

## Using the RobotLocalisationViewer:

The RobotLocalisationViewer assumes a *state* encoding based on triplets (x,y,h), with x being the row, y the column (together the position) and h the heading of the robot in the grid world, where x=0 is the top row, y=0 is the leftmost column and h runs around the compass from 0 to 3 as SOUTH-EAST-NORTH-WEST. This combination of position and heading is also called *pose* and the setup follows “robotics conventions”. Try to view the grid as a “rotated” coordinate system, as “x” describes the axis going “forward” in a mobile robot’s world (“down” in this grid), while “y” is pointing “left” for a robot (“right” in the grid). Angles (headings) are then given in the mathematical sense, i.e. counter-clockwise.

## 1 Starting:

The image shows a web-based interface for a 2D image processing application. The interface is divided into several sections:

- Top Control Bar:** Contains four sliders and two buttons.
  - Height:** A slider ranging from 0 to 4, currently set at 4.
  - Width:** A slider ranging from 0 to 4, currently set at 4.
  - SensorModel:** A button labeled "SensorModel 0=NUF, 1=UF".
  - Smoothing window length:** A button labeled "Smoothing window length, 0 = filtering".
- Left Sidebar:** Contains two buttons: "Show transitions" and "Show sensor".
- Main Area:** A large black rectangle representing the image being processed.
- Bottom Navigation Bar:** Contains four buttons: "Init filter", "One step", "Go", and "Stop".

The viewer starts up with an empty field, two sliders for the dimensions of the grid, one “toggle” slider for the sensor type, a slider for the length of the lag window for smoothing (0 means pure filtering) and six control buttons.

The figure shows the viewer with settings for a 4x4-field grid with non-uniformly failing sensor (type 0) and filtering only.

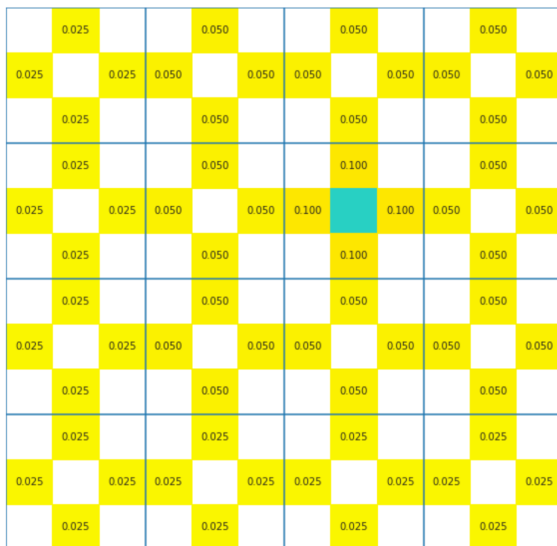
Please observe: The dimensions shown here and in the following figures (4x4) are ONLY examples, easy to fit in the document. Your implementation should consider BIGGER layouts and it is possible to have a rectangular grid, not only squares!

## 2 Checking the models (transition and observation)

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<div>0.30</div>	<div>0.00</div>	<div>0.00</div>	<div>0.00</div>
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### 2.1 Checking the transition model

Clicking on the “Show transitions”-button shows the probabilities for the different poses (x, y, h) to be reached after having been in the given state (marked in cyan). Each further click steps through the states and wraps in the end. The colour coding for the probabilities follows the idea of a heat map - the higher the value, the darker the marker.

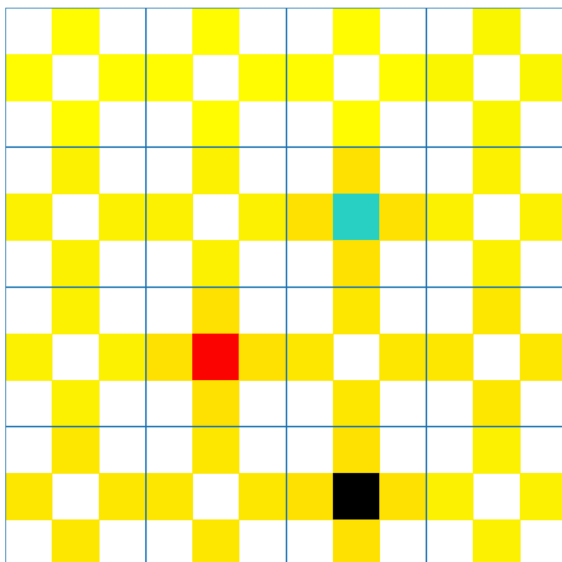


## 2.2 Checking the observation model

Clicking on the “Show sensor”-button shows the probabilities with which the sensor reports the given position (marked cyan) or “nothing” (all centers white), when the robot is actually in the **other** states (poses). Each further click steps through the sensor readings and wraps in the end. The loop starts with the visualisation for a failure (“nothing” reading).

The viewer shows again all the numbers / colours based on a heat map coding.

## 3 Visualising the filtering / smoothing steps and results



### 3.1 Initialising

Clicking on “Init filter” initialises the viewer / localiser. This step is necessary to get further steps running properly (and it shows you the initial state of the grid). The figure shows the starting position (black) at ( 1, 0) and the probability distribution you start out with. Please note: clicking “Init filter” again resets everything except the size of the grid and the sensor type, that is done with the sliders.

Note that when you just start the Viewer from the handout code, it does not actually work with a proper filter, as there is only a stub implementation in *Filters.py*.

### 3.2 Stepping through

With “One step” you advance one step in the filtering / smoothing process (i.e. cause a call to the *update()* method in the *Localizer* once). Black: true position, cyan: sensor reading, red: estimated (guessed) position. The heat map shows the probabilities for each position in all four states (poses) belonging to this position.

Please note: The results shown in the last figure are only **examples** for the visualisation - **do not assume them** as the final result for validation of your results!

### 3.3 Running continuously / stopping

With a click on “Go” you start a loop over the steps (delay according to time parameter for the driver thread in Dashboard). “Stop” interrupts the loop, it is possible to go stepwise again - or loop again. Not recommended for extensive evaluation, just for visual inspection!