SIGNALS, INSTRUMENTS AND SYSTEMS

Course project 2: Road sign recognition

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Introduction

- Simulated environment
- Leading the E-Puck out of the maze as rapidly as possible with the help of road signs pointing towards the exit.
- Compare an odometry-based with an absolute localization.
- Towards autonomous vehicle...
Methods

- FFT based strategy to decide which direction to turn
Experiments & results

- Sharp road signs
- 50 trials from each entry
- Success (escape without mistake): 100%
- Average time:

<table>
<thead>
<tr>
<th>Entry 1</th>
<th>Entry 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.9 ± 0.5 s</td>
<td>25.1 ± 0.3 s</td>
</tr>
</tbody>
</table>

With these conditions, the E-Puck performs well!
Experiments & results

- Noisy road signs
- 30 trials from each entry
- Success (escape without mistake): 23%
- Average time:
  - Entry 1: $40.6 \pm 7.4$ s
  - Entry 2: $36.4 \pm 8.4$ s

Error distribution:

<table>
<thead>
<tr>
<th></th>
<th>Error at horizontal stripes (noisy)</th>
<th>Error at vertical stripes (noisy)</th>
<th>Error at both noisy panel</th>
<th>Error at black panel</th>
<th>No error</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/60</td>
<td>14/60</td>
<td>16/60</td>
<td>0/60</td>
<td>14/60</td>
<td></td>
</tr>
<tr>
<td>~26.6%</td>
<td>~23.3%</td>
<td>~26.6%</td>
<td>0%</td>
<td>~23.3%</td>
<td></td>
</tr>
</tbody>
</table>

With these very noisy road signs, the E-Puck takes random decisions.
More experiments

- Salt-and-pepper noise
- 100 road signs analysed
- Correct decision: 97%

With these other noisy road signs, the E-Puck takes rarely wrong decisions
Odometry
Odometry

- errors are of the order of some centimeters and the maximal error is approximately 5 cm
- the further the E-Puck travels, the more uncertain its position will be
- The errors could be due to:
  - inexact axel length and wheel radius
  - no slipping hypothesis unverified
  - unprecise $90^\circ/180^\circ$ turns
More experiments

- Modified maze
- Further testing of the obstacle avoidance and trajectory modification capability
- Speed had to be reduced
- Different incidence angles were tested
Conclusion

- Sharp road signs: 100% success
- Noisy road signs: Success is very noise dependant
- Obstacle avoidance capability: With reduced speed, collision course over a circular arc of 7°
- Odometry: Accuracy in the order of a few centimeters along the path
Thank you for listening

- Do you have some questions?