Robotics Navigation/Dialogue

04/28/2021

Agenda

Robot Navigation

- Symbolic (high-level)
- Motion-planning

Dialog

Navigation

Navigating from point A to point B in a human-inhabited environment is challenging.

Robot Control Hierarchy

High level actions

Navigation level

Navigation to symbolic locations
approach door, go through door,
open door, Go to
object/door/person

Robot Control Hierarchy

High level actions

Symbolic/Task planning

Navigation level

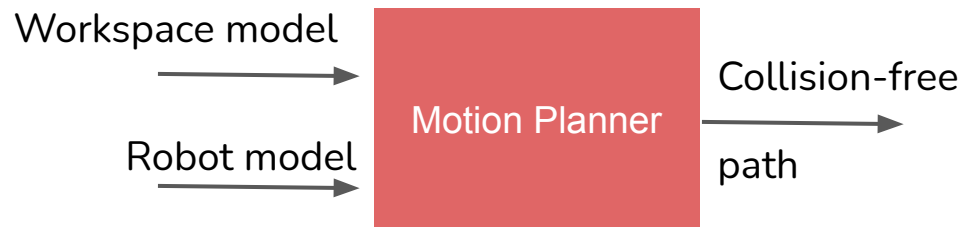Path (Motion) planning

4X s

Moving to room: l3_420

Path (Motion) Planning

Given:

- World geometry

- Robot's geometry

- Start and goal configuration

Compute:

A collision-free, feasible path to the goal

Workspace model →

Robot model →
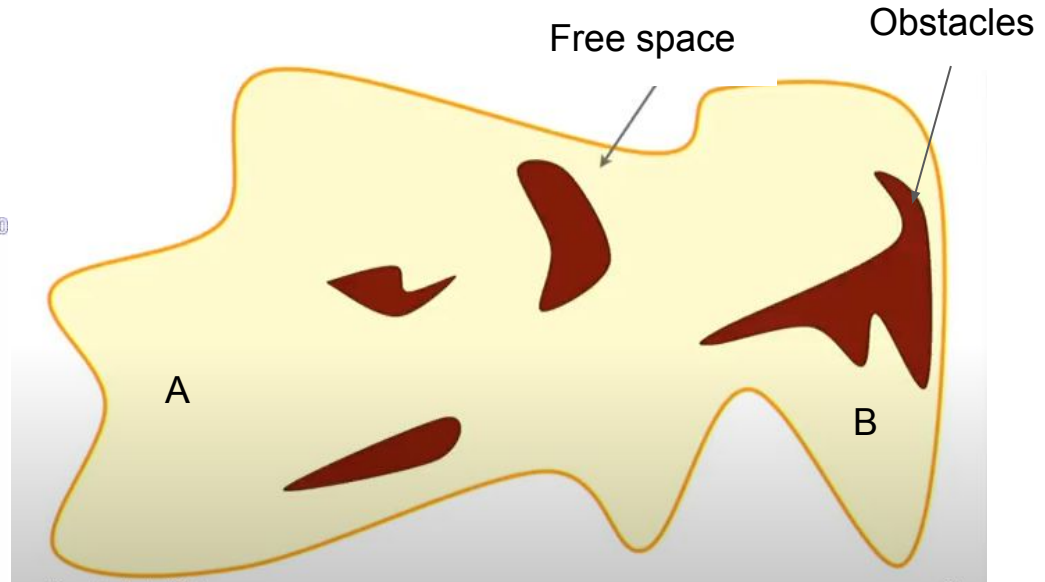
Motion Planner

→ Collision-free

path

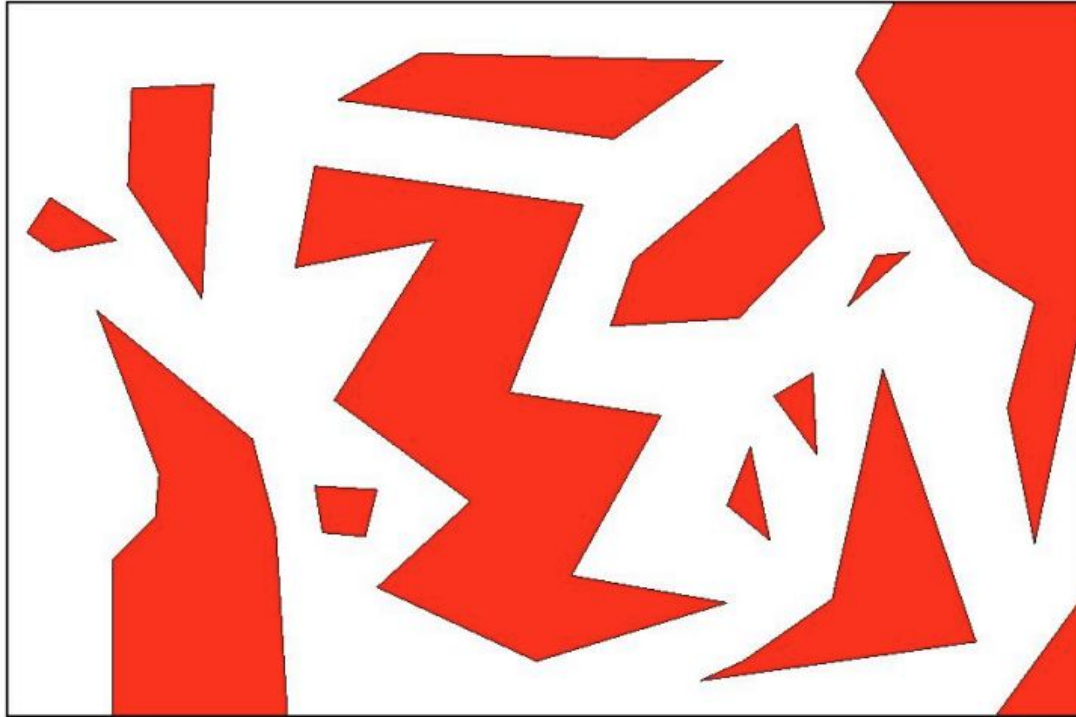# Path (Motion) Planning

Finding an obstacle-free path from point A to B??

Search algorithms (DFS, BFS) are good for finding a path in discrete spaces.
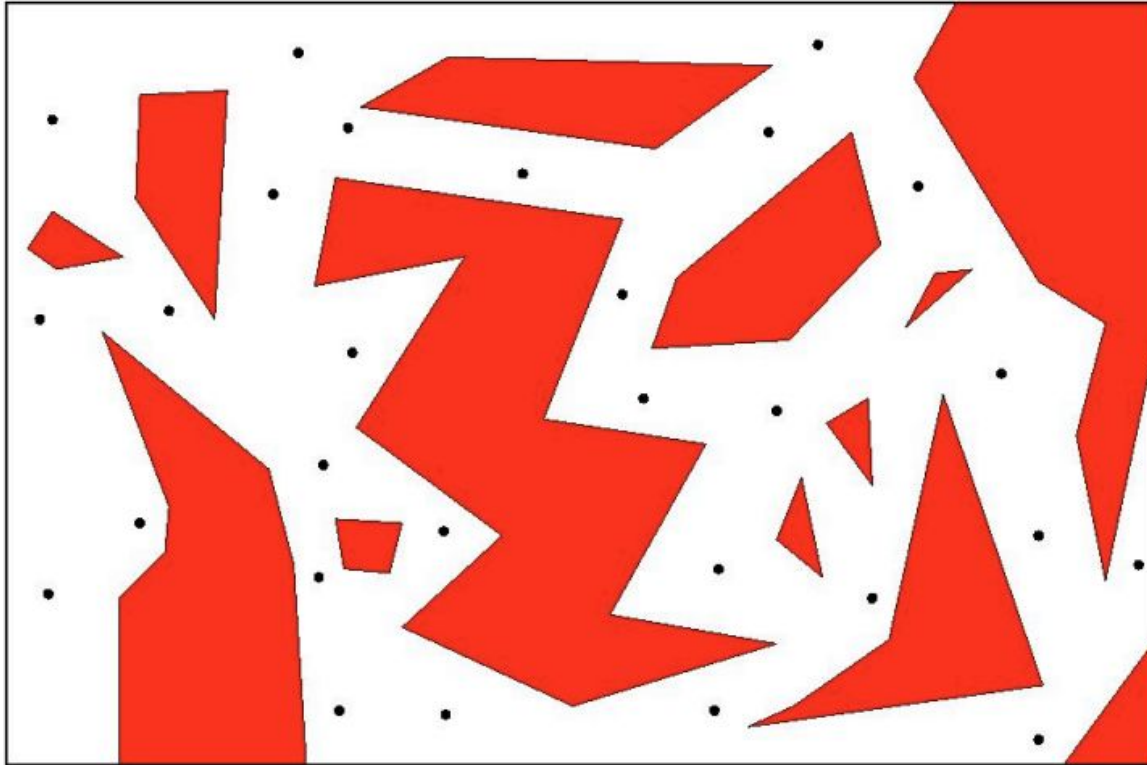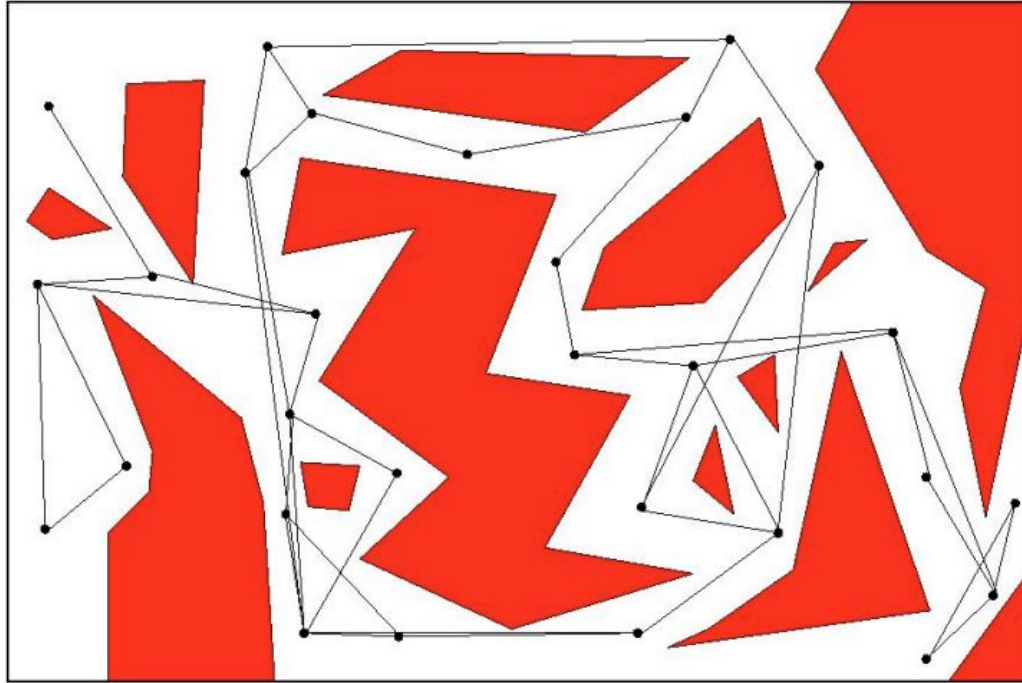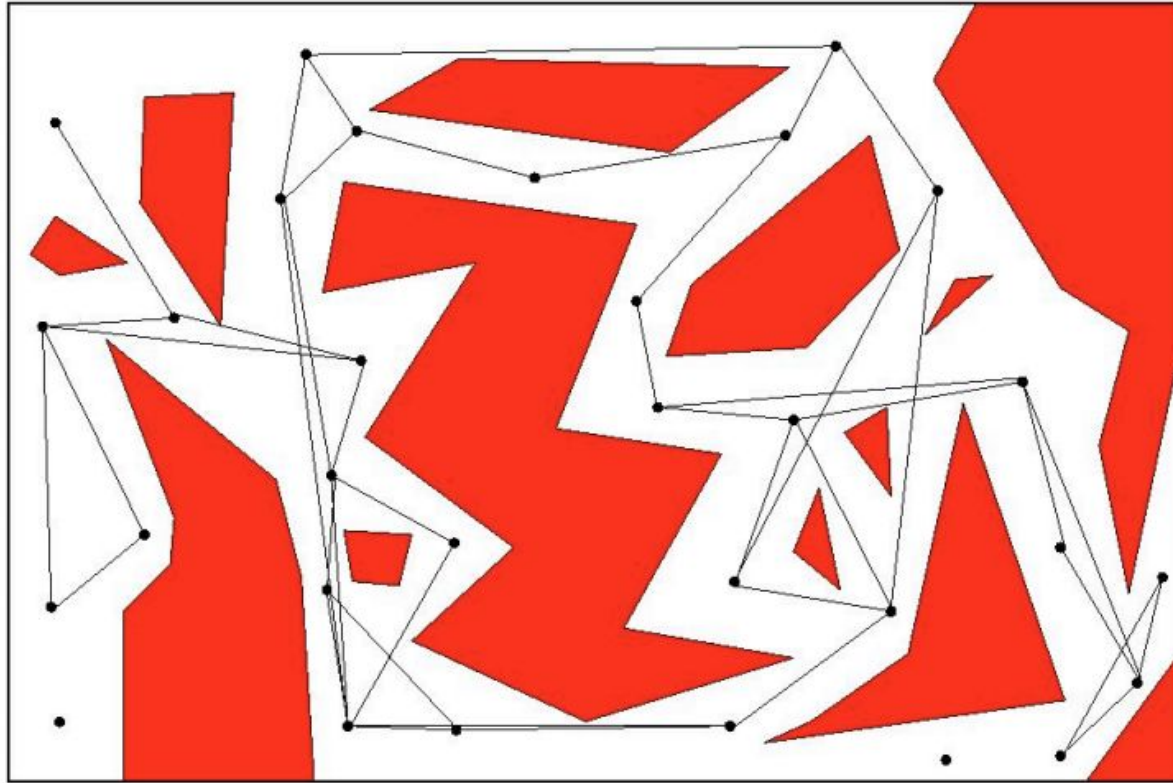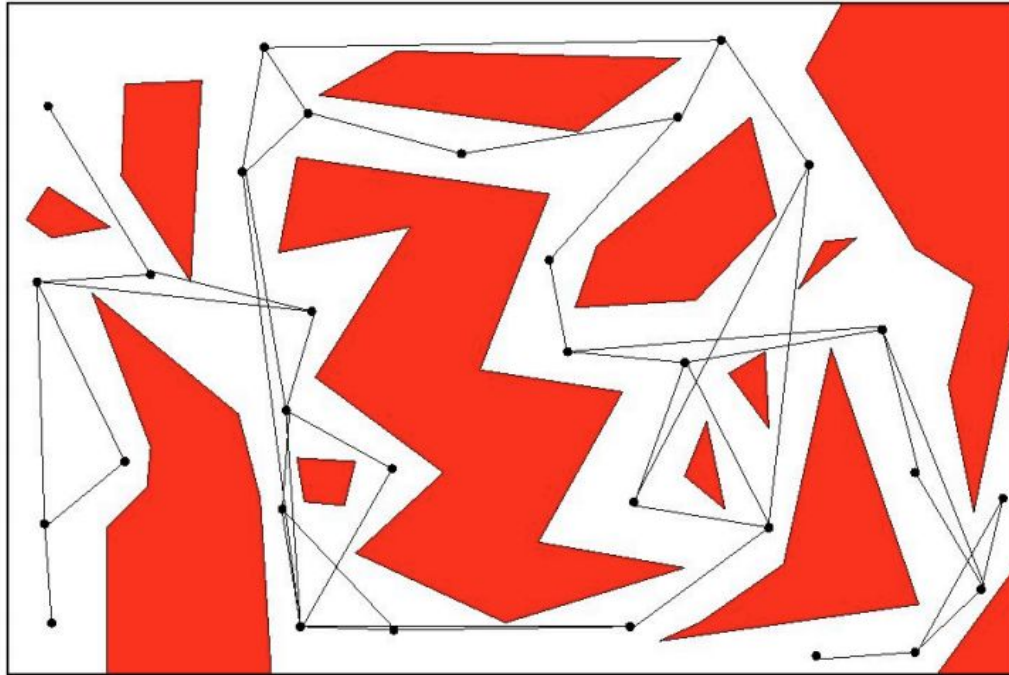
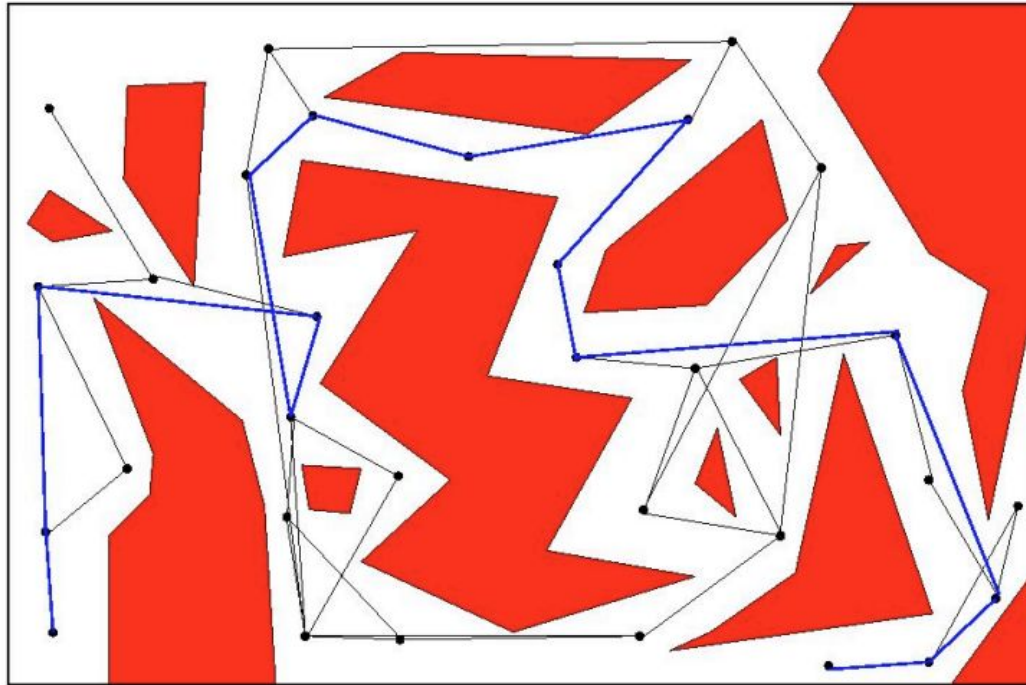# Path (Motion) Planning

Path (Motion) Planning

Path (Motion) Planning
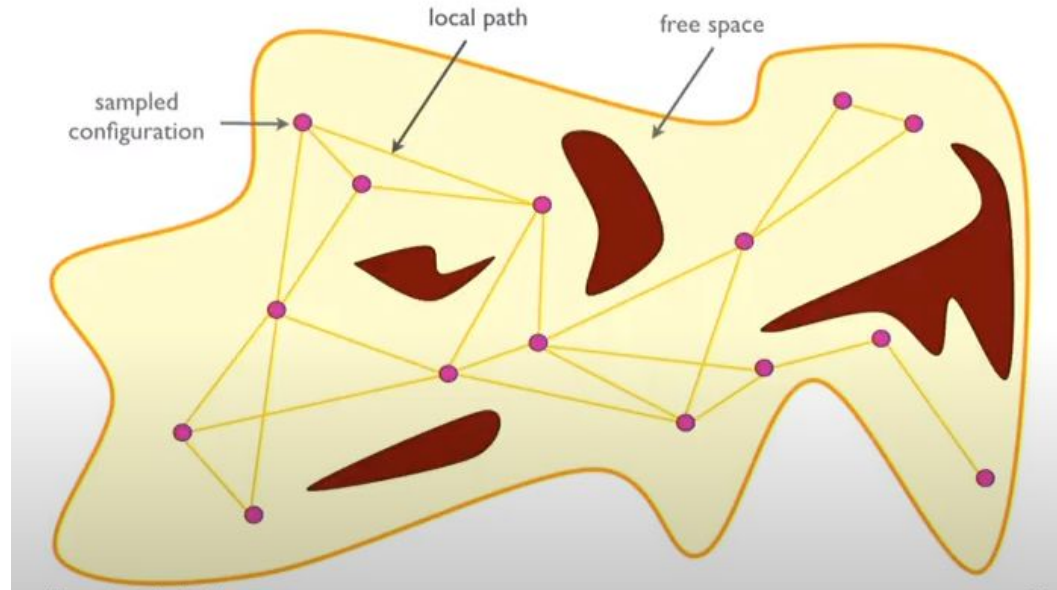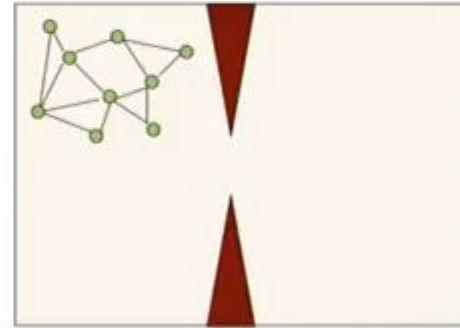
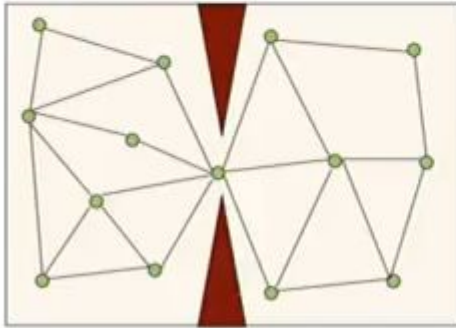# Path (Motion) Planning

Path (Motion) Planning
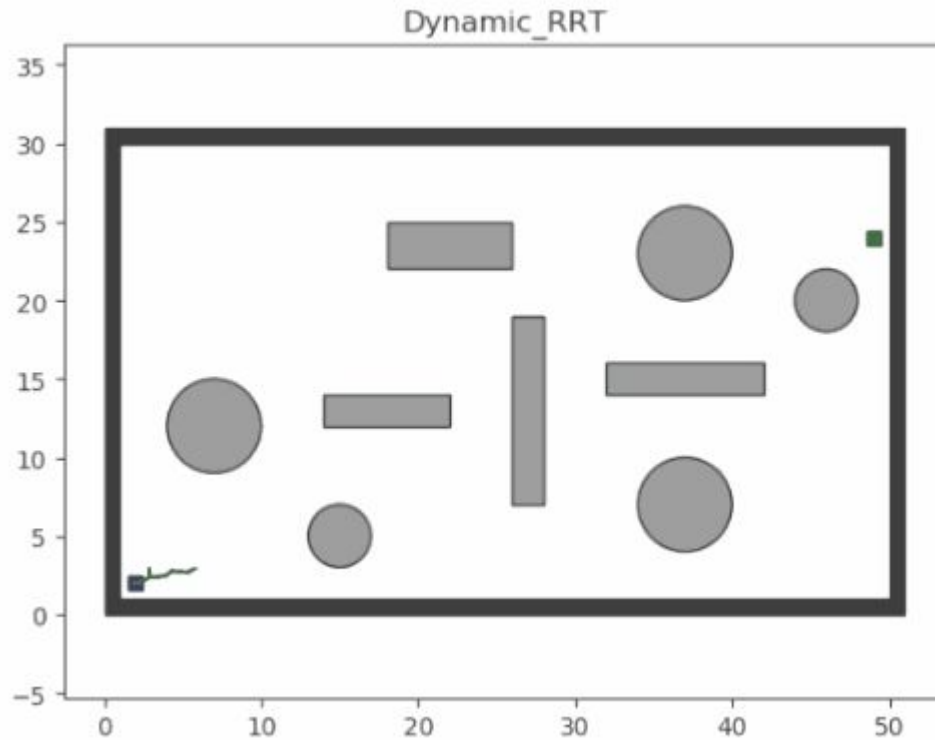
Path (Motion) Planning

Sampling in Motion Planning
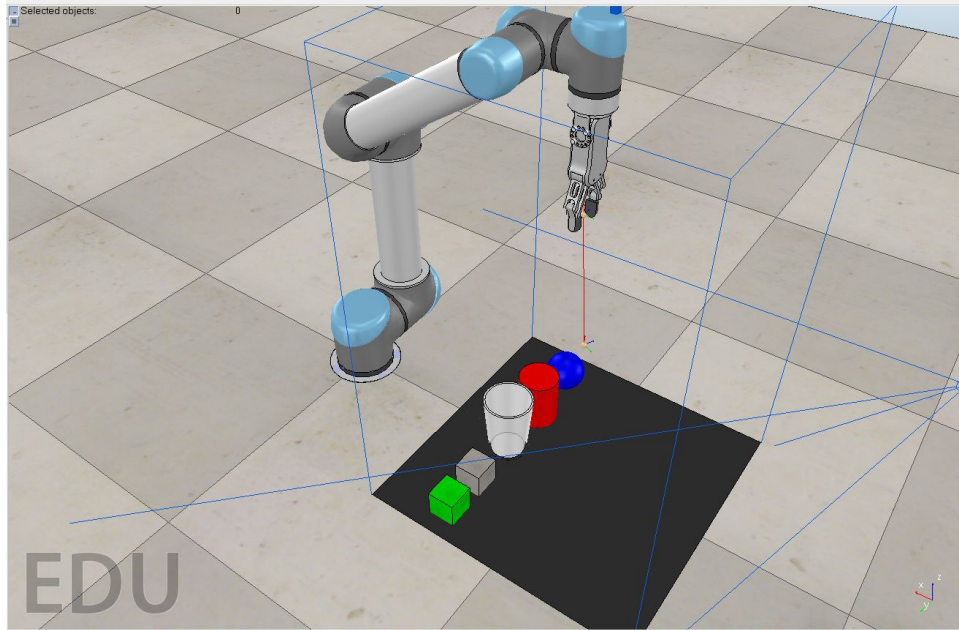
Sampling in Motion Planning

RRT sampling

Manipulation

- Joints provide relative motion

- Links are rigid members between joint

- Types of joints: linear and rotational

- Each joint provides a degree of freedom

Manipulation Demo


An informal
walkthrough

Robot Vision/Language

A service robot needs to communicate with humans using natural languag.

In recent years, the field of **Natural language Processing (NLP),** made significant improvements.

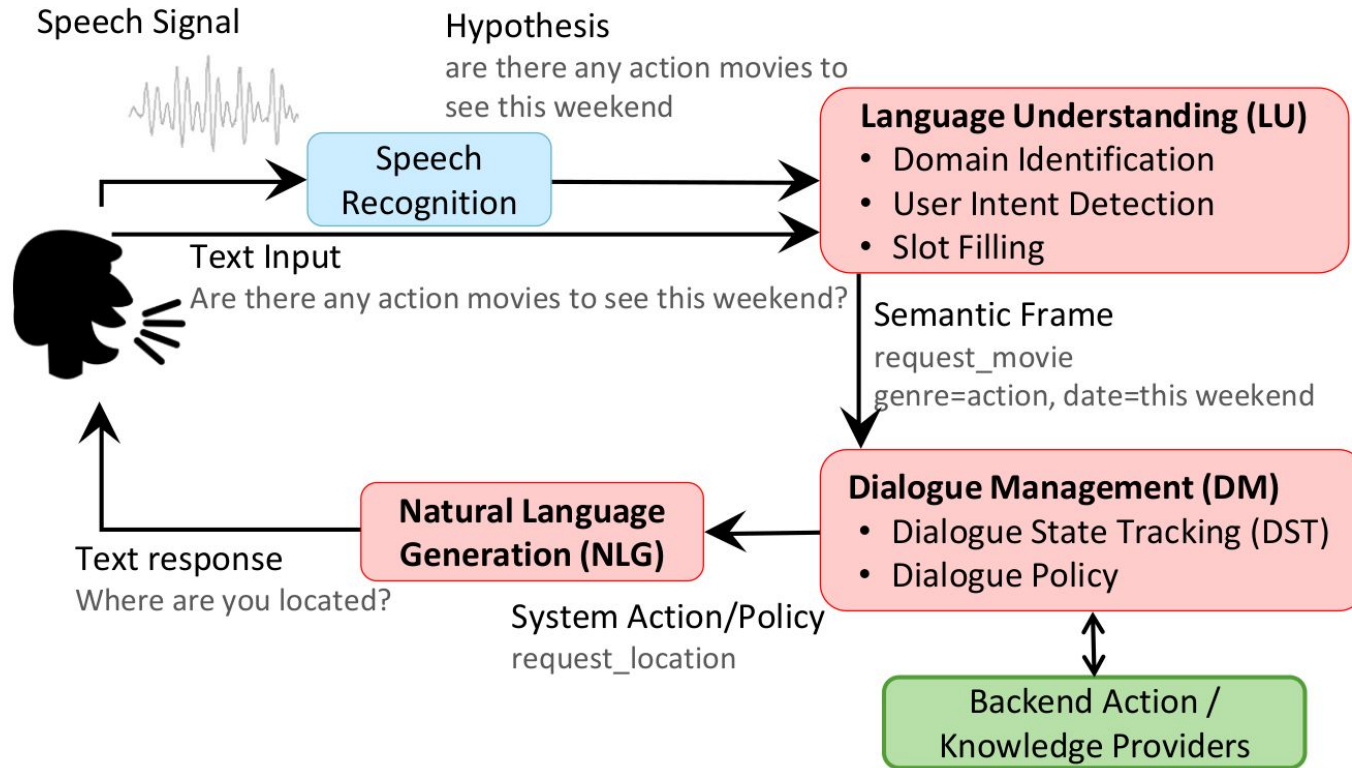At high level, NLP areas could be:

- **Syntax:** set of rules around how to structure our sentences
- **Semantics:** The meaning of the text is the concern of semantics.
- **Speech:**
  - Voice-to-text,
  - text-to-voice
- **Dialogue:** Engaging in a conversation

Language/Vision in Robotics
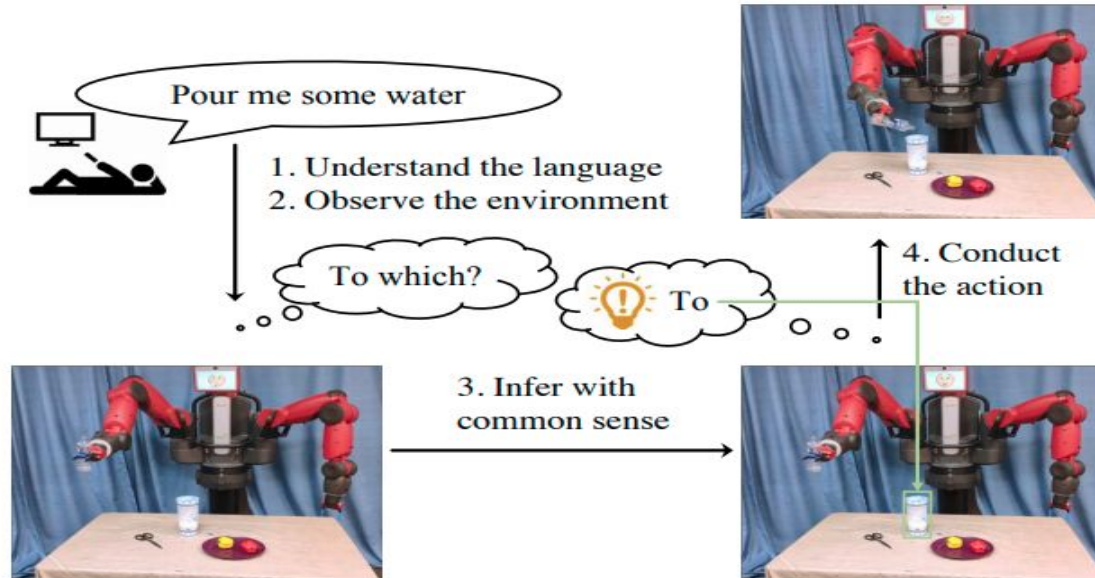
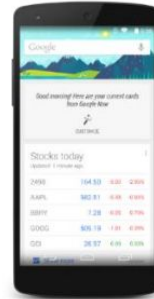
[Chen et al. 2019]

Classical Dialog systems

Dialog

Apple Siri (2011)

Google Now (2012)
Google Assistant (2016)

Microsoft Cortana (2014)

Amazon Alexa/Echo (2014)   Facebook M & Bot (2015)   Google Home (2016)   Apple HomePod (2017)

Add knowledge through dialog

TABLE III

AN EXAMPLE DIALOG FROM A HUMAN PARTICIPANT.

Robot	Human
How can I help you?	Get me coffee
What item should I bring?	Coffee
Do you want me to deliver hamburger?	No
Who should I bring the item to?	Nate
Is this delivery for ellen?	No
It seems I do not know the person you are talking about. Please write their name so I can learn it.	Nate
Who should I bring the item to?	Nate
Is this delivery for Nate?	Yes
What item should I bring?	Coffee
Execute: Robot brings coffee for Nate; the dialog is over.	