Language and Robotics: Toward Building Robots Coexisting with Human Society Using Language Interface

Introduction

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Discussion on Dory

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- https://dory.app/events/ORCeryF2DQT5E45K8oS9/ijcnlp-aacl-tutorial-langrobo/
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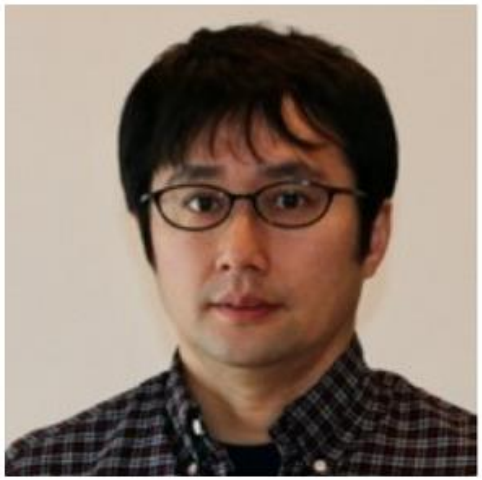
Tutorial speakers

Shuhei Kurita

Language Information Access Technology Team,
RIKEN Center for Advanced Intelligent Project (AIP)



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Behavior Learning Research Team,
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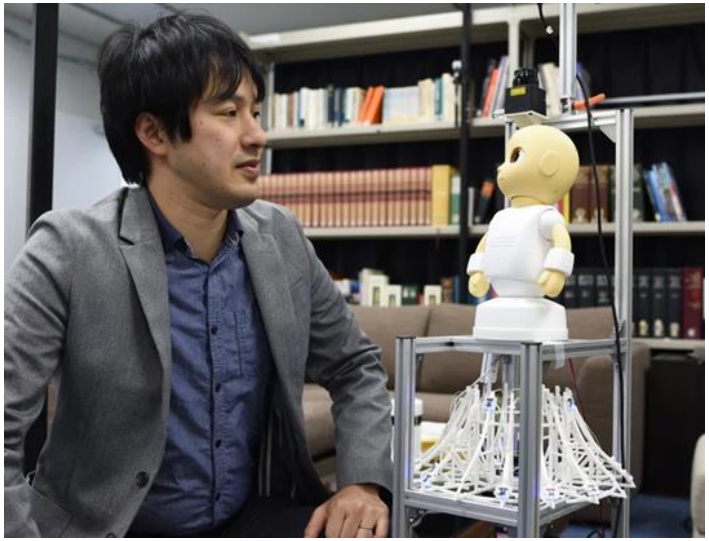
Knowledge Acquisition & Dialogue Research Team,
RIKEN R-IH Guardian Robot Project (GRP)

Self introduction

◆Koichiro Yoshino

- Team Leader (PI) of knowledge acquisition and dialogue research team, Guardian robot project, RIKEN, Kyoto, Japan
- Dialogue system technology challenge committee, action editor of ACL rolling review, IEEE-SLTC member, SIGdial board



Robots in our living space

Astro, Amazon

HSR, Toyota

Pepper, Softbank

Stretch, hello-robot

We expect them to help us,
using conversational interface
for enriching our life

Language in intelligence

◆**It is related to "human mind" and "human awareness"**

- What is mind? What is awareness?
- How do we define "intelligence"

◆**Language is an important tool for "communication" and "knowledge-building"**

- Abilities to use language are related to the work of intelligence
- *nani gigantum umeris insidentes*
- We can receive, accumulate, and rebuild the knowledge using language communication

Language and robotics

◆**Current robots do not have abilities to:**

- accumulate and use one's experience
- use the experience and knowledge of others

◆**How humans do that?**

- by using language!

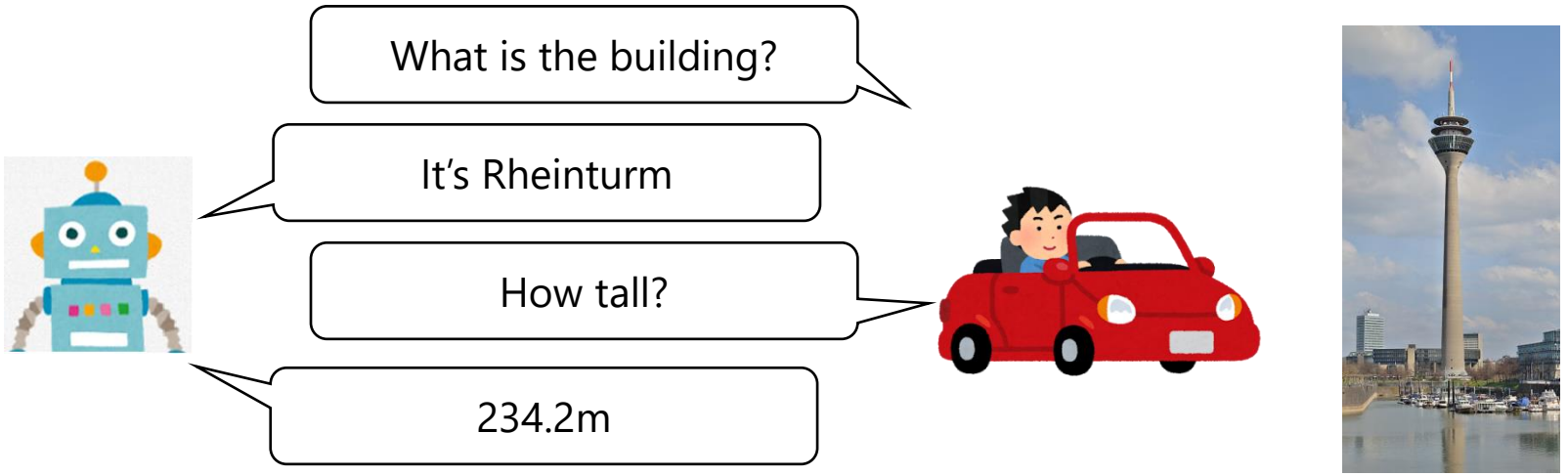
I dropped a glass cup and broke it.

Oh, I would be careful when holding a glass cup.

Nur ein Idiot glaubt, aus den eigenen Erfahrungen zu lernen.
Ich ziehe es vor, aus den Erfahrungen anderer zu lernen, um von vorneherein eigene Fehler zu vermeiden.

Using natural language in real world

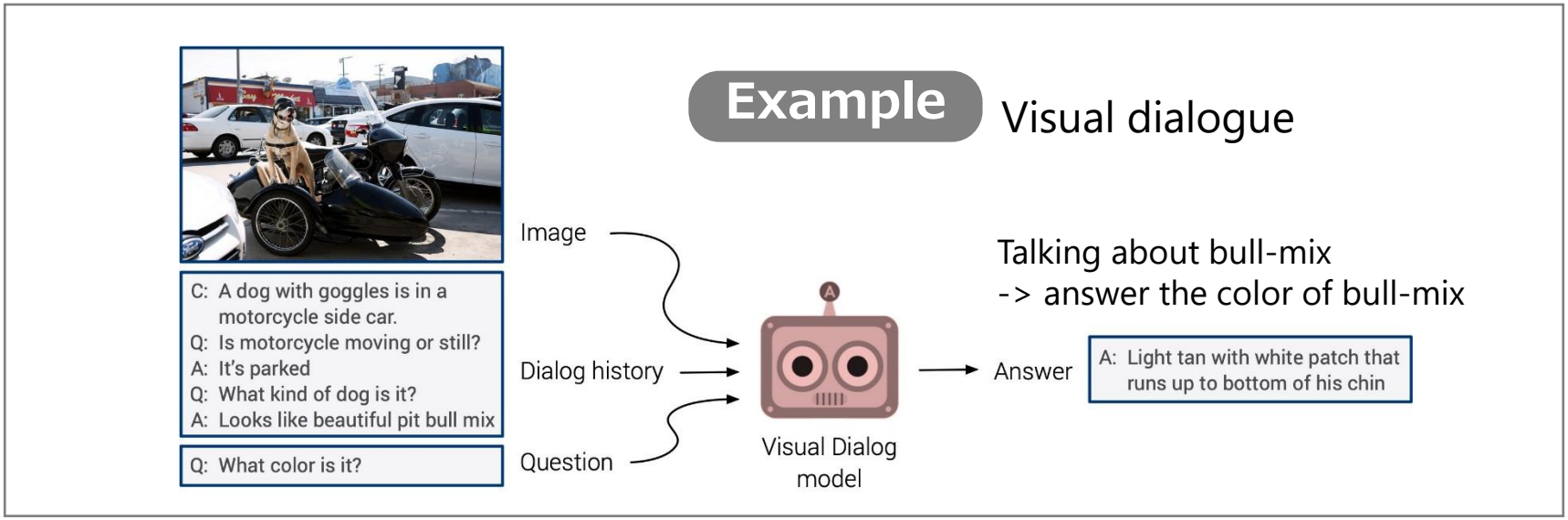
- **Systems should consider the dialogue contexts**
- **Dialogue contexts contains not only dialogue history but also shared information**
  - Dialogue context: shared information in real-world
  - Map, visibility of the user (dialogue in car, [Misu14])
  - Visual question answering, visual dialogue [Alamri 19]



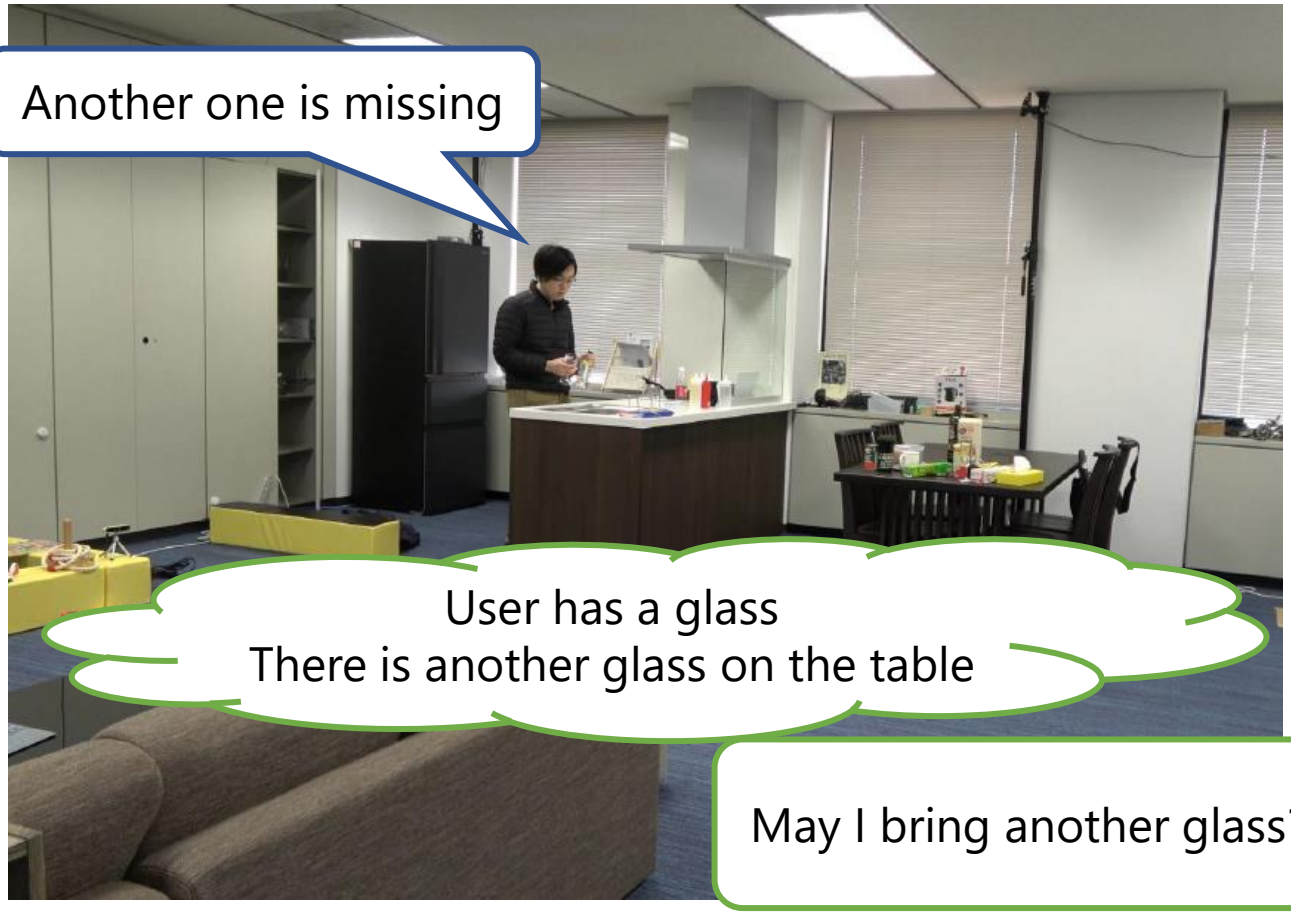
Using real-world knowledge

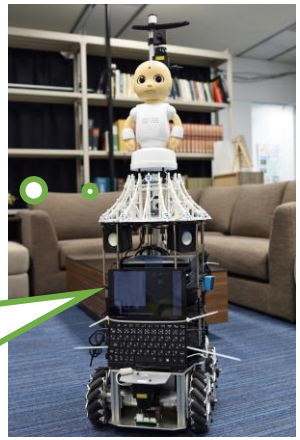
◆**Using both visual information and dialogue history (DSTC7 visual dialogue track)**

- Extension of visual question answering (VQA)
- The system changes the answer according to the dialogue context



Understanding a situation





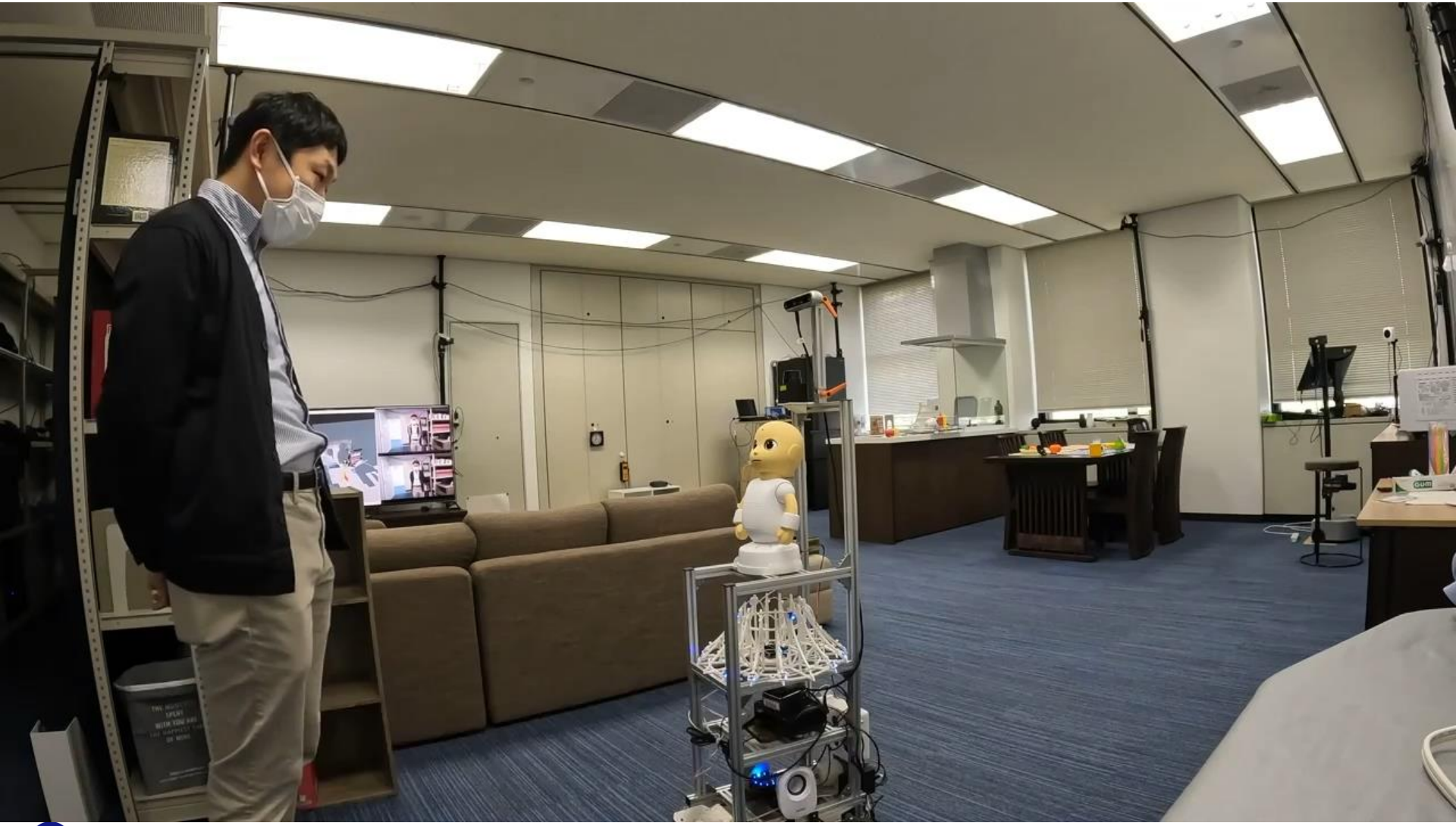
× understand the language

○ understand the situation and the intent

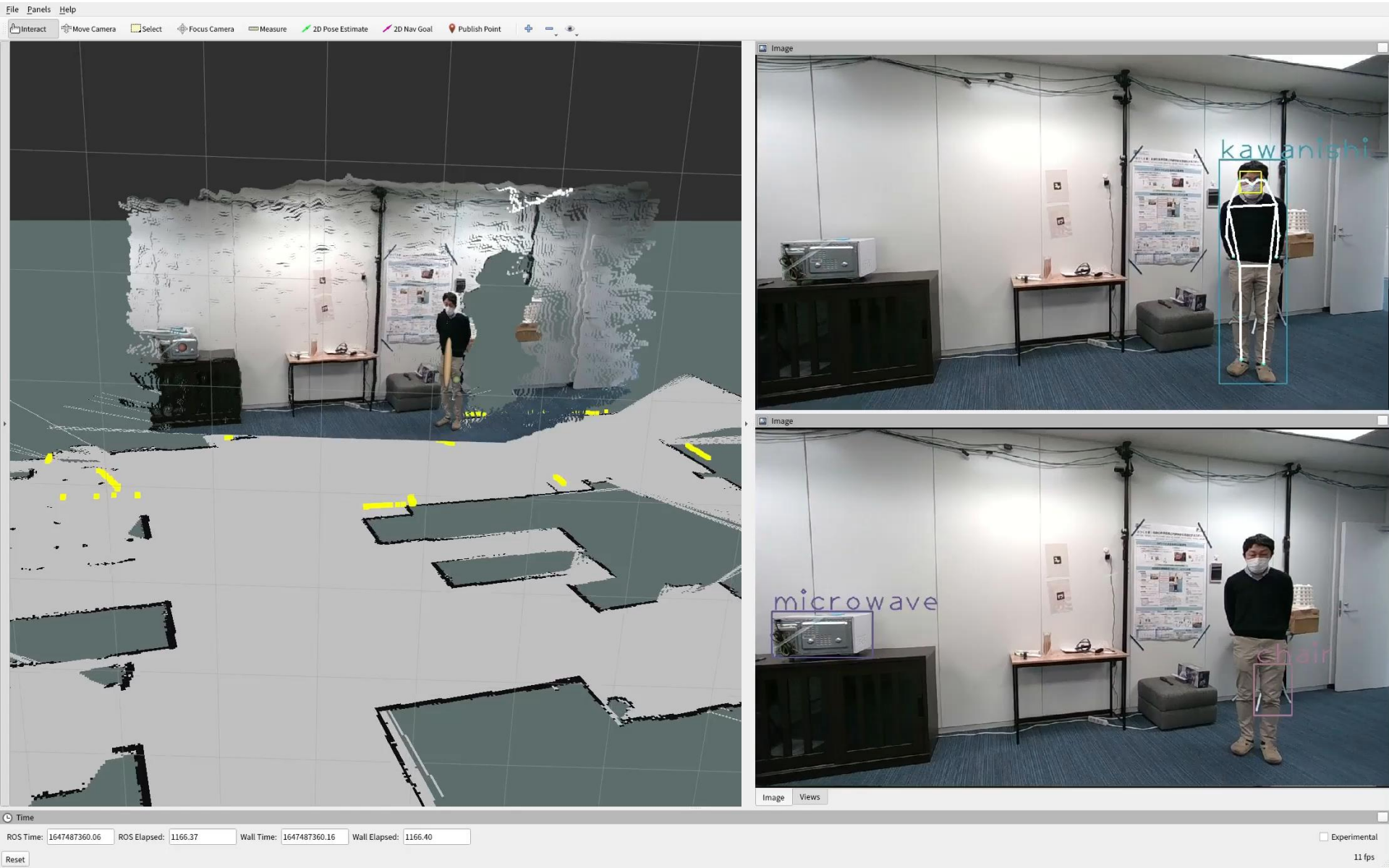
Situation recognition

To realize appropriate robot action selection, situation understanding corresponding to robot's task is important

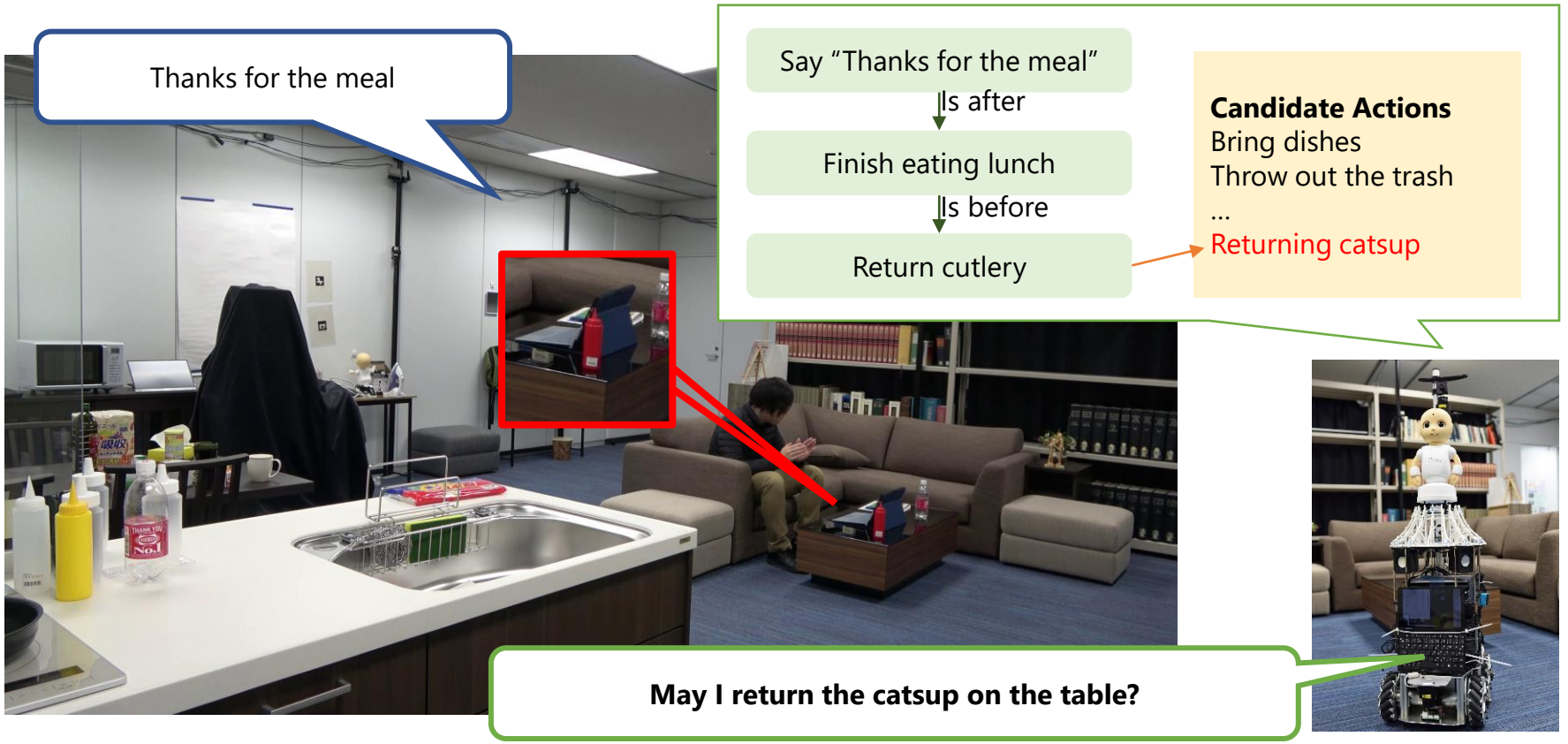
Understanding the surrounding situation



The first-person view



Reasonable action selection



How do we align the robot action with the situation?

Inference of the robot required? (for explainability?**)**

Barriers to entry

◆**Robotics research fields had barriers to entry**

- Using physical robots requires costs (money, place)
- Robots are complicated systems (many things before working)

◆The goals of this tutorial are,

- **Removing such barriers related to physical robots**
  - Try to run a simulator of manipulation robot
- **Increasing the number of people who are interested in using language to control robots**
  - Empowered by large language models!

Outline

- Introduction (Yoshino)
- Robots and actuations (Nakamura)
- Understanding from vision (Kurita)
- Future directions (Yoshino)

- Break

- Try to run HSR (manipulation robot) on ROS2
- Discussion using Dory

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Dory interface