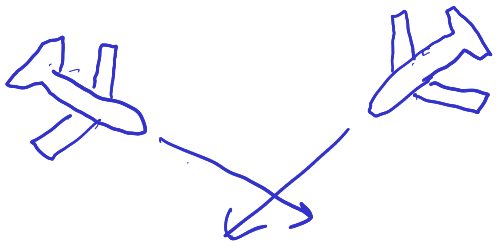
ASEN 5264

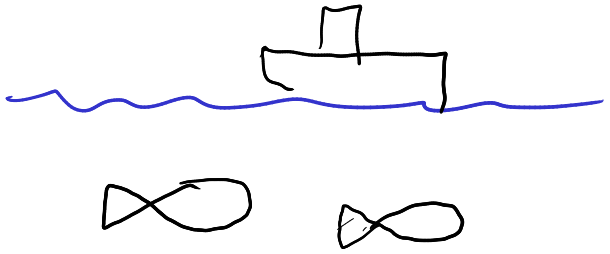
Decision Making under Uncertainty

3 Example Problems

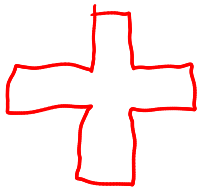
A/C Collision Avoidance



Fishery Management



Health Screening



FAA: Collision Avoidance

Quantify Uncertainty in States

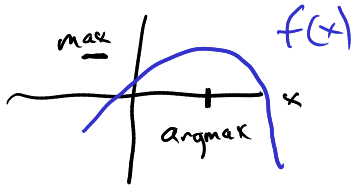
$[x_1, y_1, h_1, v_x, v_y]$

$R(s,a) = -1\,\mathbb{1}(a = up) - 1000\,\mathbb{1}(d < 1000)$

~~$\pi(a|s)$~~

$\pi : S \to A$

$\pi(s) = \underset{a \in A}{\operatorname{argmax}}\, R(s,a)$



MDP

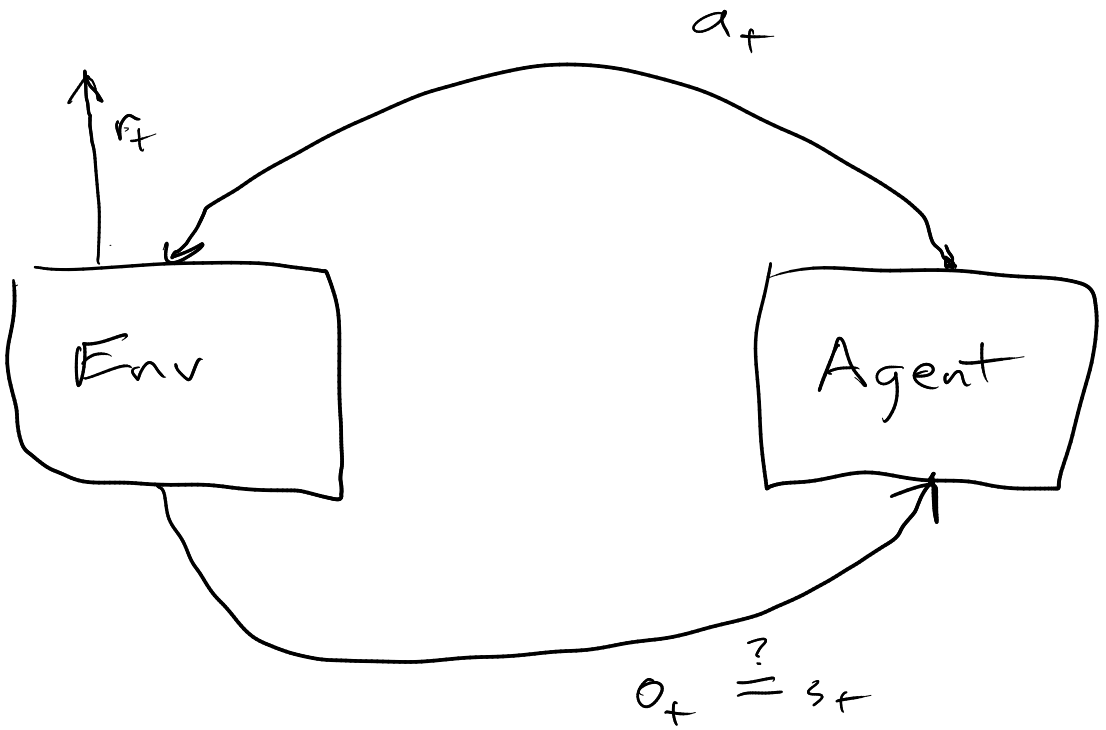
1) States: Set of variables describe the environment at the current time $[d, \dot{d}, \Delta h, \dot{\Delta h}]$

2) Actions $\{up, down\}^2$

3) Dynamics how state changes over time given an action

4) Reward Designation of which states/actions are "good"

Sense-Plan-Act Loop



Four Big Challenges in DMU

1. Immediate + Future Rewards
2. Unknown Models
3. Imperfect Observations
4. Other Agents

MDP

Reinforcement Learning

POMDP

Game Theory

Reinforcement Learning from ML perspective

Four Types of Uncertainty in DMU

1. Outcome
2. Model
3. State

Probabilistic

4. Interaction

Aleatoric

Epistemic Static

Epistemic Dynamic

Coinflip

Loaded Die

Blackjack

Rock-Paper-Scizzors

Break

Break

- Engineering is a team sport!

Break

- Engineering is a team sport!
- Groups of 2-4:
  - Name
  - Department
  - Sequential decision making problem

Course Materials/Logistics

Course Materials/Logistics

- Ed

Course Materials/Logistics

- Ed
- Syllabus

Course Materials/Logistics

- Ed
- Syllabus
- Book

Course Materials/Logistics

- Ed
- Syllabus
- Book
- Homework

Course Materials/Logistics

Julia / Python All / MATLAB All / C++ 1/2

- Ed
- Syllabus
- Book
- Homework
- Julia

A bit about me

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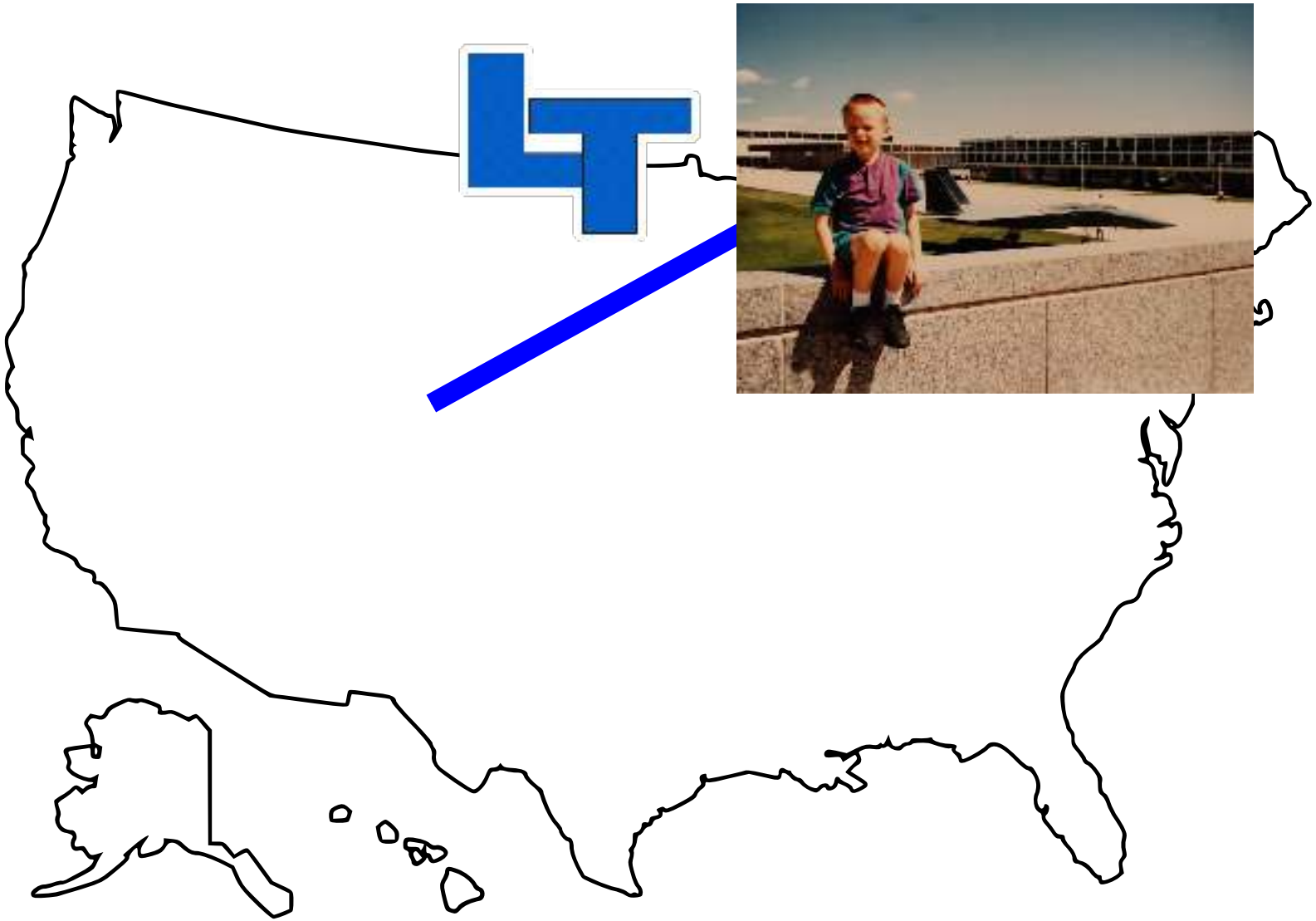

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