Recursive Bayes Filter:

$$bel(x_t) = p(x_t | z_{1:t}, u_{1:t})$$

$$= \eta p(z_t | x_t, z_{1:t-1}, u_{1:t}) p(x_t | z_{1:t-1}, u_{1:t}) \quad \text{(Bellman equation)}$$

$$= \eta p(z_t | x_t) p(x_t | z_{1:t-1}, u_{1:t}) \quad \text{(Markov assumption)}$$

$$= \eta p(z_t | x_t) \int_{x_{t-1}} p(x_t | x_{t-1}, z_{1:t-1}, u_{1:t}) p(x_{t-1} | z_{1:t-1}, u_{1:t}) \, dx_{t-1}$$

model of sensor/observation — model of motion — previous estimation

Particle Filter:

1. Sample particles from the proposal distribution:

$$x_t^{[j]} \sim \pi(x_t | \ldots)$$

2. Compute the importance weights:

$$w_t^{[j]} = \frac{\text{target}(x_t^{[j]})}{\text{proposal}(x_t^{[j]})}$$

3. Resampling: Draw samples $i \sim w_t^{[i]} \rightarrow X_t^{[j]}$

Ref: SLAM Course, Cyrill, 2013/2014.