# CSE-571
Robotics

Bayes Filter Implementations

Particle filters


Bayes Filters for Robot Localization

$\bar{Bel}(x_t)$

$P(z|x)$

$Bel(x_t)$

$\bar{Bel}(x_{t+1})$

$P(z|x)$

$Bel(x_{t+1})$
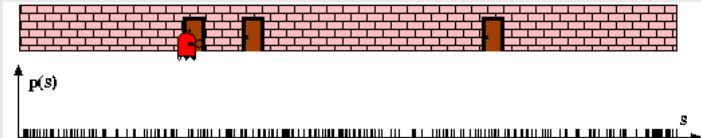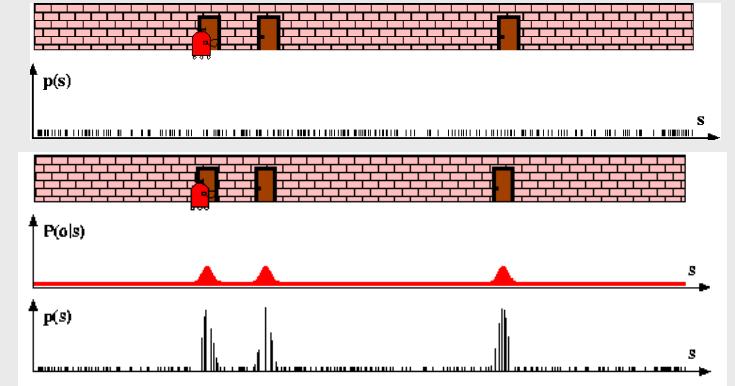
$\bar{Bel}(x_{t+2})$

Particle Filters

$p(s)$

**Sensor Information: Importance Sampling**

$p(s)$

$P(o|s)$

$p(s)$
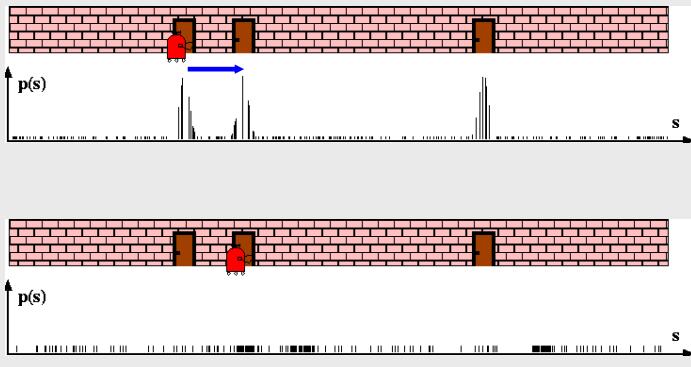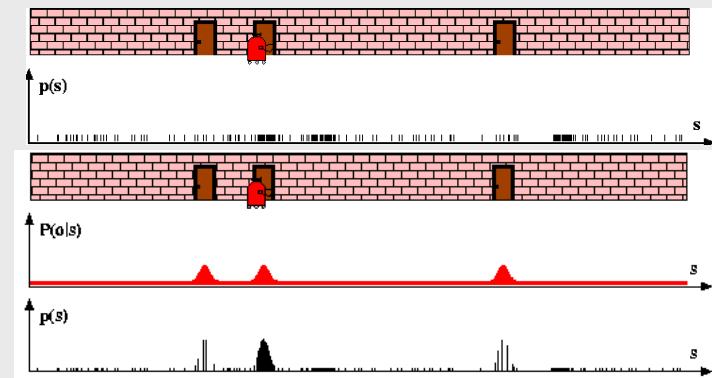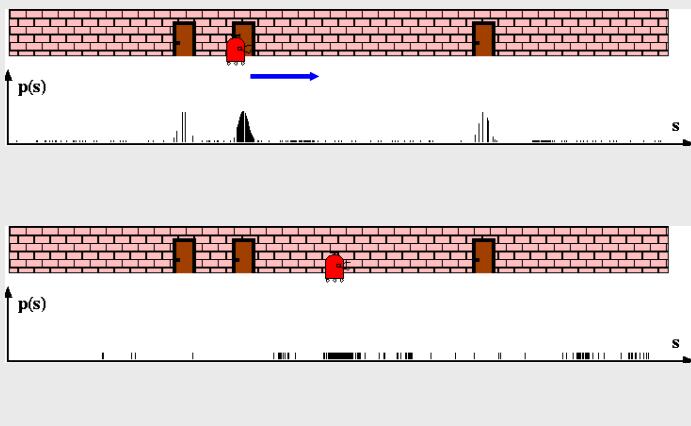
Robot Motion

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## Sensor Information: Importance Sampling
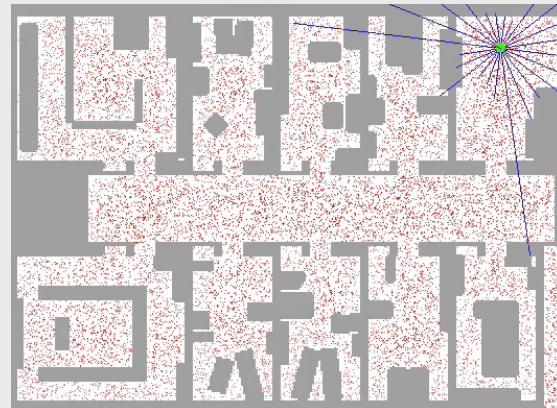

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Robot Motion

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Sample-based Localization (sonar)
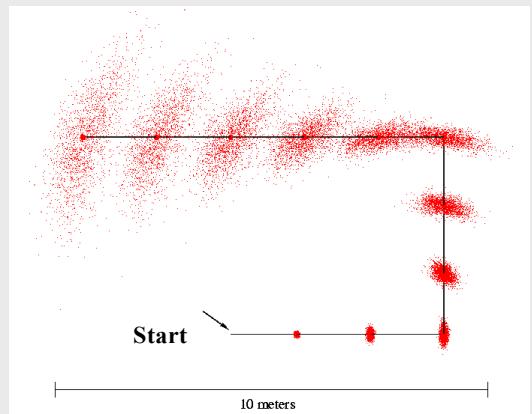
3/27/24   Probabilistic Robotics   8

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Motion Model

Start

10 meters
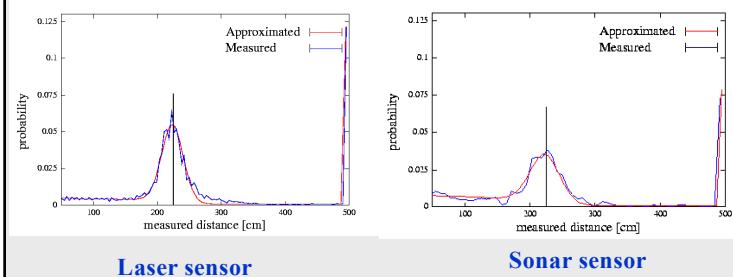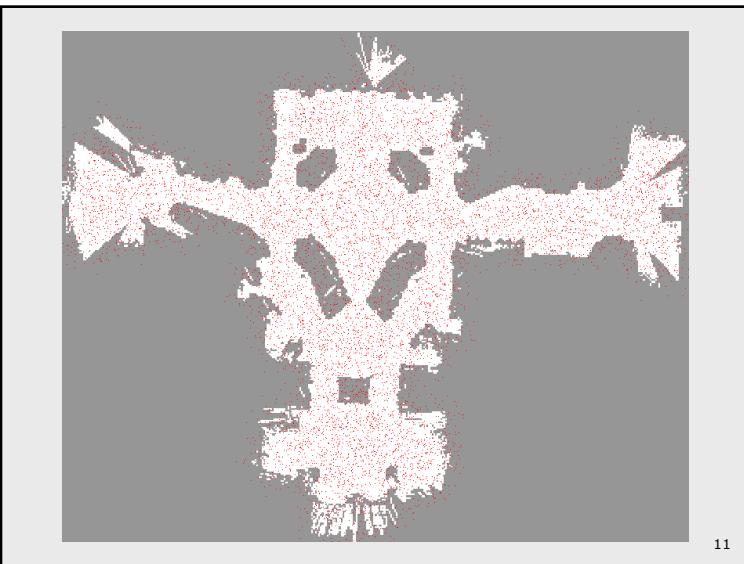
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Proximity Sensor Model

Laser sensor

Sonar sensor

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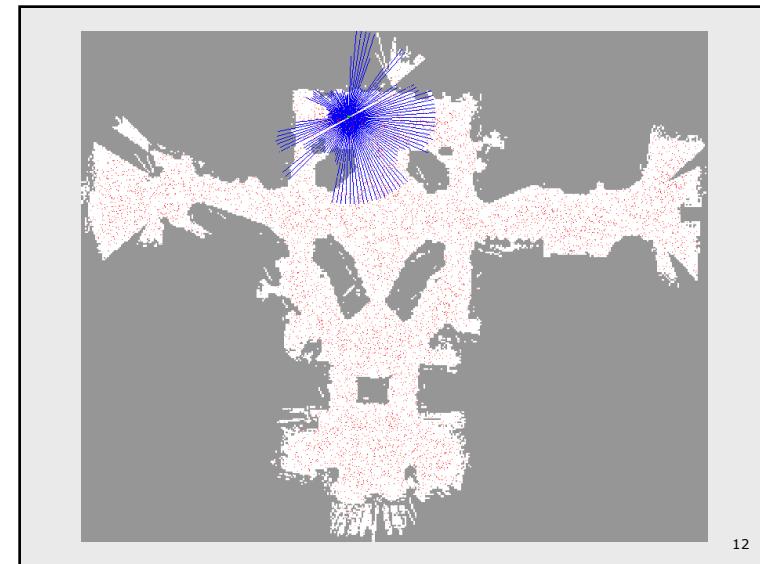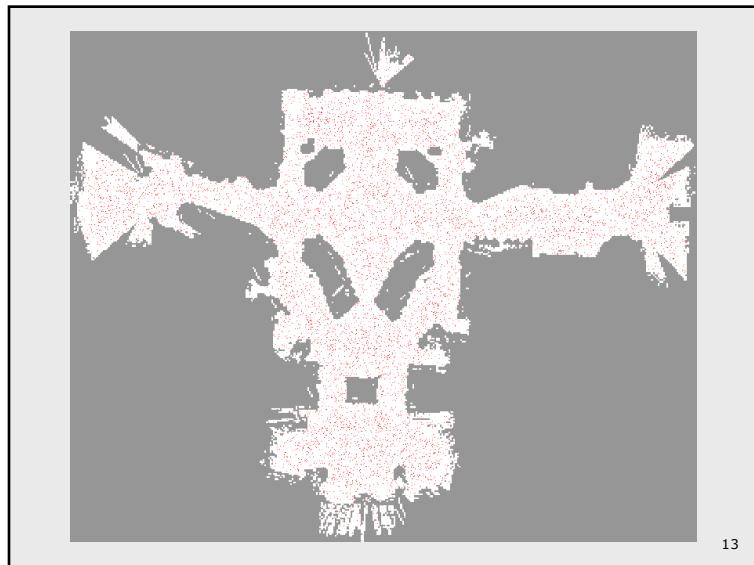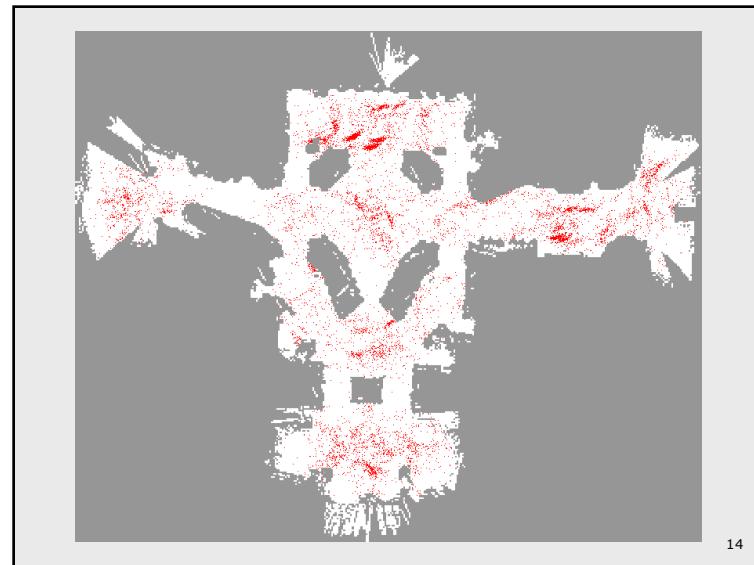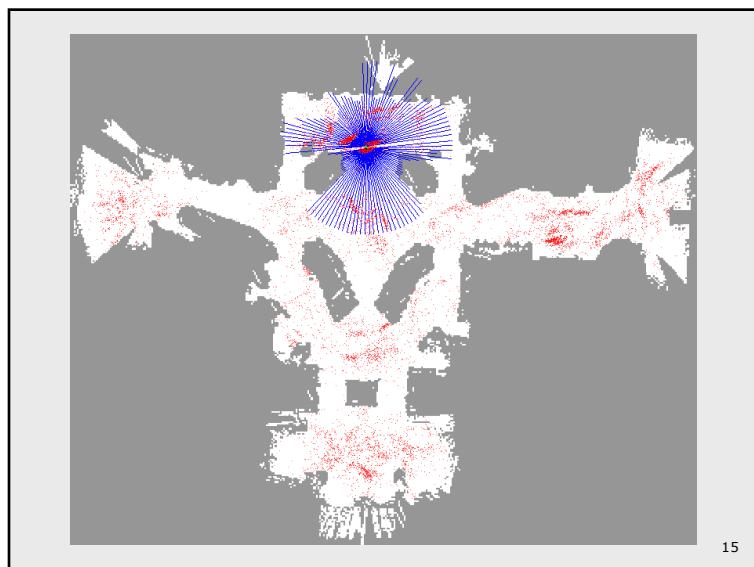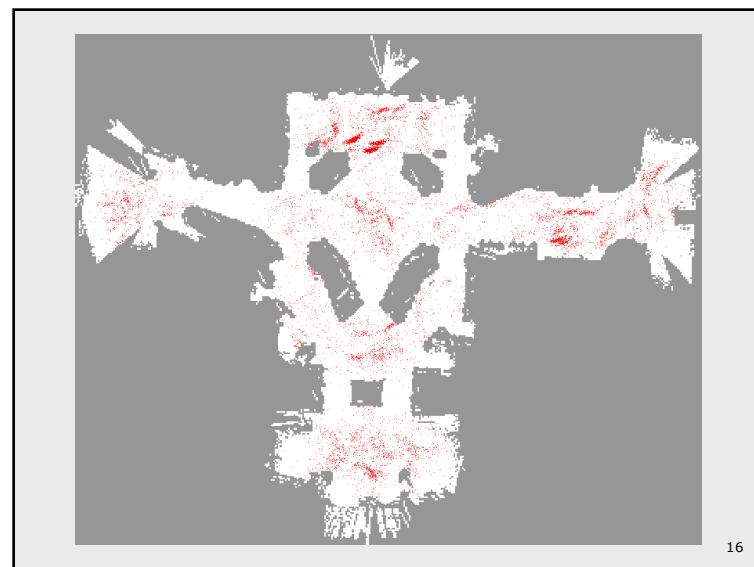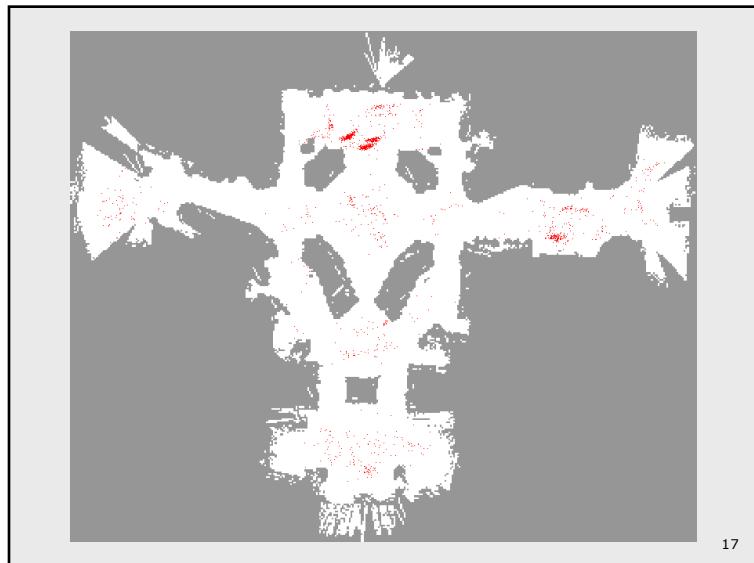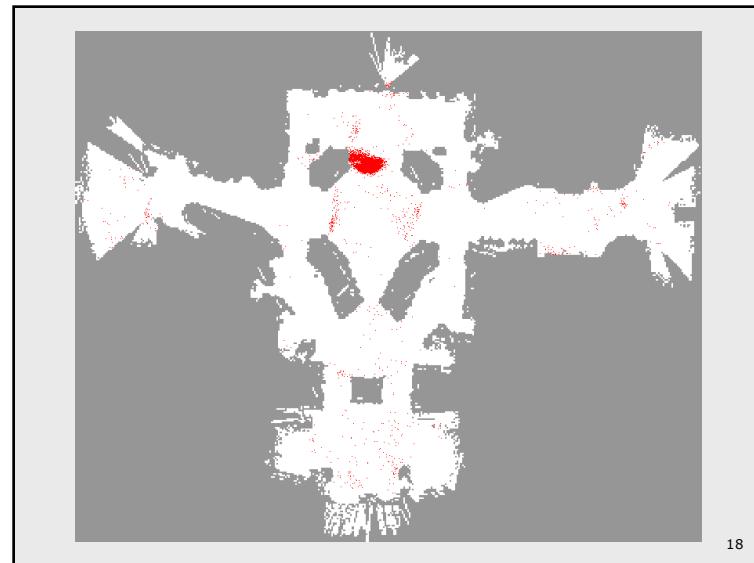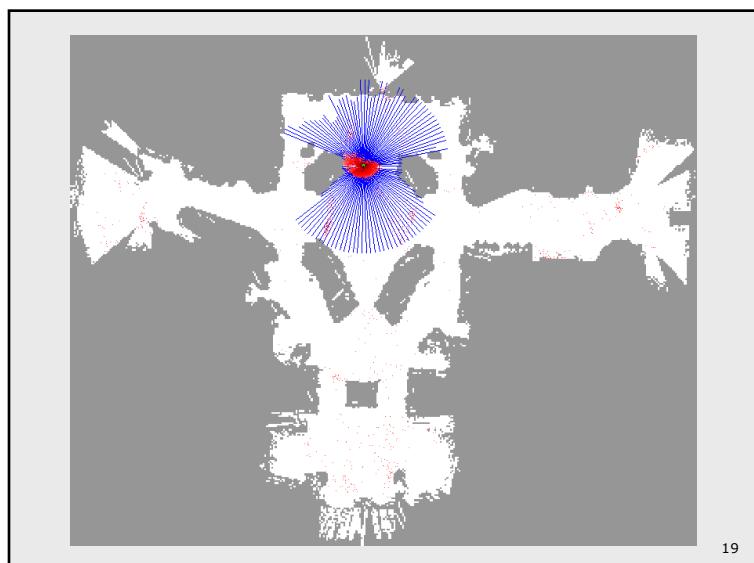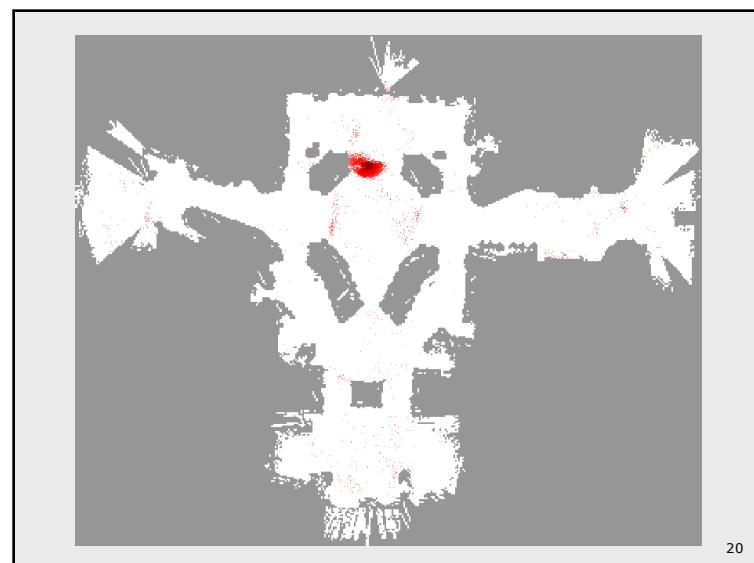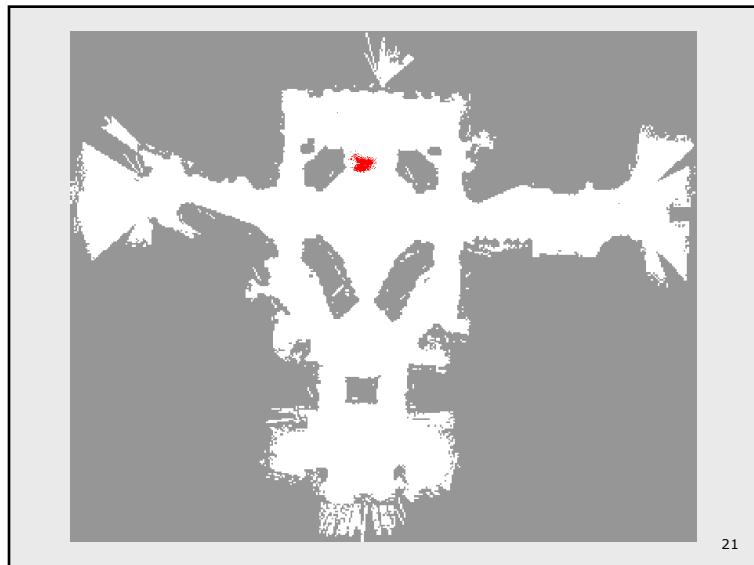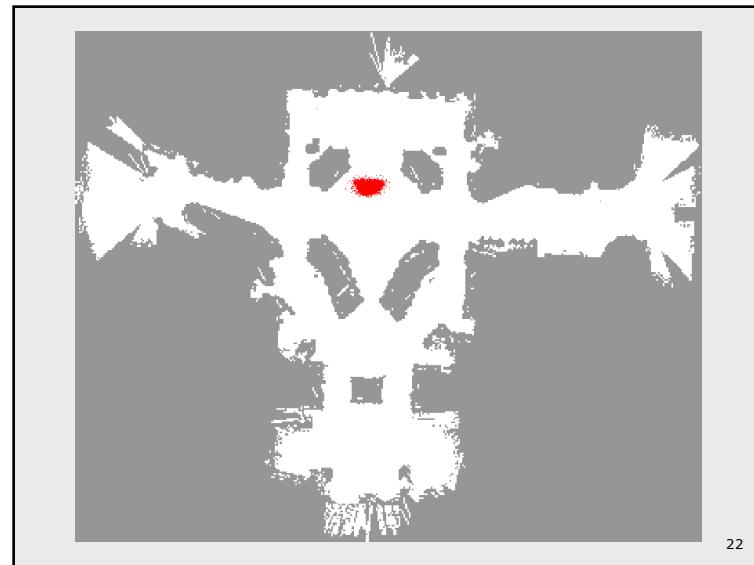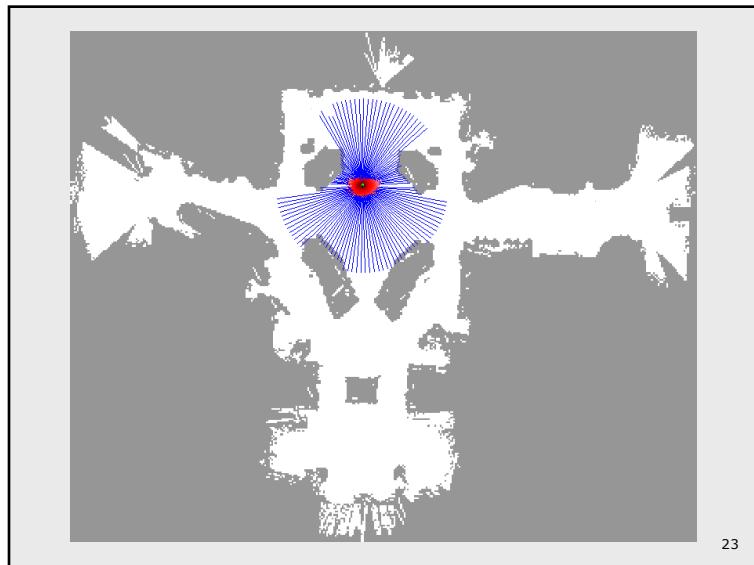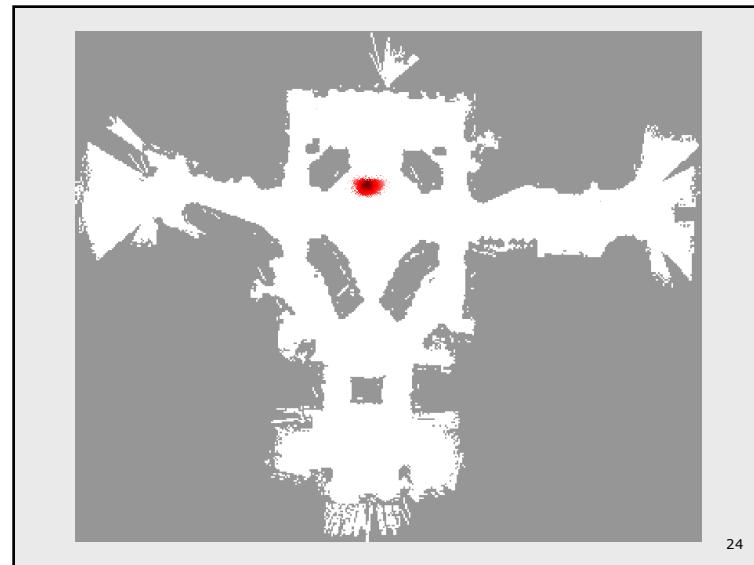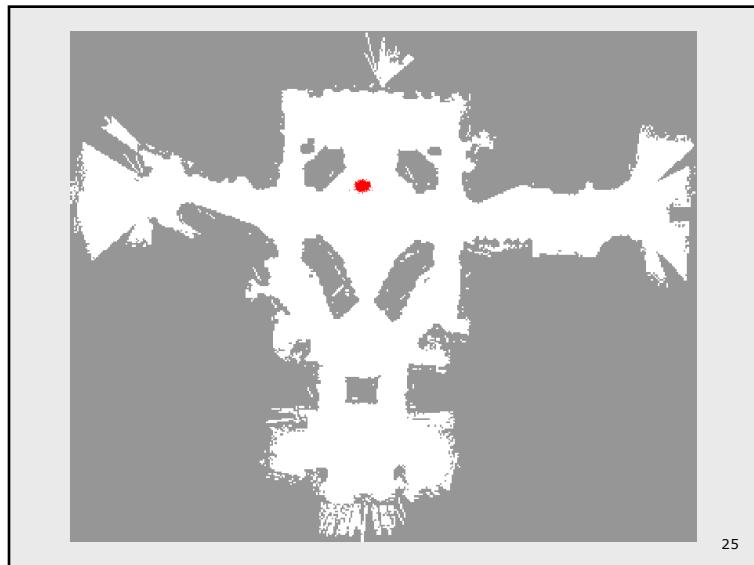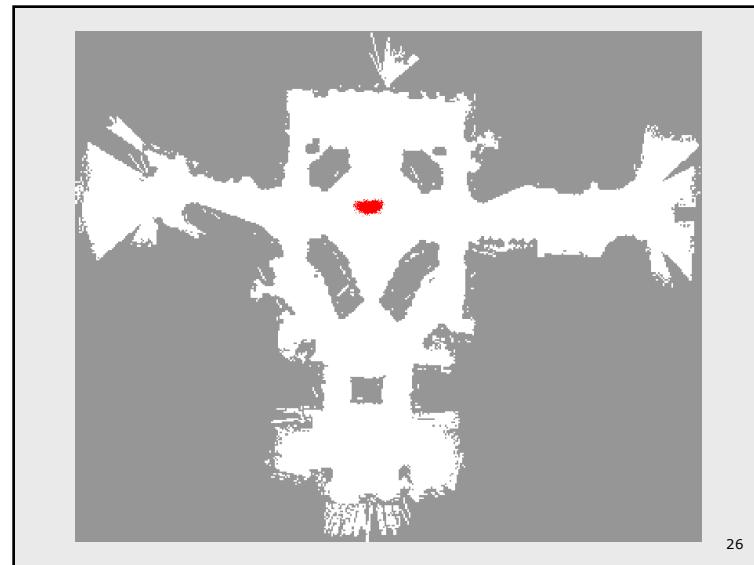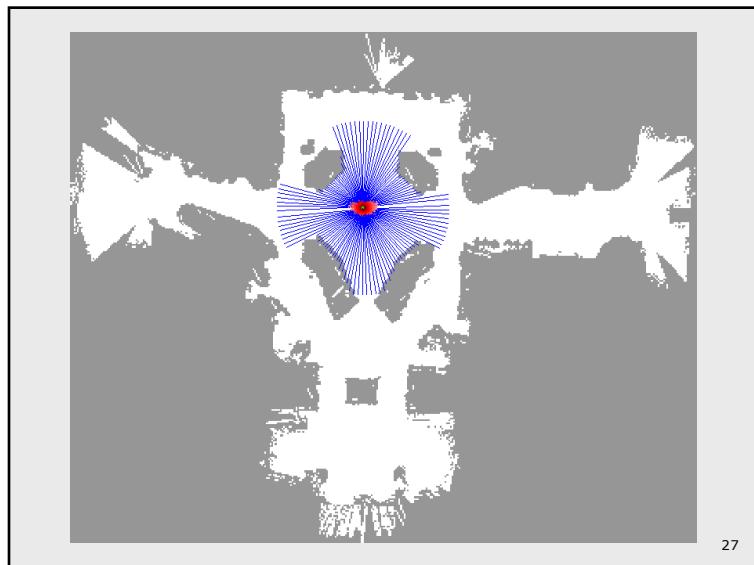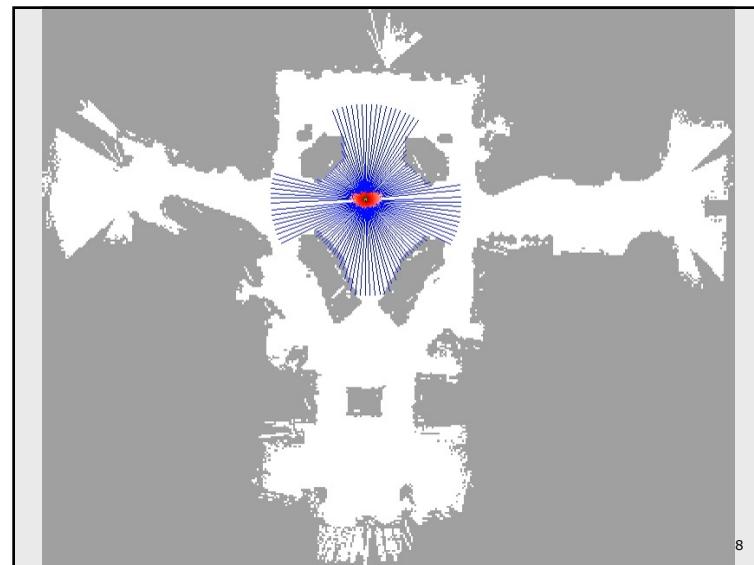
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Particle Filter Algorithm

1. Algorithm **particle_filter**(S_{t-1}, u_{t-1} z_t):

2. $S_t = \varnothing, \quad \eta = 0$

3. **For** $i = 1 \ldots n$ *Generate new samples*

4.   Sample index $j(i)$ from the discrete distribution given by w_{t-1}

5.   Sample x_t^i from $p(x_t \mid x_{t-1}, u_{t-1})$ using $x_{t-1}^{j(i)}$ and u_{t-1}

6. $w_t^i = p(z_t \mid x_t^i)$ *Compute importance weight*

7. $\eta = \eta + w_t^i$ *Update normalization factor*

8. $S_t = S_t \cup \{< x_t^i, w_t^i >\}$ *Insert*

9. **For** $i = 1 \ldots n$

10. $w_t^i = w_t^i / \eta$ *Normalize weights*

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