CSE-571
AI-based Mobile Robotics

Path Planning

The Decision Making Problem

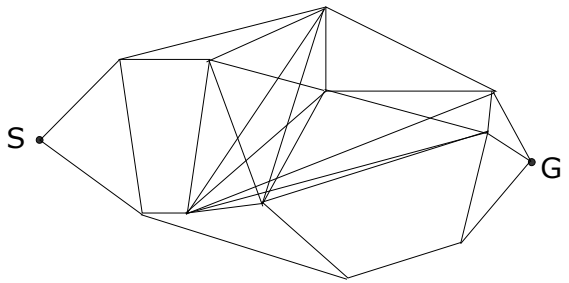
- Central Question:
  What should a robot do next?
- Embraces
  - *control* (short term, tight feedback)
  - *planning* (longer term, looser feedback)
- Probabilistic Paradigm: Considers uncertainty
  - current
  - future

Discretization of Continuous Maps

- Extract a discrete search space / graph from the continuous map.
  - Visibility graphs / roadmaps
  - Voronoi diagrams
  - Probabilistic roadmaps
  - Discrete grids

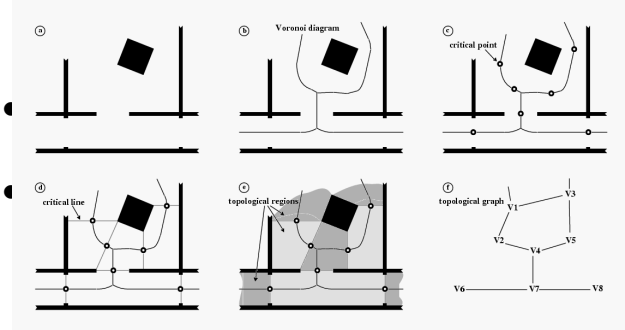
Visibility Graph / Roadmap

- Redcuce path planning to graph search

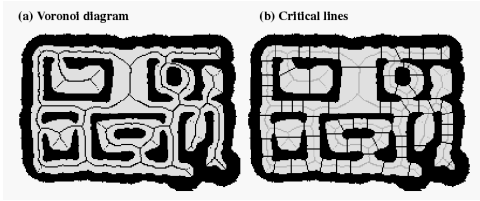


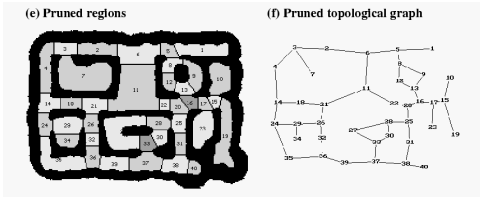
Voronoi Diagrams

- Generalized Voronoi Diagram is locus

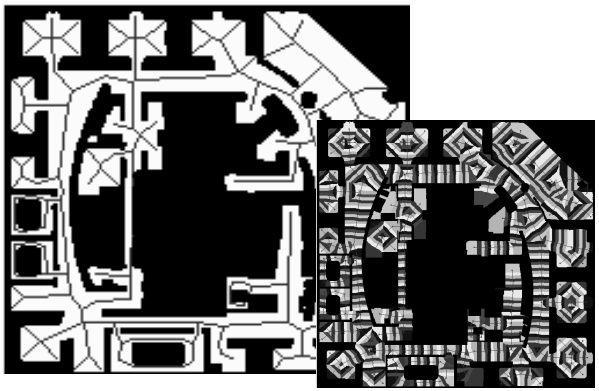


Voronoi Example



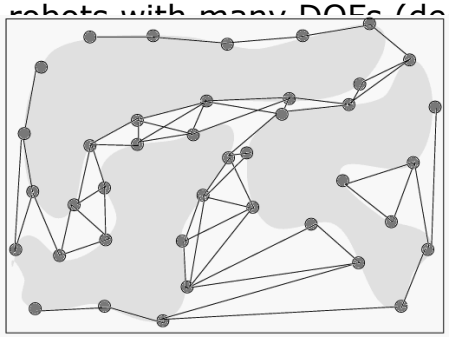


Voronoi Example



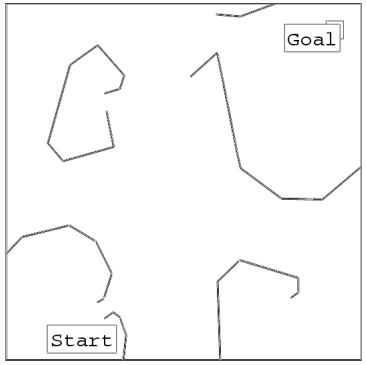
Probabilistic Roadmap

- For robots with many DOFs (degrees of f
- Sar etain tho
- Two h bet local, det



[Amato and Wu, 96]

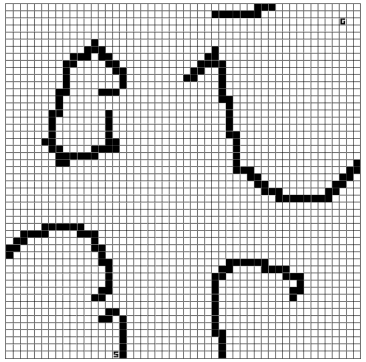
Continuous Environments



From: A Moore & C.G. Atkeson "The Parti-Game Algorithm for Variable Resolution Reinforcement Learning in Continuous State spaces," Machine Learning 1995

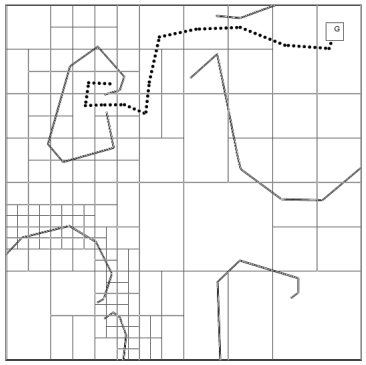
Approximate Cell Decomposition

[Latombe 91]



Parti-Game

[Moore 96]

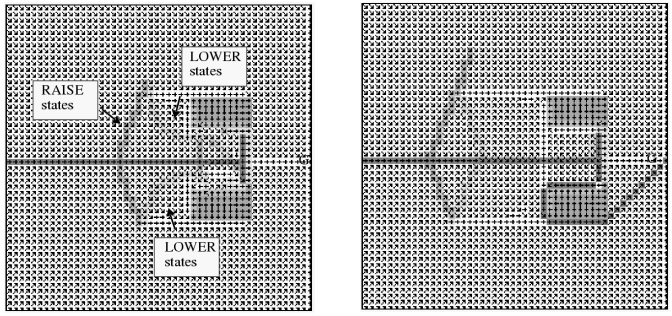
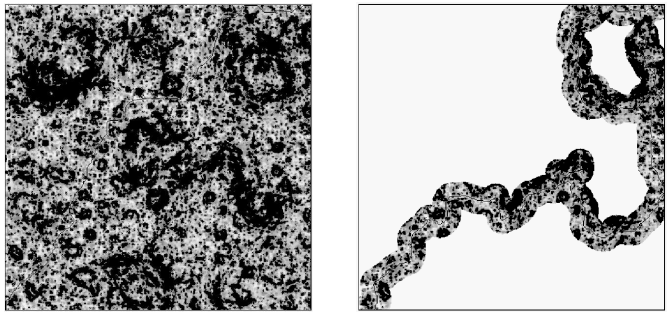


D* Path Planning

Stentz 94

- Similar to A* but designed for efficient replanning
- Maintains an Open list consisting of Raise and Lower states.
- Raise states transfer information about increased cost.
- Lower states propagate information about decreased cost.
- Whenever robot detects new obstacle, a Raise wave front is sent backwards along backpointers.
- Whenever this wave front reaches alternative route, it generates a Lower wave front back to the robot.
- Optimal w.r.t limited map information.

D* Example



D* Example