

Adaptive Routing

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1 The Problem

Do you live in a place where you have more than one *terrible* routes to come to school? Do you feel that the traffic is out to get you every morning? Like the whole universe conspires in order to miss another morning class? Stop nodding ‘yes’ and keep reading, because this project is designed specifically for you! It’s time to put your AI knowledge in good use, and develop an algorithm for always choosing the least regretful route, no matter how adversarial the world is.

2 Project Overview & Goal Description

The exploration-exploitation trade-off is a fundamental dilemma whenever you learn about the world by trying things out. The goal of this project is to acclimate students to the problem of decision making under uncertainty, by implementing various well studied algorithms in a routing domain with limited feedback.

Such scenarios can be modeled as Multi-armed bandits (MAB) problems [1] where, given a set of arms (actions), an agent pulls an arm at successive trials to receive some unknown reward. In the past few years there has been a lot of research in the area of multi-armed bandit algorithms because of their ability to balance exploration and exploitation when making decisions under uncertainty. These algorithms focus on one central question: How to minimize regret when faced with many available actions with uncertain outcomes?

In this project, the student will test the performance of various well known algorithms, starting from simple heuristics such as the ϵ -greedy algorithm, to more advanced adversarial bandit algorithms like the EXP3 [2].

3 Project Steps

- Design and implement an evaluation platform.
- Implement various decision making algorithms.
- Run simulations and evaluate their performance.

4 Required Skills

Good programming skills are required.

Having taken an AI course is preferable, although not required.

Being passionate about the topic and good English skills are a must.

References

- [1] Wikipedia, “Multi-armed bandit — wikipedia, the free encyclopedia,” 2017, [Online; accessed 2-June-2017]. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Multi-armed_bandit&oldid=779388270
- [2] P. Auer, N. Cesa-Bianchi, Y. Freund, and R. E. Schapire, “The nonstochastic multiarmed bandit problem,” *SIAM journal on computing*, vol. 32, no. 1, pp. 48–77, 2002.