Lab Background: Feature Extractions

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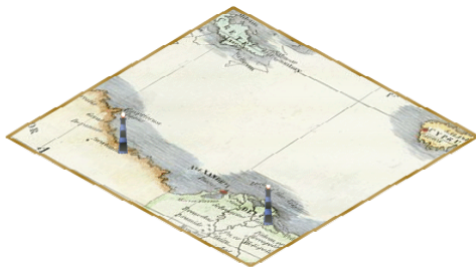
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Landmarks for

- Localization
- SLAM
- Scene analysis

Examples:

- **Lines, corners, clusters**: good for indoors
- **Circles, rocks, plants**: good for outdoor

Feature: Properties

A feature/landmark is a physical object which is:

- static
- perceptible
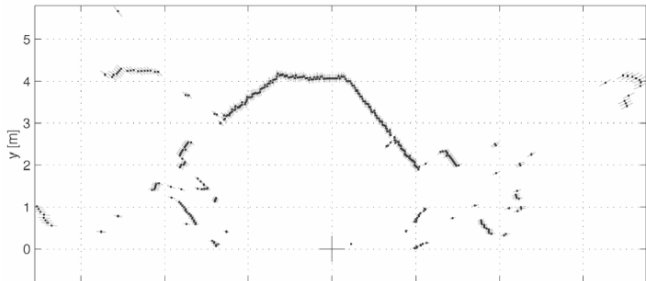- (at least locally) unique

Abstraction from the raw data...

- type (range, image, vibration, etc.)
- amount (sparse or dense)
- origin (different sensors, map)

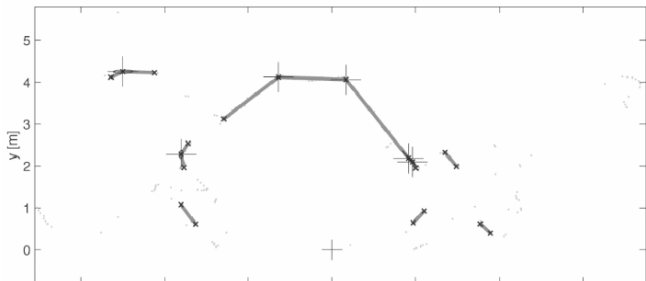**Advantage**: Compact, efficient, accurate, scales well, semantics
Disadvantage: Not general
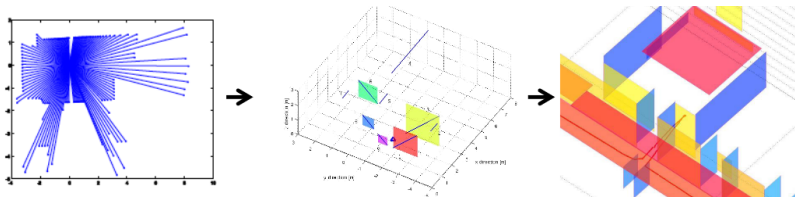
Raw range data

Line segments

Given range data (a bunch of points), how do we extract line segments (or planes) to describe the environment from these points?

- These features (line segments) can be used to build maps or be compared with an existing map.

Line Extraction Problem

From raw data, create features

- Features are much more compact than raw data
- Can reflect physical or abstract objects
- Rich in information
- Can assess accuracy of feature

Three questions that have to be answered:

1. How many lines are there?
2. Which data points belong to which lines?
3. Given which points belong to which lines, how do we estimate line parameters?
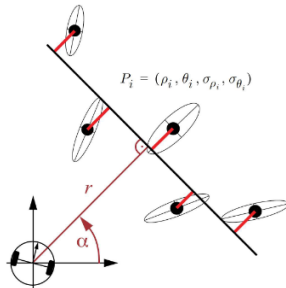
Can be subdivided into two subproblems:

- **Segmentation**: How many lines? Which points contribute?
- **Fitting**: How do the points contribute?

Segmentation

Fitting

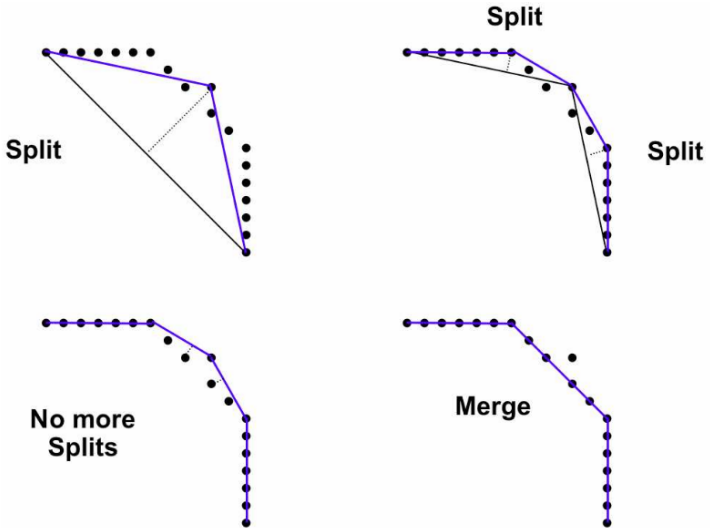$P_i = (\rho_i, \theta_i, \sigma_{\rho_i}, \sigma_{\theta_i})$

r

α
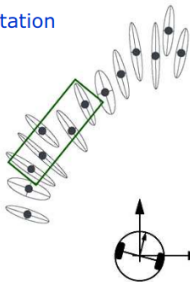
Algorithm:

1 Split

- Obtain the line passing by the two extreme points
- Find the most distant point to the line
- If distance > threshold, split and repeat with the left and right point sets

2 Merge

- If two consecutive segments are close/collinear enough, obtain the common line and find the most distant point
- If distance <= threshold, merge both segments

Picture by J. Tardos

Questions?