SC42050 Literature Assignment
Fuzzy Q-iteration for reinforcement learning

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Consider the fuzzy Q-iteration (fuzzy QI) algorithm, described in (Busoniu et al., 2008). Write a brief paper about this topic, integrating answers to the following questions in the logical flow of your paper. Do not restrict your reading to this single article (Busoniu et al., 2008); e.g., some of the questions below may require further reading.

- What is the problem addressed in this paper? Why is it necessary to approximate the Q-function?

- What is the advantage of using asynchronous fuzzy QI, instead of the synchronous variant?

- Mention (with references) several other reinforcement learning (RL) techniques from the literature that use fuzzy approximation to represent Q-functions or state value functions.

- In what way does it help to consider only discrete actions in fuzzy QI? What would be the additional difficulties if continuous actions were considered?

- Do you think there is any fundamental difference between the concept of "membership functions", as used in Section 4 of the paper, and the concept of "basis functions", as used in Section 6.3? Motivate your answer.

- The robotic navigation example is rather artificial. Give a more suitable, realistic control problem for benchmarking the fuzzy QI algorithm.

References

Busoniu, L., Ernst, D., Schutter, B. D., and Babuska, R. (2008). Continuous-state reinforcement learning with fuzzy approximation. In *Adaptive Agents and Multi-Agent Systems*, pages 27–43.