Road sign recognition with E-puck

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Introduction

- Implement strategy to read simple road signs
- Implement a supervisor to test our algorithm
- Implement odometry to follow the position of the robot
Limitations

- Resolution of the camera that can be grabbed (40x40)
- Rate of frame 8 frames/sec
- Noise intrinsic to the robot → simulated in Webots
- Noise in the road signs
Recognition strategy

- Sum over the lines and the columns

- Compute the fft of both vectors

- Compute the ratio: $\frac{\sum F_{magn,rows}}{\sum F_{magn,cols}} \Rightarrow$ Decision ratio (DR)

  DR > 3 $\Rightarrow$ Horizontal $\Rightarrow$ turn left

  DR < 1/3 $\Rightarrow$ Vertical $\Rightarrow$ turn right

  DR $\sim$ 1 $\Rightarrow$ Black $\Rightarrow$ return back
Validation of the algorithm with Matlab

2 types of noise generator:

- Swiping the pixels randomly

- Decrease the contrast


Experiments

- Exit a maze starting from 2 different initial positions
- Modify light conditions
- Modify the road signs for noisy images
Results

- Maze exits with success in 29.056 [s] (starting point n°1) and 24.736 [s] (starting point n°2)
  - Time remains the same for every simulation in normal condition

- Variation of the conditions
  - Light conditions
    - Can influence the success of the maze exiting task (not enough light or $1/3 < \text{DR} < 3$)
    - No influence on the time to exit the maze
  - Noise on the road signs:
    - Limited by the DR
    - If the task is successful $\Rightarrow$ time remains always the same

- The computation required to take the decision is invariant of the external conditions
Odometry

- Use of «angle sensor» to estimate the position of the robot with time
- Comparison with position device = «true position»
- Relative position → initial position set to coordinates (0;0)
Odometry results

- Angles not accurate
- Cumulative errors
Conclusion

- Algorithm works well

- Change of light conditions and addition of noise in the road signs ≠ longer computation

- Optimisation of the method possible