

# **CS343**

# **Artificial Intelligence**

**Prof: Peter Stone**

Department of Computer Science  
The University of Texas at Austin

# Good Morning, Colleagues

---



# Good Morning, Colleagues

---

Are there any questions?

# Some Context

---

- **First weeks:** search (BFS,  $A^*$ , minimax, alpha-beta)
  - Find an optimal plan (or solution)

# Some Context

---

- **First weeks:** search (BFS,  $A^*$ , minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions

# Some Context

---

- **First weeks:** search (BFS,  $A^*$ , minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step

# Some Context

---

- **First weeks:** search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**

# Some Context

---

- **First weeks:** search (BFS,  $A^*$ , minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs —



# Some Context

---

- **First weeks:** search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs — towards reinforcement learning

# Some Context

---

- **First weeks:** search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs — towards reinforcement learning
  - Still know transition and reward function

# Some Context

---

- **First weeks:** search (BFS,  $A^*$ , minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs — towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** — optimal action from every state

# Some Context

---

- **First weeks:** search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs — towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** — optimal action from every state
- **Action learning:** Reinforcement learning

# Some Context

---

- **First weeks:** search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs — towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** — optimal action from every state
- **Action learning:** Reinforcement learning
  - Policy without knowing transition or reward functions

# Some Context

---

- **First weeks:** search (BFS, A\*, minimax, alpha-beta)
  - Find an optimal plan (or solution)
  - Best thing to do from the current state
  - Know transition and cost (reward) functions
  - Either execute complete solution (deterministic) or search again at every step
  - **Know current state**
- **Next:** MDPs — towards reinforcement learning
  - Still know transition and reward function
  - Looking for a **policy** — optimal action from every state
- **Action learning:** Reinforcement learning
  - Policy without knowing transition or reward functions
  - **Still know state**

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**



# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities
  - **Week 7:** Conditional independence and inference (exact and approximate)

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities
  - **Week 7:** Conditional independence and inference (exact and approximate)
  - **Week 9:** State estimation over time

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities
  - **Week 7:** Conditional independence and inference (exact and approximate)
  - **Week 9:** State estimation over time
  - **Week 9:** Utility-based decisions

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities
  - **Week 7:** Conditional independence and inference (exact and approximate)
  - **Week 9:** State estimation over time
  - **Week 9:** Utility-based decisions
- **Week 10:** What if they're not known?

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities
  - **Week 7:** Conditional independence and inference (exact and approximate)
  - **Week 9:** State estimation over time
  - **Week 9:** Utility-based decisions
- **Week 10:** What if they're not known?
  - Also Bayesian networks for **classification**

# Some Context (cont.)

---

- **Probabilistic Reasoning:** Now state is unknown
- Bayesian networks – state estimation/inference
- **Prior, net structure, and CPT's known**
  - **Week 4:** Utilities
  - **Week 7:** Conditional independence and inference (exact and approximate)
  - **Week 9:** State estimation over time
  - **Week 9:** Utility-based decisions
- **Week 10:** What if they're not known?
  - Also Bayesian networks for **classification**
  - A type of **machine learning**

# Some Context (cont.)

---

- **After that:** More machine learning
  - **Week 11:** Neural nets and Deep Learning
  - **Week 12:** SVMs, Kernels, and Clustering
- **Week 13:** Classical planning
  - Reasoning with first order representations



# Some Context (cont.)

---

- **After that:** More machine learning
  - **Week 11:** Neural nets and Deep Learning
  - **Week 12:** SVMs, Kernels, and Clustering
- **Week 13:** Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions

# Some Context (cont.)

---

- **After that:** More machine learning
  - **Week 11:** Neural nets and Deep Learning
  - **Week 12:** SVMs, Kernels, and Clustering
- **Week 13:** Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.

# Some Context (cont.)

---

- **After that:** More machine learning
  - **Week 11:** Neural nets and Deep Learning
  - **Week 12:** SVMs, Kernels, and Clustering
- **Week 13:** Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.
- **Week 14:** Philosophical foundations and ethics

# Some Context (cont.)

---

- **After that:** More machine learning
  - **Week 11:** Neural nets and Deep Learning
  - **Week 12:** SVMs, Kernels, and Clustering
- **Week 13:** Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.
- **Week 14:** Philosophical foundations and ethics

It's all about building agents

**Sense, decide, act**

# Some Context (cont.)

---

- **After that:** More machine learning
  - **Week 11:** Neural nets and Deep Learning
  - **Week 12:** SVMs, Kernels, and Clustering
- **Week 13:** Classical planning
  - Reasoning with first order representations
  - So far we've dealt with propositions
  - Back to known transitions, known state, etc.
- **Week 14:** Philosophical foundations and ethics

It's all about building agents

**Sense, decide, act**

**Maximize expected utility**

# Topics not covered

---

- Knowledge representation and reasoning  
(Chapters 7-9, 11, 12)
- Game theory and auctions  
(Sections 17.5, 17.6)
- Aspects of learning  
(Chapters 18, 19)
- Natural language  
(Chapters 22, 23)
- Vision  
(Chapter 24)
- Robotics  
(Chapter 25)