Provable Safe Reinforcement Learning

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Motivation

Are you interested in Reinforcement Learning?
Are you interested in Logics?
Let's combine them to get the best of both!

As project, almost any learning problem is interesting where safety is an issue and/or the problem involves a lot of planning/thinking ahead. A few examples:

- **FM+RL for PAC-MAN**
  RL: Learns to play PAC-MAN.
  FM: Protects PAC-MAN from getting eaten by ghosts.
  (Similar: 2048, atari games like flappy brid, seaquest, etc)
- **FM+RL for autonomous driving**
  RL: An autonomous taxi has to learn to drive smoothly and has to visit several points to pick up passengers.
  FM: Finds out the optimal route and avoids accidents.
- **FM+RL for multi-agent systems**
  RL: Learns to perform complex missions.
  FM: Prevents congestions and collisions.
- **FM+RL for smart cities**
  RL: Learns a complex traffic light controller for the entire city. FM: Ensures that emergency vehicles will have a clear road, etc.
- **FM+RL for robocup logistics league** ...

Goals and Tasks

- Pick a project that excites you.
- Let's figure out together, how FM could assist a learning agent (SAT, SMT, Model Checking, Synthesis).
- Implement everything and play with it.

Literature

- M. Alshiekh et al.
  Safe Reinforcement Learning via Shielding
  Conference on Artificial Intelligence (AAAI-18)
  https://www.aaai.org/ocs/index.php/AAAI/AAAI18/paper/view/17211
- B. Könighofer et al.
  Shield synthesis
  Formal Methods in System Design 2017
  https://doi.org/10.1007/s10703-017-0276-9

Schedule

- Reading related work and first steps
- Intermediate presentation or poster
- Implementing, experiments, ...
- Writing thesis
- Final presentation

Recommended if you're studying

☒ CS ☒ ICE ☒ SEM

Prerequisites

- Interest in Logics

Advisor / Contact

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