Search Spaces I

ME/CS 132b Advanced Robotics: Navigation and Perception 4/05/2011

Before we get started...

Website updated with Spring quarter grading policy 30% homework, 20% lab, 50% course project Website updated with new late homework policy 3 late days allowed in Spring quarter

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Higher Dimensional Manifolds

unit sphere defined as

 $\mathbb{S}^2 = \{(x,y,z) \in \mathbb{R}^3 | x^2 + y^2 + z^2 = 1\}$

higher dimensional spheres are defined as

 $\mathbb{S}^n = \{ x \in \mathbb{R}^{n+1} | \parallel x \parallel = 1 \}$

n-dimensional real projective space \mathbb{RP}^n is the set of all lines in \mathbb{R}^{n+1} that pass through the origin

 $\mathbb{RP}^n \cong \mathbb{S}^n / \sim \qquad \text{``homeomorphic'' (equivalent topology) if all pairs of antipodal points can be identified}$

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	Searc	ch Space Design _{Roadmaps}	
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	Summary		
	Combining ideas from topology and geometric transformations allows us to define a configuration space for a system in 2 and 3 dimensions		
	Search space design is generally about achieving completeness while and computational cost		
	Deterministic and probabilistic search spaces have different degrees of guaranteed completeness		
	Introduced grids, rapidly-exploring dense trees, and roadmaps for search space design		
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Next Lecture (4/7)

Search Spaces II

Search Spaces with Differential Constraints

Applications

Costing

C-Space Expansion

Binary Valued Obstacle Representations

Continuous Valued Obstacle Representation

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	Document/Im	lage References	
	[Howard 09a] T.M. Howard, "Adaptive Model- Predictive Motion Planning for Navigation in Complex Environments". Ph.D. Thesis, Carnegie Mellon University, August 2009	[LaValle O6a] S. LaValle, "Planning Algorithms". Cambridge: Cambridge University Press. ISBN 0521862051.	
	[LaValle99a] S. M. LaValle and J. J. Kuffner. Randomized kinodynamic planning. In Proceedings IEEE International Conference on Robotics and Automation, pages 473–479, 1999.	[Kavraki96a] L. E. Kavraki, P. Svestka, JC. Latombe, and M. H. Overmars. Probabilistic roadmaps for path planning in high-dimensional configuration spaces. IEEE Transactions on Robotics & Automation, 12(4):566– 580, June 1996.	
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