L&LRS: Logic meets Learning
Thesis topic presentation

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Context

More and more reactive systems (e.g., self-driving cars...).
→ Their correctness is often critical.
↔ Need for safe controllers.

How to obtain safe and optimal controllers?

Formal methods

Rigorous techniques based on mathematical tools.
→ Reactive synthesis: from a specification, design a controller.

Machine learning

Powerful approach based on statistical reasoning.
→ Reinforcement learning: train an agent based on a reward system.
Motivations

Formal methods
- Exact
- Hard guarantees
- Poor scalability

Machine learning
- Good performances
- Little guarantees
- Limited understandability

→ Idea: combine formal methods and machine learning.

Current frameworks usually only permit to consider a single quantitative (or qualitative) aspect at a time.
→ Need to model interplay between several aspects = multi-objective.
→ E.g., for an application, response time and energy consumption.
Objectives

Thesis goal
Combine the formal reasoning from logic and the power of learning, focusing on multi-objective models.

Three main dimensions:
1. Learning for multi-objective and/or exact models.
2. Safety and robustness.
3. Exploring understandable controllers.
→ Software tool supporting our fundamental advances.
Thank you for your attention!