent with model

Source: R. Raguram

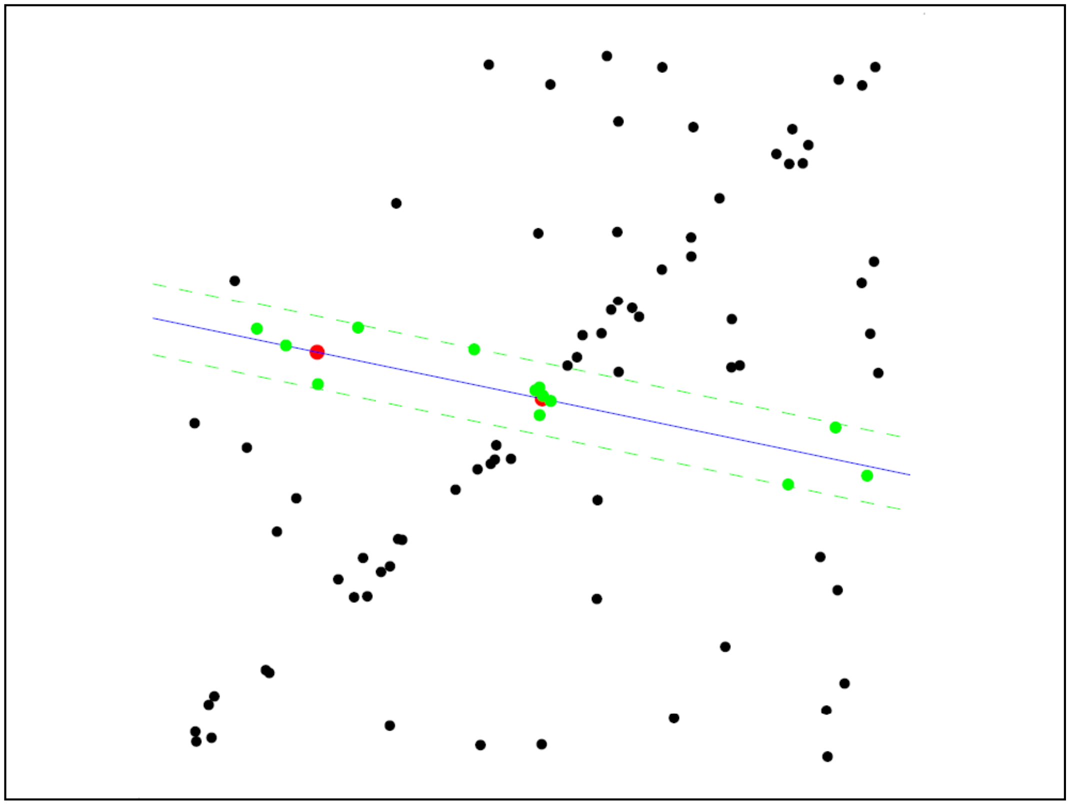
RANSAC for line fitting example



1. Randomly select minimal subset of points
2. Hypothesize a model
3. Compute error function
4. Select points consistent with model
5. Repeat *hypothesize-and-verify* loop

Source: R. Raguram

RANSAC for line fitting example



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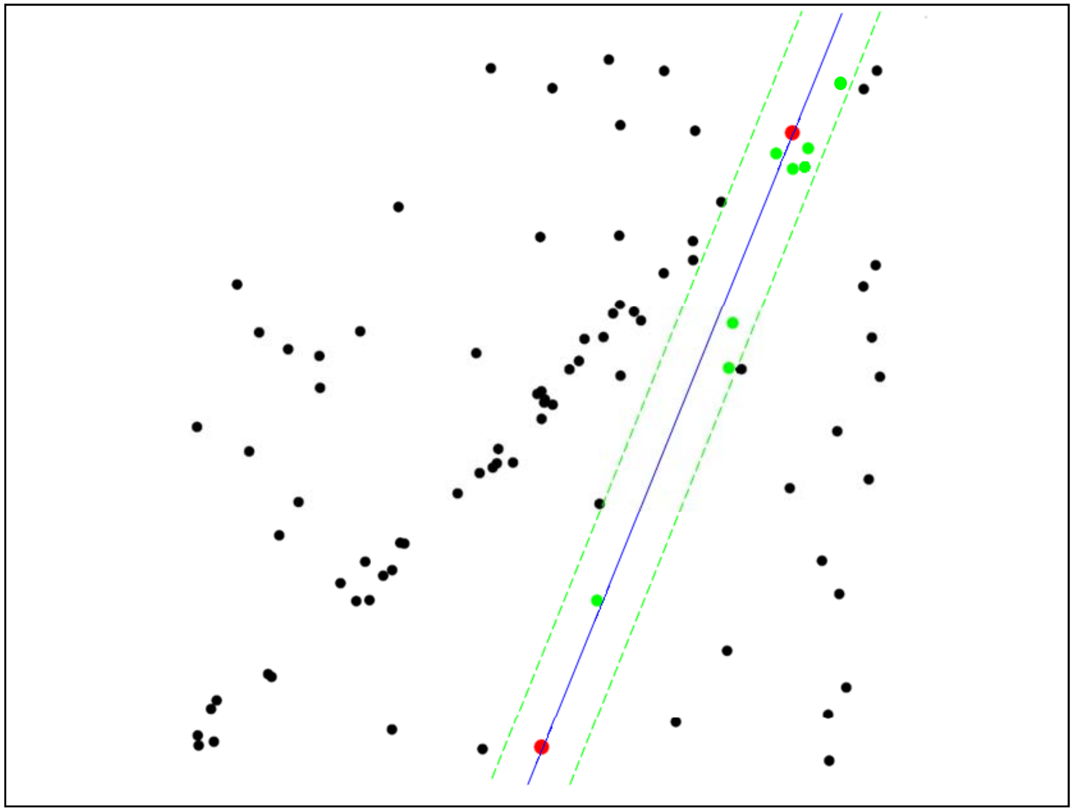
RANSAC for line fitting example



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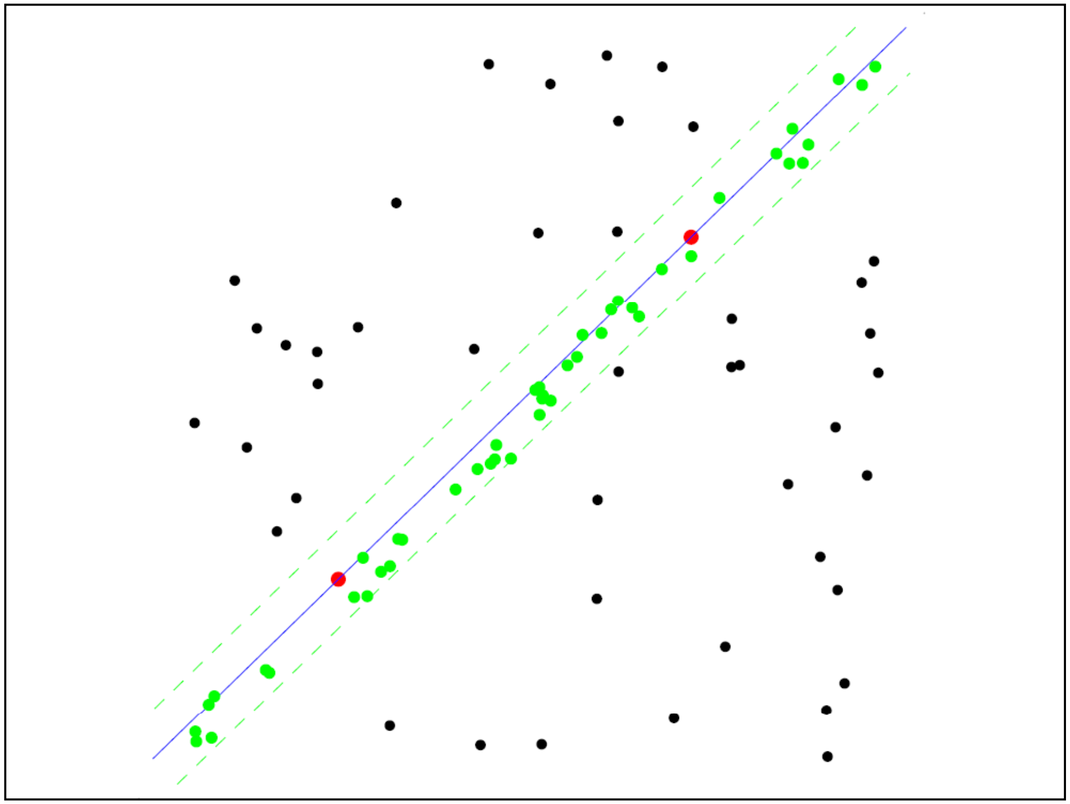
RANSAC for line fitting example

The best inlier structure



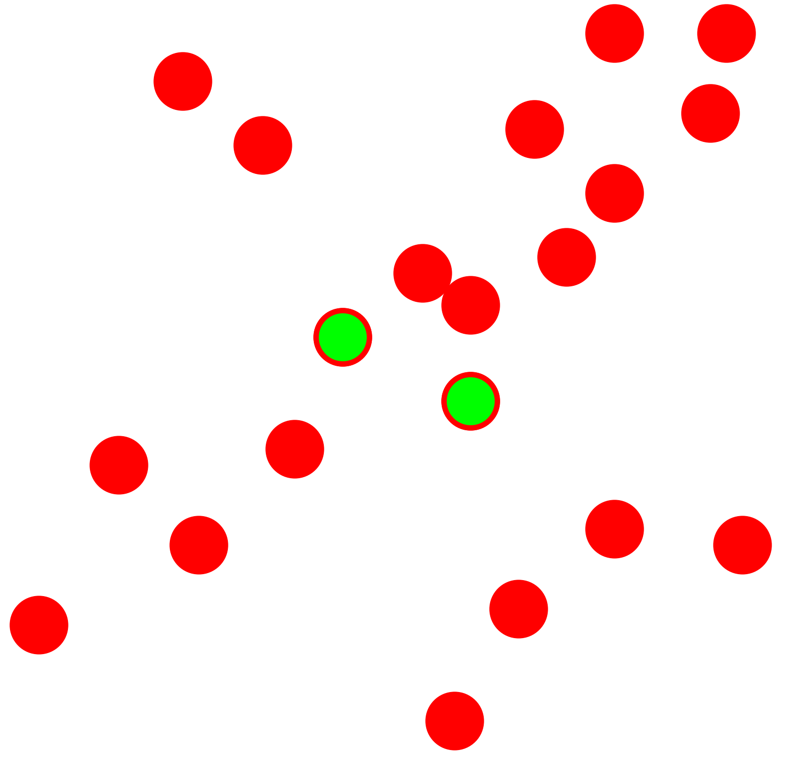
1. Randomly select minimal subset of points
2. Hypothesize a model
3. Compute error function
4. Select points consistent with model
5. Repeat *hypothesize-and-verify* loop

Source: R. Raguram

Do least-square fit on the inliers.

RANSAC

RANdom SAmple Consensus



Sample set = set of points in 2D

Algorithm:

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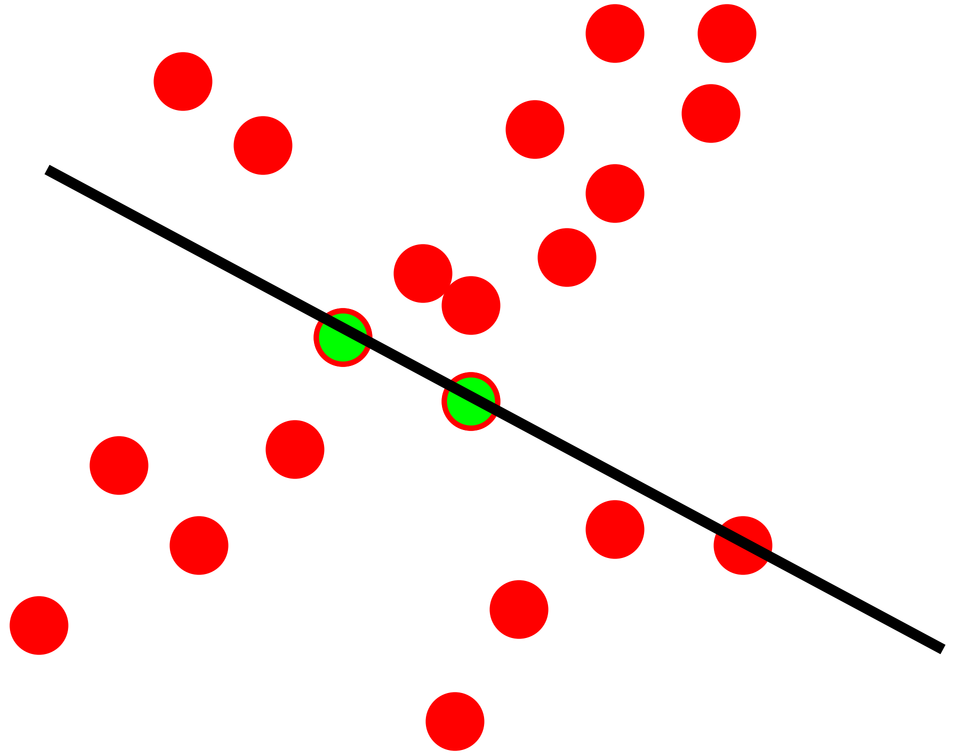
Repeat 1-3 until model with the most inliers over all samples is found

RANSAC



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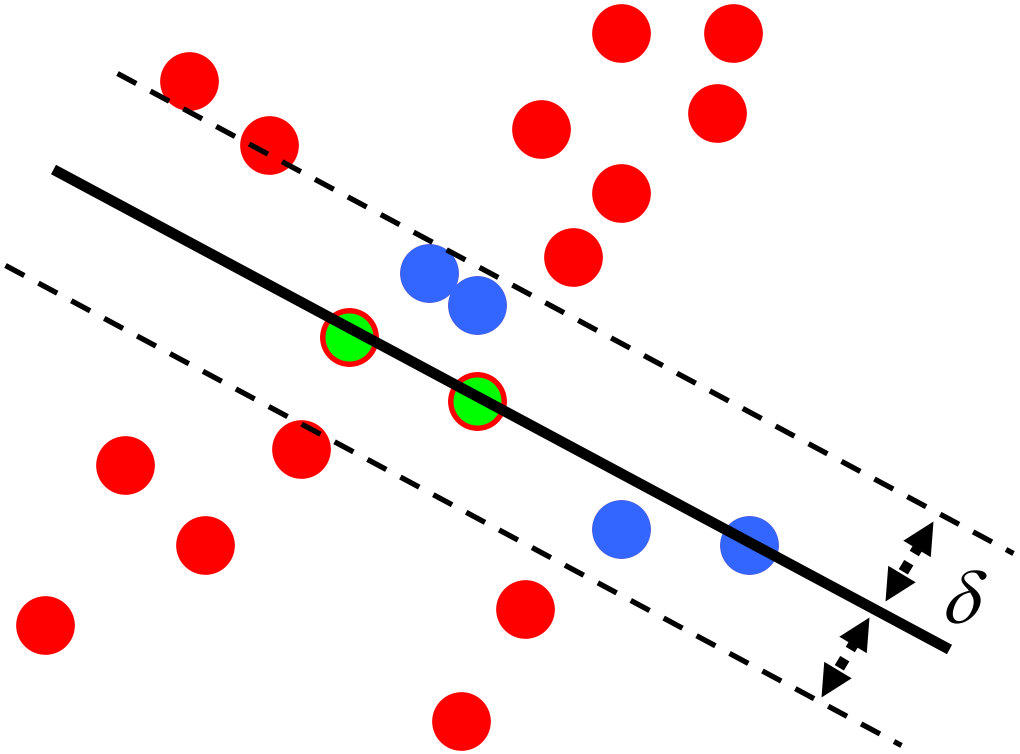
RANSAC



standard deviation of the inlier noise has to be given

Sample set = set of points in 2D

$|\boldsymbol{O}| = 6$

Algorithm:

1. Select random sample of minimum required size to fit model
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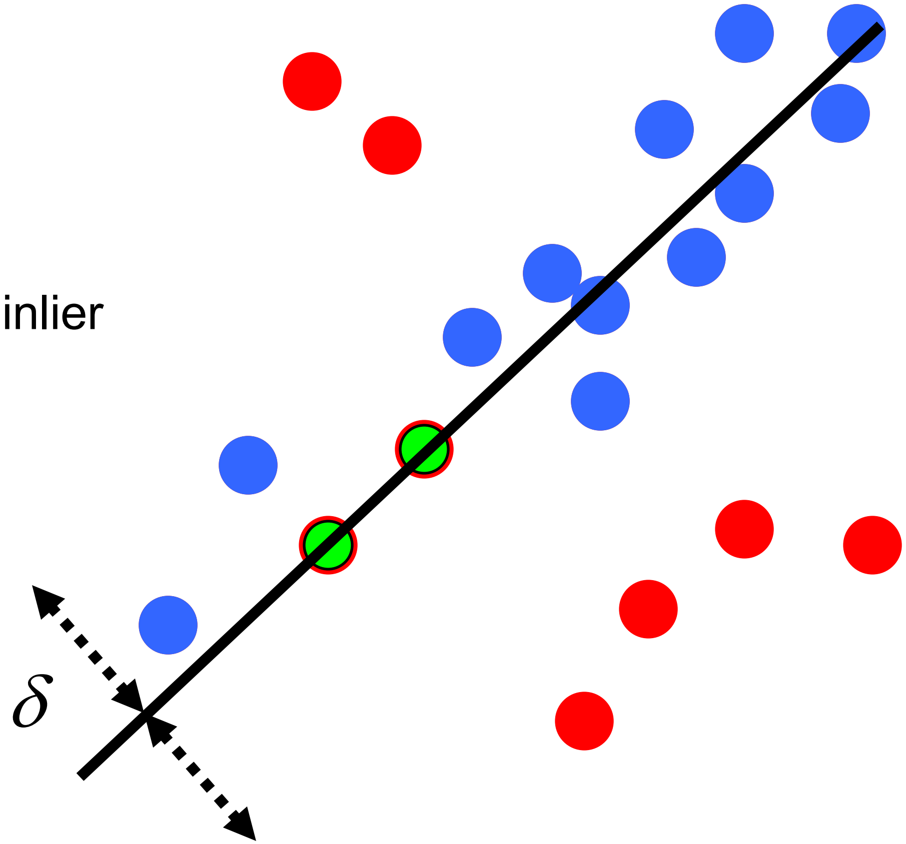
Repeat 1-3 until model with the most inliers over all samples is found

RANSAC

standard deviation of the inlier noise has to be given



$|\boldsymbol{O}| = 14$

Algorithm:

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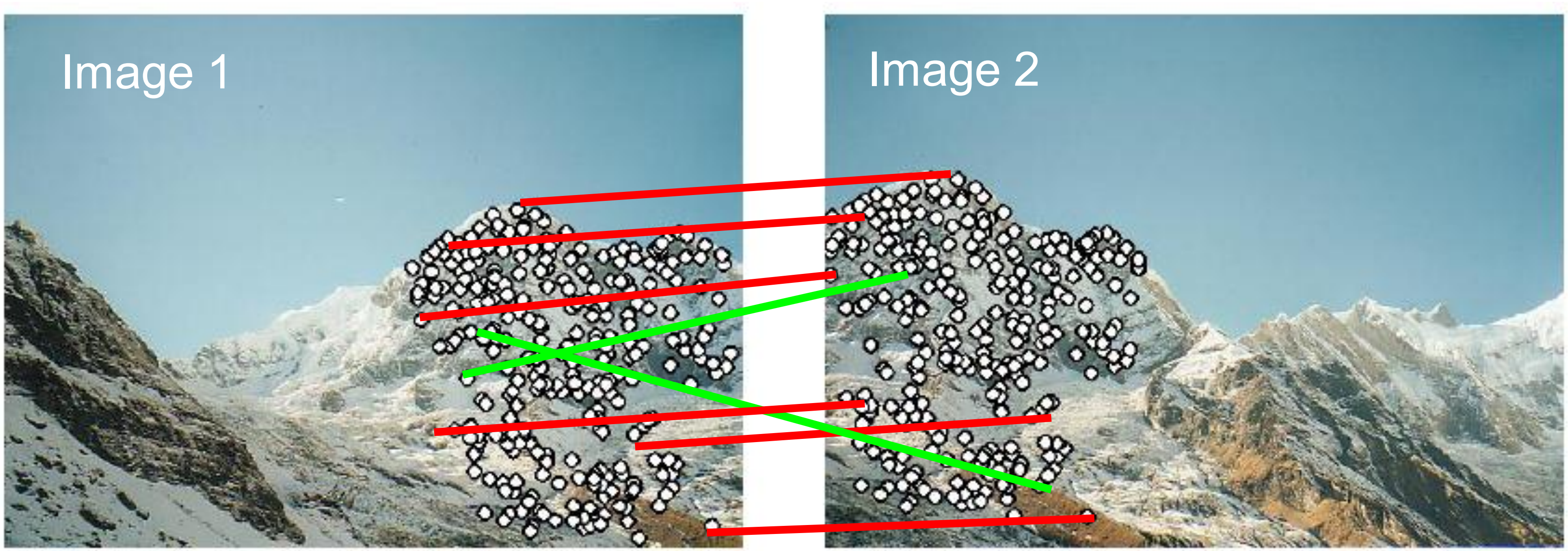
Repeat 1-3 until model with the most inliers over all samples is found

An example:



Matches:
Red: good matches
Green: bad matches

- By RANSAC fit a homography (later...) mapping features from image 1 to 2.
- Bad matches will be labeled as outliers (hence rejected).

Fitting helps matching.

this is a robust fit

RANSAC conclusions

a better robust estimator exist already

Good

- Robust to outliers.
- The number of hyphotesis N is taken sufficiently large (hundreds to thousands) that RANSAC gives very similar results every time.

Bad

- Computational time grows quickly with fraction of outliers and number of parameters.
- Not good for getting multiple inlier structures.

Common applications

- Computing a homography (e.g., image stitching)
- Estimating fundamental matrix (relating two views)