KTH ROYAL INSTITUTE
OF TECHNOLOGY

Mapping assignment presentation

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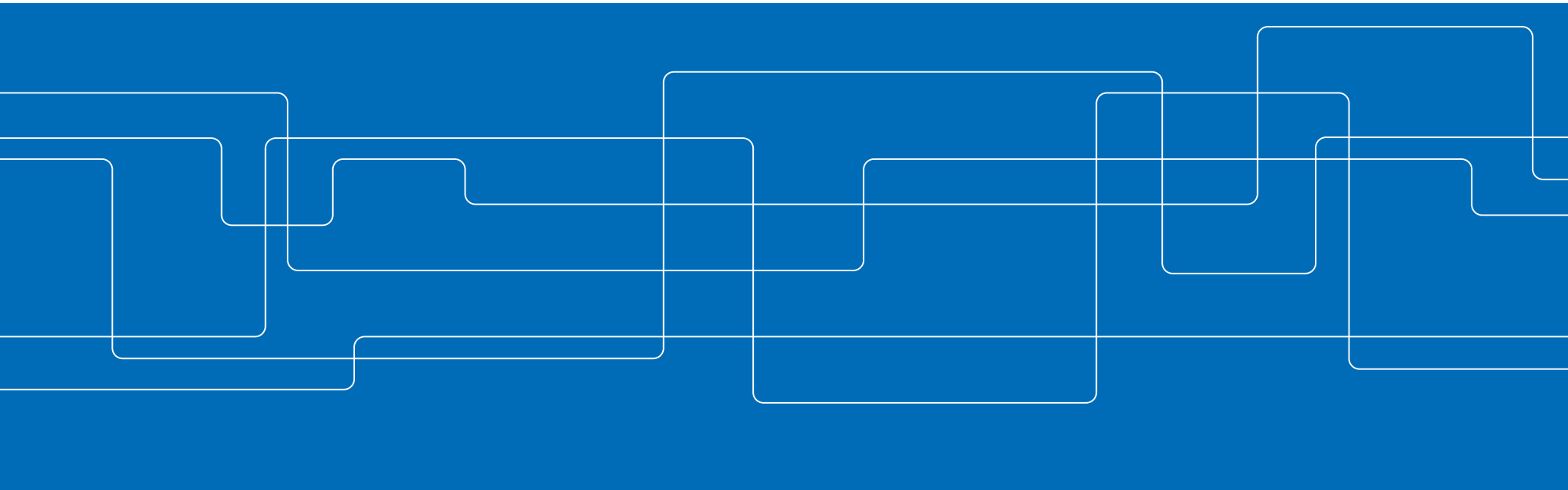
DD2410 Introduction to Robotics

September 20, 2018



Ask questions

You are welcome to ask QUESTIONS at any time during this presentation

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- Even if maps are available, such as blueprints, they are not always useful for the robot and might be incorrect
- It is therefore of great benefit if the robot can construct a map by itself from scratch

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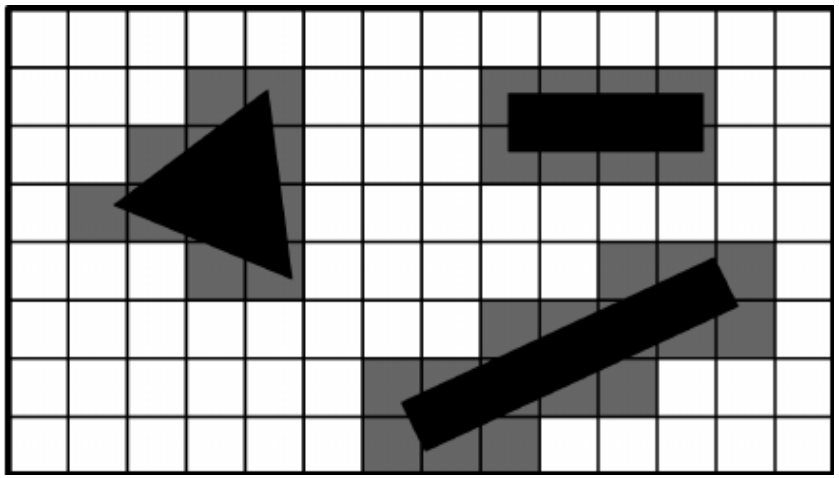
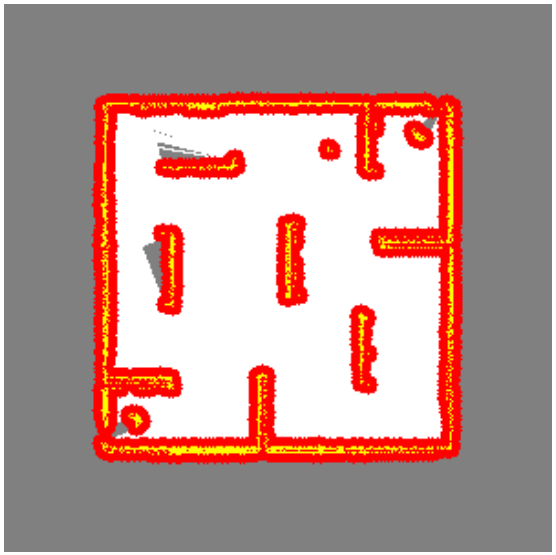
  - The value of the cell tell us if the area is free, occupied, unknown, or something else





The assignment

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- You should use the pose and laser scan data to build a map of the environment
- You should edit and submit the file: *mapping_assignment/scripts/mapping.py*

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- A rosbag contains messages from different ROS topics that have been recorded at an earlier occasion
- They are useful during development and for comparing different algorithms, since you get – almost – the exact same data every time you run the rosbag and you do not have to run a simulator or a real robot every time you want to test your code

E assignment

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  `update_map(self, grid_map, pose, scan)`

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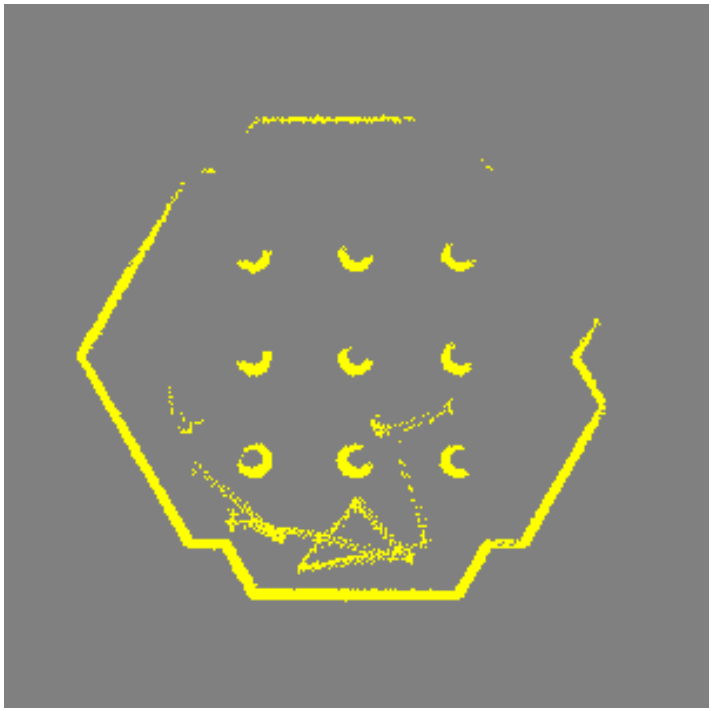
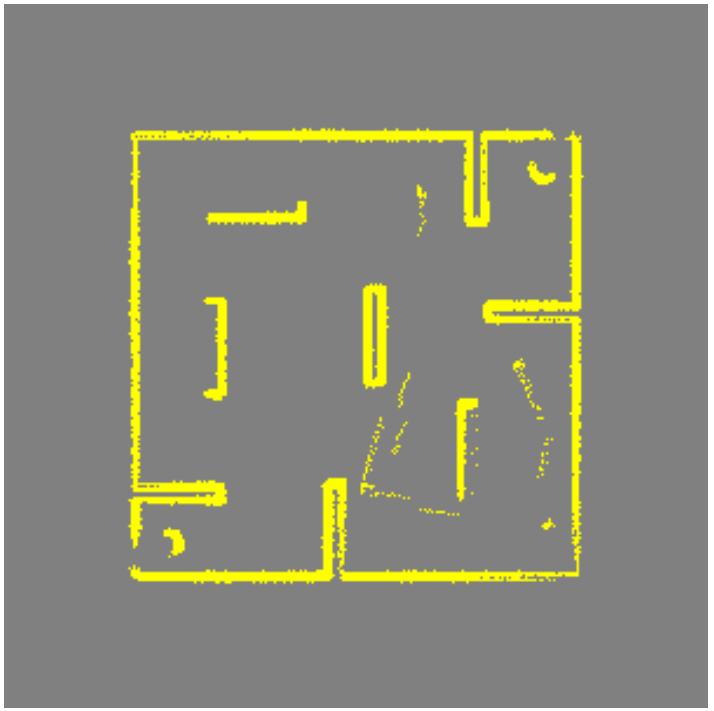
  `update_map(self, grid_map, pose, scan)`
- You can use the function:
  `add_to_map(self, grid_map, x, y, value)`
  to add `value` to `grid_map` at index `(x,y)`. This function does bounds and value checking for you

E assignment

1. Convert the laser scan ranges and bearings to coordinates in the laser frame
2. Convert the coordinates to the map frame
3. Convert the coordinates to map indices
4. Fill in the occupied cells
5. Compare your map to the correct map and when they match submit to Kattis

E assignment





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- It is also wasteful to update the whole map each time. Therefore you should return the updated part of the map
- Fill in the function:

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update_map(self, grid_map, pose, scan)
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- Fill in the function:

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inflate_map(self, grid_map)
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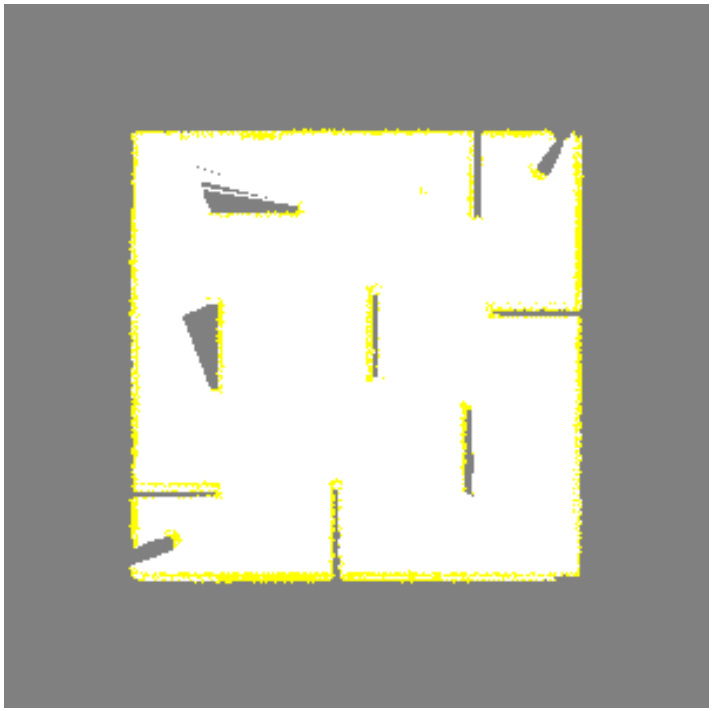
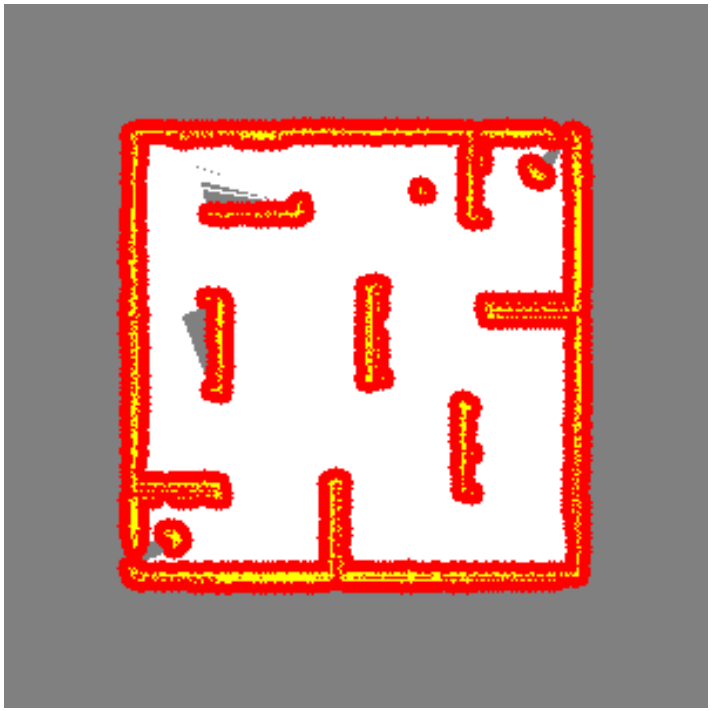
3. Fill in `update = OccupancyGridUpdate()` to only return the updated part of the map

C assignment

1. Clear free space between the scan endpoints and the robot's position, using the `raytrace(self, start, end)` function
2. Fill in occupied space as described in the E assignment
3. Fill in `update = OccupancyGridUpdate()` to only return the updated part of the map
4. Expand occupied space to create C-space in the `inflate_map(self, grid_map)` function

C assignment





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  2. Text files (good before you submit to Kattis)
     - The maps will be saved in a folder called *maps*

Hints

- Use `int(X)` when converting from float to int, do **not** use `round(x)`
- The order in which you update the map is important for the C part of the assignment. Be sure that you do **not** overwrite something you should not do

The end

Questions?

ROS messages - geometry_msgs/PoseStamped

- Contains a pose and a header
- The pose consists of the position and the orientation (in quaternion form) of the robot
- You can ignore all the headers in this assignment. They are however very useful when working with ROS

ROS messages - sensor_msgs/LaserScan

- Contains a laser scan
  - angle_min - Start angle of the scan in radians
  - angle_max - End angle of the scan in radians
  - angle_increment - Angular distance between measurements in radians
  - range_min - Minimum range value in meter
  - range_max - Maximum range value in meter
  - ranges - Range data in meter (values <= range_min or >= range_max should be discarded)[1]
- Again, ignore the header

[1] It should really be (values < range_min or > range_max should be discarded). A mistake was made... TAs are humans too :'(

ROS messages - nav_msgs/OccupancyGrid

- Contains the actual occupancy grid
- The map data is stored in data, in row-major order, starting with (0,0)
- Also contains a header
- Also contains meta data for the map, in form of nav_msgs/MapMetaData
- You will **not** be working directly with this message, instead you will be working with a class called *GridMap* which is easier to use

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- y - Starting y coordinate of the rectangle area (should be minimum y)
- width - The width of the rectangle area
- height - The height of the rectangle area
- data - The actual map data for the rectangle area, in row-major order, starting with (x,y)