ROAD SIGN RECOGNITION WITH E-PUCK ROBOT

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Project goal

Program E-puck to distinguish the signs

Three signs to distinguish

Action to take: turn left for RoadSign1, right for RoadSign2, turn around for RoadSign3

Use of 3 tools:

❖ Webots (simulation world)
❖ Matlab (FFT analysis)
❖ E-puck
Methods

A. Movement
- IR sensors
- Speed - *wait*-time relation

× IR does not work very well with dark surfaces
Methods

B. Image analysis

- Enhancing the contrast

E-puck photo of RoadSign1 in the light reduced environment

E-puck photo of RoadSign2 in the light reduced environment

Comparison to the mean value

E-puck photo of RoadSign2 in the light reduced environment with enhanced contrast
Methods

B. Image analysis

- Fast Fourier transform (FFT)

View of a signal in the time and frequency domain
Methods: Image analysis, FFT

E-puck photo of RoadSign1

E-puck photo of RoadSign2
Methods: Image analysis, FFT

RoadSign1 (horizontal) E-puck FFT

RoadSign2 (vertical) E-puck FFT
Experiments and results

Experiments:
A. Single sign recognition
B. Maze
Experiments and results

1. Only rows-wise analysis

- Horizontal seen as vertical
- Black seen as horizontal
- Vertical seen as horizontal
Experiments and results

1. Only rows-wise analysis

Successful performance statistics:

<table>
<thead>
<tr>
<th>RoadSign1</th>
<th>RoadSign2</th>
</tr>
</thead>
<tbody>
<tr>
<td>92.8%</td>
<td>92%</td>
</tr>
</tbody>
</table>

E-puck successful rate of single sign recognition

<table>
<thead>
<tr>
<th>RoadSign1</th>
<th>RoadSign2</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.5%</td>
<td>57%</td>
</tr>
</tbody>
</table>

E-puck successful rate of single sign recognition in reduced light conditions

<table>
<thead>
<tr>
<th>Path 1</th>
<th>Path 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>27%</td>
</tr>
</tbody>
</table>

E-puck successful rate of exiting the maze
Experiments and results

2. Rows-wise and columns-wise analysis

Horizontal seen as vertical

Horizontal seen as vertical

Black seen as horizontal

Vertical seen as horizontal
Experiments and results

Flowchart based on the rows-wise and columns-wise analysis:

<table>
<thead>
<tr>
<th>Path 1</th>
<th>Path 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>62%</td>
<td>68%</td>
</tr>
</tbody>
</table>

E-puck successful rate of exiting the maze
Conclusion

❖ Simulation world VS. real world
  • Limited memory and computational power
  • IR sensors
  • Light
  • Surface
❖ Processes synchronisation
❖ Test scenarios and definition of the success
❖ Limited time pressure

BUT

Overall great experience!