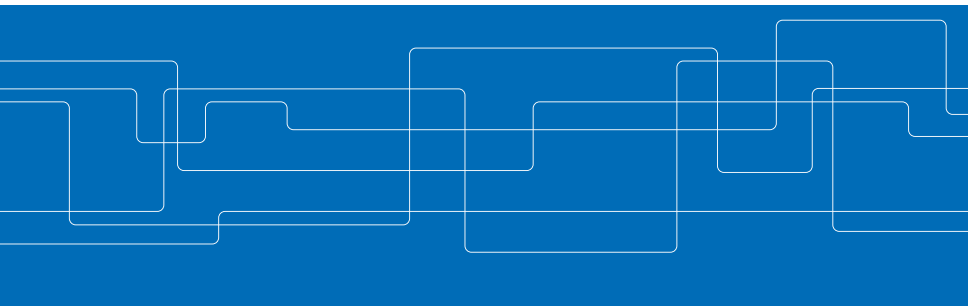




# Safe Learning for Control

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## Motivation

Why do we want to do safe learning in control?

- ▶ model-based control suffers often from poor model accuracy
- ▶ reinforcement learning algorithms not designed for satisfying constraints

## Algorithm

How to we do safe learning for control?

Example

- ▶ autonomous vehicle with partly known model
- ▶ task: learn control without driving off the road





# Algorithm

## Reinforcement Learning

General Idea: Finding the optimal policy by trying actions and receiving rewards



**Figure:** Possible Trajectories



# Algorithm

## Safe Set Calculation





# Algorithm

## Disturbance Estimation with Gaussian Processes





# Algorithm Exploration





# Experimental Results

## Policy Estimation





# Experimental Results

## Disturbance Estimation





# Experimental Results

## Simulation





## Conclusions





## Future Work

