

Mobile Robot Place Segmentation and Categorization Using Object Semantics

Jesus Moncada-Ramirez, Jose-Raul Ruiz-Sarmiento, Cipriano Galindo and
Javier Gonzalez-Jimenez

Machine Perception and Intelligent Robotics Group (**MAPIR-UMA**),
Málaga Institute for Mechatronics Engineering and Cyber-Physical Systems (**IMECH.UMA**),
University of Málaga, Spain

Padua, September 2025



UNIVERSIDAD
DE MÁLAGA

Motivation -----

1. Introduction

Mobile robots are increasingly being used for complex tasks...



Common need:
COGNITIVE CAPABILITIES

Semantic maps (3D scene graphs)

Motivation -----

1. Introduction

Maps with information of type...

Geometric

Shapes and contours of objects,
positions, dimensions, scale...

Semantic

Categories of objects (e.g., “chair”,
“table”, etc.)



(Matez-Bandera et al. 2024)

Motivation ----- 1. Introduction

...that can be enriched with information about...

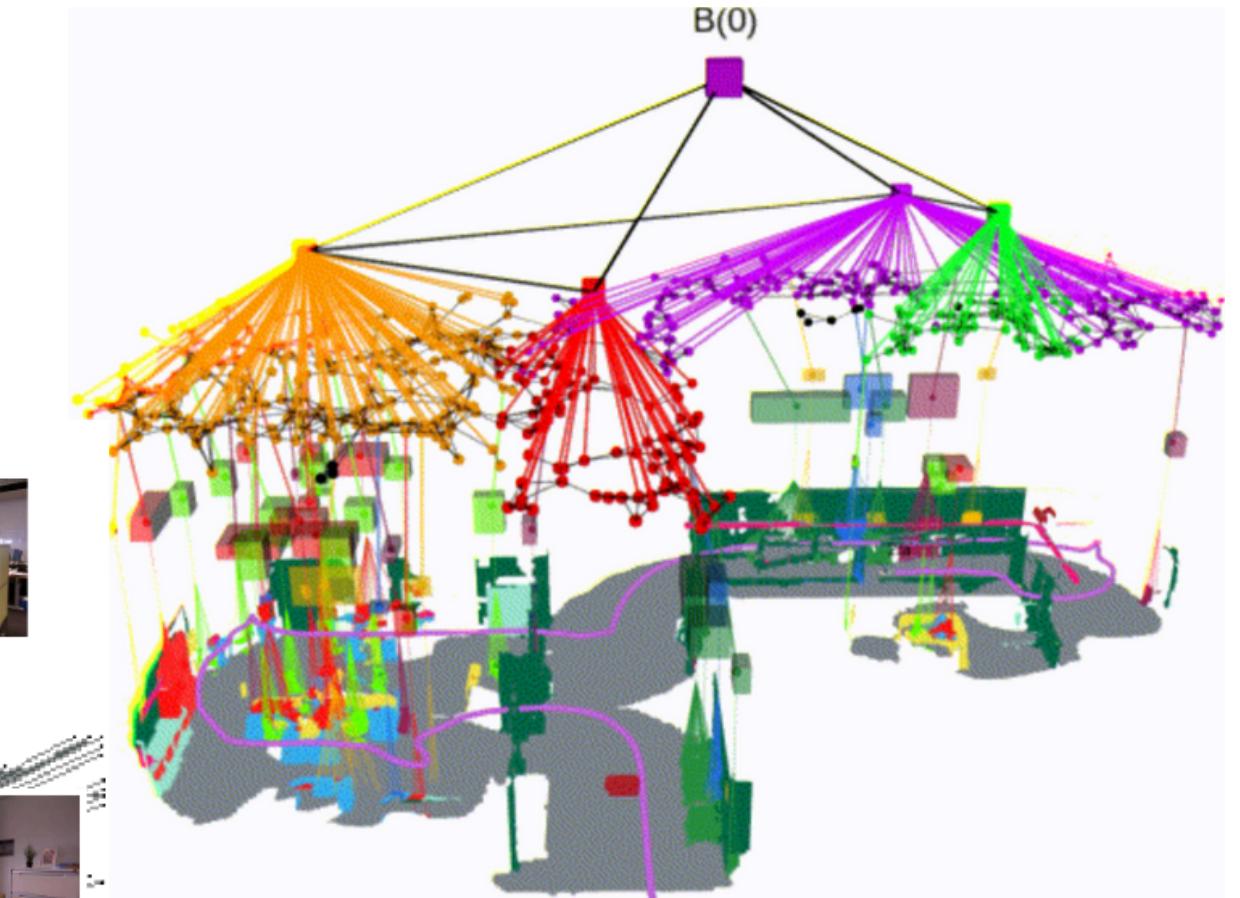
Places

Significant areas within the environment

Place **segmentation** and **categorization**



(Hughes et al. 2022)



(Sünderhauf et al. 2016)

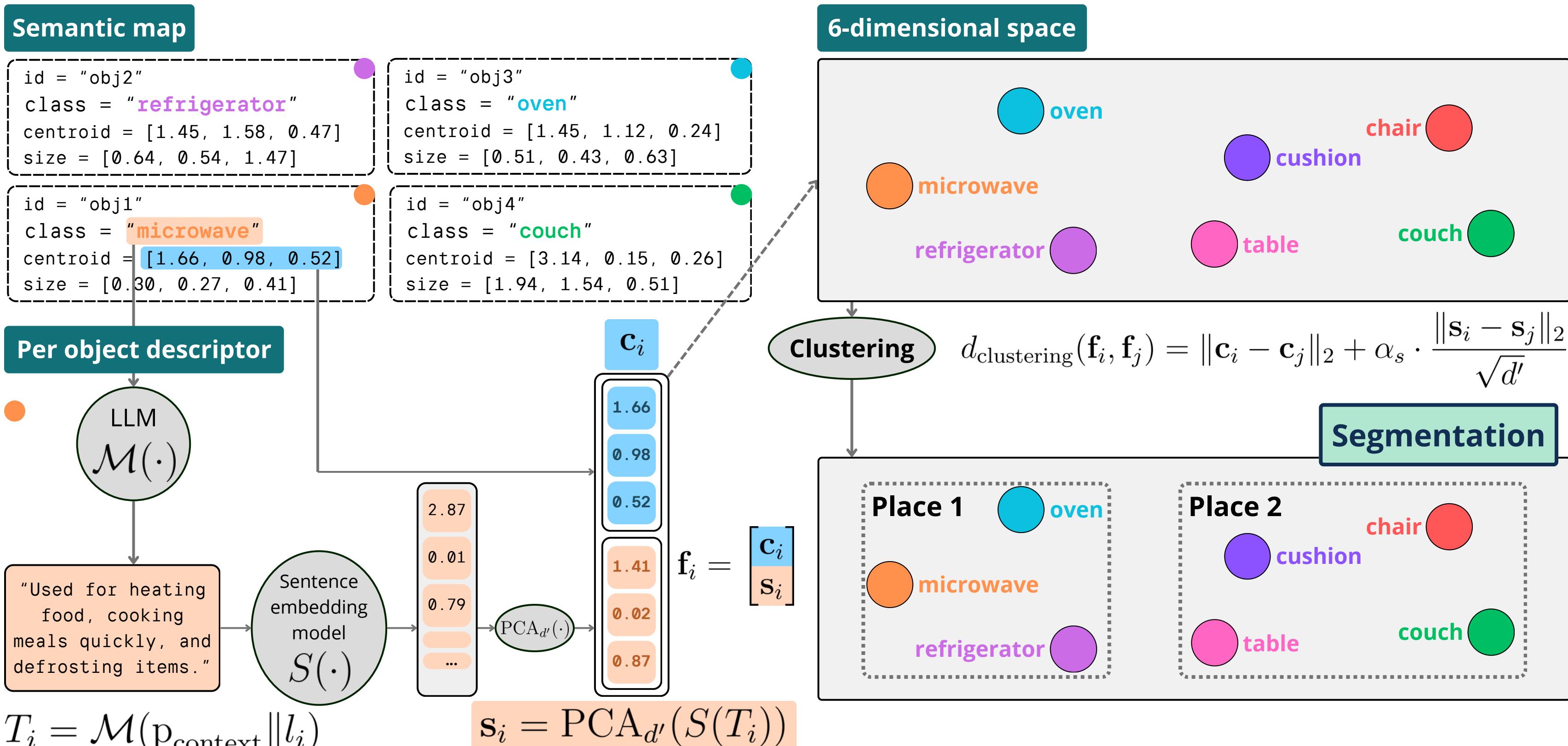
**Traditional place
segmentation +
categorization**

- **Manual** annotations
 - **Room-based** assumptions
 - **Closed** vocabulary
-
- Solution**
- **Automatic** process
 - **Functionality-based** approach
 - **Open** vocabulary

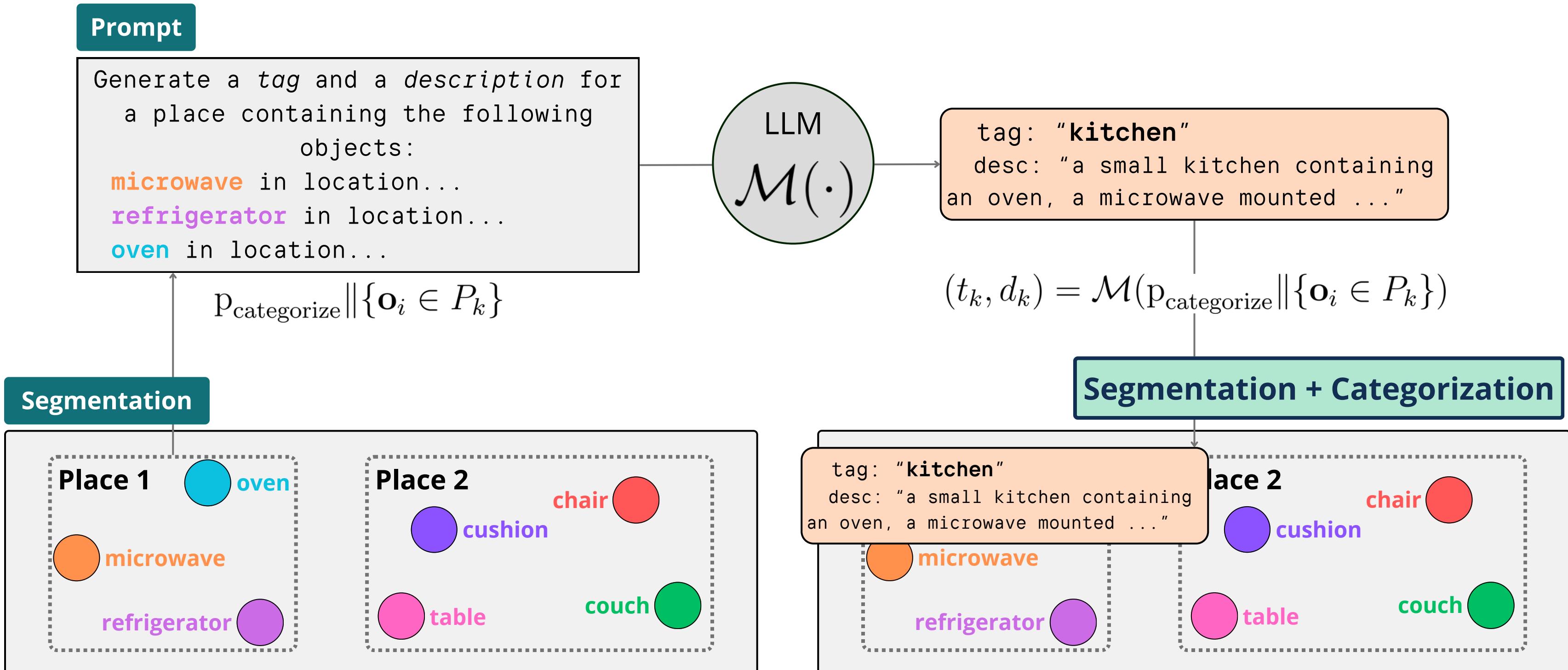
Large Models
*Large Language Models (LLMs) or
Large Vision-Language Models (LVLMs)*

Segmentation

2. Method



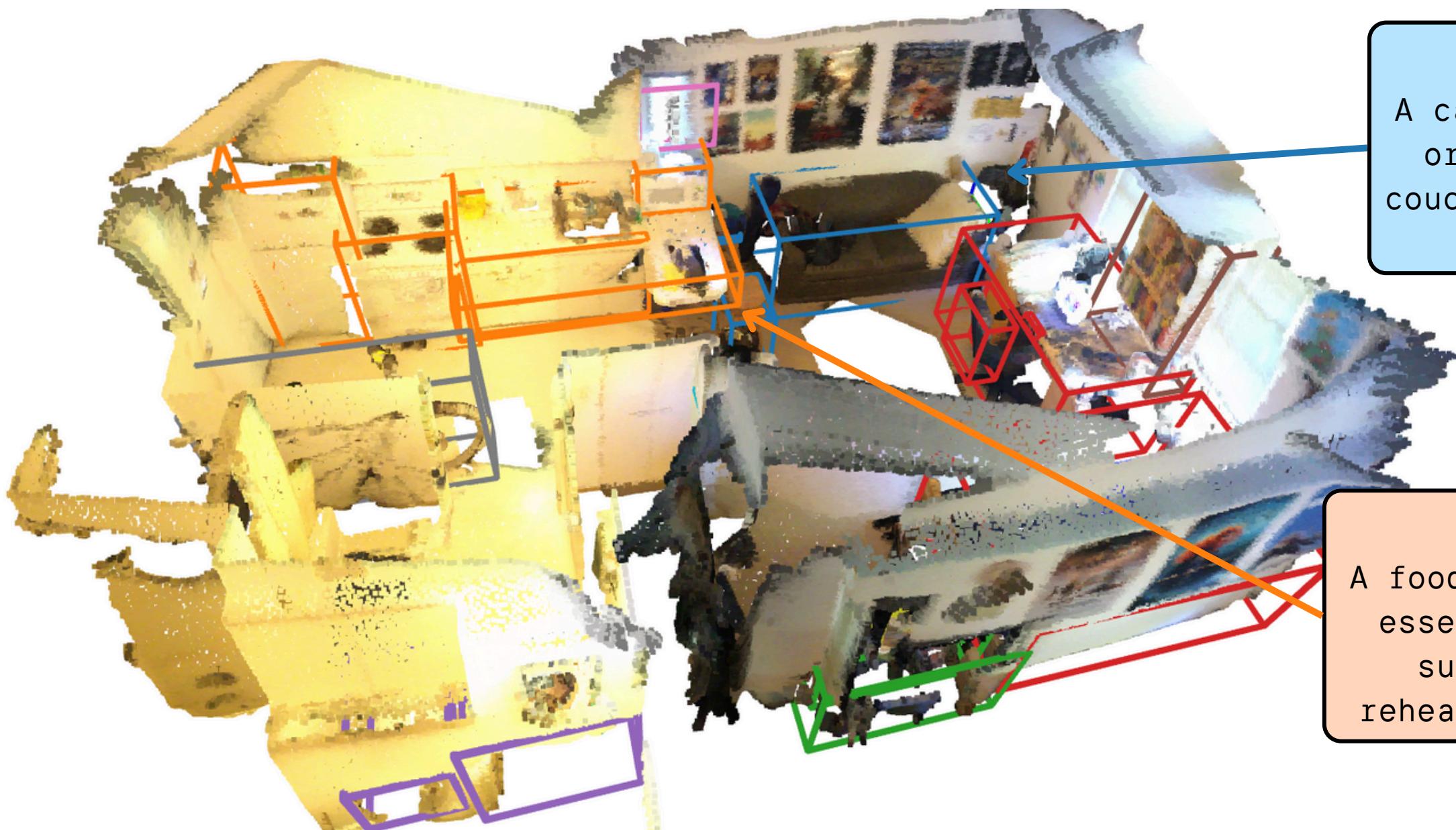
Categorization ----- 2. Method



Results -----

3. Conclusions

(Segmentation example)



(Categorization examples)

lounging_area

A casual seating zone designed for relaxation or informal interaction, centered around a couch and complemented by stools that serve as footrests or additional seats.

kitchen_zone

A food preparation and storage area featuring essential kitchen appliances and surfaces, supporting activities such as cooking, reheating meals, and organizing ingredients.

Mobile Robot Place Segmentation and Categorization Using Object Semantics

**Jesus Moncada-Ramirez, Jose-Raul Ruiz-Sarmiento, Cipriano Galindo and
Javier Gonzalez-Jimenez**



Project repository



UNIVERSIDAD
DE MÁLAGA