

Lab 9

*School of Architecture, Civil and
Environmental Engineering*

EPFL, WS 2022-2023

https://disal.epfl.ch/teaching/signals_instruments_systems/

Outline

- Contents
 - Odometry with non-deterministic uncertainties
 - Feature based navigation
 - Sensor Fusion
- Tools
 - Webots
 - C compiler
 - MATLAB

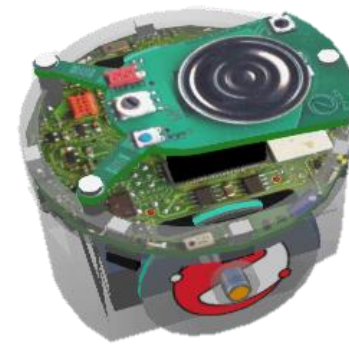
Getting Started

- Installation
 - Go to moodle and download:
Lab09 (.zip) and the assignment
- Starting with Webots
 - Launch Webots
 - Open World file for lab9
 - Clean + Build robot controller

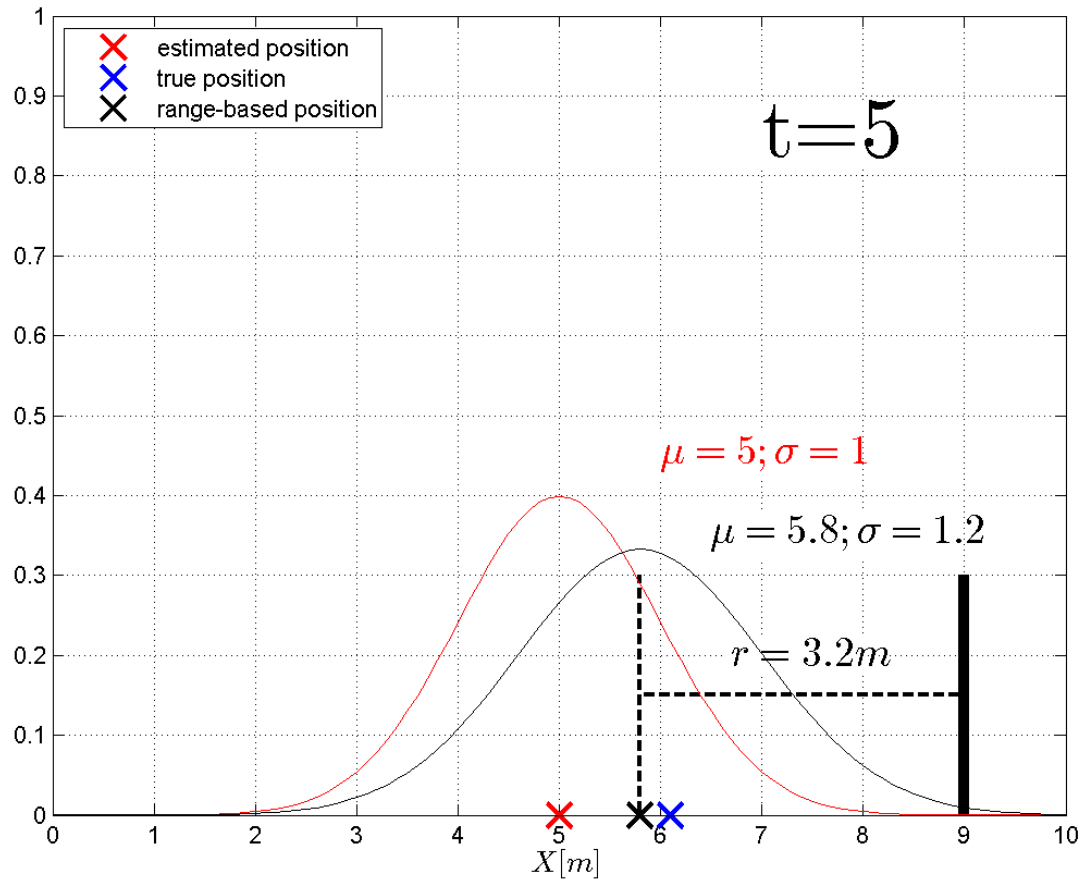
Robot Pose

- In 2D : Ground Robot
 - Needs 3 variables
(e.g. 2 positions + heading)

$$p_{2D} = [x, y, \theta]^T$$



Feature based navigation



Algorithm **Kalman_filter**(μ_{t-1} , Σ_{t-1} , u_p , z_t)

1. **Prediction:**

$$2. \quad \bar{\mu}_t = A_t \mu_{t-1} + B_t u_t$$

$$3. \quad \bar{\Sigma}_t = A_t \Sigma_{t-1} A_t^T + R_t$$

4. **Correction or update:**

$$5. \quad K_t = \bar{\Sigma}_t C_t^T (C_t \bar{\Sigma}_t C_t^T + Q_t)^{-1}$$

$$6. \quad \mu_t = \bar{\mu}_t + K_t (z_t - C_t \bar{\mu}_t)$$

$$7. \quad \Sigma_t = (I - K_t C_t) \bar{\Sigma}_t$$

8. **Return** μ_p , Σ_t

Feedback for Lab 9

Please help us improve the labs by giving us feedback.

Thank you and enjoy the lab!