ME 495, Spring 2006
Motion Planning and Control Under Uncertainty

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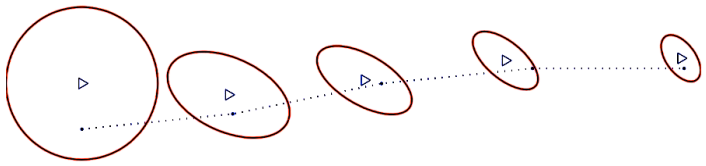
MWF 3:30-4:20, Tech M166

Robots, animals, and other control systems must constantly make action decisions based on noisy sensors, partial state information, and uncertain control models. This course studies optimal decision-making under these circumstances, incorporating ideas from classical stochastic optimal control and recent approaches in robotics.



A mobile robot reduces its own position uncertainty as it moves by noisy sensing of a landmark.

Examples

A swarm of robots is gathering information on an oil spill. How should they spread out to maximize the information gained?

To capture its prey, the weakly electric fish must move to (1) increase information on the prey's location using its electrosense and (2) position its mouth at the prey. The fish has significant dynamics and limited control actions. How should it move?

Should the outfielder backpedal or turn and run to catch the fly ball over his head?

Texts

Probabilistic Robotics, S. Thrun, W. Burgard, D. Fox
Optimal Control and Estimation, R. F. Stengel

Syllabus

- Bayes filters
- Applications: histogram and particle filters
- Kalman filters
- Extended Kalman filters
- Linear quadratic Gaussian problems and the certainty equivalence principle
- Markov decision processes
- Dynamic programming
- Partially observable Markov decision processes
- Applications in robotics and biology