CS354

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October 6, 2015

Monte-Carlo Localization aka Particle Filter

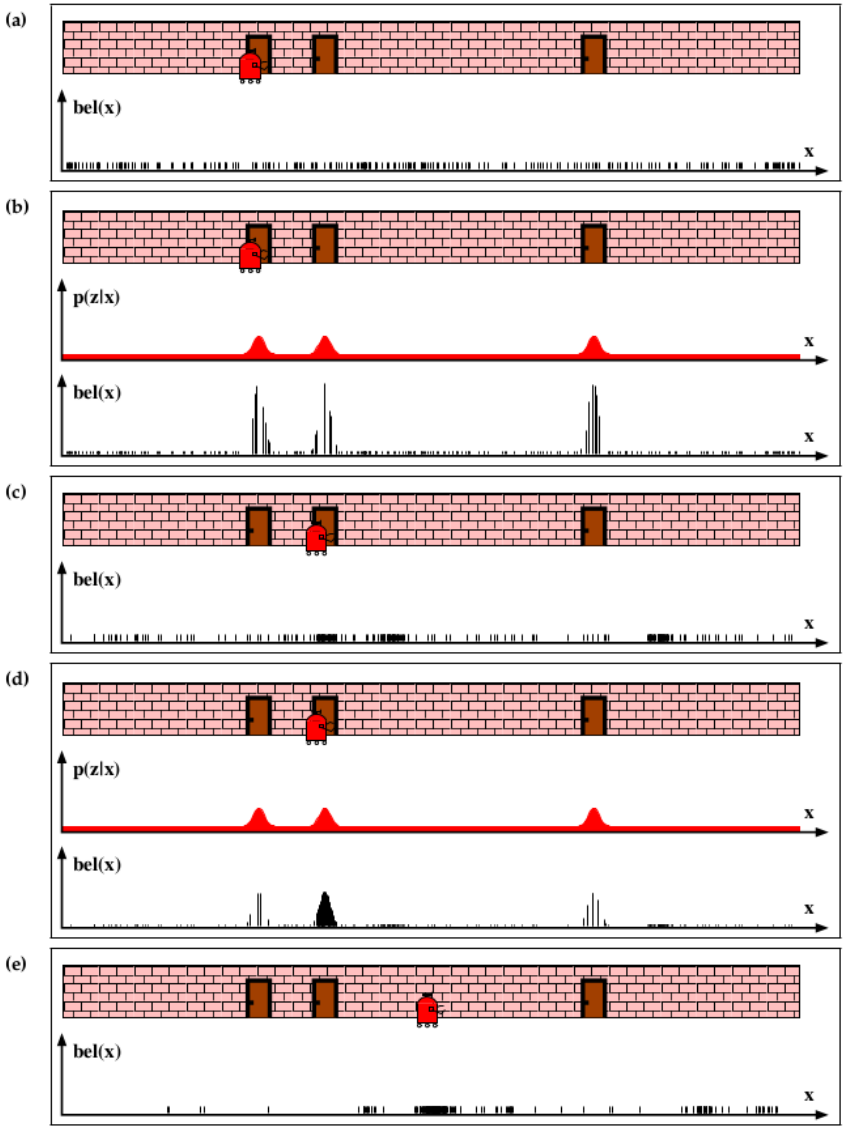

Figure 8.11 Monte Carlo Localization, a particle filter applied to mobile robot localization.

Probabilistic Robotics. Thrun, Burgard, Fox, 2005

Particle Filter Algorithm

1: **procedure** PARTICLE_FILTER($\mathcal{X}_{t-1}, u_t, z_t$)
2: **Inputs**
3: $\mathcal{X}_{t-1}$ – The previous set of particles
4: u_t – The control signal
5: z_t – The sensor value
6: **Output**
7: $\mathcal{X}_t$ – The updated set of particles

8: $\bar{\mathcal{X}}_t = \mathcal{X}_t = \emptyset$
9: $M = |\mathcal{X}_{t-1}|$
10: **for** $m = 0$ to $M - 1$ **do**
11: $x_t^{[m]} = \text{sample\_motion\_model}(u_t, x_t^{[m]})$
12: $w_t^{[m]} = \text{measurement\_model}(z_t, x_t^{[m]})$
13: $\bar{\mathcal{X}}_t = \bar{\mathcal{X}}_t \cup \langle x_t^{[m]}, w_t^{[m]} \rangle$
14: **for** $m = 0$ to $M - 1$ **do** ▷ Resampling
15: draw i with probability $\propto w_t^{[i]}$
16: $\mathcal{X}_t = \mathcal{X}_t \cup \langle x_t^{[i]}, 1/M \rangle$

Based on Algorithm in Table 4.3 in Probabilistic Robotics. Thrun, Burgard, Fox, 2005

Grid Example

Sampling From the Motion Model

Measurement Models for Laser Range Finders