

AUTONOMOUS SYSTEMS  
2018/2019

# EKF-SLAM

## With ITER + visual markers

Grupo 4

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# Goal

Estimate simultaneously the trajectory (position+orientation) of a mobile robot and the landmark positions (map);

Evaluate estimation accuracy of both trajectory and landmarks.

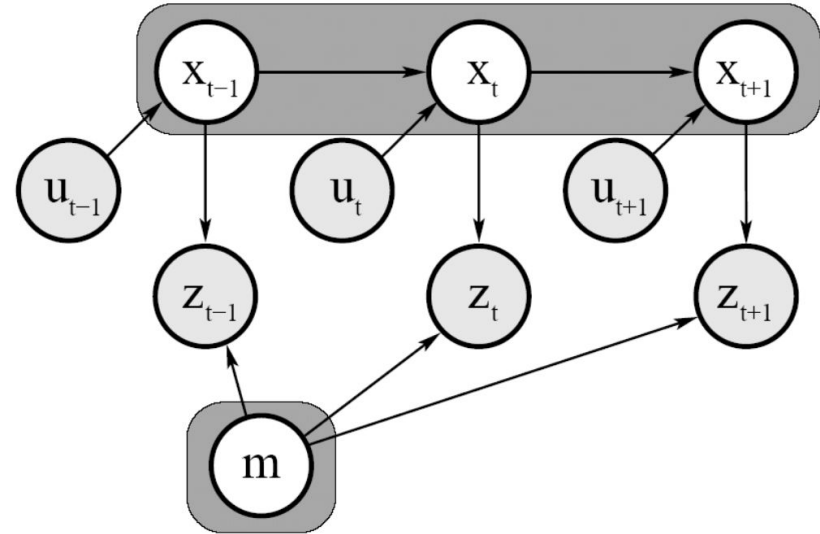
# What is SLAM?

## Input

- Robot's controls ( $u_{1:T}$ )
- Observations of the environment ( $z_{1:T}$ )

## Output

- Map of features ( $m$ )
- Path of the robot ( $x_{0:T}$ )



$$P(x_{0:T}, m \mid z_{1:T}, u_{1:T})$$

# Available methods

EKF-SLAM

FastSLAM

# EKF-SLAM

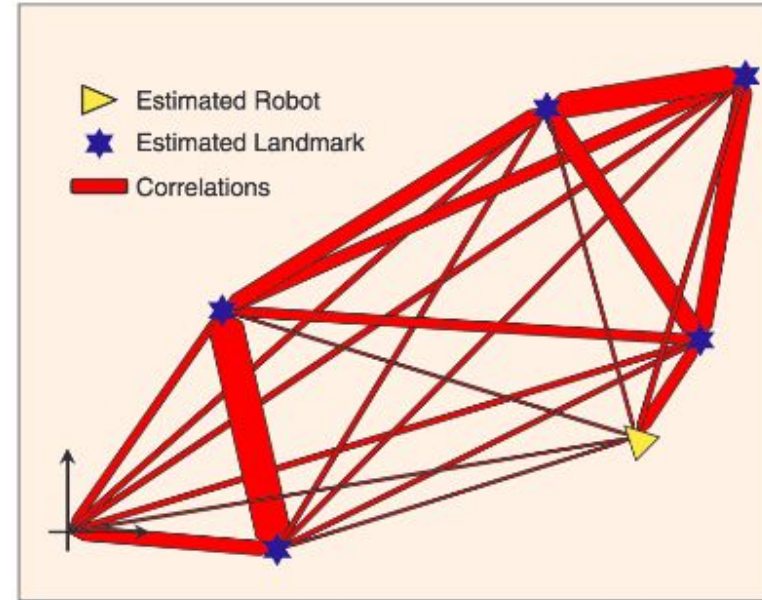
Kalman Filter:

Assumes a linear system

Quadratic on the number of landmarks:  $O(n^2)$

Extended Kalman Filter:

Allows non-linear systems by linearizing them

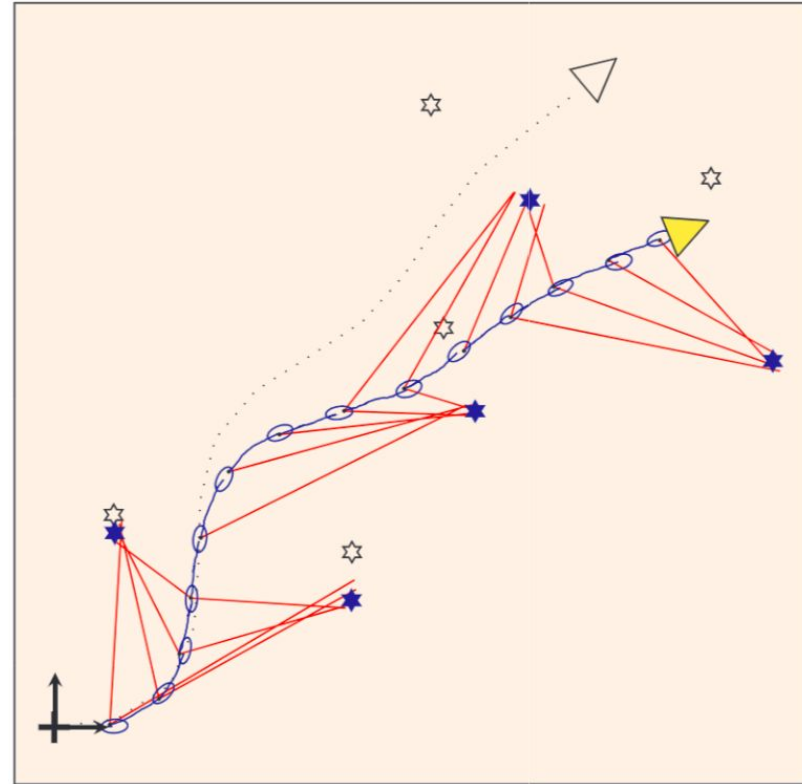


# FastSLAM

Allows non-linear systems.

Each observed landmark is processed individually as an EKF measurement update from a known pose.

Each particle has its own map estimate



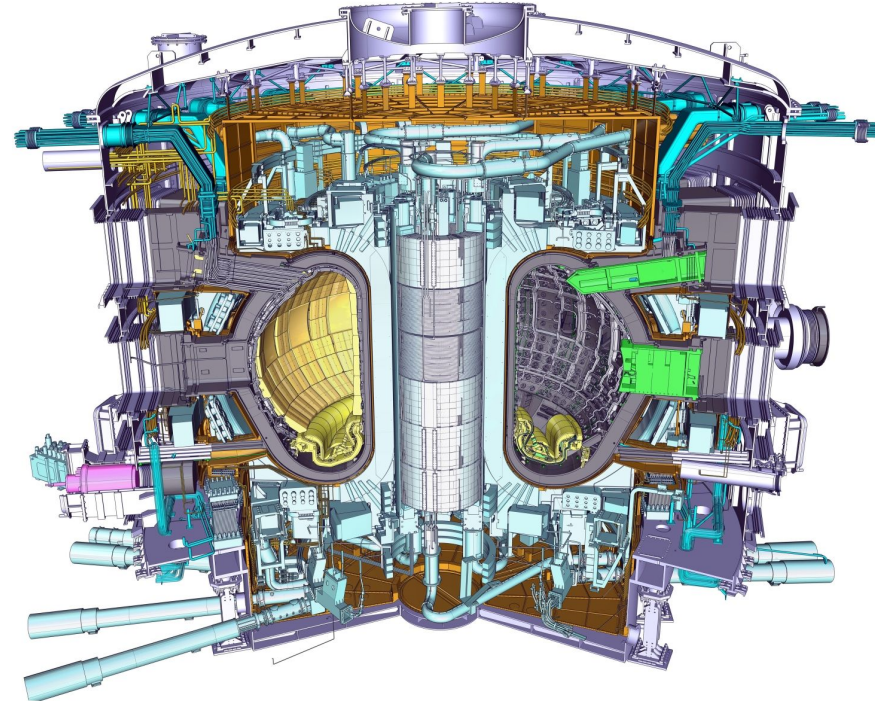
# Plan

16-21 Oct	Understand the robot and its sensors. Make a simple program to control it.
22-28 Oct	Make the robot identify landmarks.
29-4 Nov	Implement EKF-SLAM. (using simulator)
5-11 Nov	Implement EKF-SLAM. (using simulator)
12-18 Nov	Test the algorithm. Evaluate trajectory.
19-25 Nov	Evaluate landmarks, their setting and define how many to use.
26-2 Dec	Final tests. Understand restrictions of the method. Focus on report.
3-9 Dec	Poster + Report final touches (Deadline 9 Dec)

# ITER vehicle

international thermonuclear experimental  
reactor

the world's largest fusion experiment





# Questions

- What are the landmarks (artificial/natural)? Where? How many?
- What sensors are we using?
- How to make the right data associations? (Landmark matching)
- Passive (using a definitive path) or Active SLAM?

