

## Sheet 10

### Topic: FastSLAM

Submission deadline: July 8, 2013

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#### Exercise: FastSLAM Implementation

Implement the landmark-based FastSLAM algorithm as presented in the lecture. Assume known feature correspondences.

To support this task, we provide a detailed listing of the algorithm as a PDF file and a small *Octave* framework (see course website). The framework contains the following folders:

**data** contains files representing the world definition and sensor readings.

**octave** contains the FastSLAM framework with stubs to complete.

**plots** this folder is used to store images.

The below mentioned task should be implemented inside the framework in the directory **octave** by completing the stubs.

After implementing the missing parts, you can run the FastSLAM system. To do that, change into the directory **octave** and launch *Octave*. Type **fastslam** to start the main loop (this may take some time). The script will produce plots of the state of the FastSLAM algorithm and save them in the **plots** directory. You can use the images for debugging and to generate an animation. For example, you can use **ffmpeg** from inside the **plots** directory as follows:

```
ffmpeg -r 10 -b 500000 -i fastslam_%03d.png fastslam.mp4
```

Implement the correction step in **correction\_step.m**. For the noise in the sensor model, assume that  $Q_t$  is a diagonal  $2 \times 2$  matrix as follows

$$Q_t = \begin{pmatrix} 0.1 & 0 \\ 0 & 0.1 \end{pmatrix}.$$

Some implementation tips:

- Turn off the visualization to speed up the computation by commenting out the line `plot_state(...` in the file `fastslam.m`.
- While debugging, run the filter only for a few steps by replacing the for-loop in `fastslam.m` by something along the lines of `for t = 1:50`.
- When converting implementations containing for-loops into a vectorized form it often helps to draw the dimensions of the data involved on a sheet of paper.
- Many of the functions in *Octave* can handle matrices and compute values along the rows or columns of a matrix. Some useful functions that support this are `sum`, `cumsum`, `sqrt`, `sin`, `cos`, and many others.