Unconventional reinforcement learning on traffic lights with SUMO

Master Degree in Computer Science

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Outline

1. Traffic and Simulations
2. **RO 1**: Acquiring a baseline
3. **RO 2**: Evaluating the effectiveness of Curriculum Learning
4. **RO 3**: Comparing Deep Learning with Tabular Learning
5. **RO 4**: Comparing Reinforcement Learning with existing solutions
6. **RO 5**: Evaluating the impact of determinism over performances
7. **RO 6**: Evaluating the impact of quantization over performances
8. **RO 7**: Comparing Multi-Agent Learning with Single-Agent Learning
9. **RO 8**: Evaluating the effectiveness of Self-Adaptive strategies

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Traffic Congestion

SUMO

SUMO-RL

Research Questions

- **RQ 1.1**: Which is the best implemented reward function?
- **RQ 1.2**: Which is the best implemented observation function?

Research Questions

- **RQ 2.1**: Does curriculum learning leads to better running performances?
- **RQ 2.2**: Is there a loss of knowledge due to curriculum learning not being exhaustive?
- **RQ 2.3**: Does adding disruption episodes in the training set enable agents to tackle problematic conditions?

Research Questions

- **RQ 3.1**: Which is the best implemented tabular agent?
- **RQ 3.2**: Which is the best implemented neural agent?
- **RQ 3.3**: Is Deep Learning worth its cost?

Research Questions

- **RQ 4.1**: What is the impact of cycle time in Fixed Cycle Agents?
- **RQ 4.2**: Are RL Agents an improvement over non-AI solutions?

Research Questions

- **RQ 5.1**: Is non-determinism helping the agents?
- **RQ 5.2**: Locking determinism does cause a significant drop in performance?

Research Questions

- **RQ 6.1**: Do agents benefit from a small quantization?
- **RQ 6.2**: Do continuous-space agents benefit from disabling quantization?

Research Questions

- **RQ 7.1**: Does sharing rewards to neighbour agents improve globally the solution?
- **RQ 7.2**: Does sharing observations to neighbour agents improve globally the solution?

Research Questions

- **RQ 8.1**: Can a reinforcement learning system be designed to update itself as needed?
- **RQ 8.2**: Is the self-adaptive system improving performance over time?
- **RQ 8.3**: Is the self-adaptive system updating as intended?

Thank You