

ECE183DA (Winter 2021)

Design of Robotic Systems I

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Problem set 3: Discretization and function approximation Due 3pm PST Monday Feb. 1, 2021

Key takeaways

After this lecture, you should understand:

- Scaling issues in MDP solving;
- How to approximate the solution to a continuous space (or large discrete space) MDP by solving a smaller MDP;
- How to derive discretization as a special case of solving MDPs in (basis) function space; and
- The impact of the choice of basis as you solve a large MDP using function approximation.

Assignment

Consider the planning problem of circumnavigating the Earth by sea¹ with a holonomic ocean-going robot boat. In order to succeed, you must start and end in Los Angeles, making a complete loop around the world having passed through the antipode of LA off the coast of Madagascar².

- 3(a). Define the 2D position of your robot on the surface of the Earth by its latitude and longitude coordinates. In two or three English sentences, explain: Is this position sufficient to represent the state of the robot for this task? Why or why not? If not, what more would you need?
- 3(b). Consider discretizing the (continuous) robot position by a lattice (grid) decomposition of the lat/lon coordinates. In two or three English sentences, explain why this might not be a computationally effective method of discretization.
- 3(c). In two or three English sentences: choose and defend a small set of basis functions (features) on the state you described in 3(a) that you could use for value function approximation on this specified task.
- 3(d). Would you be willing to let us use your correct responses as (anonymized) examples for the class?

¹<https://en.wikipedia.org/wiki/Circumnavigation#Definition>

²<https://www.geodatos.net/en/antipodes/united-states/los-angeles>