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FAU FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG
TECHNISCHE FAKULTÄT

[RL22] Q&A Session on Model-based RL #2

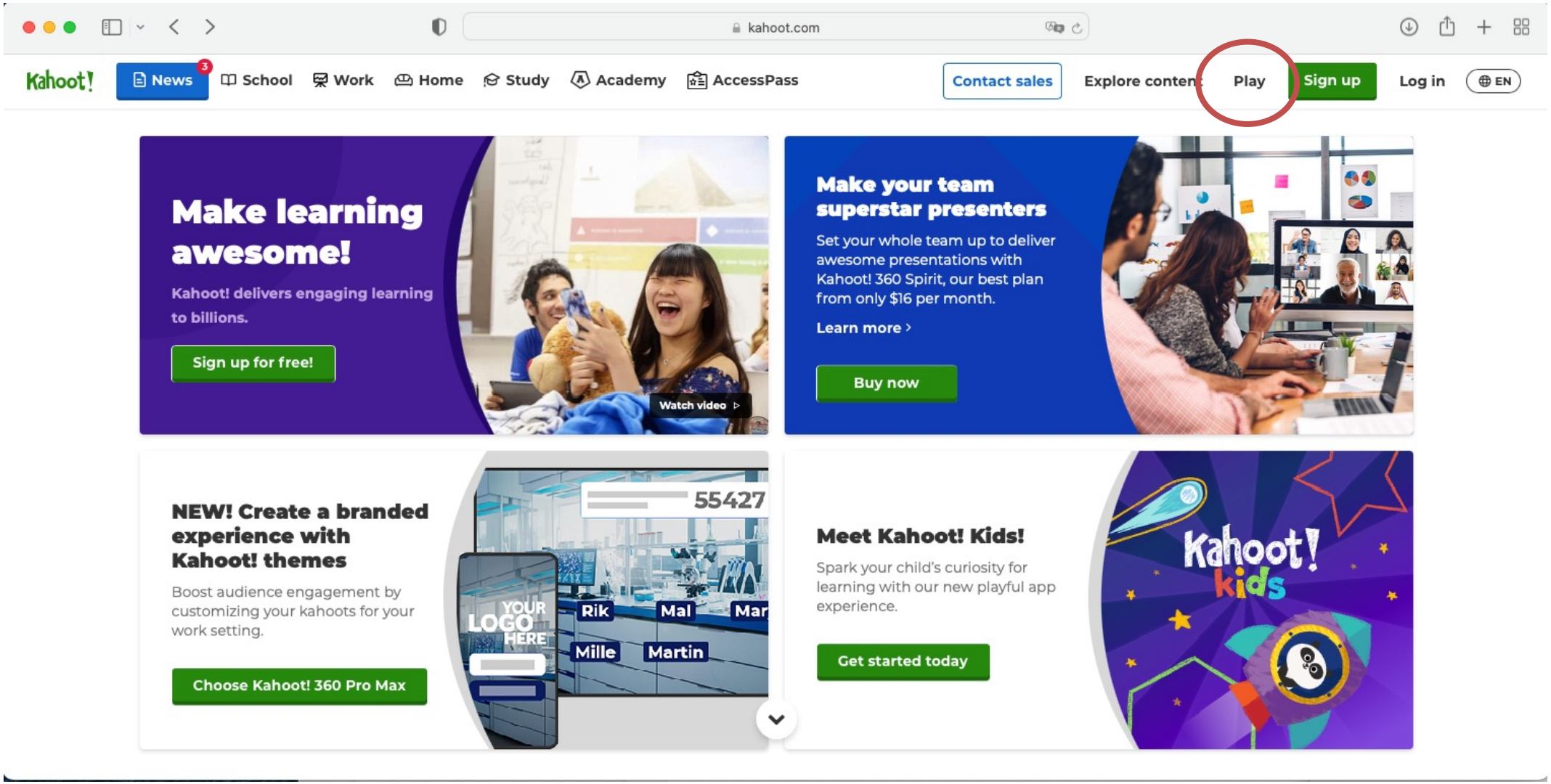
07.07.2022

Christopher Mutschler

Let‘s play Kahoot! again…

Kahoot!

Let‘s play Kahoot!



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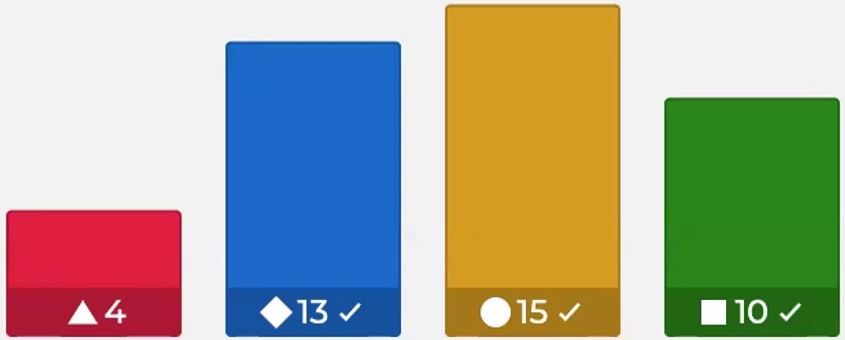
Trajectory Optimization with Derivatives



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- ▲ LSTMs help with the poor conditioning induced by the recursive gradients ✗
- ◆ Samples the initial action sequence randomly ✓
- ● Optimizes the action sequence via gradient descent ✓
- ■ Collocation makes downstream state changes less sensitive to early changes ✓

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Veronica Buckina

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Takuma Nishimura

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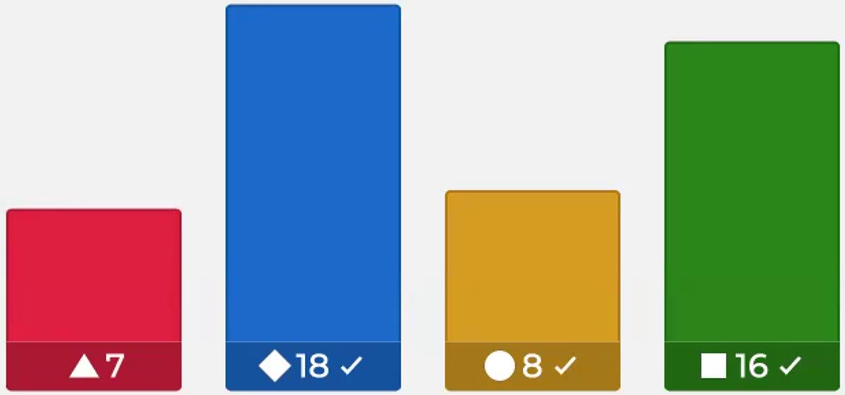
Cross Entropy Maximization



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- ▲ Uses gradients to optimize a number of action sequences ✗
- ◆ Fits a Gaussian to sample policy parameters at every iteration ✓
- ● Is able to find the global optimum ✓
- ■ Is easy to implement and embarrassingly easy to parallelize ✓

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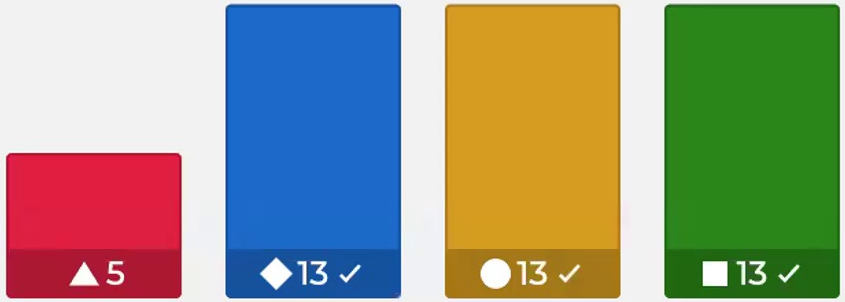
Uncertainty of models in RL



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- ▲ Aleatoric uncertainty can be reduced close to 0 by training with more data ✗
- ◆ Episdemic uncertainty often leads to extrapolation errors ✓
- ● Episdemic uncertainty changes over the course of learning ✓
- ■ Aleatoric uncertainty captures the world's inherent stochasticity ✓

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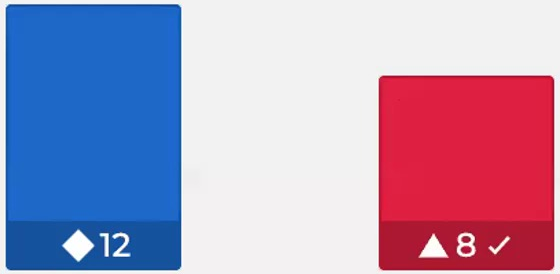
Model Predictive Control applies a sequence of actions at once (with a maximum length of the planning horizon)



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True

False

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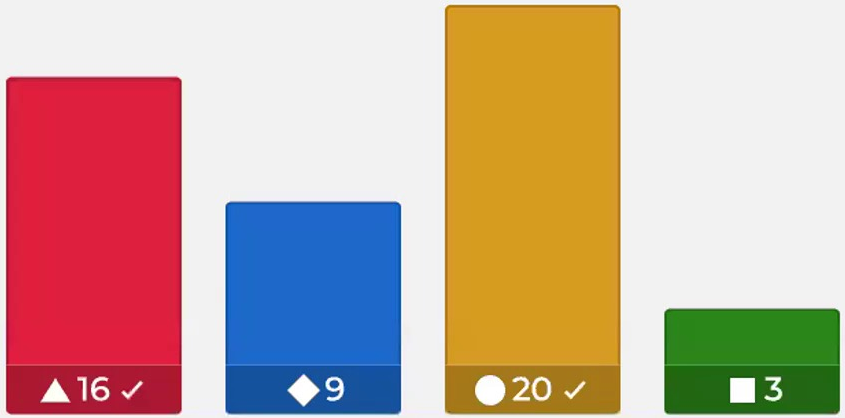
Uncertainty Estimation: what models can we use?



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- ▲ Model Ensembles ✓
- ◆ Recurrent Neural Networks ✗
- ● Gaussian Processes ✓
- ■ Support Vector Machines ✗

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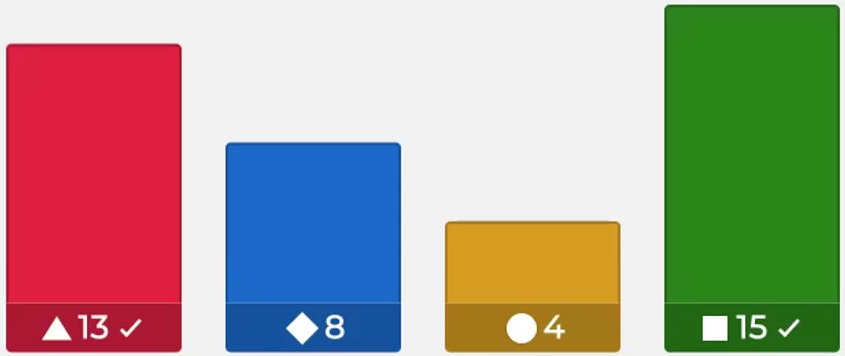
Uncertainty Propagation: what methods can we use?



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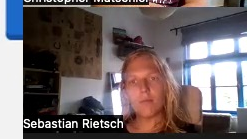
- ▲ Moment Matching ✔
- ◆ Stochastic Gradient Descent ✖
- ● Time-Difference Learning ✖
- ■ Trajectory Sampling ✔



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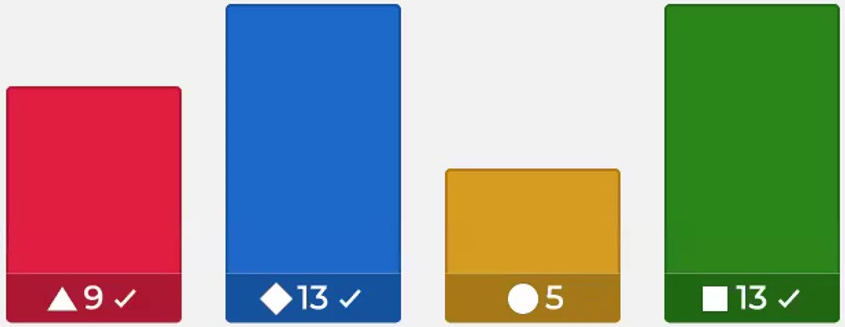
PILCO



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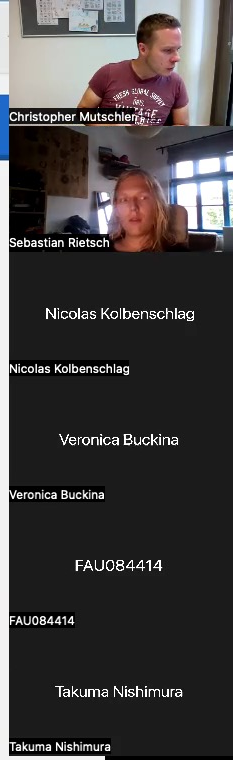
- ▲ Is robust to small model errors ✓
- ◆ Is very sample efficient ✓
- ● Does not require smooth dynamics ✗
- ■ Is computationally expensive w.r.t. the available training data ✓



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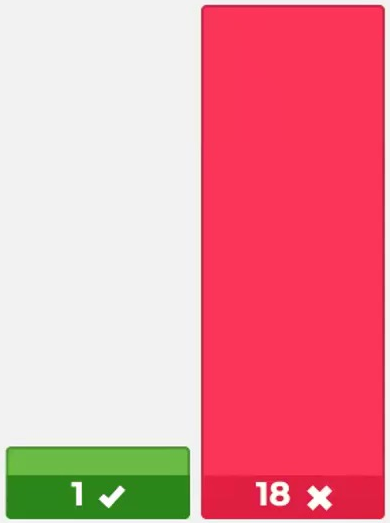
MBRL: Sample Efficiency (top: requires many samples, bottom: requires little samples)



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- Augmented Random Search ✓
- Policy-based RL ✓
- Value-based RL ✓
- Model-based RL ✓

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