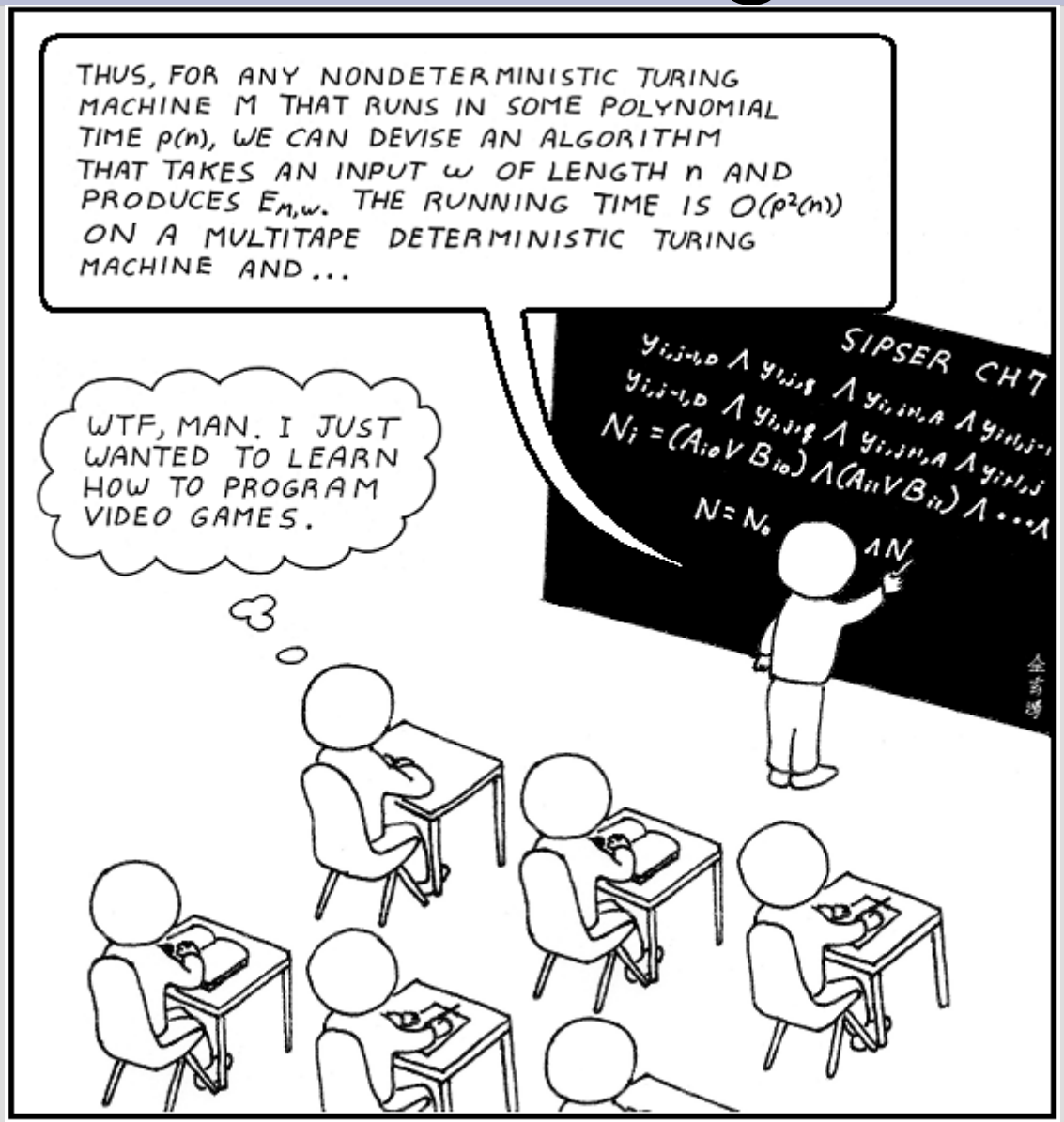
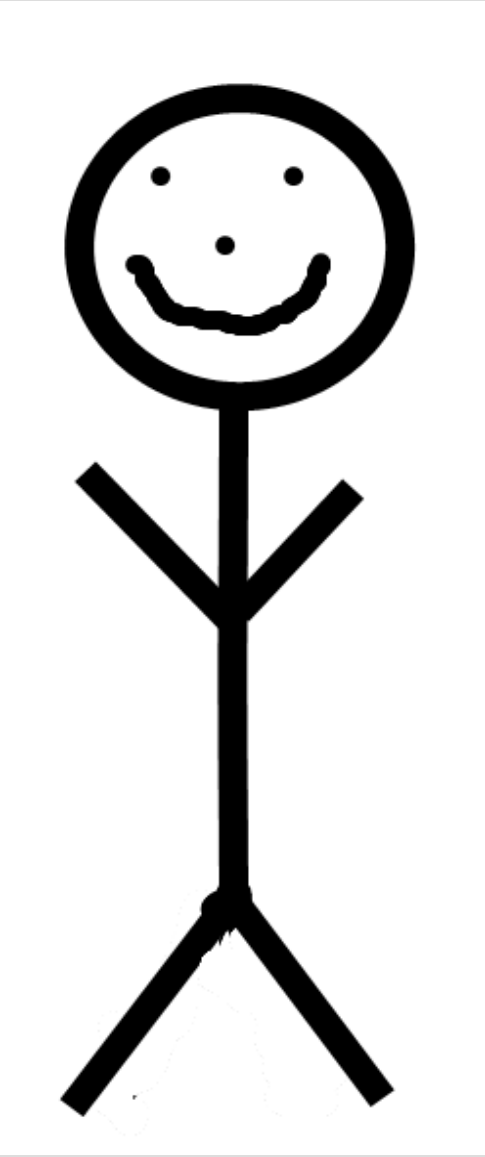
Welcome to CSci 5512 Artificial Intelligence II



Instructor (me)

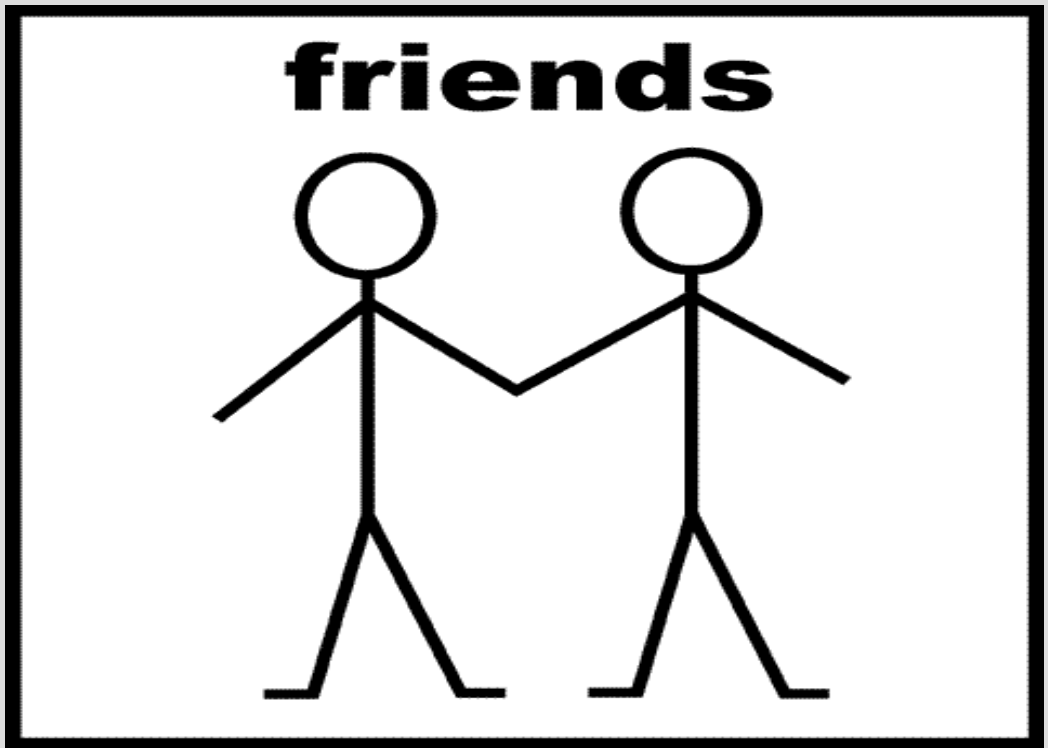
James Parker
Shepherd Laboratories 391
(potentially unsafe)

Primary contact:
jparker@cs.umn.edu



Teaching Assistants

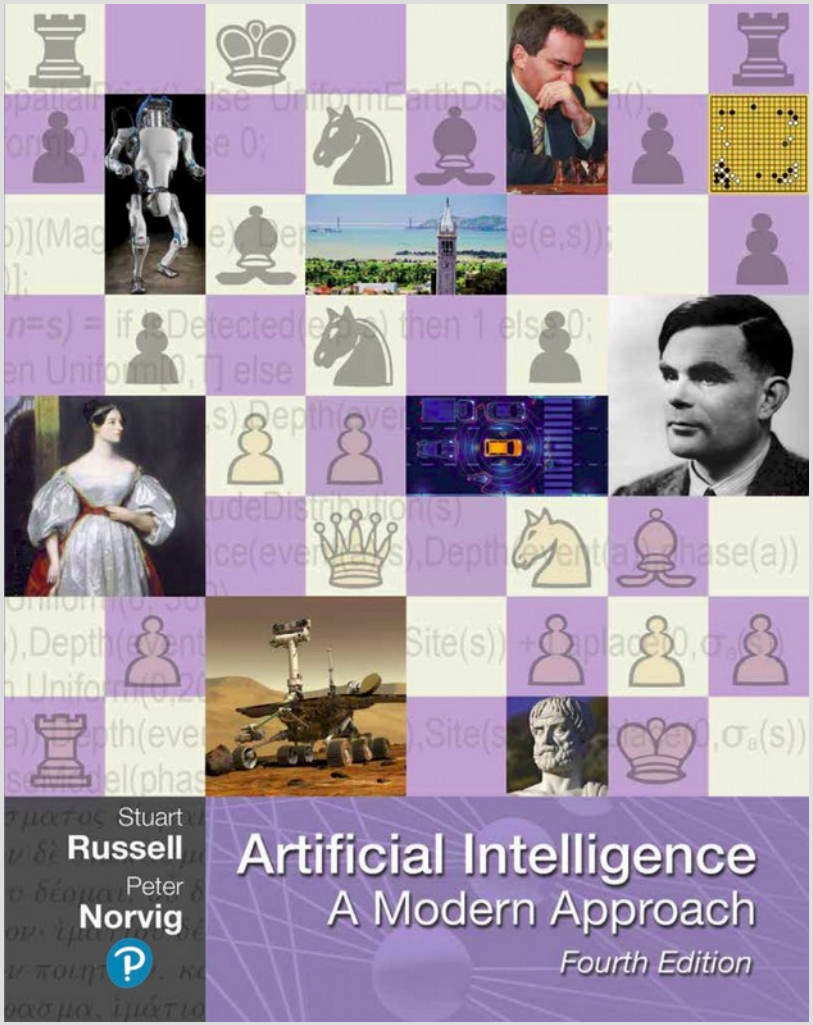
Ben Lilja



Textbook

Artificial Intelligence
A Modern Approach,
Russel and Norvig,
4th edition

(older editions fine)



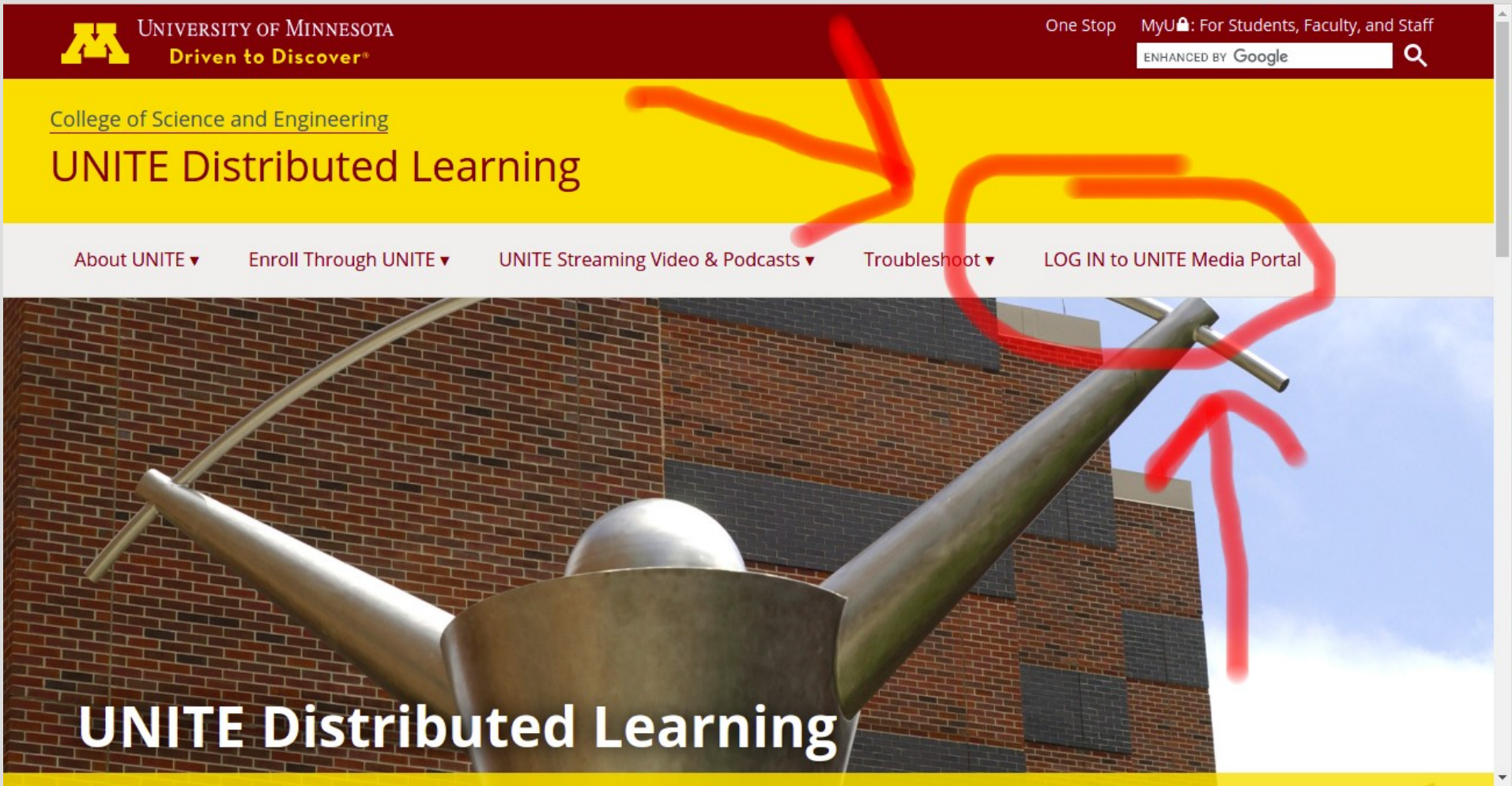
Lectures & COVID

Lectures are recorded by UNITE and will be available for viewing (thanks UNITE!)

If you feel sick: please stay home and recover (then watch the videos)

Lectures & COVID

https://cse.umn.edu/unite/



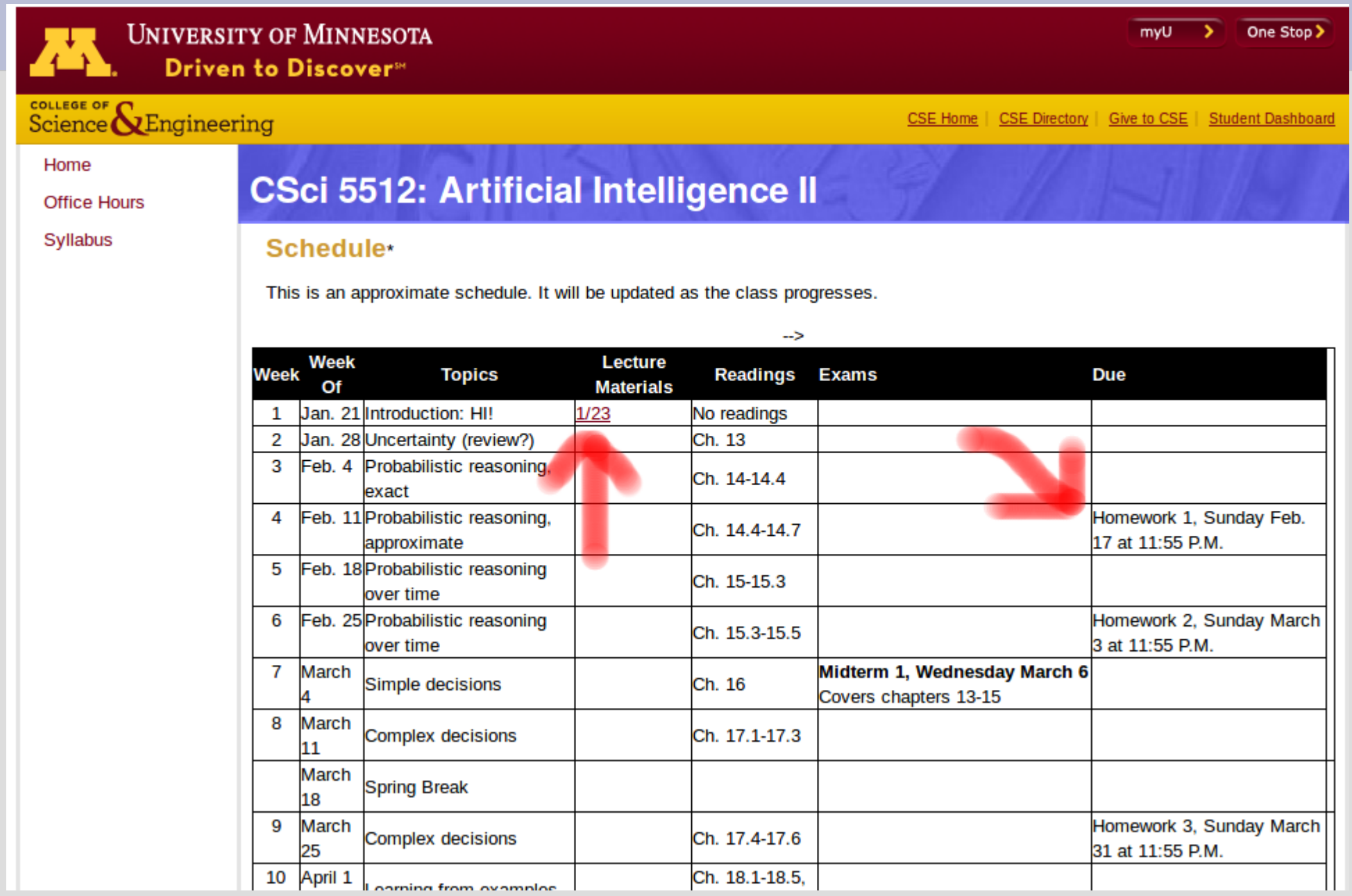
Class website

www.cs.umn.edu/academics/classes
Or google “umn.edu csci class”

Syllabus, schedule, other goodies

Canvas page will have grades and homework submission

www.cs.umn.edu



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COLLEGE OF Science & Engineering

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Home
Office Hours
Syllabus

CSci 5512: Artificial Intelligence II

Schedule*

This is an approximate schedule. It will be updated as the class progresses.

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Week	Week Of	Topics	Lecture Materials	Readings	Exams	Due
1	Jan. 21	Introduction: HI!	1/23	No readings		
2	Jan. 28	Uncertainty (review?)		Ch. 13		
3	Feb. 4	Probabilistic reasoning, exact		Ch. 14-14.4		
4	Feb. 11	Probabilistic reasoning, approximate		Ch. 14.4-14.7		Homework 1, Sunday Feb. 17 at 11:55 P.M.
5	Feb. 18	Probabilistic reasoning over time		Ch. 15-15.3		
6	Feb. 25	Probabilistic reasoning over time		Ch. 15.3-15.5		Homework 2, Sunday March 3 at 11:55 P.M.
7	March 4	Simple decisions		Ch. 16	**Midterm 1, Wednesday March 6** Covers chapters 13-15	
8	March 11	Complex decisions		Ch. 17.1-17.3		
	March 18	Spring Break				
9	March 25	Complex decisions		Ch. 17.4-17.6		Homework 3, Sunday March 31 at 11:55 P.M.
10	April 1	Learning from examples		Ch. 18.1-18.5,		

Office hours

All office hours will be on zoom (links on cs webpage/Canvas)

Drop an email to schedule an appointment outside the official time

I can meet people in-person upon request (but TAs are not expected to)

Don't like my slides? =(

http://aima.eecs.berkeley.edu/slides-pdf/

Constructing Bayesian networks

Need a method such that a series of locally testable assertions of conditional independence guarantees the required global semantics

1. Choose an ordering of variables $X_1, \ldots, X_n$
2. For $i = 1$ to n
   add X_i to the network
   select parents from $X_1, \ldots, X_{i-1}$ such that
   $\mathbf{P}(X_i|Parents(X_i)) = \mathbf{P}(X_i|X_1, \ldots, X_{i-1})$

This choice of parents guarantees the global semantics:

$$\begin{aligned}\mathbf{P}(X_1, \ldots, X_n) &= \prod_{i=1}^{n} \mathbf{P}(X_i|X_1, \ldots, X_{i-1}) \quad \text{(chain rule)} \\ &= \prod_{i=1}^{n} \mathbf{P}(X_i|Parents(X_i)) \quad \text{(by construction)}\end{aligned}$$

Prerequisites

1. Competent programmer
2. Common data structures (graph/tree)
3. Some statistics (probabilities, random variables)
4. Some math (calculus)

Prerequisites

You went to the doctor and tested for a rare disease (1/1,000 people have it)

Test chances	Detected	Not Detected
Have disease	100%	0%
Just fine	1%	99%

If the test “detects” the disease, what is the probability you are sick?

Prerequisites

These algorithms will often involve some math

Hopefully things like this are not that intimidating:

$$E[f(s)]_p \approx \frac{1}{N} \sum_{i=1}^{N} f(s^{(i)})$$

$$\begin{aligned} p(x_{1:n}|\lambda_1)p(x_{n+1:N}|\lambda_2)p(\lambda_1)p(\lambda_2)p(n) \\ = \left(\prod_{i=1}^{n} p(x_i|\lambda_1)\right)\left(\prod_{i=n+1}^{N} p(x_i|\lambda_2)\right)p(\lambda_1)p(\lambda_2)p(n) \end{aligned}$$

Syllabus

50% Homework (-15% per day late)
15% Midterm (Thurs. Oct. 21)
15% Midterm 2 (Tues. Nov. 30)
20% Project (Wed. Dec. 22)

If you are sick anywhere near the deadline, please let me know ASAP

Project

For the project you have your choice of three different types:

(1) Experimental. Implement and compare interesting algorithms on a data set.

(2) Literature review. Read a wide range of papers and compare and contrast them.

(3) Theoretical. Prove an idea.

Project

An example layout of an experimental project would be 10-12 pages:

-Title, authors, abstract
-Introduction & problem description (1-2 pg)
-Literature review (2-3 pages)
-Description of your approach (2-3 pages)
-Analysis of results (1-2 pages)
-Conclusion and summary
-Bibliography

Project

You pick the project, but must be related to an advanced AI topic

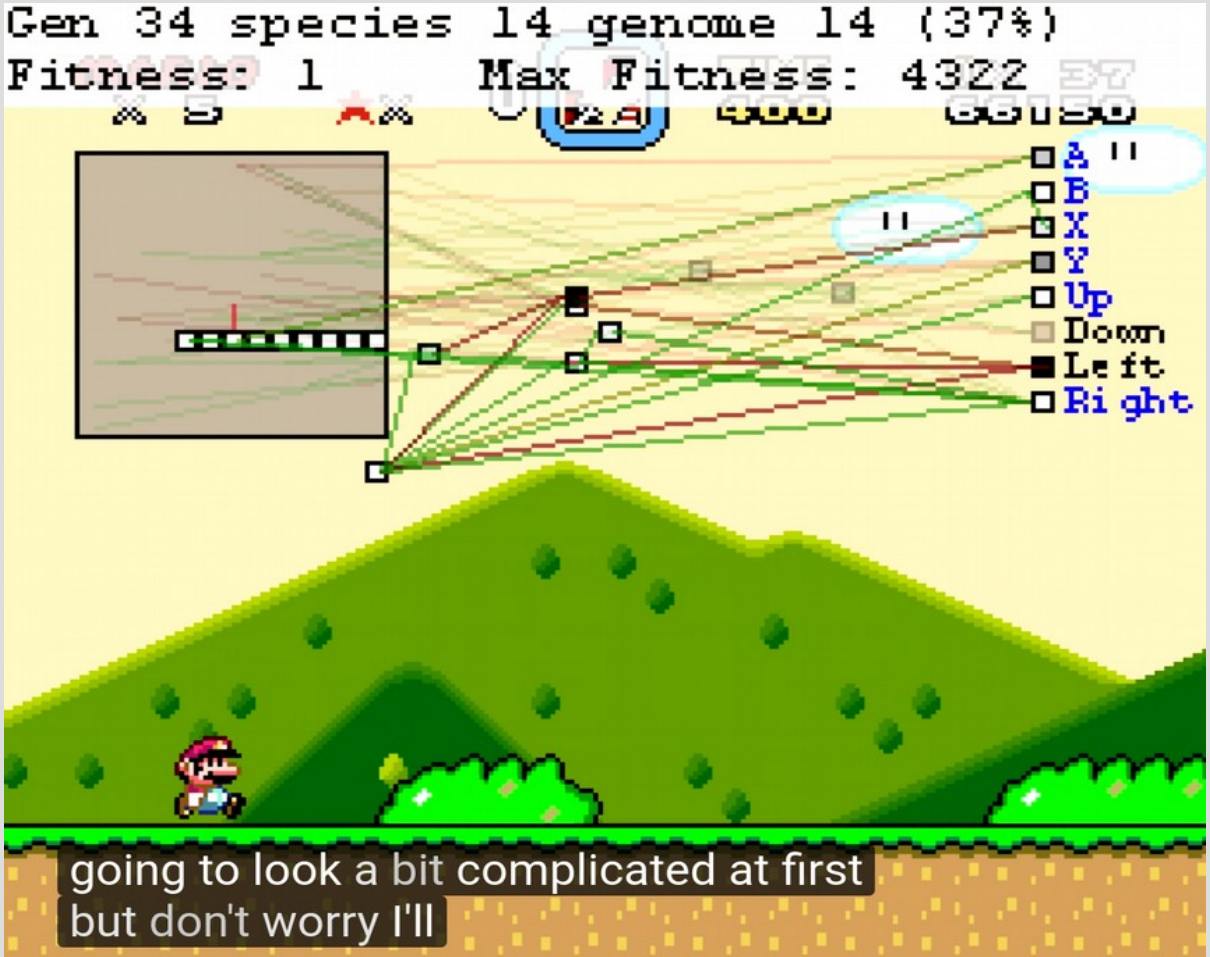
If you are unsure about the scope/difficulty of a topic, feel free to ask me

If you want to work in a group, you must receive my consent first

Project

Mario?

https://www.youtube.com/watch?v=qv6UVOQ0F44



Exams

All exams are open book/notes (most people think they are hard)

You can use an electronic device if you want on exams, but no:

- phones
- internet
- running code (ish)

Exams

For now the exams are planned to be in-class for the whole period

However, this is subject to change if things get unsafe

Homework

Homework are individual assessments

Please ensure the work you turn in is your own

Submit homework on Canvas in pdf or txt format (you can do it on paper and take pictures if you want, but you have to group them into a single pdf)

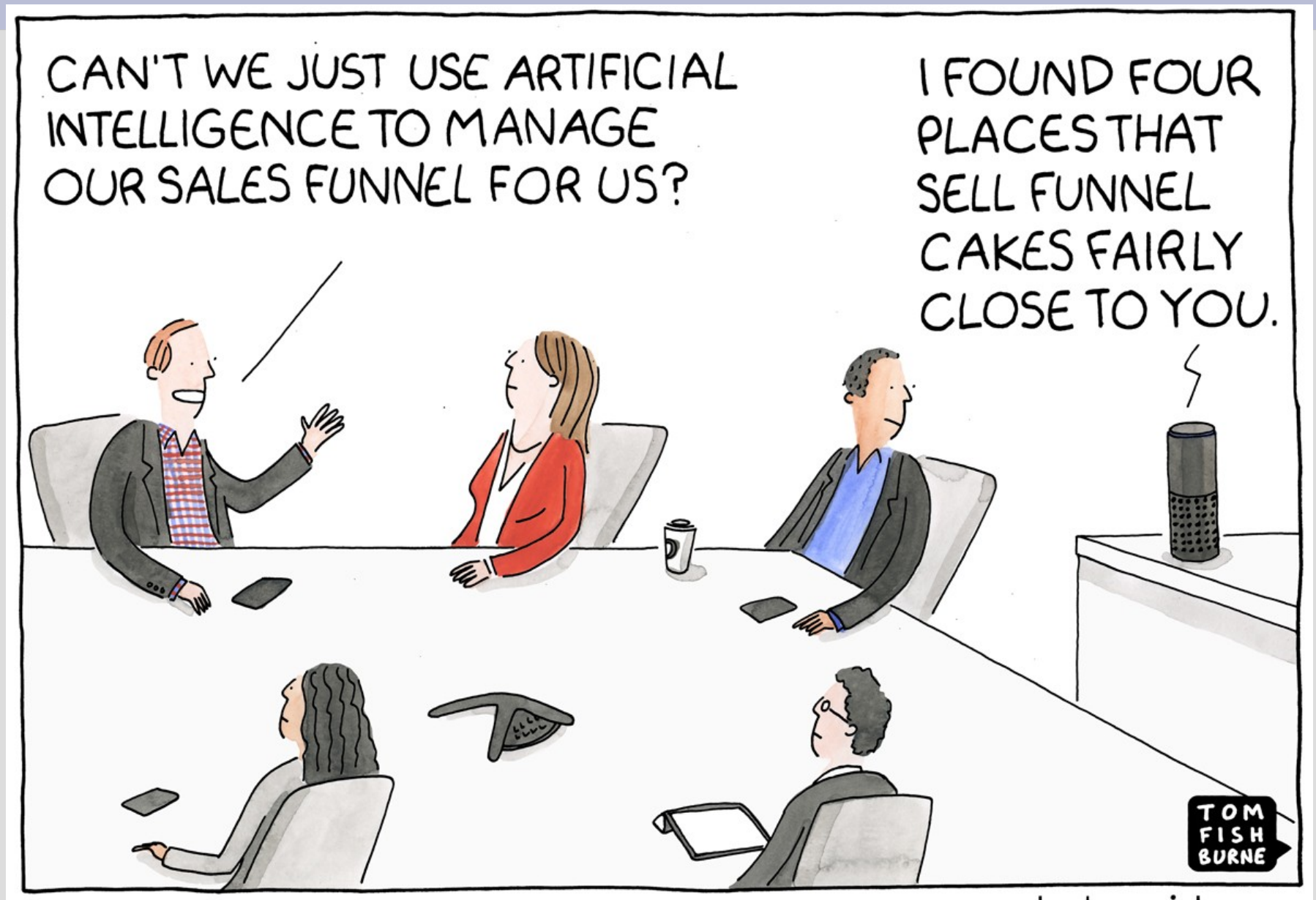
Syllabus

Grading scale:
93% A
90% A-
87% B+
83% B
80% B-
77% C+
73% C
70% C-
67% D+
60% D
Below F

Syllabus

Any questions?

Artificial Intelligence



Turing Test

For a long time, the Turing Test was a supposed indication of intelligence

A person would question two entities and have to determine which one is the computer and human

This is not very popular anymore

Turing Test

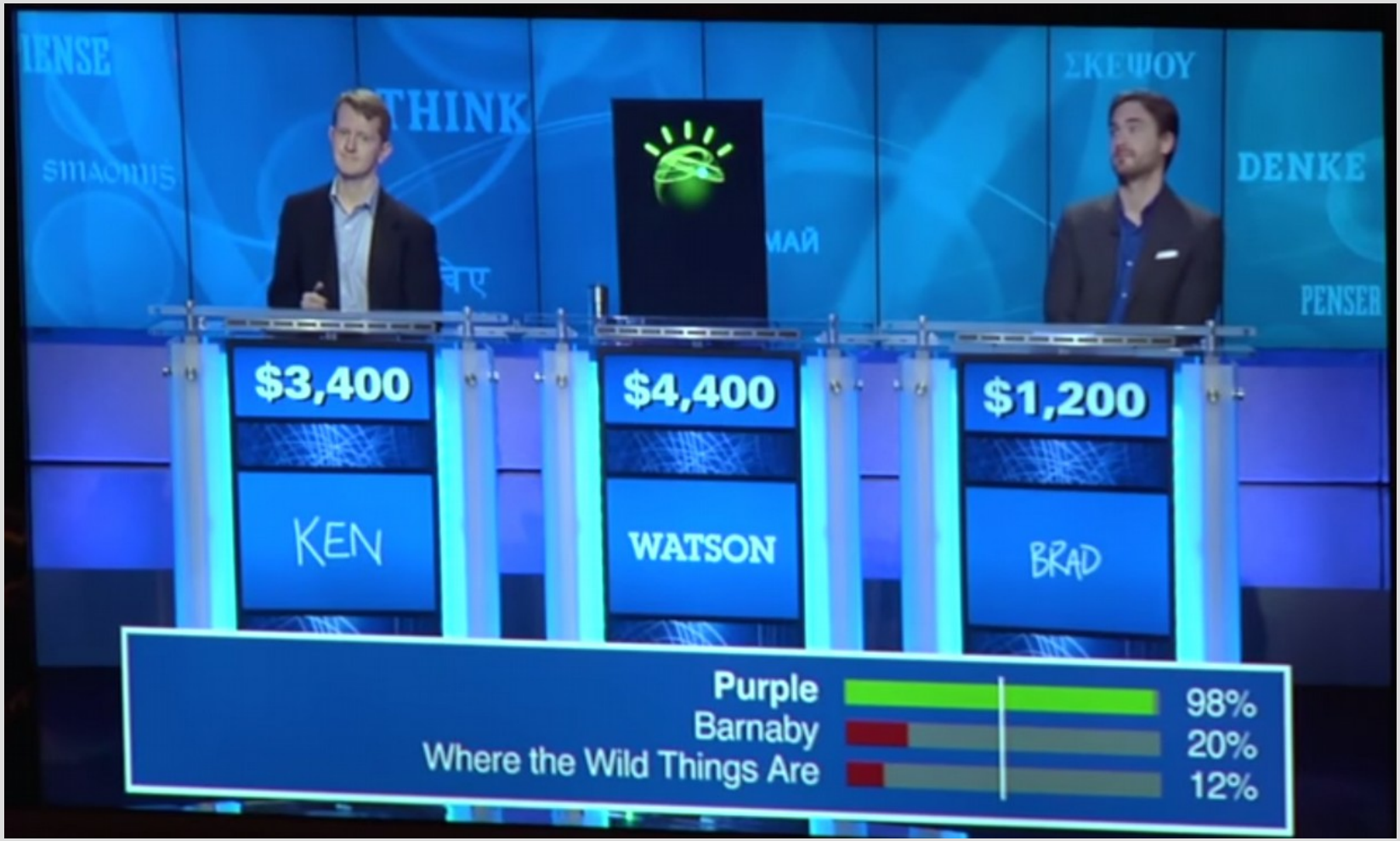
To pass the Turing Test, a computer needs the following:

- Natural language processing (as the test is written and not verbal)
- Knowledge representation (storage)
- Reasoning (logical conclusions)
- Machine Learning (extrapolation)

Turing Test

Jeopardy!

https://www.youtube.com/watch?v=WFR3lOm_xhE



AI

Often times, fully exploring all the options is too costly (takes forever)

Chess: 10^{47} states (tree about 10^{123})
Go: 10^{171} states (tree about 10^{360})
At 1 million states per second...
Chess: 10^{109} years
Go: 10^{346} years

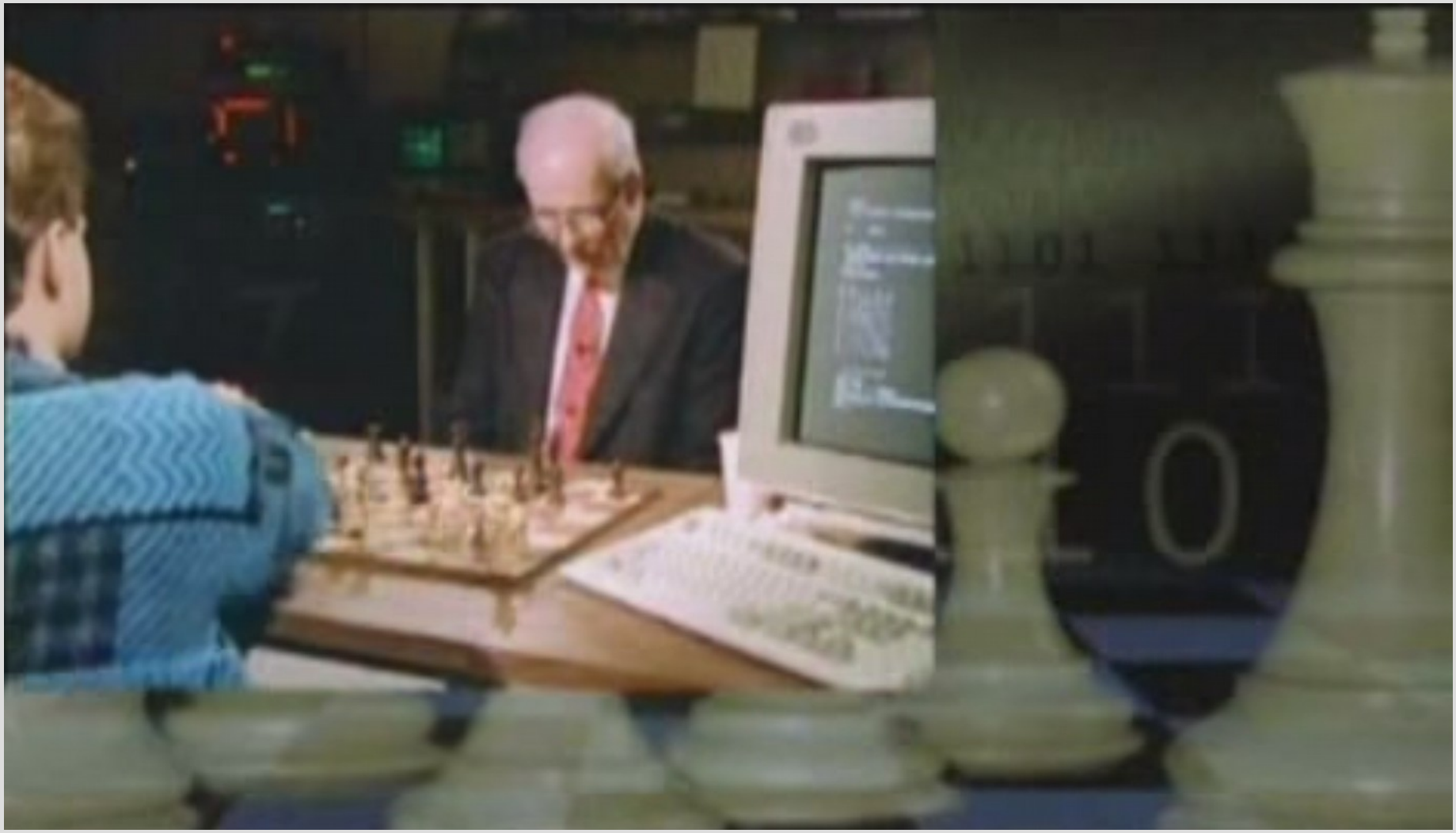
AI

Simple computers have been built for hundreds of years

For artificial intelligence to mature, it needed to borrow from other fields:
Math - logic and proofs
Statistics - probability
Economics - utility

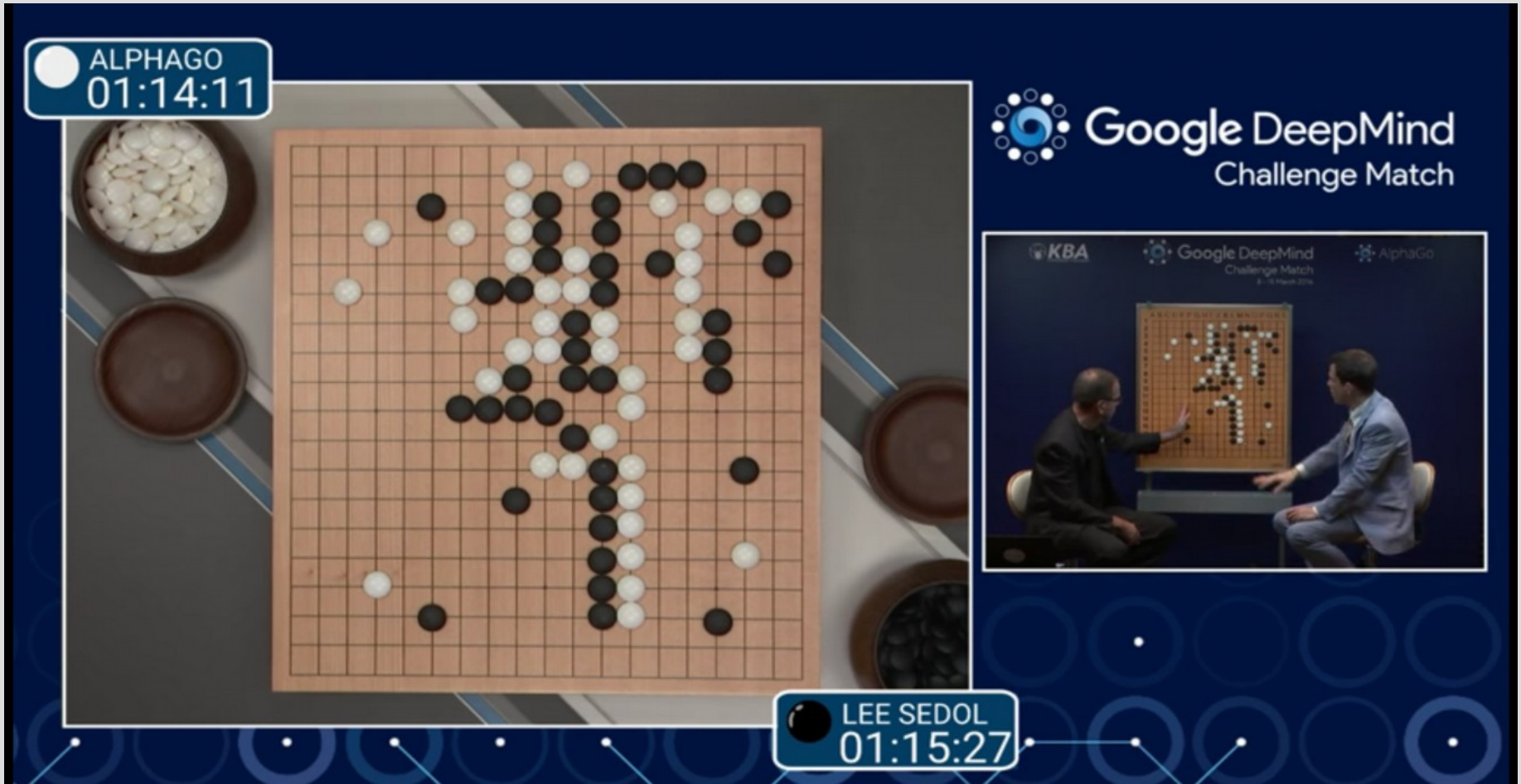
AI - Chess

Spring 1997 - Deep(er) Blue (CMU / IBM)



AI - Go

Spring 2016 - AlphaGo (Google)
December 2017- AlphaZero



AI - Dota2

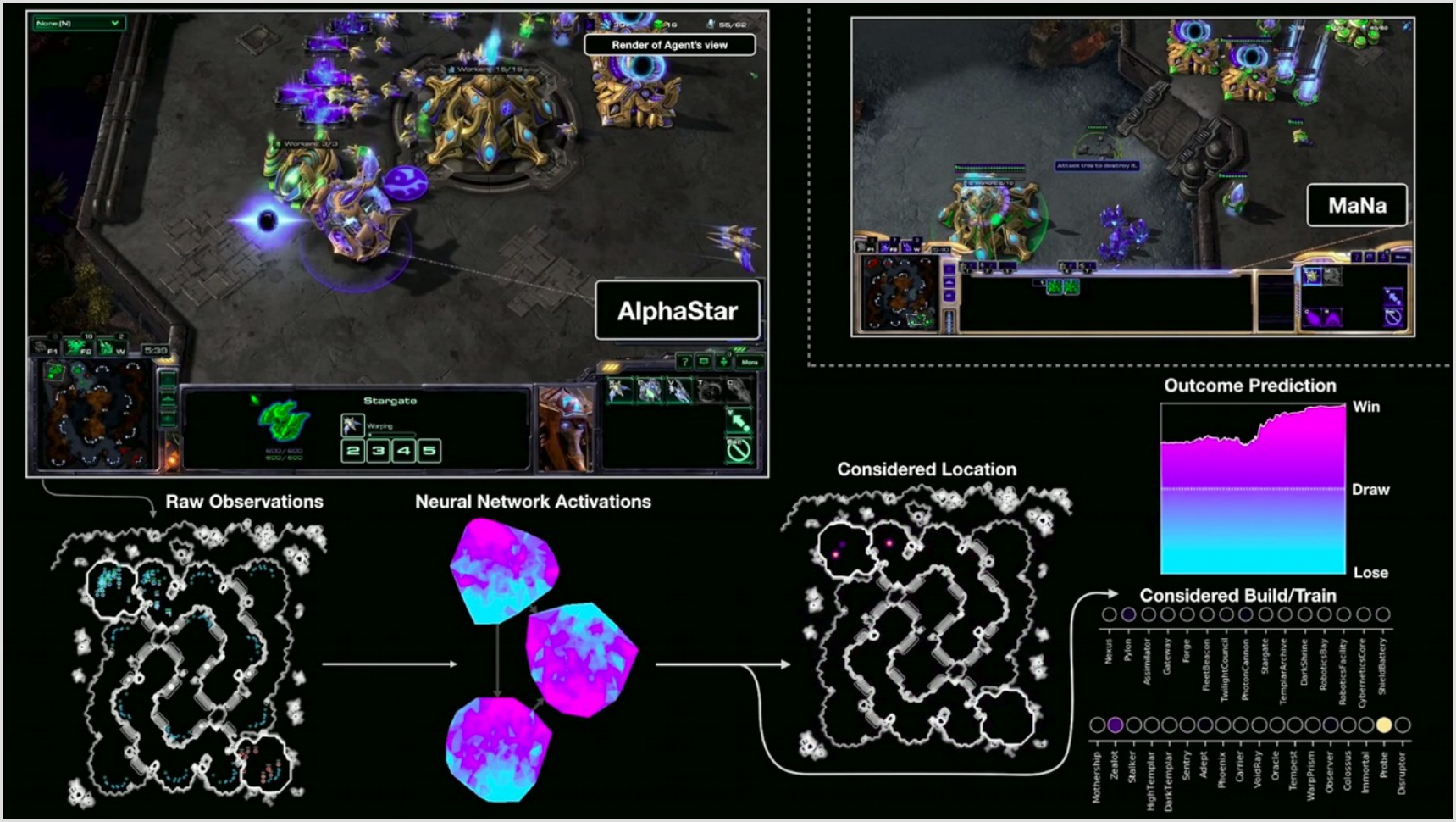
August 2017 - OpenAI (Elon Musk)

https://www.youtube.com/watch?v=l92J1UvHf6M&feature=youtu.be

AlphaStar – Jan. 2019

Starcraft 2:

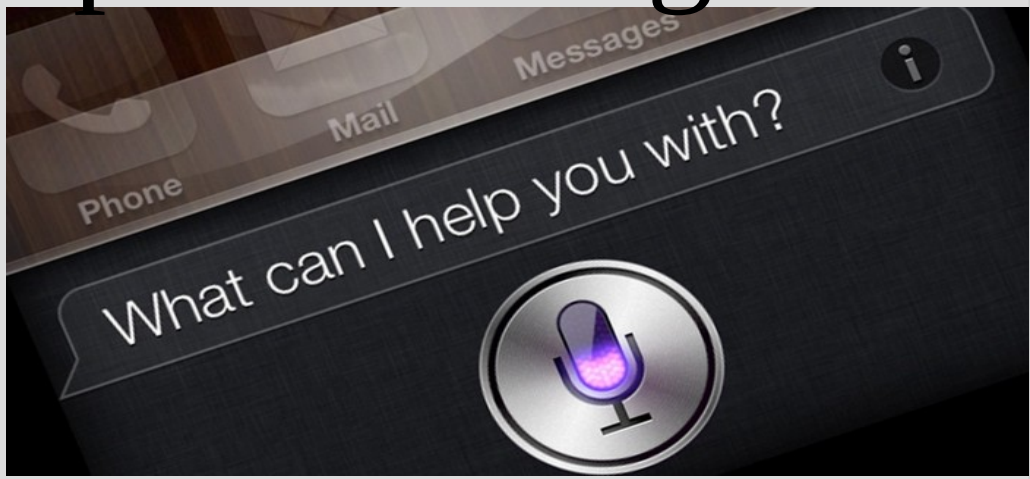
https://www.youtube.com/watch?v=cUTMhmVh1qs



AI

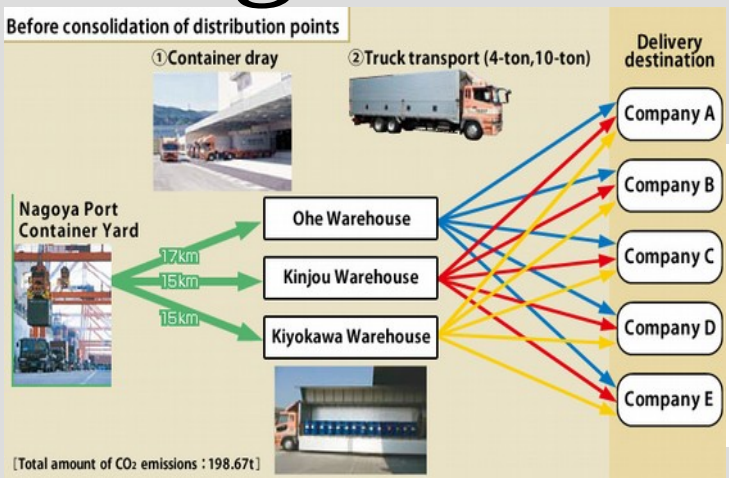
Self driving cars

Speech recognition



Game playing

Logistics



Spam filter