Homework 3: Solvers

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1 Linear SLAM

1.1 Measurement Function

1.2 Odometry Measurement

The odometry measurement should just be the vector from the pose at time t to the pose at time $t+1$

$$h_o(\mathbf{r^t}, \mathbf{r^{t+1}}) = \begin{bmatrix} r_x^{t+1} - r_x^t & r_y^{t+1} - r_y^t \end{bmatrix}^T$$

$$H_o = \begin{bmatrix} \frac{\partial r_x^{t+1} - r_x^t}{\partial r_x^t} & \frac{r_x^{t+1} - r_x^t}{\partial r_y^t} & \frac{\partial r_x^{t+1} - r_x^t}{\partial r_x^{t+1}} & \frac{\partial r_x^{t+1} - r_x^t}{\partial r_y^{t+1}} \\ \frac{\partial r_y^{t+1} - r_y^t}{\partial r_x^t} & \frac{\partial r_y^{t+1} - r_y^t}{\partial r_y^t} & \frac{\partial r_y^{t+1} - r_y^t}{\partial r_x^{t+1}} & \frac{\partial r_y^{t+1} - r_y^t}{\partial r_y^{t+1}} \end{bmatrix}$$

$$H_o = \begin{bmatrix} -1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 1 \end{bmatrix}$$

1.3 Landmark Measurement

This will be extremely similar, just find the vector from the robot's position to the landmark

$$h_l(\mathbf{r^t}, \mathbf{l^k}) = \begin{bmatrix} l_x^k - r_x^t & l_y^k - r_y^t \end{bmatrix}^T$$

$$H_l = \begin{bmatrix} \frac{\partial l_x^k - r_x^t}{\partial r_x^t} & \frac{\partial l_x^k - r_x^t}{\partial r_y^t} & \frac{\partial l_x^k - r_x^t}{\partial l_x^k} & \frac{\partial l_x^k - r_x^t}{\partial l_y^k} \\ \frac{\partial l_y^k - r_y^t}{\partial r_x^t} & \frac{\partial l_y^k - r_y^t}{\partial r_y^t} & \frac{\partial l_y^k - r_y^t}{\partial l_x^k} & \frac{\partial l_y^k - r_y^t}{\partial l_y^k} \end{bmatrix}$$

$$H_l = \begin{bmatrix} -1 & 0 & 1 & 0 \\ 0 & -1 & 0 & -1 \end{bmatrix}$$