Course information
Prerequisites

CMPU 145: Foundations of Computer Science
CMPU 203: Software Design and Implementation

Not CMPU 245.

There will be some math and some programming.
Coursework and grades

Reading journal & class activities  15%

4–5 programming assignments  35%
  Python
  Groups of 1–2

2 midterm exams  35%

Final paper  15%
Academic integrity

cs.vassar.edu/integrity
Important this week

Check the course website: cs.vassar.edu/~cs365

Register on Gradescope and Campuswire
Coming up

Reading

Python tutorial assignment
What is artificial intelligence?
Past: How did the ideas in AI come about?

Present: What is the state of the art?

Future: Will robots take over the world?
Movie AI

Star Wars, 1977
Movie AI

Metropolis, 1927
Movie AI

2001: A Space Odyssey, 1968
Movie AI

Westworld, 1973
Movie AI

The Stepford Wives, 1975
Movie AI

The Terminator, 1984
Movie AI

The Matrix, 1999
IBM’s Watson Jeopardy Computer Shuts Down Humans in Final Game

Silicon prevails in men vs. machine challenge

by Erica Guizzo

Watson, the Jeopardy supercomputer created by IBM, defeated its human opponents, Ken Jennings [above] and Brad Rutter, in the final round of the challenge.

The Jeopardy-IBM challenge has ended, and silicon prevailed over gray.
Blizzard will show off Google's Deepmind AI in StarCraft 2 later this week

By Andy Chalk  January 22, 2019

Google and Blizzard launched the artificial intelligence project in 2016.
What is AI?

The science of making machines that…
What is AI?

The science of making machines that…

think like people?
What is AI?

The science of making machines that…

*act like people?*
What is AI?

The science of making machines that... think rationally?
What is AI?

The science of making machines that…

*act rationally!*
Designing rational agents

An *agent* is an entity that *perceives* and *acts*.

A *rational agent* selects actions that maximize its (expected) *utility*. 
Designing rational agents

Characteristics of the **percepts**, **environment**, and **action space** dictate techniques for selecting rational actions.
What about the brain?

Brains (human minds) are very good at making rational decisions, but far from perfect.

- They result from accretion over evolutionary timescales.
- We don’t really know how they work.

“Brains are to intelligence as wings are to flight.”

Lessons learned from human minds:

- Memory, knowledge, feature-learning, procedure-formation, and simulation are key to decision-making.
A (short) history of AI
A short prehistory of AI

*Philosophy* from Aristotle onwards

*Mathematics*: logic, probability, optimization

*Neuroscience*: neurons, adaptation

*Economics*: rationality, game theory

*Control theory*: feedback

*Psychology*: learning, cognitive models

*Linguistics*: grammars, formal representations of meaning
Al’s official birth: Dartmouth, 1956

“An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. *We think that a significant advance can be made if we work on it together for a summer.*”

John McCarthy and Claude Shannon, Dartmouth Workshop Proposal
Nova
1940–1950: Early days

1943: McCulloch & Pitts: Boolean circuit model of brain
1950: Turing’s “Computing Machinery and Intelligence”

1950–70: Excitement: Look, Ma, no hands!

1950s: Early AI programs: chess, checkers, theorem proving
1956: Dartmouth meeting: “Artificial Intelligence” adopted
1965: Robinson’s complete algorithm for logical reasoning

1970–90: Knowledge-based approaches

1969–79: Early development of knowledge-based systems
1980–88: Expert systems industry booms

1990–2012: Statistical approaches & subfield expertise

Resurgence of probability, focus on uncertainty
General increase in technical depth
Agents and learning systems… “AI Spring”?

2012–: Excitement: Look Ma, no hands again?

Big data, big compute, neural networks
Some reunification of subfields
AI used in many industries
What can AI do?
Which of the following can be done at present?
Which of the following can be done at present?

Play a decent game of table tennis?
Which of the following can be done at present?

Play a ✔️ cent game of table tennis?
Which of the following can be done at present?

Play a decent game of table tennis?

Play a decent game of Jeopardy?
Which of the following can be done at present?

- Play a game of table tennis?
- Play a game of Jeopardy?
Which of the following can be done at present?

- Play a game of table tennis?
- Play a game of Jeopardy?
- Drive safely along a curving mountain road?
Which of the following can be done at present?

- Play a cent game of table tennis?
- Play a cent game of Jeopardy?
- Drive ely along a curving mountain road?
Which of the following can be done at present?

- Play a decent game of table tennis? ✅
- Play a decent game of Jeopardy? ✅
- Drive safely along a curving mountain road? ✅
- Drive safely through campus?
Which of the following can be done at present?

- Play a **cent** game of table tennis?
- Play a **cent** game of Jeopardy?
- Drive **ely** along a curving mountain road?
- Drive safely through campus?
Which of the following can be done at present?

- Play a decent game of table tennis?
- Play a decent game of Jeopardy?
- Drive safely along a curving mountain road?
- Drive safely through campus?
- Buy a week’s worth of groceries on the web?
Which of the following can be done at present?

- Play a cent game of table tennis? ✅
- Play a cent game of Jeopardy? ✅
- Drive ely along a curving mountain road? ❓
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ✅
Which of the following can be done at present?

- Play a cent game of table tennis? ✓
- Play a cent game of Jeopardy? ✓
- Drive safely along a curving mountain road? ?
- Drive safely through campus? ✓
- Buy a week’s worth of groceries on the web? ✓
- Buy a week’s worth of groceries at Stop & Shop?
Which of the following can be done at present?

- Play a 🟢cent game of table tennis?
- Play a 🟢cent game of Jeopardy?
- Drive 🟢ely along a curving mountain road?
- Drive safely through campus? 🟢
- Buy a 🟢ek’s worth of groceries on the web?
- Buy a week’s worth of groceries at Stop & Shop? ❌
Which of the following can be done at present?

- Play a **cent** game of table tennis?
- Play a **cent** game of Jeopardy?
- Drive **ely** along a curving mountain road?
- Drive safely through campus?
- Buy a **ek**’s worth of groceries on the web?
- Buy a **ek’s** worth of groceries at Stop & Shop?
Which of the following can be done at present?

- Play a game of table tennis?
- Play a game of Jeopardy?
- Drive along a curving mountain road?
- Drive safely through campus?
- Buy a week’s worth of groceries on the web?
- Buy a week’s worth of groceries at Stop & Shop?
Which of the following can be done at present?

- Play a cent game of table tennis? ✅
- Play a cent game of Jeopardy? ✅
- Drive safely along a curving mountain road? ✅
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ✅
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem?
Which of the following can be done at present?

- Play a cent game of table tennis? ✅
- Play a cent game of Jeopardy? ✅
- Drive safely along a curving mountain road? ✅
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ✅
- Buy a week’s worth of groceries at Stop & Shop? ✗
- Discover and prove a new mathematical theorem? ❓
Which of the following can be done at present?

Play a ✓ cent game of table tennis?
Play a ✓ cent game of Jeopardy?
Drive ✓ ely along a curving mountain road?
Drive ✓ safely through campus?
Buy a ✓ ek’s worth of groceries on the web?
Buy a ✗ egk’s worth of groceries at Stop & Shop?
Discover and prove a new mathematical theorem?
Converse successfully with another person for an hour?
Which of the following can be done at present?

- Play a cent game of table tennis? ✅
- Play a cent game of Jeopardy? ✅
- Drive along a curving mountain road? ✅
- Drive safely through campus? 🟢
- Buy a week’s worth of groceries on the web? ✅
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem? 🟢
- Converse successfully with another person for an hour? ❌
Which of the following can be done at present?

- Play a game of table tennis? ✔
- Play a game of Jeopardy? ✔
- Drive along a curving mountain road? ✔
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ✔
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem? ❓
- Converse successfully with another person for an hour? ❌
- Perform a surgical operation? ❌
Which of the following can be done at present?

- Play a [✓]cent game of table tennis?
- Play a [✓]cent game of Jeopardy?
- Drive [✓]ely along a curving mountain road?
- Drive safely through campus?
- Buy a [✓]ek’s worth of groceries on the web?
- Buy a [✗]ek’s worth of groceries at Stop & Shop?
- Discover and prove a new mathematical theorem?
- Converse successfully with another person for an hour?
- Perform a surgical operation?
Which of the following can be done at present?

- Play a decent game of table tennis? ✅
- Play a decent game of Jeopardy? ✅
- Drive safely along a curving mountain road? ✅
- Drive safely through campus? ❮❓❯
- Buy a week’s worth of groceries on the web? ✅
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem? ❮❓❯
- Converse successfully with another person for an hour? ❌
- Perform a surgical operation? ❮❓❯
- Put away the dishes and fold the laundry?
Which of the following can be done at present?

- Play a decent game of table tennis?
- Play a decent game of Jeopardy?
- Drive safely along a curving mountain road?
- Drive safely through campus?
- Buy a week’s worth of groceries on the web?
- Buy a week’s worth of groceries at Stop & Shop?
- Discover and prove a new mathematical theorem?
- Converse successfully with another person for an hour?
- Perform a surgical operation?
- Put away the dishes and fold the laundry?
Which of the following can be done at present?

- Play a cent game of table tennis? ✅
- Play a cent game of Jeopardy? ✅
- Drive along a curving mountain road? ✅
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ❌
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem? ❓
- Converse successfully with another person for an hour? ❌
- Perform a surgical operation? ❓
- Put away the dishes and fold the laundry? ✅
Which of the following can be done at present?

- Play a cent game of table tennis? ✓
- Play a cent game of Jeopardy? ✓
- Drive along a curving mountain road? ?
- Drive safely through campus? ?
- Buy a week’s worth of groceries on the web? ✓
- Buy a week’s worth of groceries at Stop & Shop? x
- Discover and prove a new mathematical theorem? ?
- Converse successfully with another person for an hour? x
- Perform a surgical operation? ?
- Put away the dishes and fold the laundry? ✓
Which of the following can be done at present?

- Play a decent game of table tennis? ✅
- Play a decent game of Jeopardy? ✅
- Drive safely along a curving mountain road? ✅
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ❌
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem? ❓
- Converse successfully with another person for an hour? ❌
- Perform a surgical operation? ❓
- Put away the dishes and fold the laundry? ✅
Which of the following can be done at present?

- Play a decent game of table tennis? ✔
- Play a decent game of Jeopardy? ✔
- Drive safely along a curving mountain road? ✔
- Drive safely through campus? ❓
- Buy a week’s worth of groceries on the web? ✔
- Buy a week’s worth of groceries at Stop & Shop? ❌
- Discover and prove a new mathematical theorem? ❓
- Converse successfully with another person for an hour? ❌
- Perform a surgical operation? ❓
- Put away the dishes and fold the laundry? ✔
- Translate spoken Chinese into spoken English in real time?
Which of the following can be done at present?

- Play a decent game of table tennis? [✅]
- Play a decent game of Jeopardy? [✅]
- Drive safely along a curving mountain road? [✅]
- Drive safely through campus? [❓]
- Buy a week’s worth of groceries on the web? [✅]
- Buy a week’s worth of groceries at Stop & Shop? [❌]
- Discover and prove a new mathematical theorem? [❓]
- Converse successfully with another person for an hour? [❌]
- Perform a surgical operation? [❓]
- Put away the dishes and fold the laundry? [✅]
- Translate spoken Chinese into spoken English in real time? [✅]
Which of the following can be done at present?

- Play a decent game of table tennis?
- Play a decent game of Jeopardy?
- Drive safely along a curving mountain road?
- Drive safely through campus?
- Buy a week’s worth of groceries on the web?
- Buy a week’s worth of groceries at Stop & Shop?
- Discover and prove a new mathematical theorem?
- Converse successfully with another person for an hour?
- Perform a surgical operation?
- Put away the dishes and fold the laundry?
- Translate spoken Chinese into spoken English in real time?
- Write an intentionally funny story?
Which of the following can be done at present?

- Play a decent game of table tennis?  
- Play a decent game of Jeopardy?  
- Drive safely along a curving mountain road?  
- Drive safely through campus?  
- Buy a week’s worth of groceries on the web?  
- Buy a week’s worth of groceries at Stop & Shop?  
- Discover and prove a new mathematical theorem?  
- Converse successfully with another person for an hour?  
- Perform a surgical operation?  
- Put away the dishes and fold the laundry?  
- Translate spoken Chinese into spoken English in real time?  
- Write an intentionally funny story?
Unintentionally funny stories
Unintentionally funny stories

One day Joe Bear was hungry. He asked his friend Irving Bird where some honey was. Irving told him there was a beehive in the oak tree. Joe walked to the oak tree. He ate the beehive. The End.

Shank, Tale-Spin System, 1984
Unintentionally funny stories

Henry Squirrel was thirsty. He walked over to the river bank where his good friend Bill Bird was sitting. Henry slipped and fell in the river. Gravity drowned. The End.

Shank, Tale-Spin System, 1984
Unintentionally funny stories

Once upon a time there was a dishonest fox and a vain crow. One day the crow was sitting in his tree, holding a piece of cheese in his mouth. He noticed that he was holding the piece of cheese. He became hungry, and swallowed the cheese. The fox walked over to the crow. The End.

Shank, Tale-Spin System, 1984
I trained a neural network on more than 43,000 jokes and asked it to invent new jokes of its own.

aiweirdness.com/post/174691534...

What do you call a cat does it take to screw in a light bulb?
They could worry the banana.

What did the new ants say after a dog?
It was a pirate.

Why did the monsters change a lightbulb?
And a cow the cough.

What do you call a pastor cross the road?
He take the chicken.

What do you call a farts of tea?
He was calling the game of the dry.
Tried retraining the neural net on just "what do you get when you cross a X with a X?" jokes. Results did not improve. And for some reason, bungees are its favorite thing.

What do you get when you cross a dog and a vampire? A bungee

What do you get when you cross a gorilla and a bull? A spider.

What do you get when you cross a cow with a rhino? A bungee with a dog.

What do you get when you cross a mountain and a bungee and a cow? A cow with a rhinocero.

What do you get when you cross a street and a bungee with a cow? A bungee and a pig with a cow.

What do you get when you cross a street and a cow? A bungee with a bungee and a rhino.

What do you get when you cross a pig with a cow with a party? Because the engineers with a dog.

What do you get when you cross a weee and a rooster? I don't know.
To be continued…
Acknowledgments

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