Classifying Laser Range Data "Images"

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Project Description

Purpose and Goals

The main task of the
project was to make a robot identify certain elements in its surroundings, for example, doors, , open room, clutter and maybe chairs, tables, humans, e.t.c.

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Offline data to be used during development
and if ported into ROS maybe test on online data.

Laser Range Data

Parser

The laser scanner took measurements with 4-5 Hz. Each measurement was stored in the following format:

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<unknown> <unknown> <number_of_points> <timestamp_seconds>
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The parser yields polar coordinates which are hard to work with.

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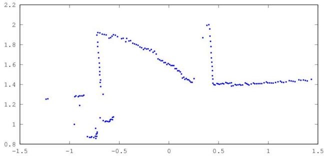
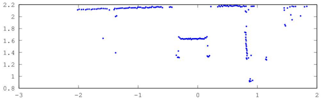
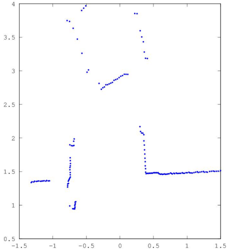
For instance, we can use well-known algorithms and mathematical formulas to interpolate the data or find patterns in the data.

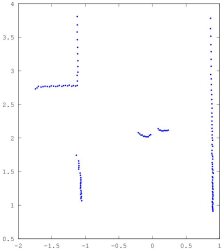
Laser Range Data

Example Plots









Algorithm

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Eventually we had to only use supervised learning as we had to change the way the whole classifier was going to work.

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Directly Comparing Measurements

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- Difficult to find an algorithm to compare measurements
- Since the list grows, the classifier can introduce small errors that will accumulate

Algorithm

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However this is quite an unstable solution since slightest shift will become an error.

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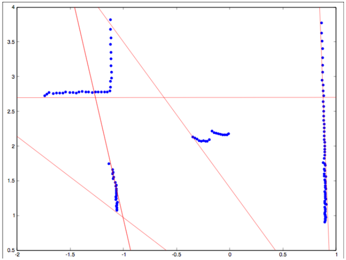
1. Find the first line between startpoint and the next point
2. Check if the next point is in bounds of y_{upper} and y_{lower}
3. If 2 Adjust the original line with weight to the new point
4. When done check if line length $>$ 0.25 m and has at least 3 points
5. Repeat 1 until no more points can be checked

Algorithm

Line Finding

Ran linefinding with 0.2 m thick line, and 10 degrees of margin of error for finding perpendicular and parallell lines.



- Number of lines: 5
- Mean length of lines: 0.892474 m
- Parallel: 4
- Perpendicular: 3

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The algorithm we chose was the ID3 (Decision tree algorithm) which was a perfect algorithm to represent this abstract data structure.

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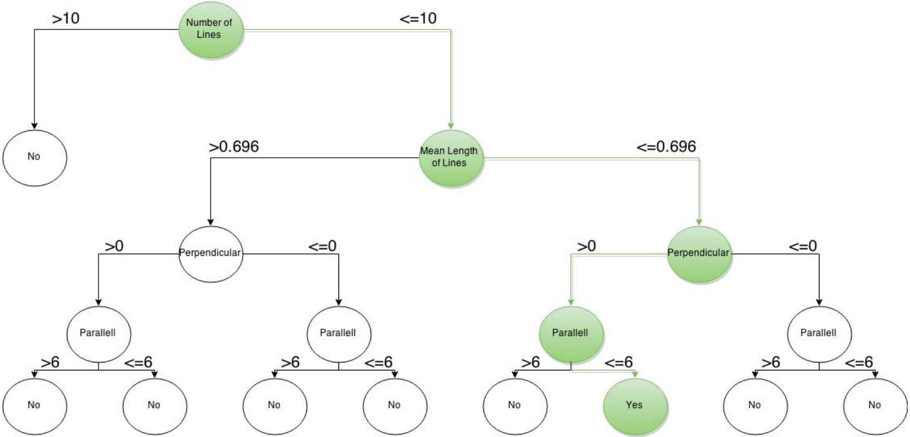

Conclusion

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The attributes we have might not be enough.

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- Introduce more layers to the classifier, identify other structures and based on this make a classification

Thanks for listening

Any questions?