

## IRO Homework 2: 2D beacon SLAM.

Karel Zimmermann

Robot has followed trajectory consisting of  $M$  unknown positions  $\mathbf{x}_j \in \mathbb{R}^2, j = 1 \dots N$ . From each  $j$ -th position,  $N$  directional unit vectors  $\mathbf{k}_i^j \in \mathbb{R}^2$  towards  $N$  different beacons at unknown locations  $\mathbf{a}_i \in \mathbb{R}^2, i = 1 \dots M$  was measured. Given the set of  $M \times N$  measured directions  $\mathbf{k}_i^j \in \mathbb{R}^2$ , reconstruct the trajectory and beacon positions.

1. Download `K.mat` data file, which contains  $2 \times N \times M$  array with measured directions.
2. Formulate the problem as a overdetermined set of linear equations. Avoid trivial solution  $\mathbf{x}_j = \mathbf{a}_i = \mathbf{0}$ , by imposing scale and initial position.
3. Draw reconstructed trajectory and beacons into a common figure.
4. **Bonus:** Correct the scale of the final solution by imposing constraint  $\|\mathbf{a}_1 - \mathbf{a}_2\| = 6$ .