Mobile Robot Systems Mini Project 5

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Lent 2020

Project Outline

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- LIDAR based localisation (ex1)

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- Improve with range and bearing of other robots (sjs252)

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- Decentralised approach to world coverage (pd452)

Localisation

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- Particle filter

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- LIDAR

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- LIDAR
- Range & bearing

LIDAR

$$w_i = \prod_{s_j \in \text{Sensors}} \Phi(R(i,j), s_{ij}, \sigma^2)$$

- w_i = LIDAR weight of particle i
- s_{ij} = distance recorded by sensor j on the robot
- $\Phi(x, \mu, \sigma)$ = Gaussian PDF with mean μ and standard deviation σ
- $R(i,j)$ = ray traced distance from particle i in the direction of sensor j

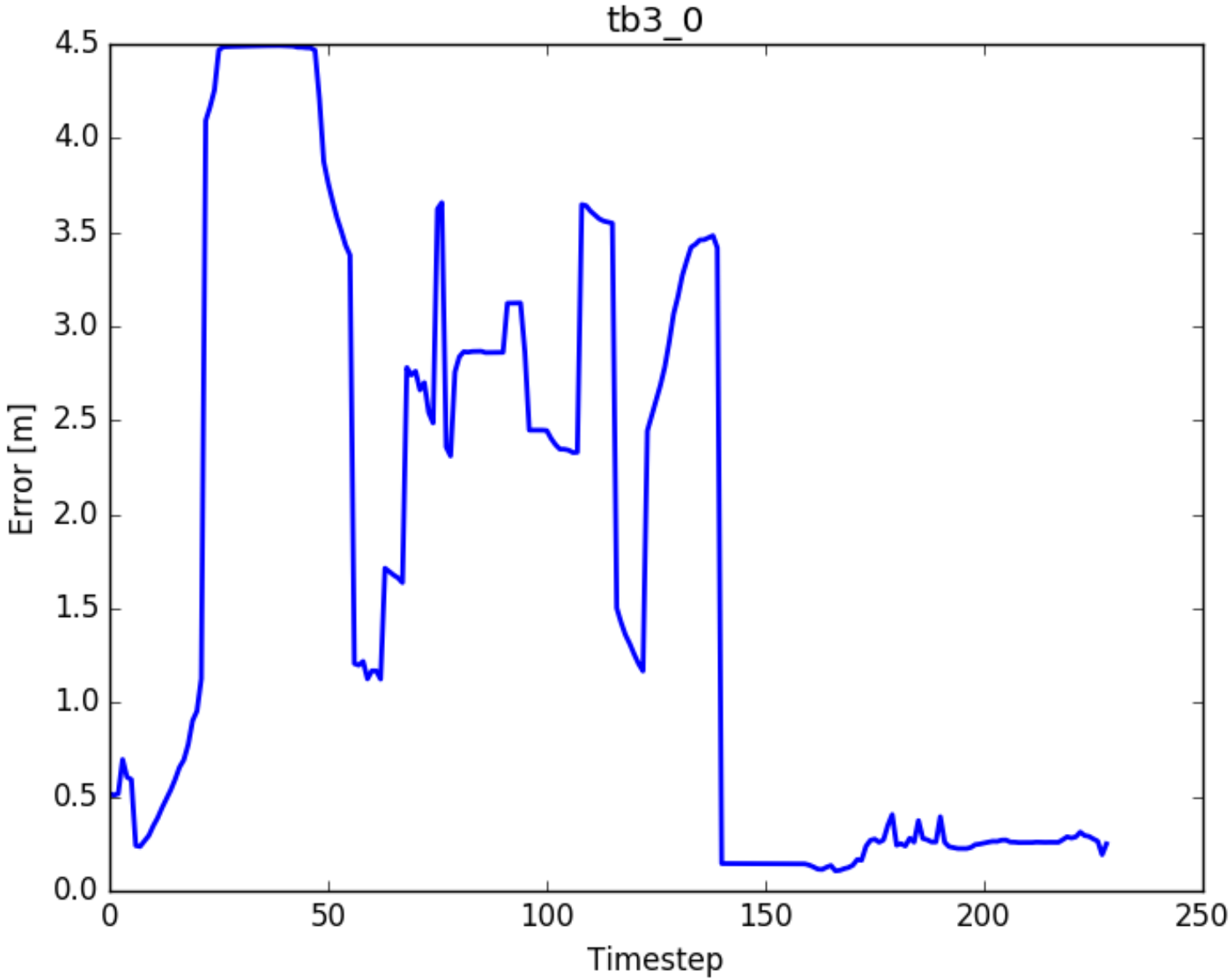
Range & Bearing

$$\bar{w}_i = \prod_{r_j \in N_i} \sum_{p_k \in r_j} \Phi \left(\begin{bmatrix} D_i(p_k) \\ \Theta_i(p_k) \end{bmatrix}, \begin{bmatrix} d_j \\ \theta_j \end{bmatrix}, \xi \right) \cdot w_{p_k}$$

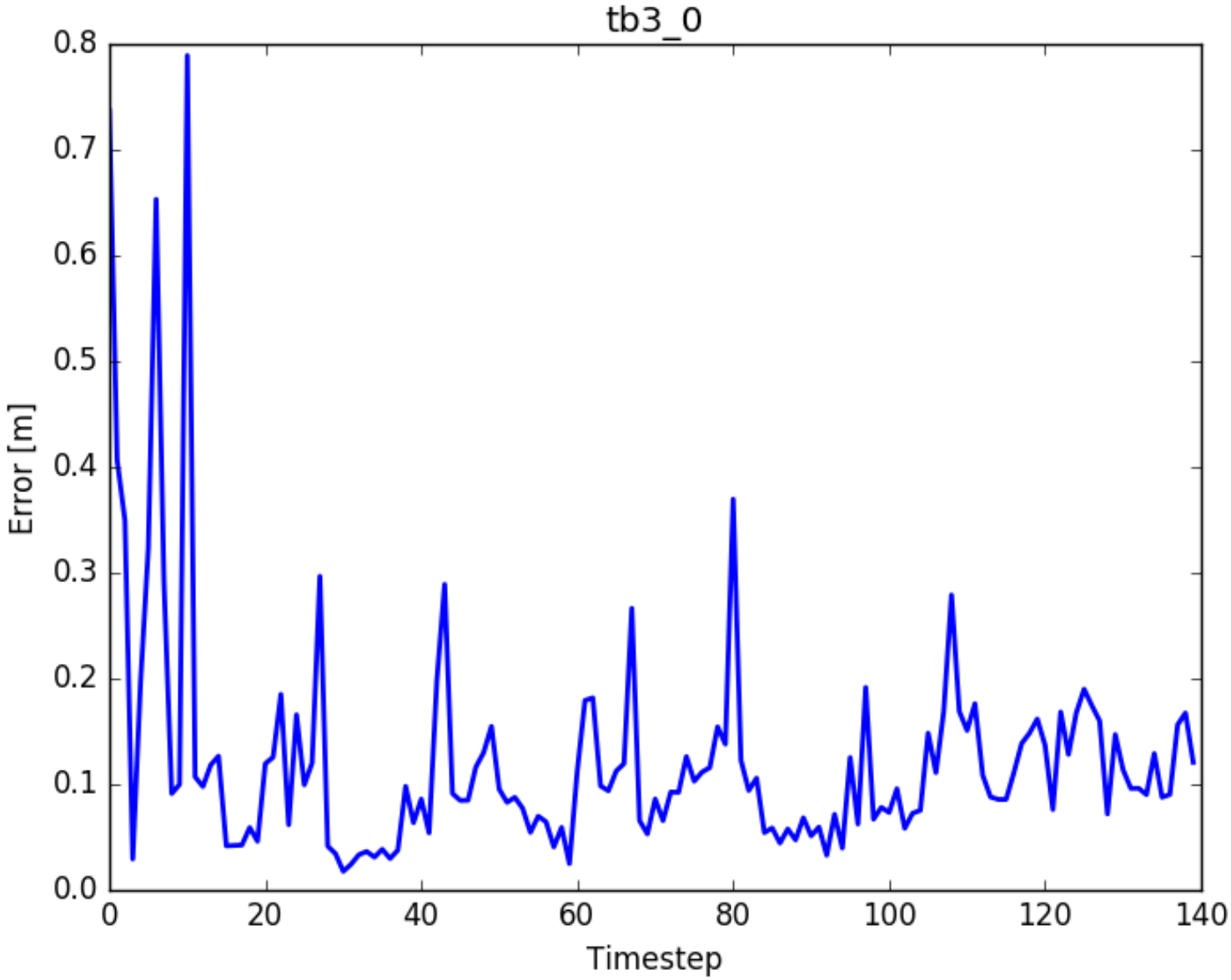
- $\bar{w}_i$ range & bearing weight of particle i
- N_i = robot i's neighbours
- p_k ranges over the set of particles from robot r_j
- d_j = received distance between this robot and robot r_j
- θ_j = received bearing of this robot from r_j
- $D_i(p_k)$ = distance between the particle i on this robot and the particle p_k from the other robot
- $\Theta_i(p_k)$ = bearing between the particle i and the particle p_k on the other robot
- w_{p_k} = weight of particle k
- ξ = covariance matrix

Normalising factors omitted.

Performance Without Enhancement



Performance With Enhancement



Demo

https://drive.google.com/file/d/
1VfTZwqM-bqTKbOAGtHgcXKm1kq8-nVVY/view?usp=sharing