Monte Carlo

7.1)

given initial pose $x_{t-1} = [x, y, \theta]$

odometry $u_t = [\delta_{rot1}, \delta_{trans}, \delta_{rot2}]$

noise $\alpha = [\alpha_1, \alpha_2, \alpha_3, \alpha_4]$

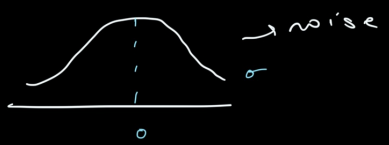
Output: new (sampled) pose predicted by motion model.

Motion update is:

$$x_t = f(x_{t-1}, u_t) + \text{noise}.$$

What is Monte Carlo here?

↳ we are adding random noise to the final pos^n.



So we generate say 500 points to indicate the uncertainity of pos^n.

→ possibilities. All this noise is random from the gaussian distn.

$$\text{var\_rot1} = \alpha_1 |\delta_{rot1}| + \alpha_2 |\delta_{trans}|$$

$$\text{var\_trans} = \alpha_3 |\delta_{rot2}| + \alpha_4 (|\delta_{rot1}| + |\delta_{rot2}|)$$

$$\text{var\_rot2} = \alpha_1 |\delta_{rot2}| + \alpha_2 |\delta_{trans}|$$

7.2) Assign weights.

Talks about believability of each particle.

given : laser scan → ρ, ϕ. what robot sees
map → where walls are
each particle pose → [x, y, θ]

ranges2cells (ranges, angles, particles_pose)
↓
↳ takes raw laser scan (ρ, ϕ)
uses particle pose (x, y, θ)
converts laser endpoint into map cell coordinates.

if the robot was here, where would each laser hit the map?

Resampling.

eg) P_0 P_1 P_2 P_3

0.1 0.2 0.4 0.3

cum_sum = [0.1, 0.3, 0.7, 1]

set i = 0

while 0.12 > cum_sum[j]

j += 1

N = 4

step = 0.25

u_0 = 0.12 → random

u = [0.12, 0.37, 0.62, 0.87]

① 0.12 > 0.1 ✓

j = 1

② 0.12 > 0.3 ✗

j = 1 → copy P_1

- i = 1

while 0.37 > cum_sum[j]

j += 1

⇒ 0.37 > 0.3 ✓

j = 2

0.37 > 0.7 ✗

j = 2 → copy P_2

- i = 2

while 0.62 > 0.7 ✗

j = 2 → copy P_2

- i = 3

while 0.87 > 0.7

j = 3

0.87 > 1

✗ ↪ copy P_3

→ resampled

[P_1 P_2 P_2 P_3]