~~Large-scale planning for resource management problems~~
Why I love POMDPs and so should you

Anthony Corso
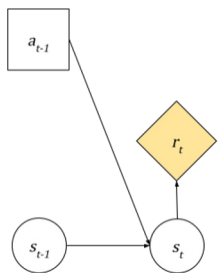*acorso@stanford.edu*

October 21, 2022

SAFE Stanford Center for AI Safety
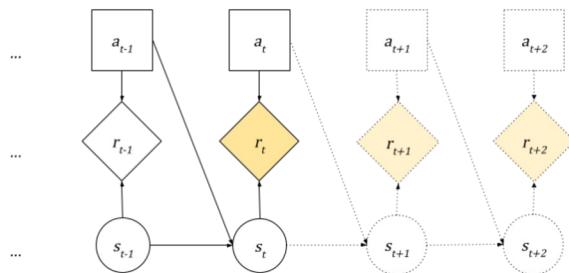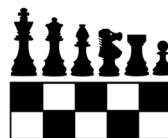
Stanford | Doerr School of Sustainability

SISL Stanford Intelligent Systems Laboratory

Models for decision making

Single-shot	Markov Decision Process (MDP)	Partially Observable (POMDP)
(States, Actions, Rewards)	(States, Actions, Rewards, Transition)	(States, Actions, Rewards, Transition, Observations)
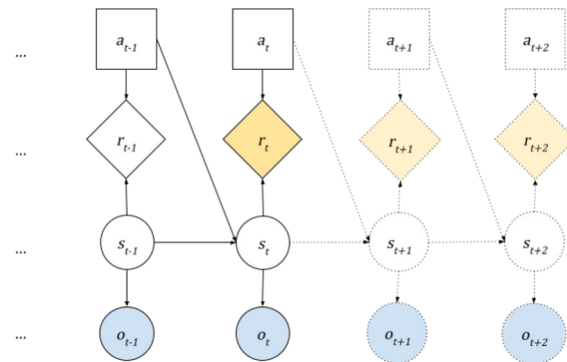
Aircraft Collision Avoidance

POMDPs allow for reasoning about the acquisition of **future information**, enabling safe and efficient **planning under uncertainty**.

M. J. Kochenderfer, J. E. Holland, and J. P. Chryssanthacopoulos, "Next generation airborne collision avoidance system," *Lincoln Laboratory Journal*, vol. 19, iss. 1, pp. 17-33, 2012.
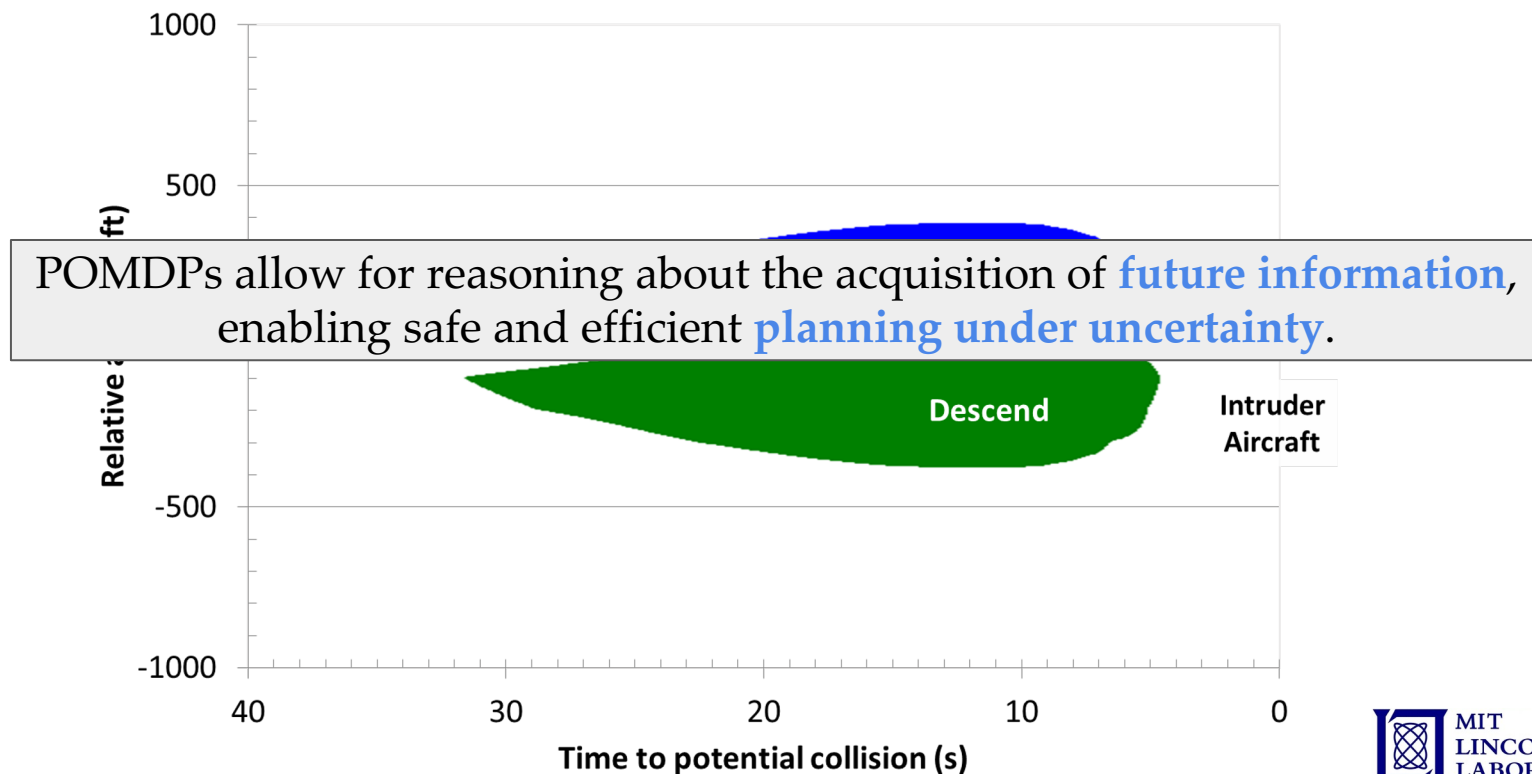
Geological Carbon Storage

State Uncertainty

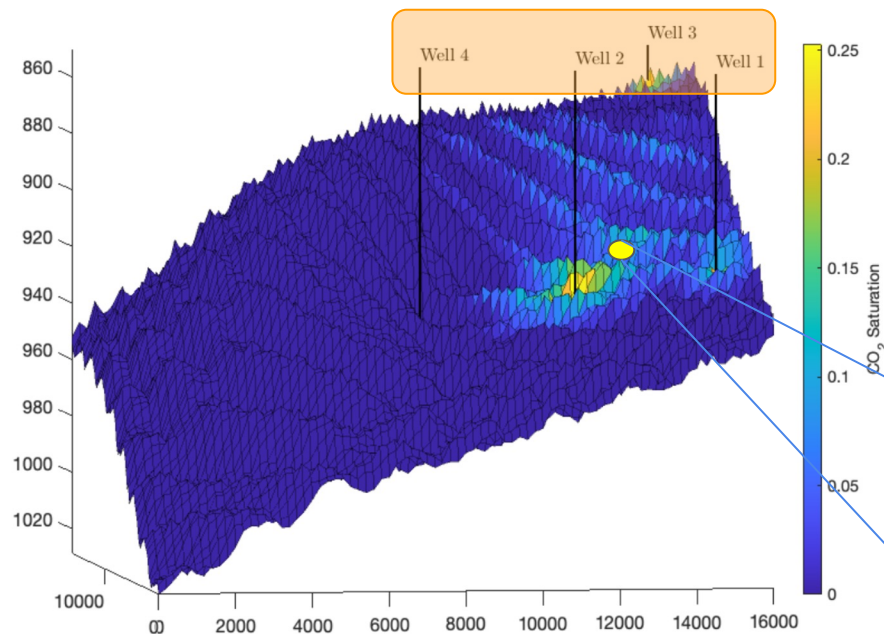**Transitions**

Actions

Well 4   Well 2   Well 3   Well 1
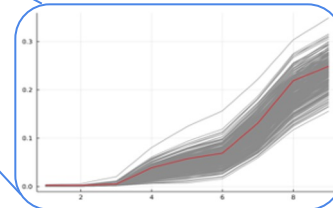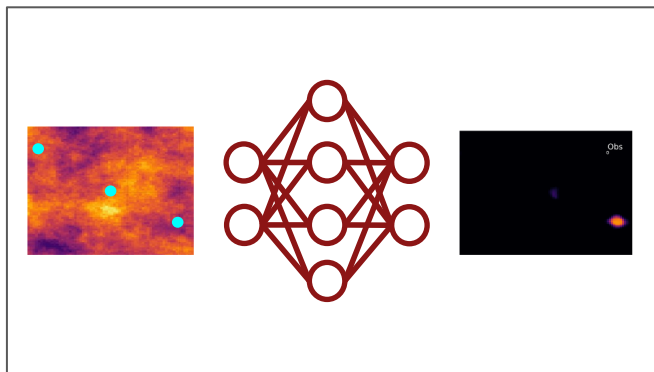
CO_2 Saturation
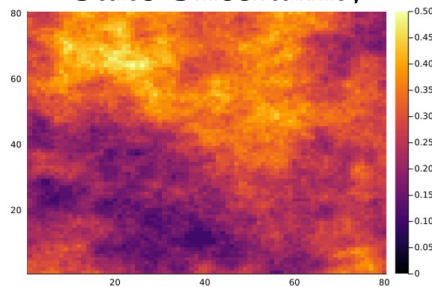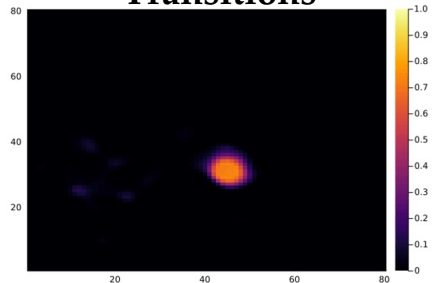
Reward

Trapped Volume
Exited Volume
Max Pressure

Observations

Modern Solution Techniques
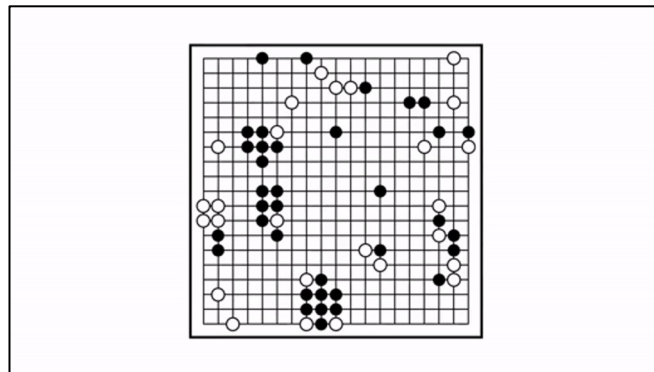
Deep Surrogate Modeling

Forward Tree Search

Image credit: DeepMind, Alpha Go, 2016.

Method	Trapped volume (Gt)	Exited volume (Gt)	Total reward
Random policy	844.855	5022.96	-1.17864e6
Expert solution	1915.2	8.83861	1331.67
POMDP solver	**2805.4**	**0.0**	**5403.65**

Lets collaborate!

Objectives/Constraints

Simulator or Data +
Surrogate Model

Problem Formulation

POMDP Solver

POMDP
Magic
☆☆☆

IN

OUT

Plan of action

Image credit: Dr. Seuss