

EXPLOITING SEMANTIC INFORMATION IN INDOOR ENVIRONMENTS

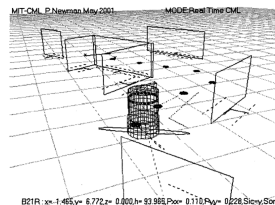
Mathias Fassini Mantelli

Federal University of Rio Grande do Sul
Institute of Informatics
Postgraduate Program in Computing

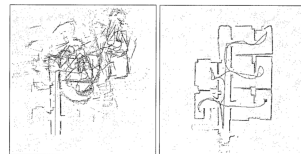
November 27, 2021

FIRST YEARS OF MOBILE ROBOTICS

- Ages of mobile robotics:
 - Classical age (1986-2004)



(A) Real Time CML¹



(B) Online mapping²

FIGURE: Initial works on SLAM

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 - ▶ Introduction of the main probabilistic formulations for **SLAM**
 - ▶ **Lidar** and **sonar** sensors

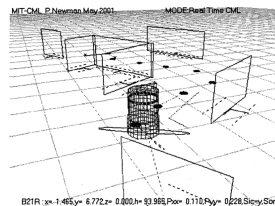
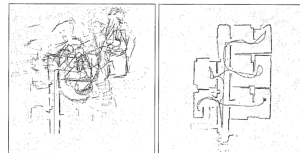
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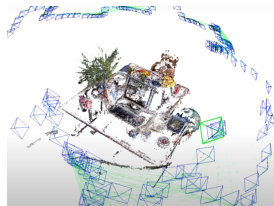
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FIGURE: Improved SLAM and Visual SLAM

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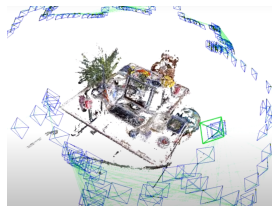
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 - ▶ **Visual** sensors
 - Geometric perception

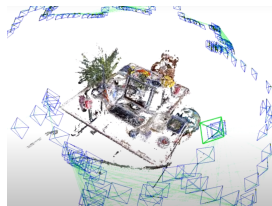
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GEOMETRIC PERCEPTION

- Useful for many **robotic tasks**

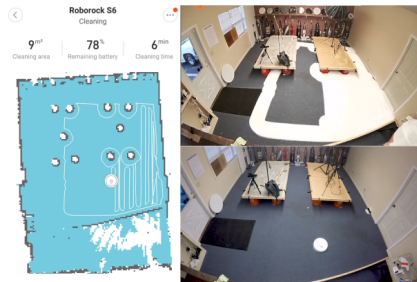


FIGURE: Vacuum cleaner robot in operation.⁵

⁵Extracted from [youtube.com/watch?v=5O8VmDiab3w](https://www.youtube.com/watch?v=5O8VmDiab3w)

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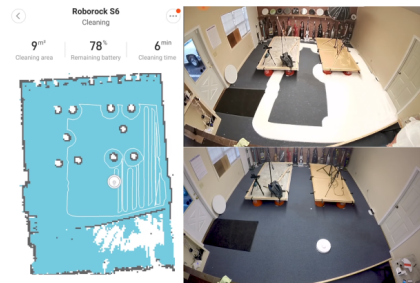


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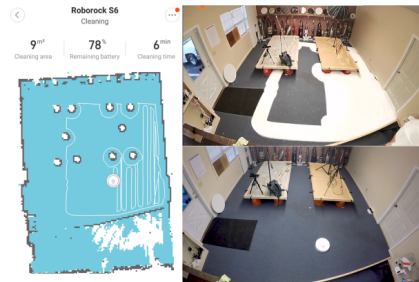


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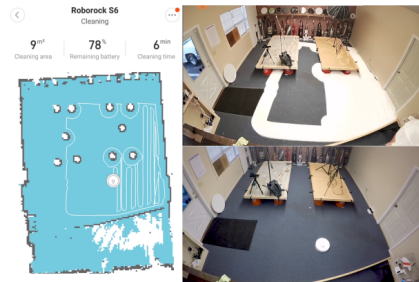


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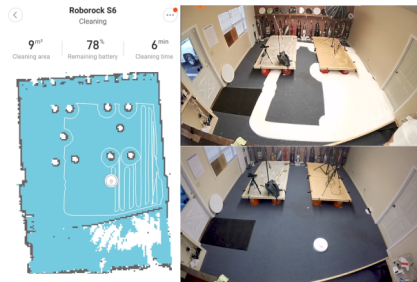


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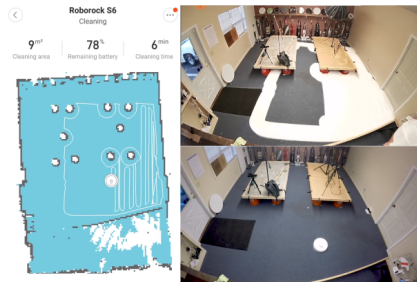


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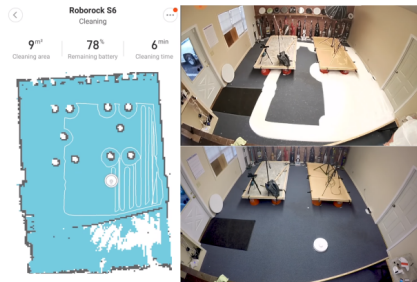


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- How to **overcome** these **limitations**?

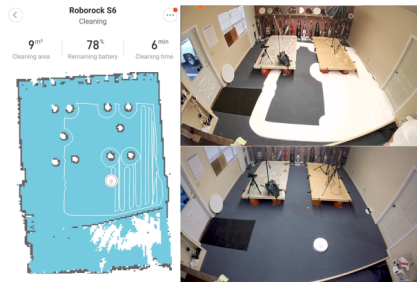


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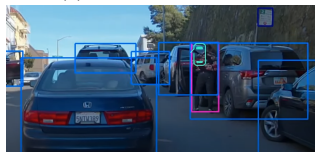
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EXPAND THE GEOMETRIC PERCEPTION

- **Understand** the **concepts** of parts of the **environment** (Semantic information)



(A) The siren of the fire truck



(B) The car door

FIGURE: Self-Driving System of an autonomous driving car.⁶

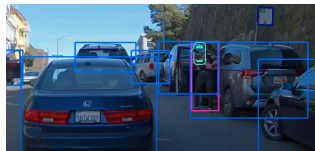
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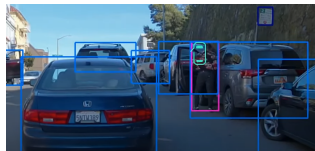
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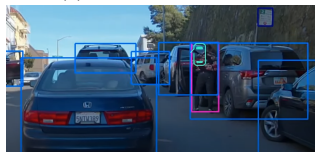
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- Enhance robot's autonomy and robustness, **facilitate** more **complex tasks**
- Essential for **high-level reasoning**



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HYPOTHESIS

Semantic information *associated with the* **spatial and temporal organization** *of the environment help mobile robotics to* **overcome the limitations** *to deal with* **high-level tasks**

SEMANTIC INFORMATION WITHIN MOBILE ROBOTICS

- **Which** type of **semantic information** is **relevant** to the **task**?

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- **How** to perform the **inference/estimation** of the semantic information?
- **How** to **use** the **semantic information** to improve the **robot's performance**?
- We **investigate** this questions in the context of a **high-level task: object search (OS)**

OBJECT SEARCH (OS) TASK

- Challenging and unsolved task for robots

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 - Semi-dynamic obstacles

PROBLEMS INVOLVED IN THIS WORK

- **Mobile robotics** problems:
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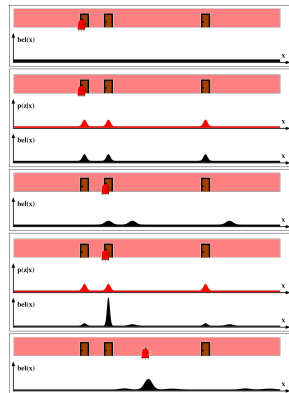


FIGURE: Illustration of the Markov localization algorithm.⁷

⁷Thrun, Sebastian. "Probabilistic robotics." Communications of the ACM 45.3 (2002): 52-57.

PROBLEMS INVOLVED IN THIS WORK

- **Mobile robotics** problems:
 - **Localization**
 - **Mapping**



FIGURE: Mapping with position indexed by odometry.⁸

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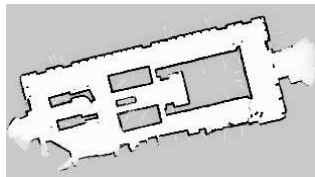


FIGURE: Occupancy grid map.⁹

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OBJETIVOS

OBJETIVO GERAL

O objetivo geral é fazer um algoritmo para calcular expressão gênica a partir de uma parte da sequência de RNA

OBJETIVOS ESPECÍFICOS

- Objetivo específico 1
- Objetivo específico 2
- Objetivo específico 3
- Objetivo específico 4

FUNDAMENTAÇÃO TEÓRICA

- Nós utilizamos essa abordagem
- Assim assim
- Assado

FUNDAMENTAÇÃO TEÓRICA

Nesta **abordagem** nós fizemos bla bla bla

- Exemplo de item
- Exemplo de item

THEOREM (MASS-ENERGY EQUIVALENCE)

$$E = mc^2$$

METODOLOGIA

Passos da metodologia

- 1 Statement
- 2 Explanation
- 3 Example

Explicando alguma coisa ... lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer lectus nisl, ultricies in feugiat rutrum, porttitor sit amet augue. Aliquam ut tortor mauris. Sed volutpat ante purus, quis accumsan dolor.

RESULTADOS

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

TABLE: Table caption

RESULTADOS



CONCLUSÃO

- more work
- more responsibility
- more satisfaction

AGRADECIMENTOS

Agradeço a fulano, ciclano e beltrano que apoiaram o desenvolvimento dessa pesquisa.

REFERÊNCIAS I



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