

- 1: **Algorithm EKF\_SLAM**( $\mu_{t-1}, \Sigma_{t-1}, u_t, z_t, N_{t-1}$ ):
- 2:  $N_t = N_{t-1}$
- 3:  $F_x = \begin{pmatrix} 1 & 0 & 0 & 0 \cdots 0 \\ 0 & 1 & 0 & 0 \cdots 0 \\ 0 & 0 & 1 & 0 \cdots 0 \end{pmatrix}$
- 4:  $\bar{\mu}_t = \mu_{t-1} + F_x^T \begin{pmatrix} -\frac{v_t}{\omega_t} \sin \mu_{t-1, \theta} + \frac{v_t}{\omega_t} \sin(\mu_{t-1, \theta} + \omega_t \Delta t) \\ \frac{v_t}{\omega_t} \cos \mu_{t-1, \theta} - \frac{v_t}{\omega_t} \cos(\mu_{t-1, \theta} + \omega_t \Delta t) \\ \omega_t \Delta t \end{pmatrix}$
- 5:  $G_t = I + F_x^T \begin{pmatrix} 0 & 0 & -\frac{v_t}{\omega_t} \cos \mu_{t-1, \theta} + \frac{v_t}{\omega_t} \cos(\mu_{t-1, \theta} + \omega_t \Delta t) \\ 0 & 0 & -\frac{v_t}{\omega_t} \sin \mu_{t-1, \theta} + \frac{v_t}{\omega_t} \sin(\mu_{t-1, \theta} + \omega_t \Delta t) \\ 0 & 0 & 0 \end{pmatrix} F_x$
- 6:  $\bar{\Sigma}_t = G_t \Sigma_{t-1} G_t^T + F_x^T R_t F_x$
- 7:  $Q_t = \begin{pmatrix} \sigma_r^2 & 0 & 0 \\ 0 & \sigma_\phi^2 & 0 \\ 0 & 0 & \sigma_s^2 \end{pmatrix}$
- 8: *for all observed features*  $z_t^i = (r_t^i \ \phi_t^i \ s_t^i)^T$  *do*
- 9:  $\begin{pmatrix} \bar{\mu}_{N_t+1, x} \\ \bar{\mu}_{N_t+1, y} \\ \bar{\mu}_{N_t+1, s} \end{pmatrix} = \begin{pmatrix} \bar{\mu}_{t, x} \\ \bar{\mu}_{t, y} \\ s_t^i \end{pmatrix} + r_t^i \begin{pmatrix} \cos(\phi_t^i + \bar{\mu}_{t, \theta}) \\ \sin(\phi_t^i + \bar{\mu}_{t, \theta}) \\ 0 \end{pmatrix}$
- 10: *for*  $k = 1$  *to*  $N_t + 1$  *do*
- 11:  $\delta_k = \begin{pmatrix} \delta_{k, x} \\ \delta_{k, y} \end{pmatrix} = \begin{pmatrix} \bar{\mu}_{k, x} - \bar{\mu}_{t, x} \\ \bar{\mu}_{k, y} - \bar{\mu}_{t, y} \end{pmatrix}$
- 12:  $q_k = \delta_k^T \delta_k$

see next page for continuation