Acting on Language Instructions

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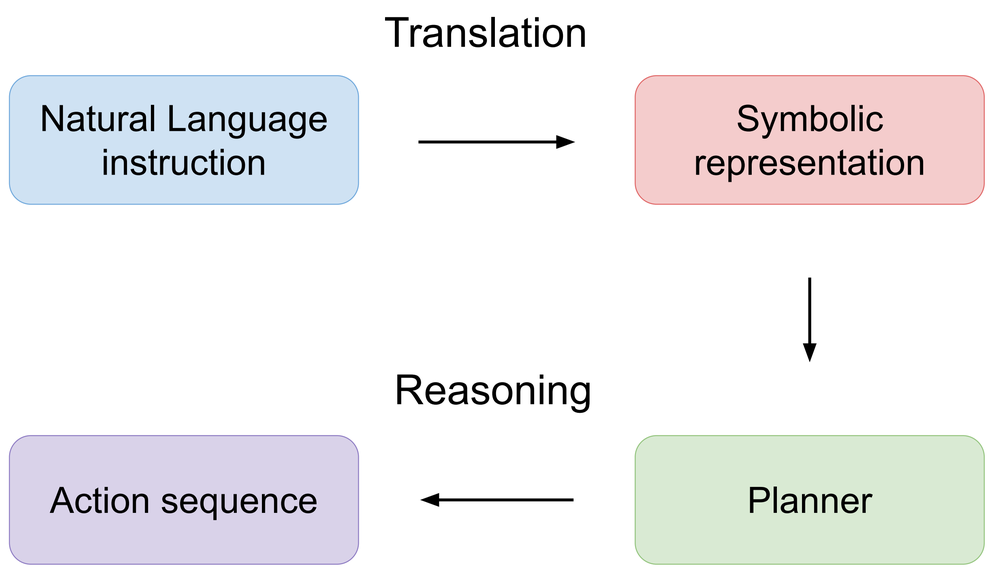
Motivation & Research Goals

How do we make AI agents **understand** language instructions?

Our approach

- **Hybrid** approach
- Leverage strengths:
  - **Translation** abilities of **LLMs**
  - **Reasoning** abilities of **symbolic planners**

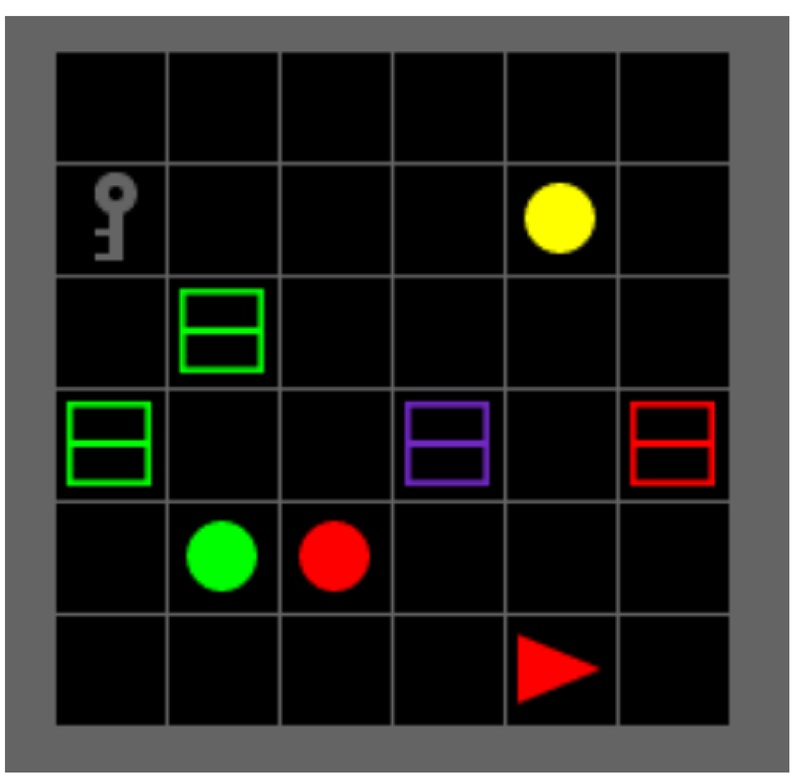


Research goals

- Having an agent acting **correctly** on human language instructions

Methods

Go to the red ball



Action sequence: Left, Forward, Left, Forward

- Translage Natural Language (NL) instruction into a **symbolic** goal, using an **LLM**.
  - go to the red ball $\rightarrow$ at-robot$(4, 5) \wedge$ direction(left)
- The **prompt** consits of: *domain description, domain PDDL, one example, PDDL instance and NL goal*
- The **PDDL goal** is combined with the *PDDL instance* and a **planner** produces a sequence of actions that are executed in the environment

Results

Example goals:

- GoTo: "go to the yellow ball"
- PutNext: "put a green box next to the red ball"
- PickupLoc: "pick up the green ball behind you"

Preliminary results

- The LLM consistently selects an object of the correct **type** and **color**
- Important to **disambiguate** the NL instructions e.g. "go to the red ball" can have multiple meanings
- **Syntax errors** can be fixed by re-prompting with the error message
- The LLM seems to be bad at determining **object locations** e.g. given the instruction "go to the ball on your right" it is equally likely to pick the ball on the left and right.

Model	# correct	Env	Example
gpt-4o	**20**	GoToRedBall	GoTo
gpt-4o	**20**	PutNext	PutNext
gpt-4o	17	Synth	PutNext
gpt-4o	17	Unreach	GoTo
gpt-4o	9	PickupLoc	GoTo
gpt-4o	14	PickupLoc	PickupLoc
o1-mini	9	PickupLoc	PickupLoc
o1-preview	11	PickupLoc	PickupLoc

Table: Results for different environments.

WASP WALLENBERG AI, AUTONOMOUS SYSTEMS AND SOFTWARE PROGRAM