Mobile Robots and Autonomous Vehicles

Week 5: Behavior Modeling and Learning

- Other approaches: Planning-based approaches

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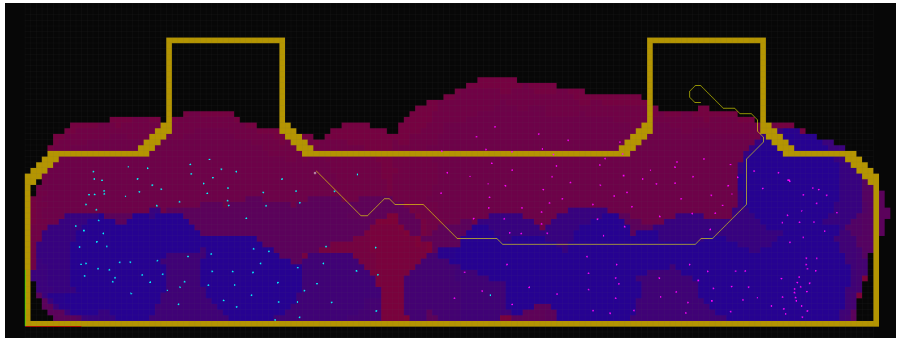
Planning-based approaches

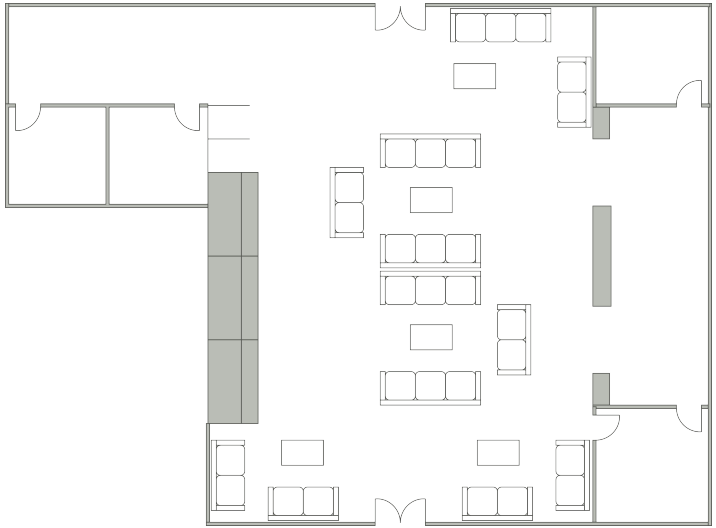
- Assume that agents act like planners
- Easy inclusion of *a priori* knowledge
- Able to model both static and dynamic interaction
- Works on any environment
- Requires additional goal inference mechanisms
- Computationally expensive



Planning approaches: Overall algorithm

- At every time step:
  - Gather observations.
  - Infer destinations
  - Compute cost maps from maps & perception
  - Execute planning algorithm

Inferring destinations



Identifying destinations

- Semantic annotations from maps
- End-point clustering

Inferring goals

- External method (HMM, goal direction)
- Integrated in planning (multiple plans, probabilistic planning)

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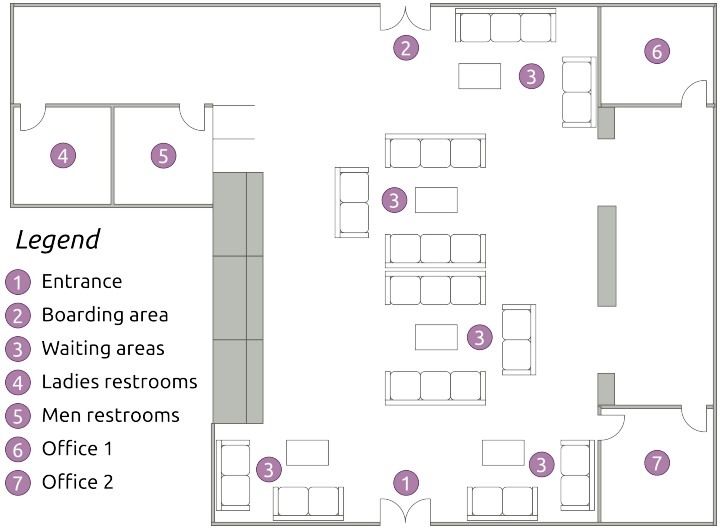

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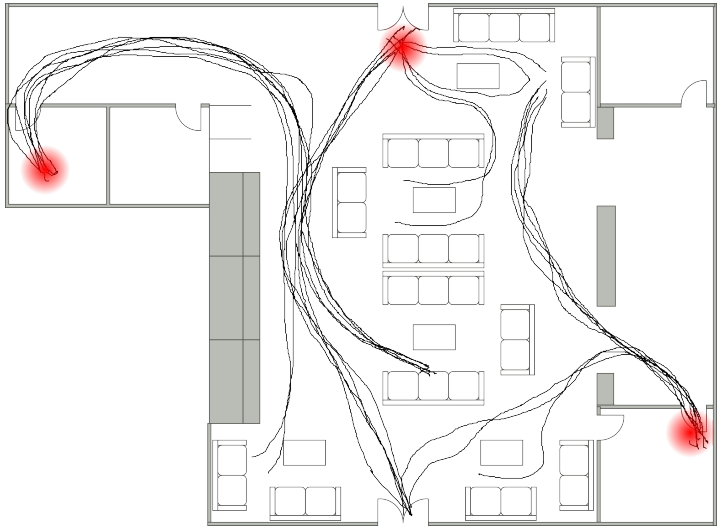

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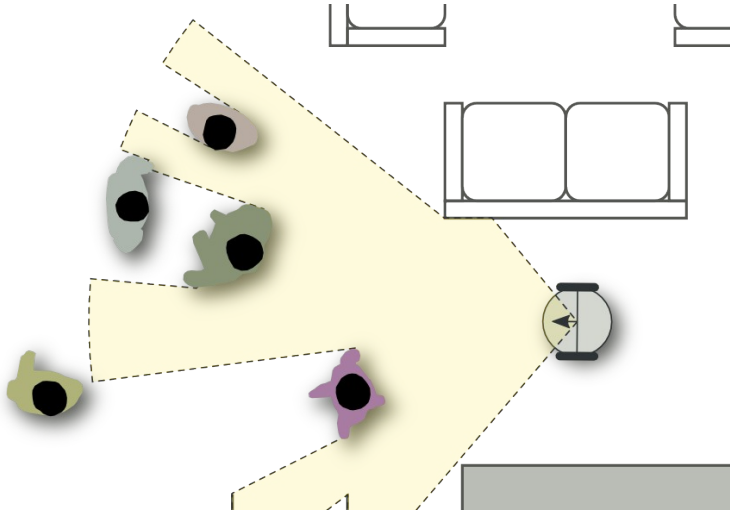
Computing cost maps

- Take information from maps and perception.
- Transform it into a cost map (e.g. grid representation)
- **Problem**: assigning costs to different objects and situations (static obstacles, moving people, groups, etc.)
- **Approaches**:
  - Manual tunning
  - Inverse reinforcement learning



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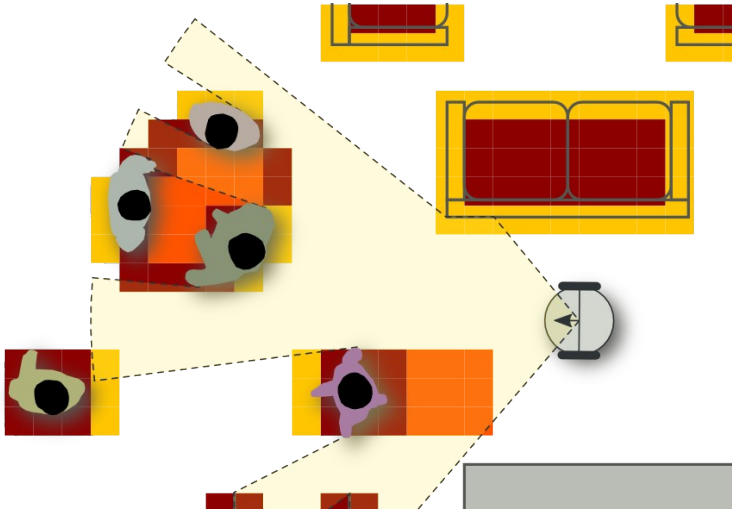

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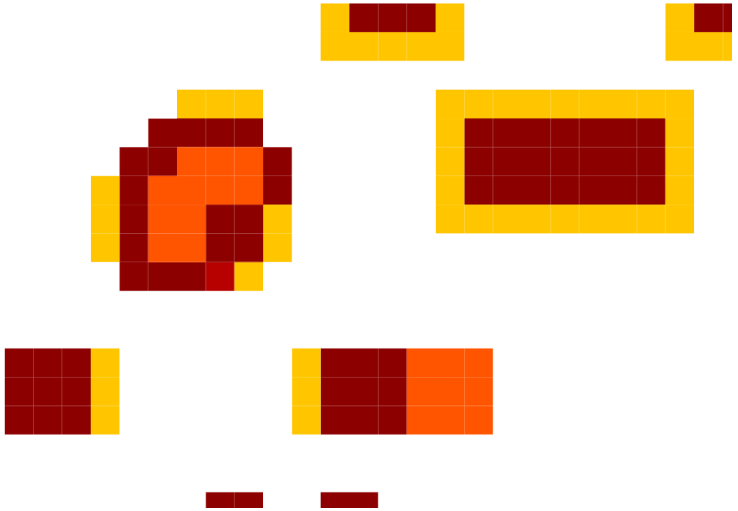
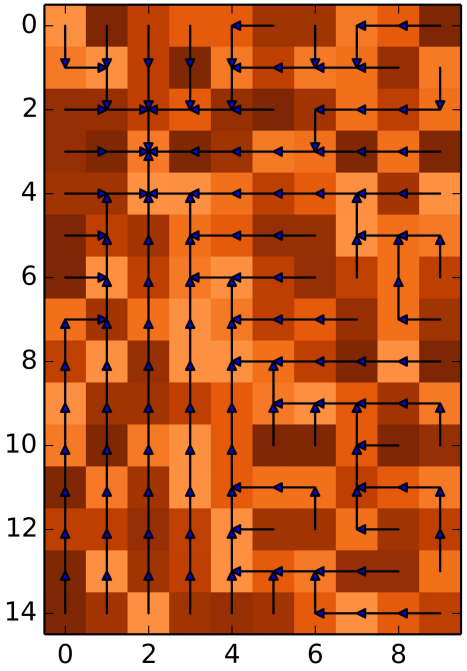


Planning: popular algorithms

Deterministic:

- Dijkstra
- A-Star

- *Probabilistic*:
  - Markov Decision Processes (MDP)
  - Rapidly Exploring Random Trees (RRT)



Planning approaches: pros & cons

Advantages

- Easy inclusion of *a priori* knowledge
- Able to model both static and dynamic interaction
- Generalizes to multiple environments
- Long-term predictions

Drawbacks

- Computationally expensive
- Obtaining good cost maps is difficult
- Handling recursive planning