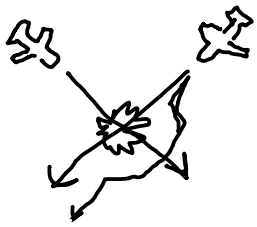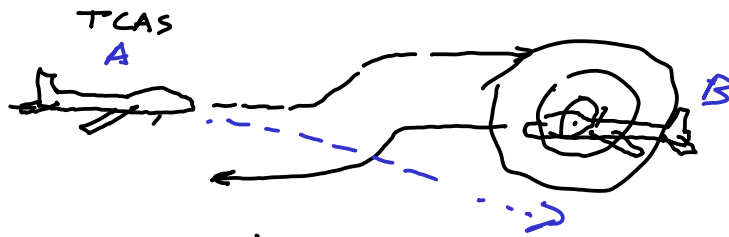Collision Avoidance

FAA: Prevent Collision
How?
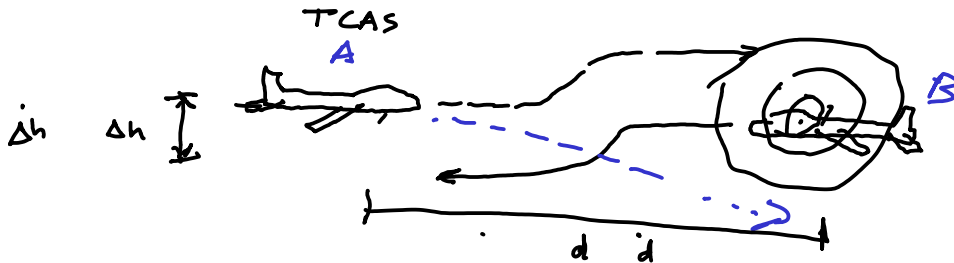
TCAS
A

B

What should we tell pilots

Rules

If above other plane, go up
If above and descending ?

TCAS
A

B

$\dot{\Delta h}$ Δh

d $\dot{d}$

1. variables that describe env   state $s = [\Delta h, \dot{\Delta h}, d, \dot{d}]$
2. how does state change over time   dynamics
3. what actions can we take $A = \{up, down\}$
4. which state/actions are more desirable

$$R(s,a) = \begin{cases} -1000 & \text{if collision} \\ -1 & \text{if ascending} \end{cases}$$

Goal: find policy $\pi: S \to A$
$$a = \pi(s)$$

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

4 Big Problems

1. Immediate and Future Rewards   MDP
2. Unknown Models   Reinforcement Learning
3. Partial Observability   POMDP
4. Other Agents   Game Theory

Types of Uncertainty

1. Outcome $^{\text{Action}}$ Uncertainty   **Alleatory**   Coin Flip
        ↳ can't learn anything

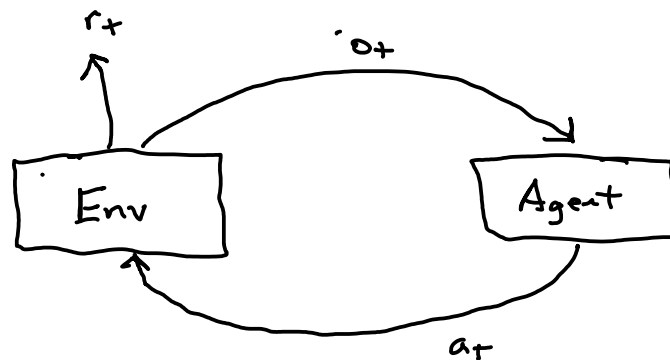2. Model Uncertainty   Static Epistemic   Loaded Dice

3. State Uncertainty   Dynamic Epistemic   Blackjack

4. Interaction Uncertainty   Poker

r_t o_t

Env   Agent

a_t

- A concept you're excited to learn
- Application domain
- DMU in your life   uncertainty how did you make decision