

1: **Algorithm EKF\_SLAM**( $\mu_{t-1}, \Sigma_{t-1}, u_t, z_t, N_{t-1}$ ):

2:  $N_t = N_{t-1}$

$$3: F_x = \begin{pmatrix} 1 & 0 & 0 & 0 \cdots 0 \\ 0 & 1 & 0 & 0 \cdots 0 \\ 0 & 0 & 1 & 0 \cdots 0 \end{pmatrix}$$

$$4: \bar{\mu}_t = \mu_{t-1} + F_x^T \begin{pmatrix} -\frac{v_t}{\omega_t} \sin \mu_{t-1, \theta} + \frac{v_t}{\omega_t} \sin(\mu_{t-1, \theta} + \omega_t \Delta t) \\ \frac{v_t}{\omega_t} \cos \mu_{t-1, \theta} - \frac{v_t}{\omega_t} \cos(\mu_{t-1, \theta} + \omega_t \Delta t) \\ \omega_t \Delta t \end{pmatrix}$$

$$5: G_t = I + F_x^T \begin{pmatrix} 0 & 0 & -\frac{v_t}{\omega_t} \cos \mu_{t-1, \theta} & +\frac{v_t}{\omega_t} \cos(\mu_{t-1, \theta} + \omega_t \Delta t) \\ 0 & 0 & -\frac{v_t}{\omega_t} \sin \mu_{t-1, \theta} & +\frac{v_t}{\omega_t} \sin(\mu_{t-1, \theta} + \omega_t \Delta t) \\ 0 & 0 & 0 & 0 \end{pmatrix} F_x$$

6:  $\bar{\Sigma}_t = G_t \Sigma_{t-1} G_t^T + F_x^T R_t F_x$

$$7: Q_t = \begin{pmatrix} \sigma_r & 0 & 0 \\ 0 & \sigma_\phi & 0 \\ 0 & 0 & \sigma_s \end{pmatrix}$$

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