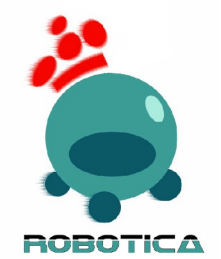
Robot evolutionary localization based on attentive visual short term memory

Julio Vega, Eduardo Perdices, José M. Cañas



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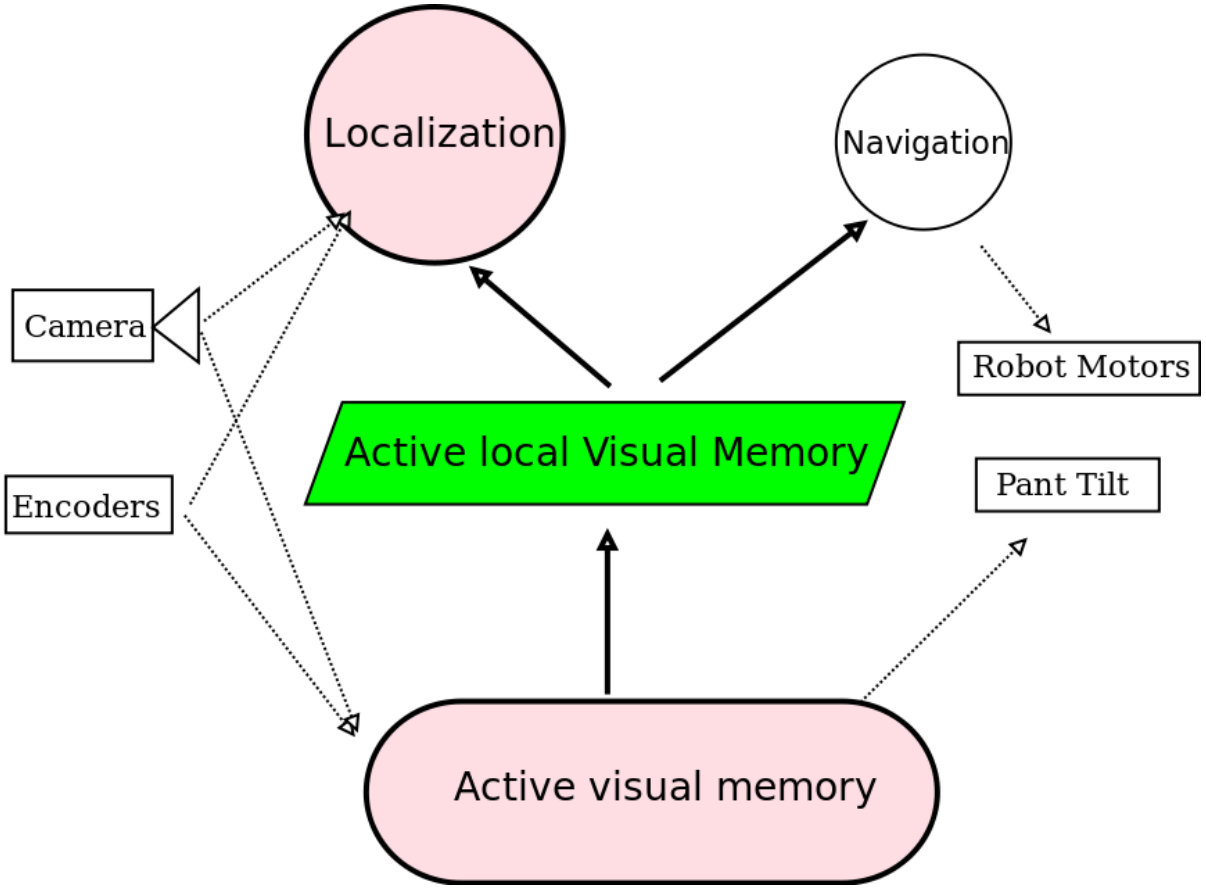
1. Introduction

- Cameras are one of the most relevant sensors in autonomous robots.
- A challenge is to extract useful information from captured images.
- And to manage the small field of view of regular cameras.

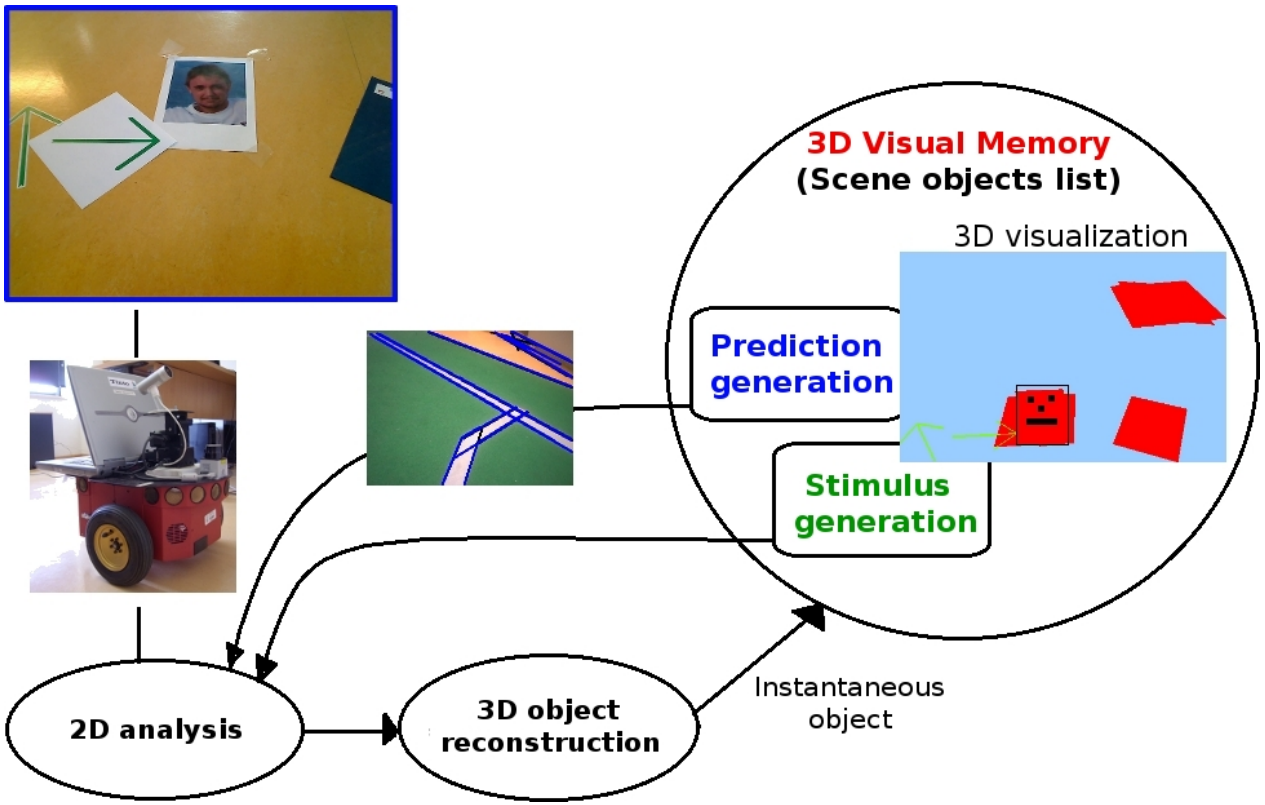
2. Objectives

- Avoid false positives and occlusions.
- Create a robust visual memory.
- Locate the robot with robustness.

3. Design

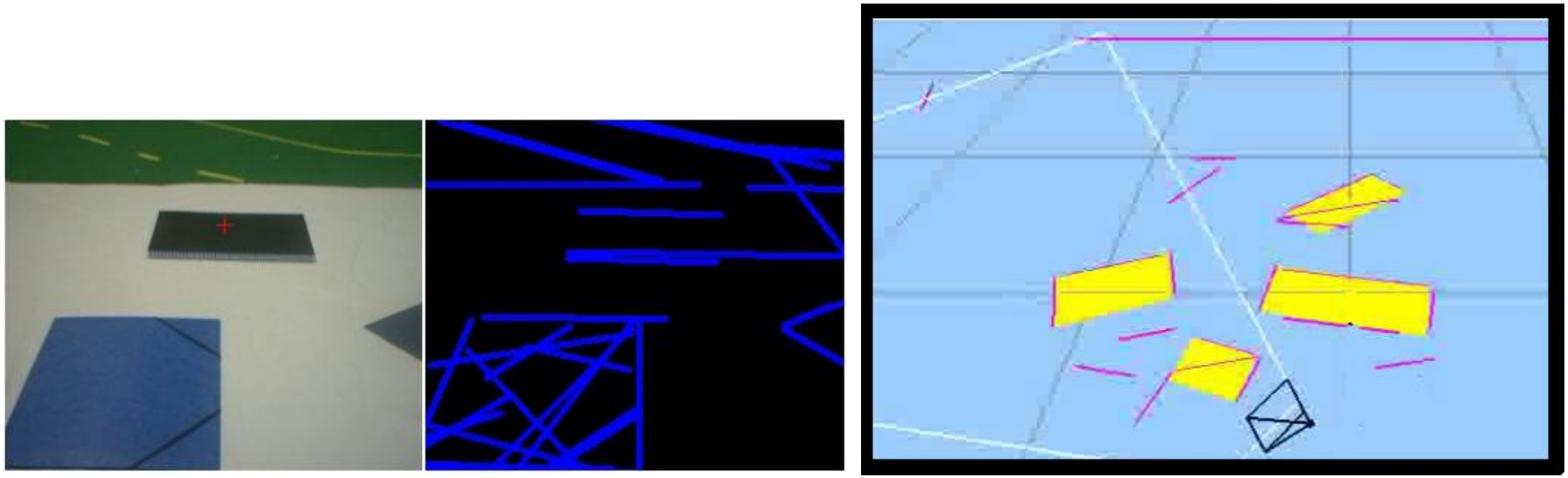

Localization
Navigation
Camera
Robot Motors
Active local Visual Memory
Encoders
Pant Tilt
Active visual memory

4. Attentive short term visual memory



2D Image Processing

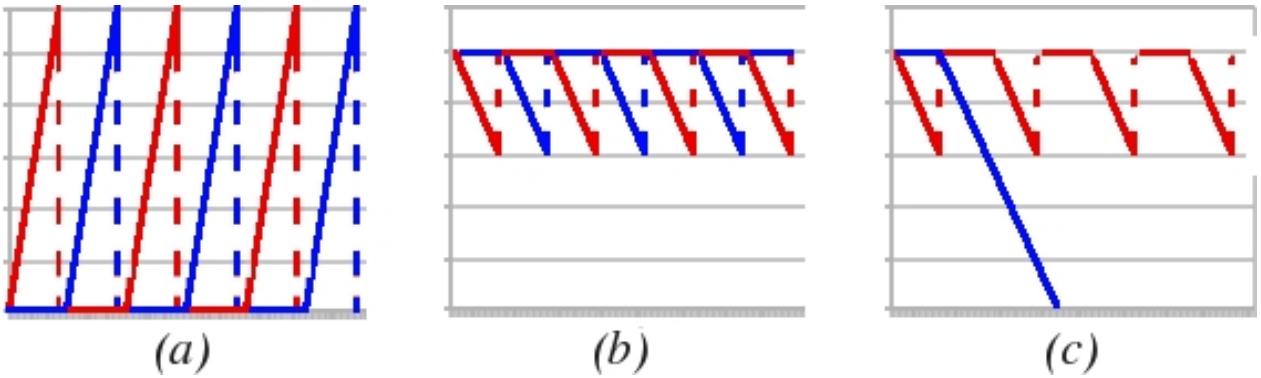
The goal: to extract 2D segments as a basic primitive to get object shapes.



- Each stored 3D visible object is projected on the image plane.
- The system corroborates such segments, comparing with image ones.
- We create more complex objects such as parallelograms.

Visual attention system

The goal: to control the camera movements to track objects and explore areas.



- *Salience*: and attention points: to control the movement of the PT unit.
- *Life*: to forget old elements.

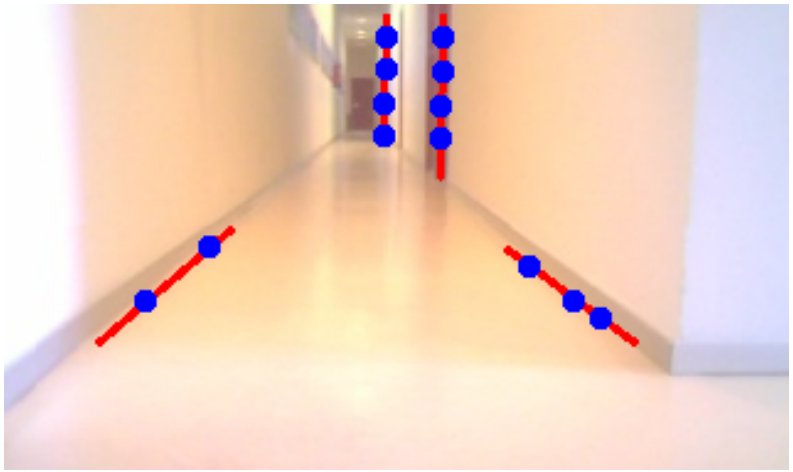
5. Evolutionary visual localization

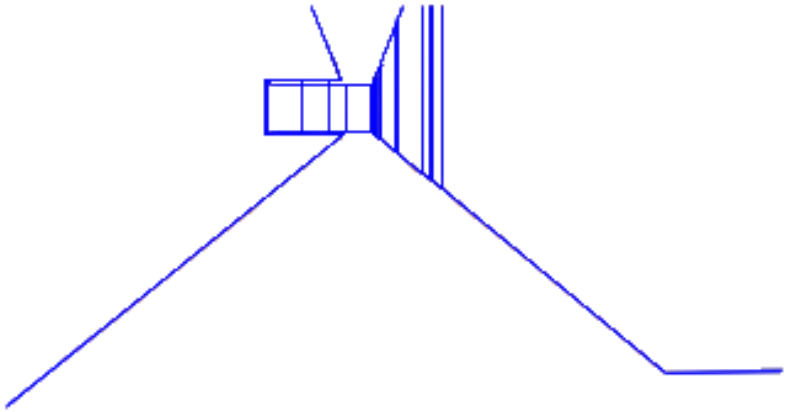
The goal: Locate the robot inside a known environment.

- *Individuals*: Candidate positions and health.
- *Races*: Population of Individuals that evolve over time using genetic operators.

Health calculation

The goal: Compare theoretical and real images.

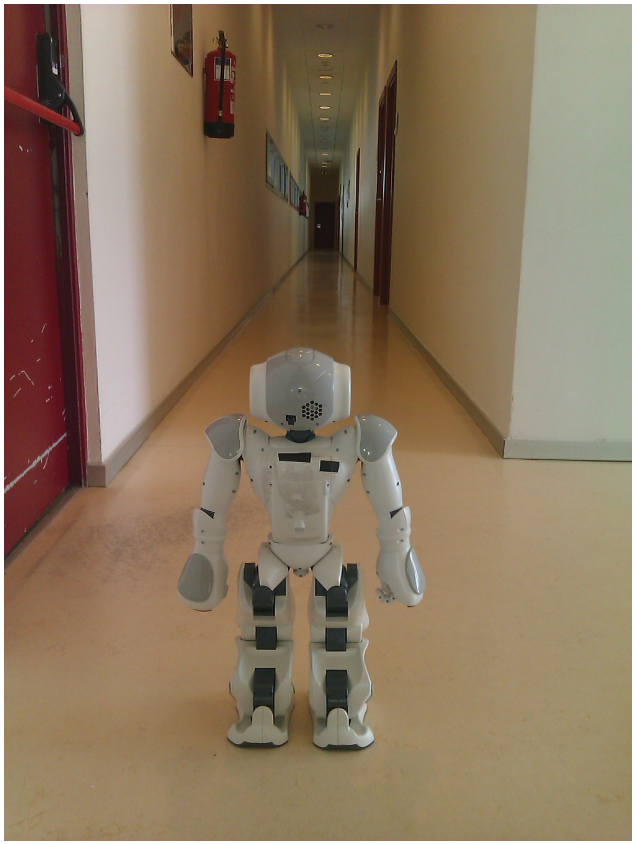




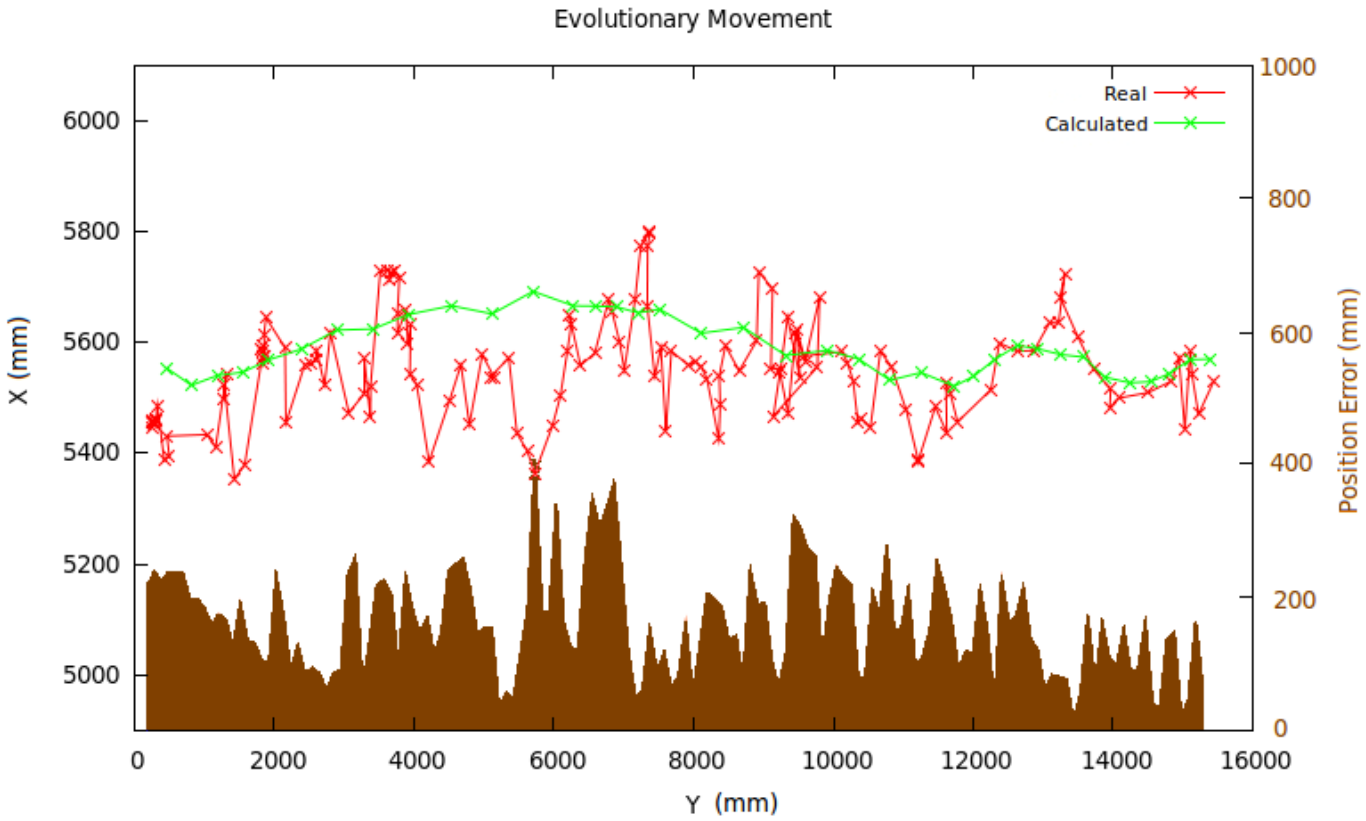
Race management and evolution

- Create, delete and merge races.
- Evolve races with:
  - Genetic operators.
  - Robot odometry.
- Select the current robot pose.

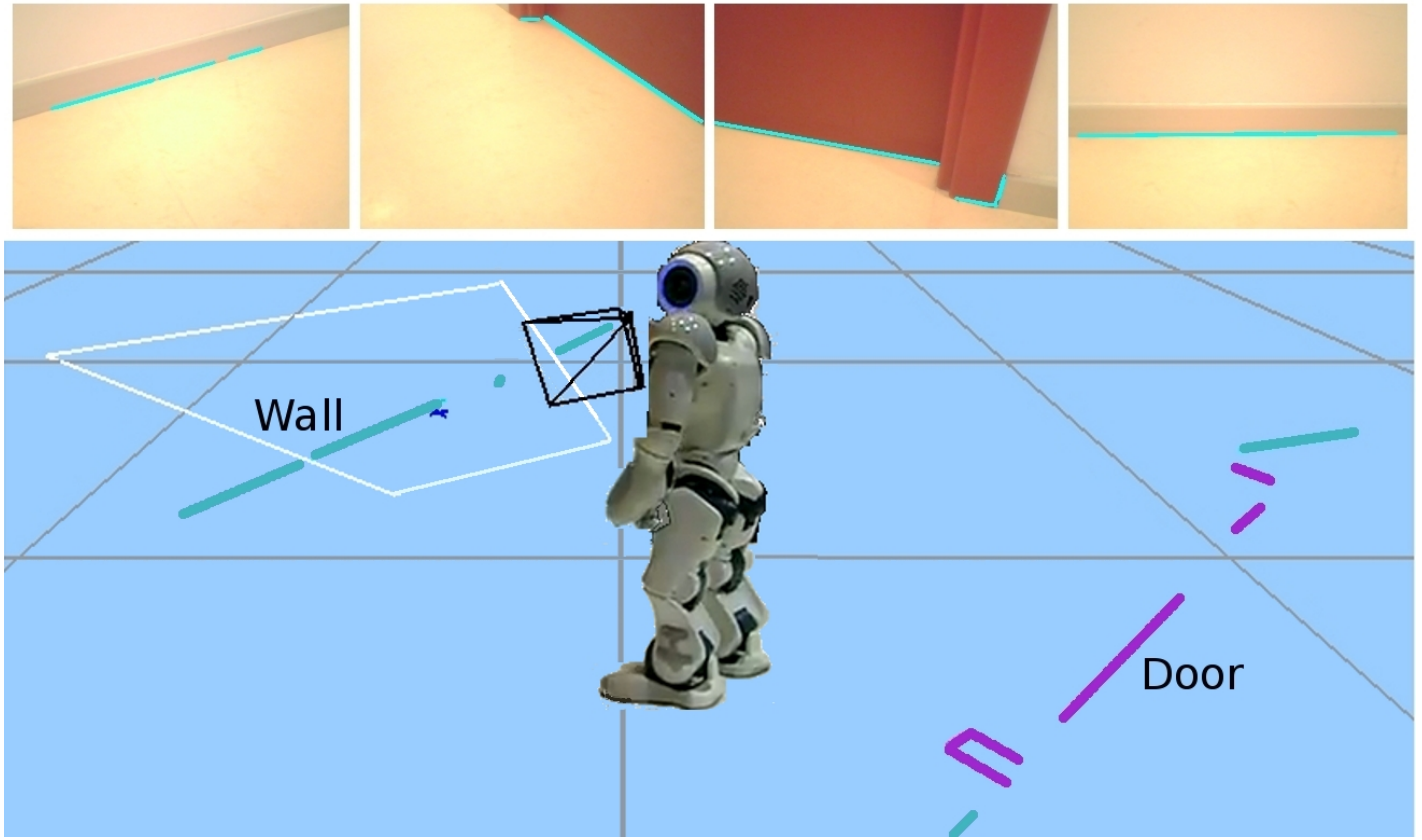
6. Experiments



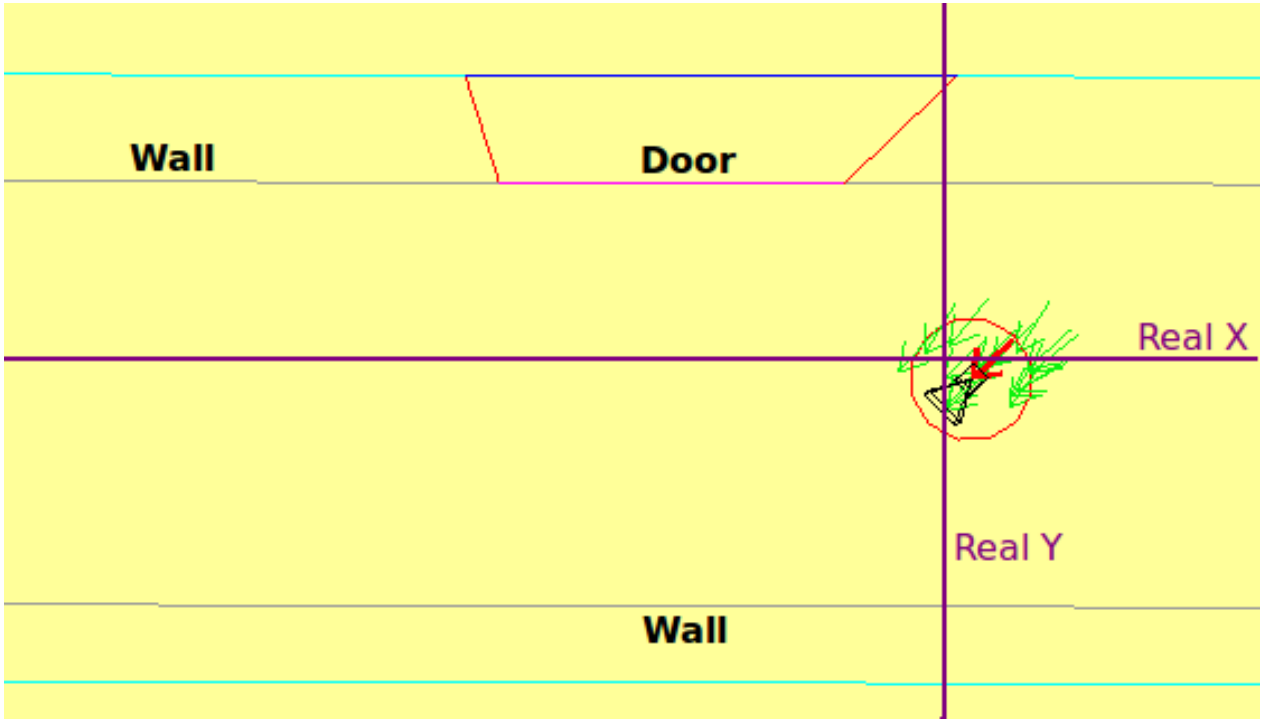
Localization experiment



Visual Memory



Localization with visual memory



7. Conclusions

- Visual memory mechanism.
- Visual attention system.
- Robust localization algorithm.
- Visual memory improves localization.

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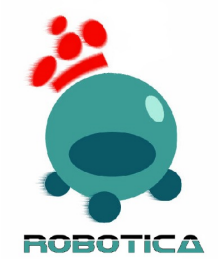

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