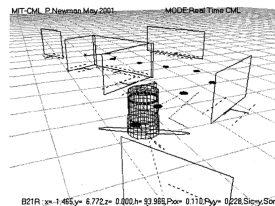# EXPLOITING SEMANTIC INFORMATION IN INDOOR ENVIRONMENTS

Mathias Fassini Mantelli

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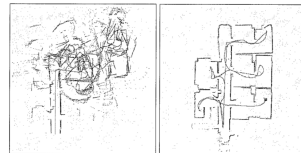Postgraduate Program in Computing

November 27, 2021

FIRST YEARS OF MOBILE ROBOTICS

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

(A) Real Time CML[1]

(B) Online mapping[2]

FIGURE: Initial works on SLAM

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[1] Newman, Paul, et al. "*Explore and return: Experimental validation of real-time concurrent mapping and localization.*" ICRA, 2002

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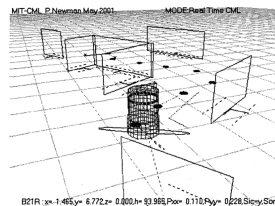   - ▶ **Lidar** and **sonar** sensors

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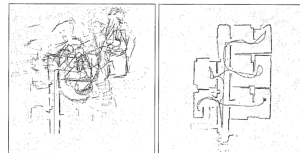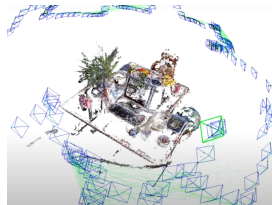   - **Lidar** and **sonar** sensors
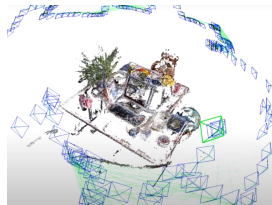 - Algorithmic-analysis age (2004-2015)

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FIGURE: Improved SLAM and Visual SLAM

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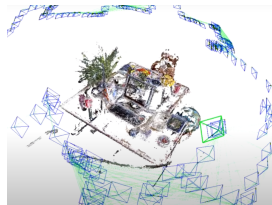   - ▶ **Visual** sensors
  - **Geometric perception**

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GEOMETRIC PERCEPTION

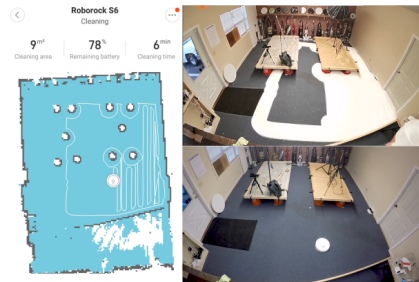- Efficient for **building maps** and **state estimation**

FIGURE: Vacuum cleaner robot in operation.[5]

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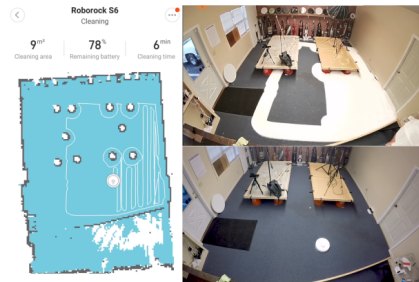- Useful for many **robotic tasks**
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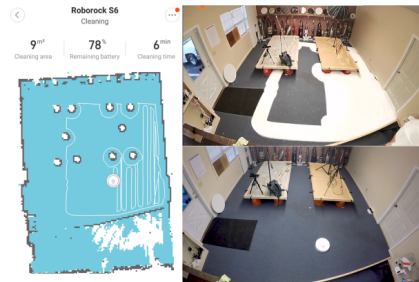- Useful for many **robotic tasks**
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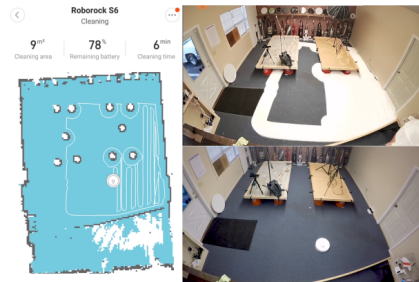- Useful for many **robotic tasks**
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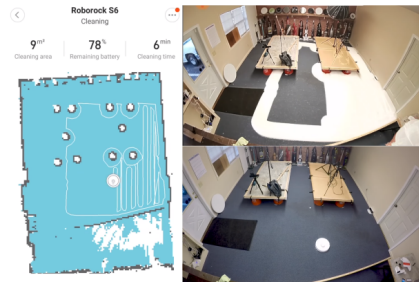   - Type of maps (free, occupied, unknown)
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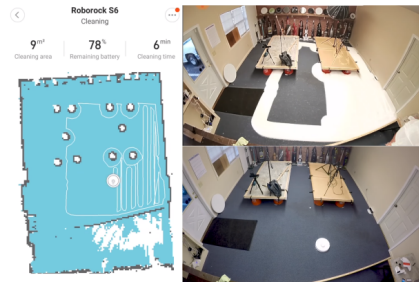   - Does not distinguish obstacles
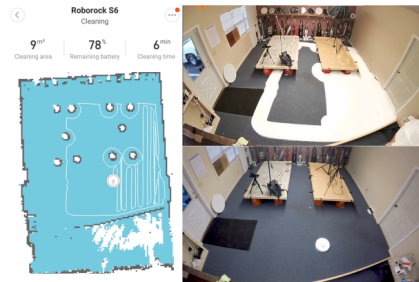   - Insufficient for high-level tasks
- How to **overcome** these **limitations**?
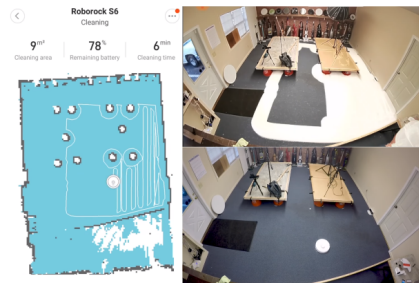
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EXPAND THE GEOMETRIC PERCEPTION

- **Understand** the **concepts** of parts of the **environment** (Semantic information)
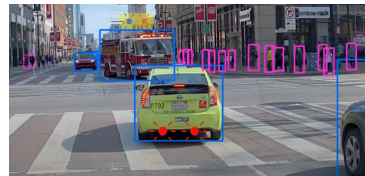
(A) The sire of the fire truck

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

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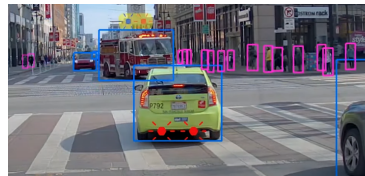
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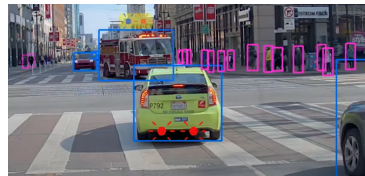FIGURE: Self-Driving System of an autonomous driving car.[6]

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- Essential for **high**-level reasoning
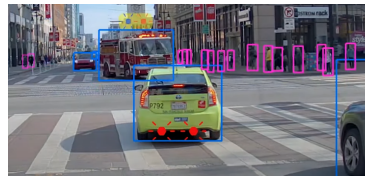
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HYPOTHESIS

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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SEMANTIC INFORMATION WITHIN MOBILE ROBOTICS

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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

- Involves SLAM, path planning, and object recognition

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- The robot looks for a target object in an unknown environment
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  - text
  - dynamic obstacles

OBJECT SEARCH (OS) TASK

- Types of OS:

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Object search (OS) task

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JUSTIFICATIVA: BLOCOS

BLOCK 1

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.

BLOCK 2

Pellentesque sed tellus purus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Vestibulum quis magna at risus dictum tempor eu vitae velit.

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

Figure: Aqui temos a imagem do padrao.

Conclusão

- more work

- more responsibility

- more satisfaction

Agradecimentos

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

Referências I

📄 Shuntaro Takahashi, Hiroyuki Furusawa, Takuya Ueda, and Yoshio Okahata.
Translation enhancer improves the ribosome liberation from translation initiation.
Journal of the American Chemical Society, 135(35):13096–13106, 2013.

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