IDALAB

PARIS
LODRON
UNIVERSITÄT
SALZBURG

Tutorial RL Bootcamp Salzburg

Simon Hirlaender

- Well studied in several papers/thesis

- Linear Dynamics with up to 10 degrees of freedom in actions and states

- Non-trivial due to action limitations

- Analytical benchmark policy

- Easy to understand, focus on the RL problem not the MDP

- The simulation corresponds exactly to a real system

- All our algorithms were tested on the real machine

5

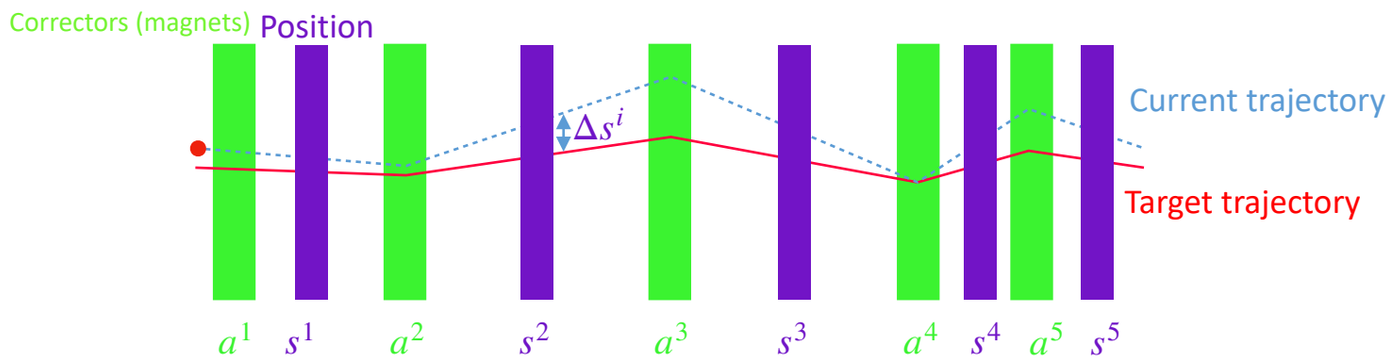
CERN AWAKE steering problem

CERN AWAKE steering problem

- Well studied in several papers/thesis
- Linear Dynamics with up to 10 degrees of freedom in actions and states
- Non-trivial due to action limitations
- Analytical benchmark policy
- Easy to understand, focus on the RL problem not the MDP
- The simulation corresponds exactly to a real system
- All our algorithms were tested on the real machine

CERN AWAKE steering problem

Markov decision process: (S, A, R, P, ρ_0, γ)



- 10 continuous states S and actions $A \in [-1,1]$ **(actions are bounded/constraints)** (10 DoF problem - observation is state)
- Rewards R negative of RMS of states $r_t \propto -\sqrt{\sum_k \Delta(s_t^k)^2}$
- The dynamics of the system is characterised by: $s_{t+1} = \mathbf{R}a_t + s_t$
- Initial criteria: Initial distribution ρ_0
- Episodic training
- Termination criteria:
  - Maximal number of interactions (truncation)
  - RMS below measurement uncertainty (successful termination)
  - States s_i > beam pipe (termination or clipping)
- Transitions P are deterministic os stochastic, γ =1
- If we speak about different tasks i (MPDs) we mean different matrices $\mathbf{R}_i$