

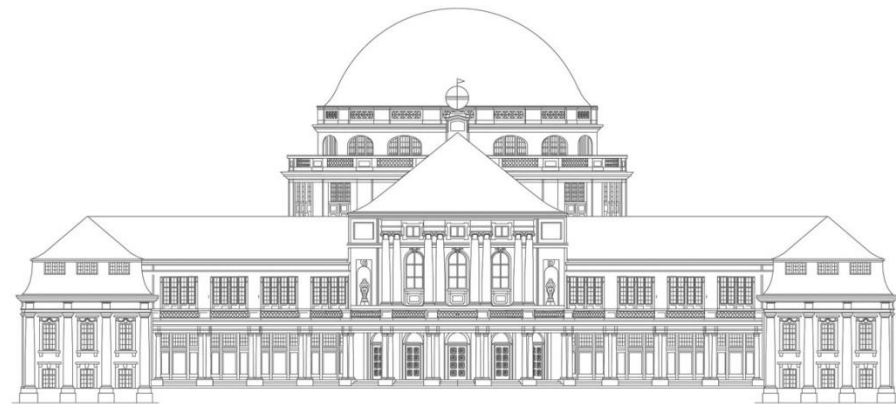


Universität Hamburg

DER FORSCHUNG | DER LEHRE | DER BILDUNG

Basics of Motion Planning

Seminar of Intelligent Robotics





Outline

- Introduction
- Basic Motion Planning
- Algorithms
 - Dijkstra / A*
 - Cellular Decomposition
 - Potential Fields
 - Sampling-Based Algorithms
- Applications

Introduction

What is it about?

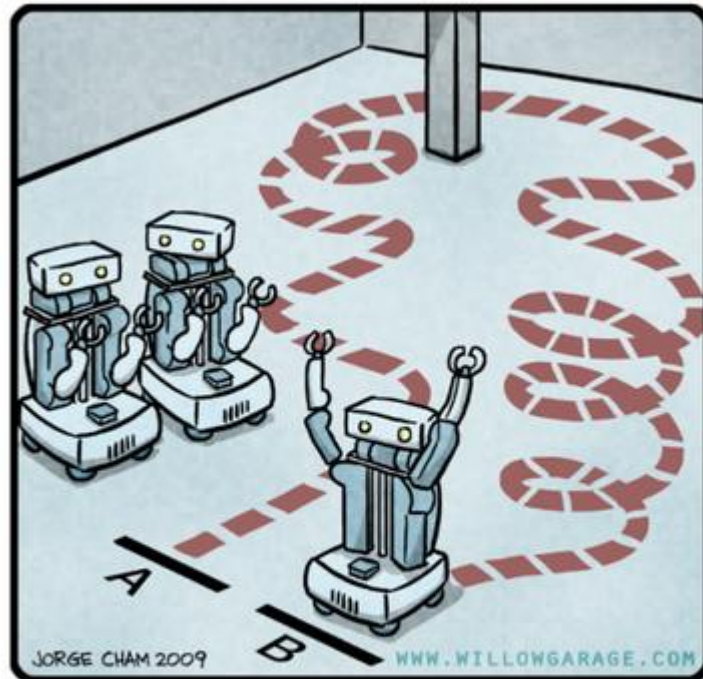
Concepts?

Free Space

Configuration Space

Holonomic

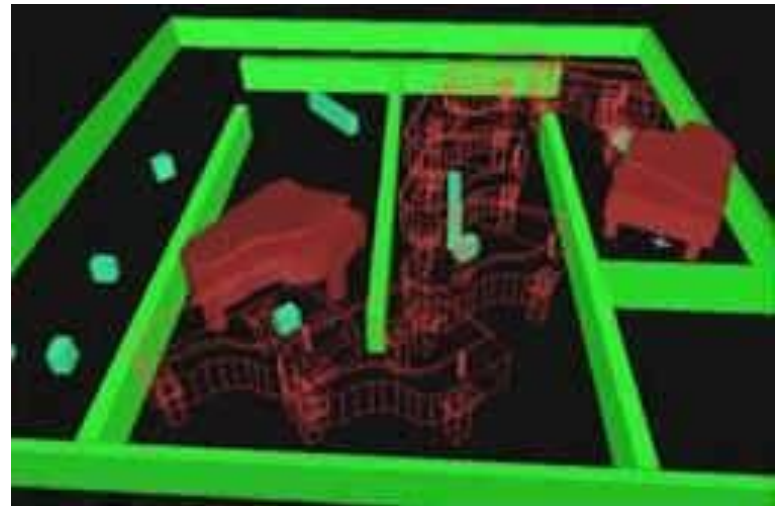
Non-Holonomic



"HIS PATH-PLANNING MAY BE SUB-OPTIMAL, BUT IT'S GOT FLAIR."

Basic Motion Planning

- Robot is the only moving object in the space
- Non-contact motions
- Motions are only constrained by the obstacles
- Piano Moving Problem





Algorithms

- Dijkstra / A*
- Cell Decomposition
- Potential Fields
- Sampling Based Algorithms

Dijkstra / A*

What is it?

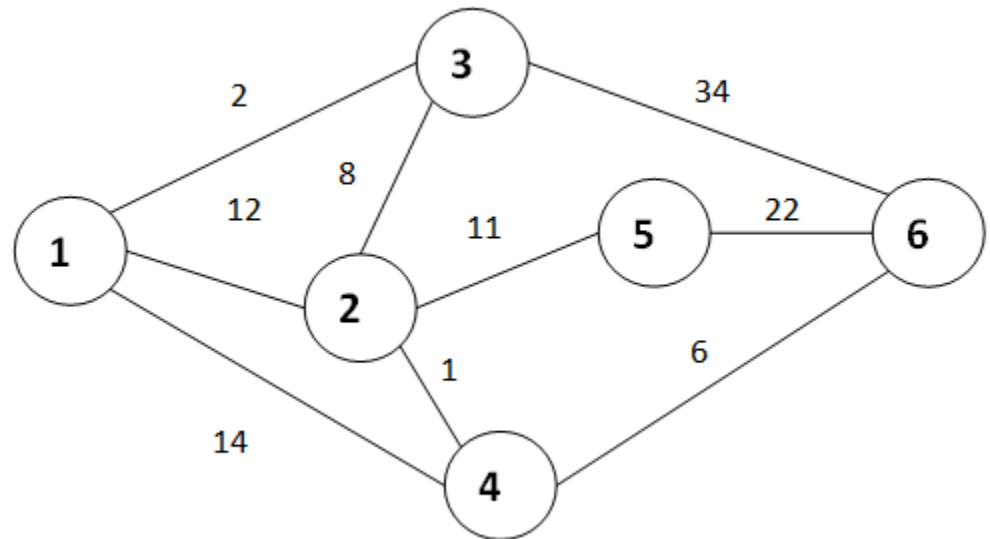
- Informed search algorithm
- Searches for the shortest Path

Pros

- optimal

Cons

- Memory consuming



Cell Decomposition

What is it?

- Separate Space into Cells
- Search for possible Paths
- Uses a shortest path algorithm

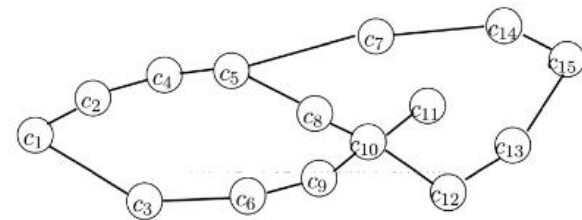
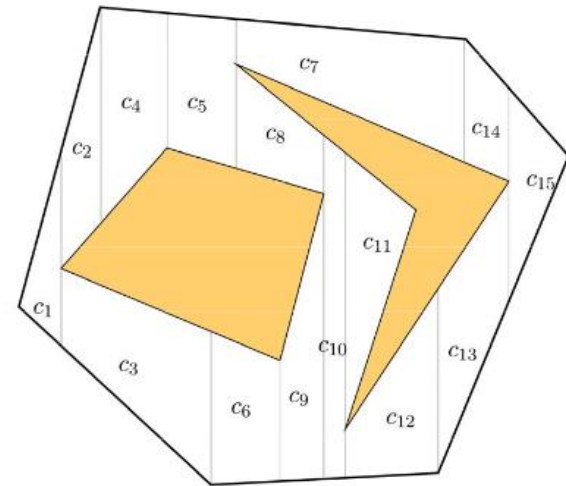
Pros

- Simple method

Cons

- Computation effort raises exponentially with higher dimensions

Trapezoidal Decomposition



Potential Fields

What is it?

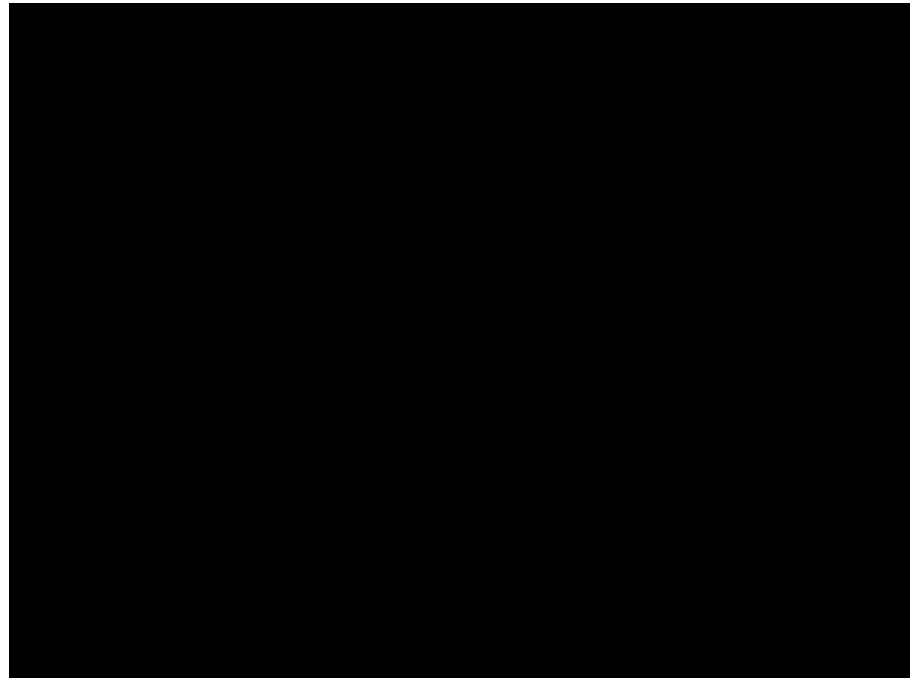
- Attraction to the goal
- Repulsion from obstacles

Pros

- Simple computation

Cons

- Can get stuck in a local minima



Sampling-Based Algorithm

What is it?

- Building own roadmap using collision avoidance
- State-of-the-Art

Pros

- Large amounts of computational savings

Cons

- Only probabilistic completeness
- Relating on good 'visibility' in the C-Space
- unable to determine that no path exists

Applications

- Robotics (Navigation, Surgery)
- Artificial intelligence
- Automotive sector
- Biological molecules
- Computer games
- Animation
-





Thank you for your attention!

References

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