from slides by Prof Syrill Stachniss

FastSLAM1.0_known_correspondence(z_t, c_t, u_t, X_{t-1}):

for k = 1 to N do — loop through N particles

Let $\langle x_{t-1}^{[k]}, \langle \mu_{1,t-1}^{[k]}, \Sigma_{1,t-1}^{[k]} \rangle \ldots \langle \mu_{M,t-1}^{[k]}, \Sigma_{M,t-1}^{[k]} \rangle \rangle$ be a particle in X_{t-1}

$x_t^{[k]} \sim p(x_t | x_{t-1}, u_t)$ — sample pose

$j = c_t$ — observed feature with correspondence

if feature j never seen before:

$\mu_{j,t}^{[k]} = h^{-1}(z_t, x_t^{[k]})$ — initialize mean

$H = h^{'}(\mu_{j,t}^{[k]}, x_t^{[k]})$ — calculate Jacobian

$\Sigma_{j,t}^{[k]} = H^{-1} Q_t (H^{-1})^T$ — initialize covariance

$w^[k] = p_0$ — default importance weight

else

$\hat{z}^{[k]} = h(\mu_{j,t-1}^{[k]}, x_t^{[k]})$ — measurement prediction

$H = h^{'}(\mu_{j,t-1}^{[k]}, x_t^{[k]})$ — calculate Jacobian

$Q = H \Sigma_{j,t-1} H^T + Q_t$ — measurement Covariance

$K = \Sigma_{j,t-1}^{[k]} H^T Q^{-1}$ — calculate Kalman gain

$\mu_{j,t}^{[k]} = \mu_{j,t-1}^{[k]} + K(z_t - \hat{z}^{[k]})$ — update mean

$\Sigma_{j,t}^{[k]} = (I - KH) \Sigma_{j,t-1}^{[k]}$ — update covariance

$w^{[k]} = |2\pi Q|^{-\frac{1}{2}} exp\{-\frac{1}{2}(z_t - \hat{z}^{[k]})^T Q^{-1} (z_t - \hat{z}^{[k]})\}$

endif

for all unobserved features $j^{'}$ do:

$\langle \mu_{j,t}^{[k]}, \Sigma_{j,t}^{[k]} \rangle = \langle \mu_{j,t-1}^{[k]}, \Sigma_{j,t-1}^{[k]} \rangle$ — leave unchanged

end for

$X_t = resample \langle x_{t-1}^{[k]}, \langle \mu_{1,t-1}^{[k]}, \Sigma_{1,t-1}^{[k]} \rangle \ldots, w^{[k]} \rangle$