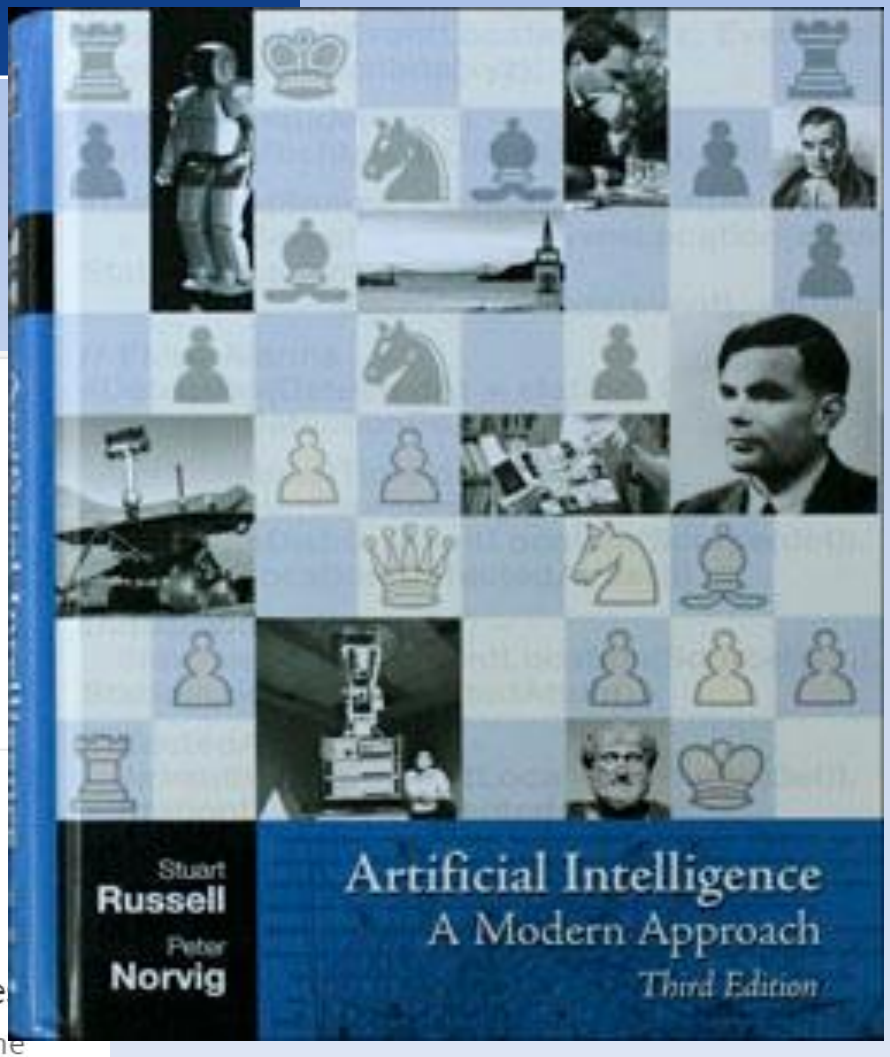
FRESNO STATE | Discovery. Diversity. Distinction.

Department of Computer Science

COLLEGE OF SCIENCE AND MATHEMATICS

WELCOME Spring '20




```
38 int Move(string& board, int dir){
39   int row, col;
40   LocBlank(board, row, col);
41   if ((dir==1 || dir == -3) && row > 0){
42     Swap(board, row, col, row-1, col);
43   }
44   else if ((dir == 2 || dir == -4) && col < MAXDIM-1){
45     Swap(board, row, col, row, col+1);
46   }
47   else if ((dir == 3 || dir == -1) && row < MAXDIM-1){
48     Swap(board, row, col, row+1, col);
49   }
50   else if ((dir == 4 || dir == -2) && col > 0 ){
51     Swap(board, row, col, row, col-1);
52   }
53   else {
54     return -1;
55   }
56   return 0;
```

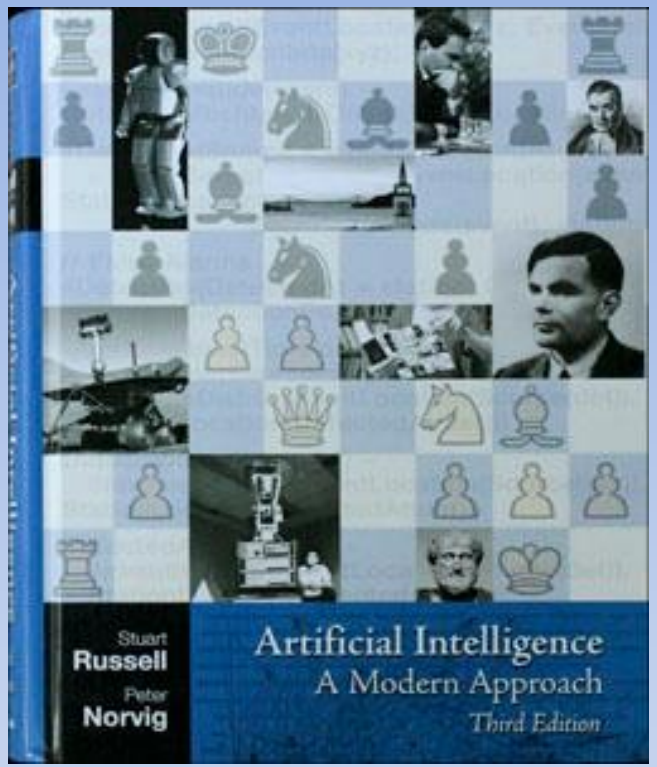
david ruby

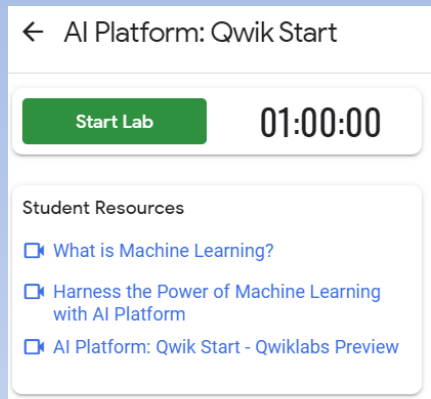
Lecturer at California State University, Fre

California State University, Fresno • UC Irvine

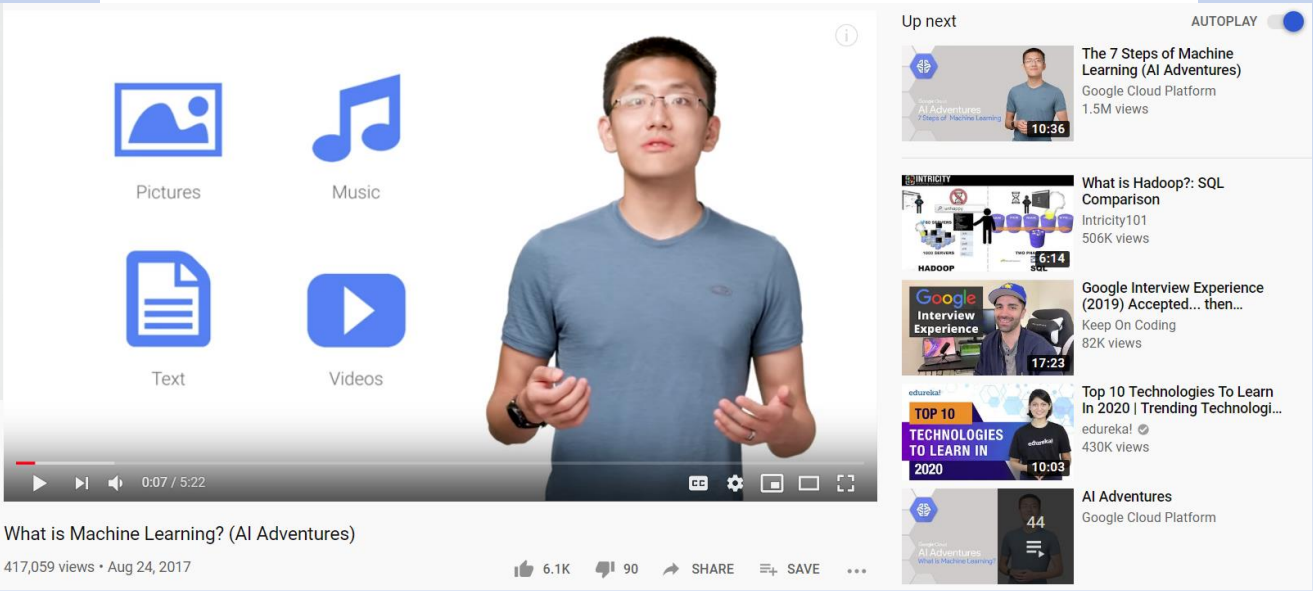
CSCI 164

AI Programming





AI Platform: Qwik Start



Tech Topics

- Artificial Intelligence
  - It’s everywhere

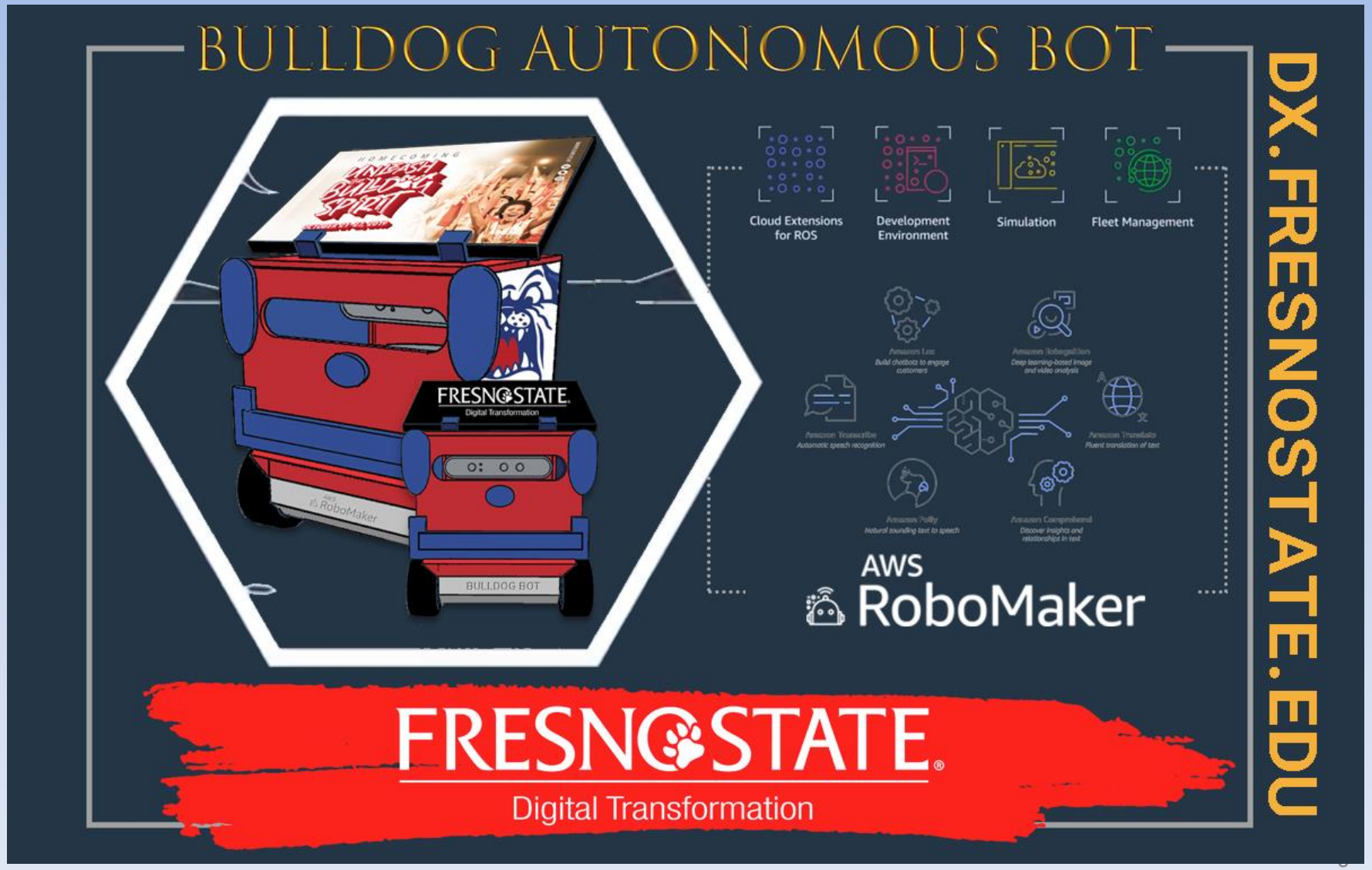
Current Context: Information Age Arrival

- Machine Learning/Artificial Intelligence
- Data Insanely Important
- Computers Driving Change

Recent Advances

- Smart Speakers
  - Amazon Echo
  - Google Home
  - Apple Siri
- Speech Recognition
  - Speech-To-Text
  - Trigger Word/Wake-Up Word
    - Siri!
  - Speaker ID
  - Speech Synthesis

AI @ Fresno State



Areas of Advances

- Natural Language Processing
  - Text Classification
  - Information Retrieval
  - Name Entity Recognition
  - Machine Translation
  - Parsing, Parts of speech tagging

Areas of Advances

- Self Driving Cars
- Computer Vision
  - Image Classification/Object Recognition
  - Object Detection
  - Image Segmentation
  - Tracking

AI/ML Research Projects @ Fresno State

- **Automating pistachio canopy temperature identification: A machine learning approach**
  - Funding body: Agricultural Research Institute
  - Value: $64,825
  - Investigator(s): **Athanasios Aris Panagopoulos (PI)**, Shawn Ashkan (co-PI)

  CSU student impact: More than 10 CSU (grad and undergrad) students

- **Customer-controlled, Price-mediated, Automated Demand Response for Commercial Buildings**
  - Funding body: UC Berkeley (California Energy Commission Passthrough)
  - Value: $30,000
  - Investigator(s): **Athanasios Aris Panagopoulos (PI)**

  CSU student impact: 1 grad students

Areas of Advances

- Robotics
  - Perception
  - Motion Planning
  - Control

Smart Campus with AI, IoT, and Cloud

We have successfully completed several adoptions of IoT innovation toward a Smart Fresno State Campus with the partnership of DISCOVERe, Library, and PD, and Auxiliary. We received direct sponsorship from Amazon Enterprise Button program as the first Higher Ed institution highlighted in AWS re:Invent conference. Technology Services/Innovation is in collaboration with Lyles Center for further innovation and entrepreneurship opportunities.

California State University, Fresno - Technology Services/Innovation

IoT@ Fresno State

Internet of Things

"The Internet of things (IoT) is the inter-networking of physical devices (also referred to as "connected devices" and "smart devices") embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data."

Just Launched

Library Book Stack Assistance

Pilots

Guides On-The-Go!

Pay for Print

Workspace Climate

Entrance Assistance

Press to Report

Awareness Button

Learning

IoT Readiness Assessment

- Infrastructure (for MTC/M2M)
- Device Management (and Security)
- Service Architecture & Cloud
- Big Data and Analytics

Establish a campus IoT Framework of

- solution design;
- technology selection guidelines;
- full scope of infrastructure support;
- device management;
- security policies;
- user support and training;
- the best practices

Highlighted at AWS re:Invent Conference

Fresno State is the First Higher Ed partner sponsored by Amazon to join the AWS Enterprise IoT Button.

Presented by

Max J. Tsai and Jonathan Castro
Technology Services
innovate.fresnostate.edu

FRESNO STATE
Discovery. Diversity. Distinction.

President's SHOWCASE of Excellence 2018

Algorithms Feeding on Data

- Data, Data, Data

Regulating the internet giants

The world's most valuable resource is no longer oil, but data

The data economy demands a new approach to antitrust rules

Print edition | Leaders ›
May 6th 2017

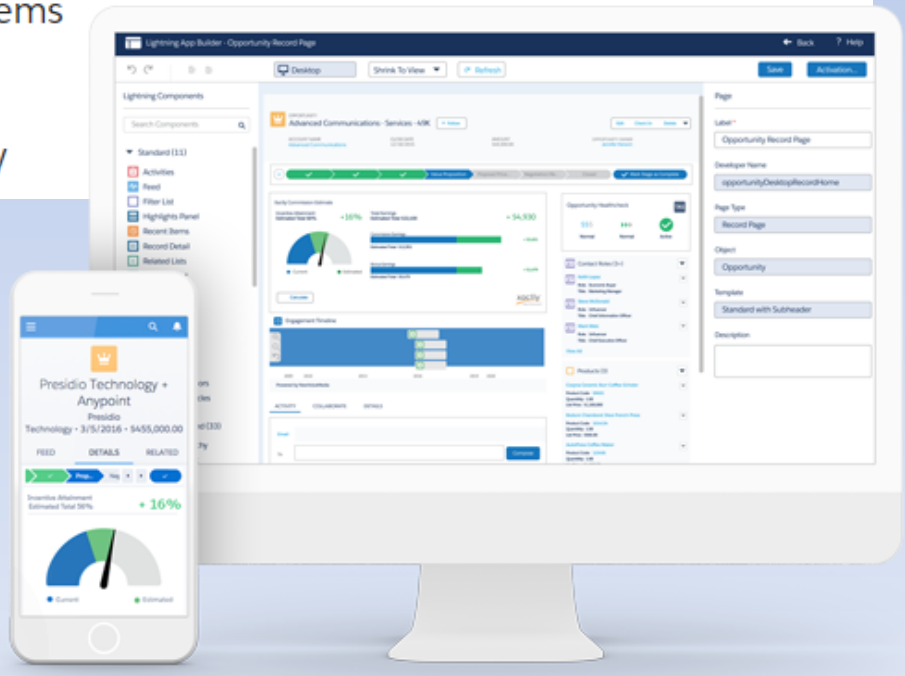
Salesforce Tower San Francisco

- Tallest Building in SF when completed in 2018.

Connect to your customers in a whole new way with the world's #1 CRM platform.

Integrate every part of your company that interacts with customers – including marketing, sales, service, and more – onto one CRM platform, Salesforce Customer 360 :

- ✓ Gives teams a shared view of every customer
- ✓ Automates workflows using artificial intelligence
- ✓ Integrates easily with existing data and systems
- ✓ Keeps your business data safe and secure
- ✓ Customizes and scales for any size company



Salesforce Completes Acquisition of Tableau

PUBLISH DATE: AUGUST 1, 2019 - 5:30AM

World's #1 CRM and #1 analytics platform come together to supercharge customers' digital transformations

Combination to accelerate Salesforce's opportunity in the $1.8 trillion digital transformation space

Customers will be able to unlock even greater value from their data to drive smarter business decisions and more intelligent customer experiences

Tableau will be positioned to further its mission to help the world see and understand data

AI/Data In Cloud

- Amazon Web Services (AWS)
- Microsoft Web Services (Azure)
- Google Cloud Services (GCP)

AI w/
Amazon AWS

AI w/
Amazon AWS

DeepLens w/ AWS

Meet the AWS DeepLens Hackathon Winners

First Place

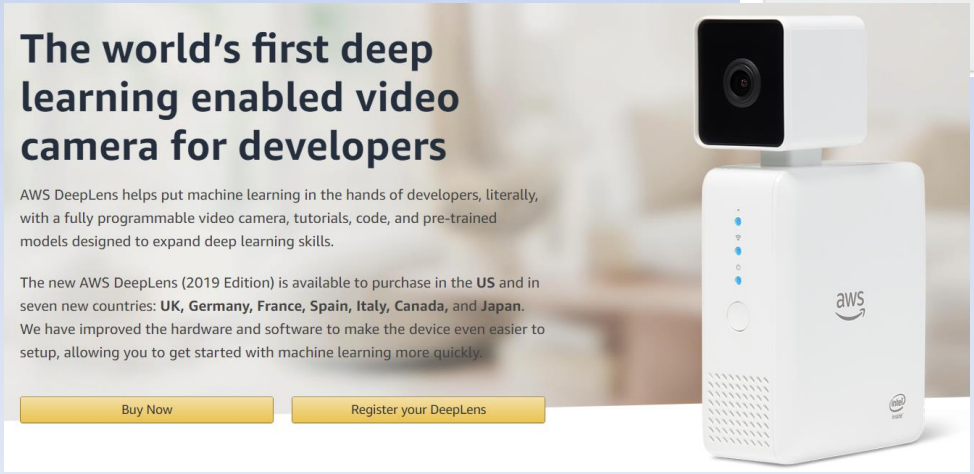
ReadToMe

This is a Deep Learning enabled application which is able to read books to kids.

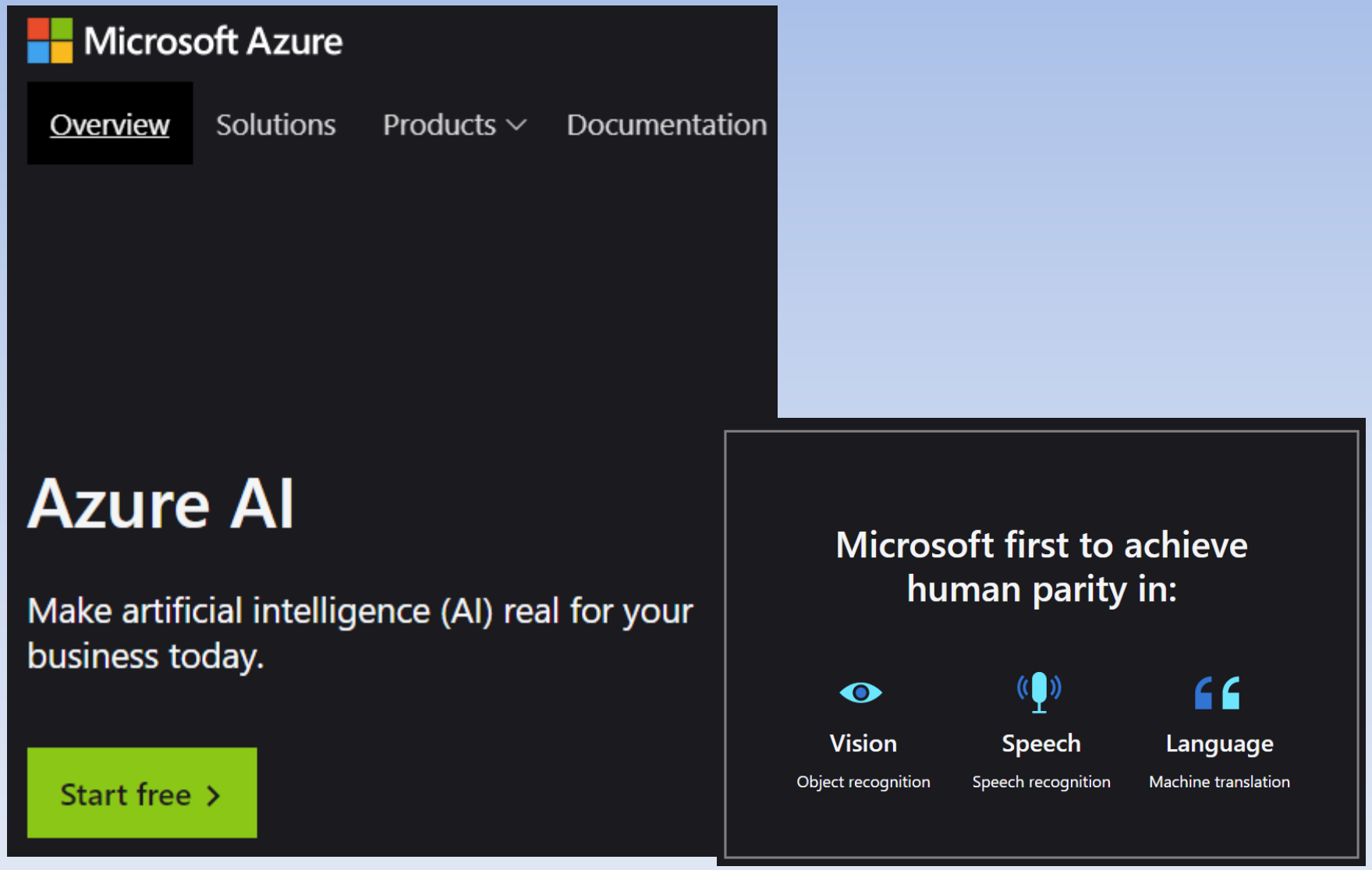
Second Place

Dee

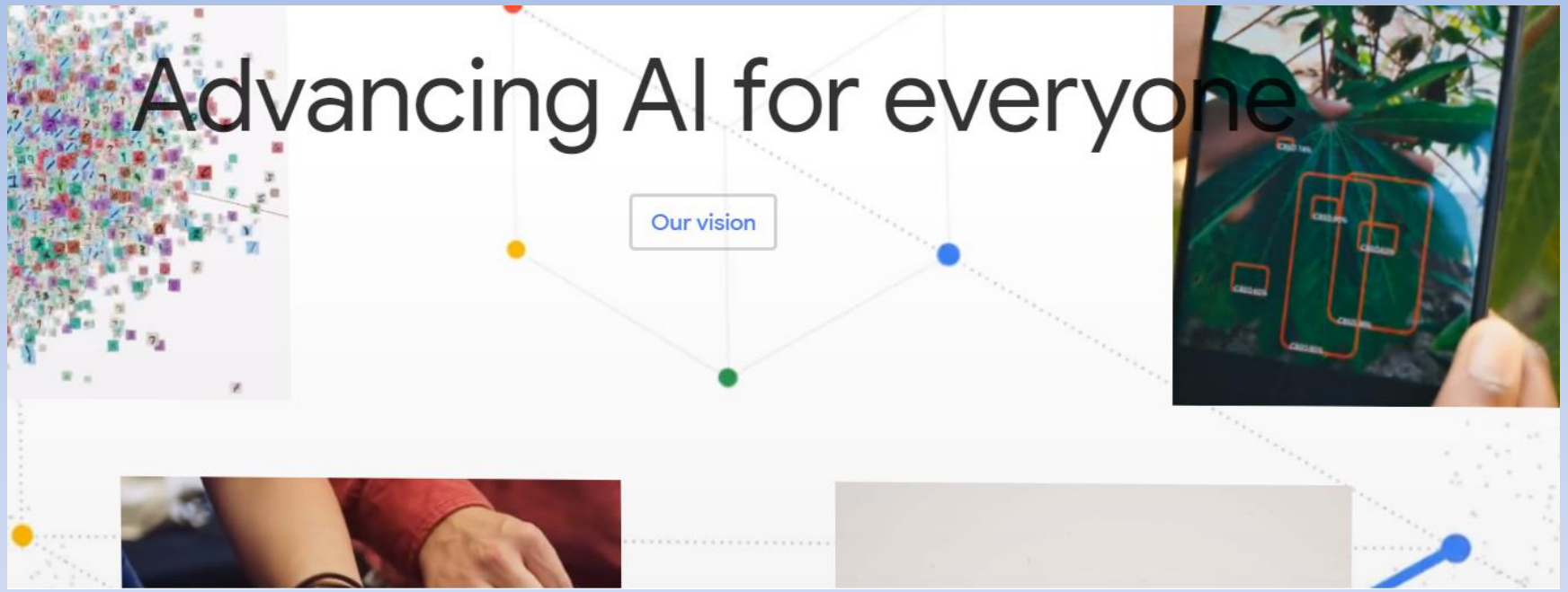
A fun, interactive device for children that asks them to answer questions by showing the right things.



AI w/ Microsoft Azure



ai.google



Google Dialogflow

Google Cloud Why Google Solutions Products Pricing Getting started Docs Support Langua

AI & Machine Learning Products

Dialogflow

Create conversational experiences across devices and platforms.

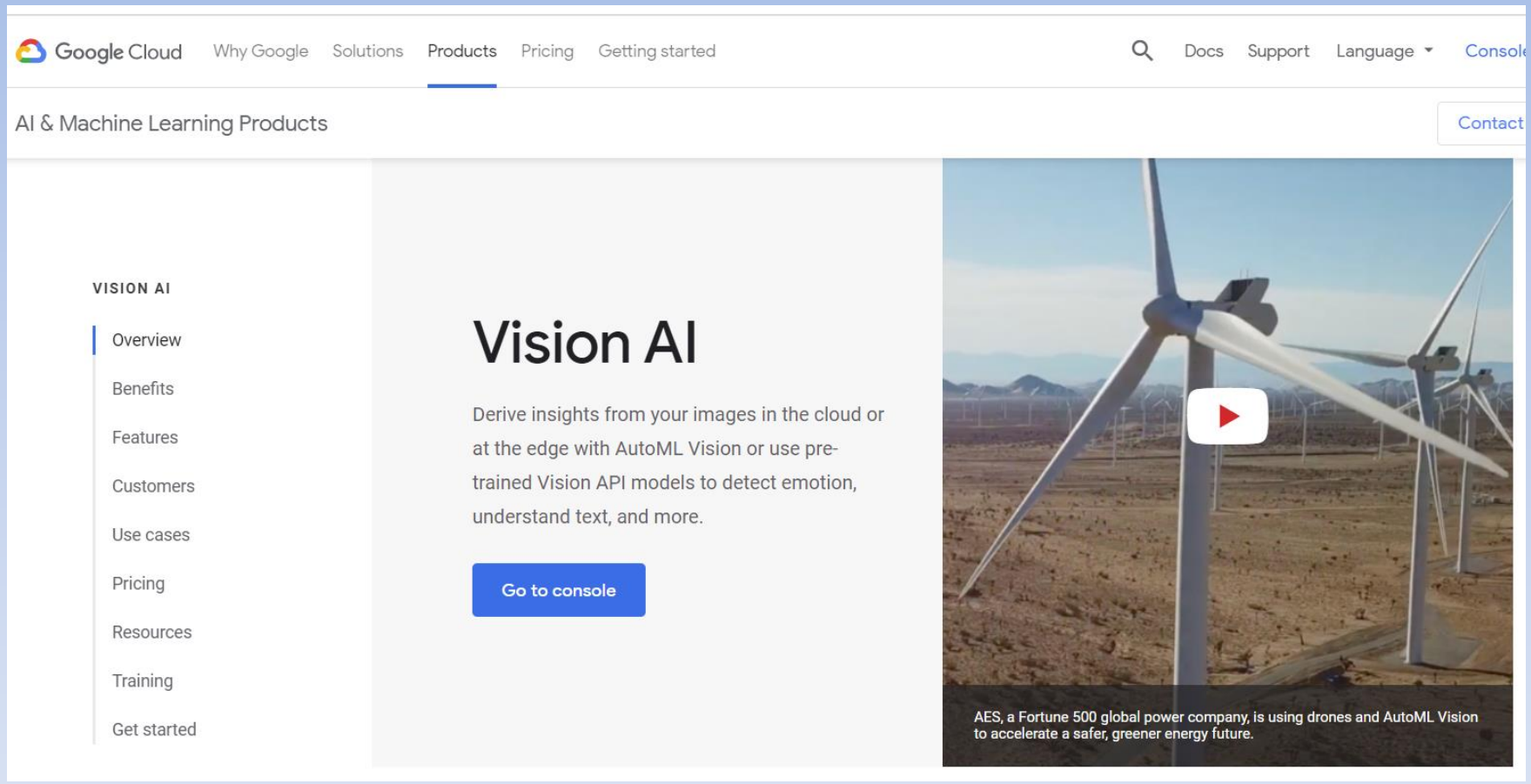
Go to console

View documentation for this product.

Natural conversational experiences

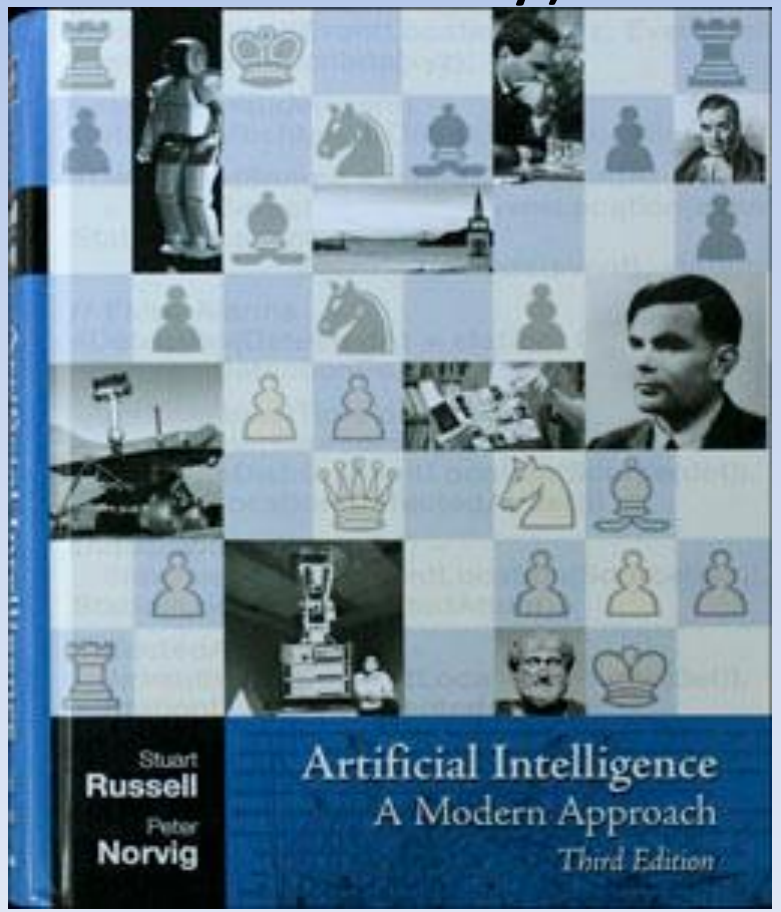
Dialogflow is an end-to-end, build-once deploy-everywhere development suite for creating conversational interfaces for websites, mobile applications, popular messaging platforms, and IoT devices. You can use it to build interfaces (such as chatbots and conversational IVR) that enable natural and rich

Google Cloud Vision



Textbook

- The 22nd most cited computer science publication on Citeseer (and 4th most cited publication of this century).



Dr. Stuart Russell

Professor of Computer Science and Michael H. Smith and Lotfi A. Zadeh Chair in Engineering,
Computer Science Division
University of California
Berkeley, CA 94720

Adjunct Professor of Neurological Surgery, University of California, San Francisco

Tel. (510) 642-4964
Fax (510) 642-5775
Email russell@cs.berkeley.edu
Home page http://www.cs.berkeley.edu/~russell

Education

B.A. (Hons.) 1st Class, Physics, Wadham College, University of Oxford, 1979--82.
Ph.D., Computer Science, Stanford University, 1982--86.

Employment history

2012--present, Professeur Invité, Université Pierre et Marie Curie, Paris
2012--present, Professeur, Fondation de l'École Normale Supérieure, Paris
2008--present, Adjunct Professor, Department of Neurological Surgery, University of California, San Francisco
2008--2010, Chair, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley
2006--2010, Chair, Computer Science Division, University of California, Berkeley
1996--present, Professor, Computer Science Division, University of California, Berkeley
1991--96, Associate Professor, Computer Science Division, University of California, Berkeley
1986--91, Assistant Professor, Computer Science Division, University of California, Berkeley
1986, Summer employee, MCC, Austin, Texas, Machine learning research in the Large Scale KB Project (CYC)
1985--86, Research Assistant, Computer Science Dept., Stanford University
1983, Teaching Assistant, Computer Science Dept., Stanford University
1981, Programmer, graphics research project, IBM Los Angeles Scientific Center
1978--80 (1 year total), Programmer, IBM Systems Engineering Centre, Warwick, UK

Dr. Peter Norvig

Professional Employment (Full-Time)

2001-now	Google	Director of Research (2006-now); formerly Director of Search Quality (2002-2006) and Machine Learning (2001).
1998-2001	NASA Ames Research Center	Division Chief, Computational Sciences
1996-1998	Junglee Corp.	Chief Scientist
1994-1996	Harlequin, Inc.	Chief Designer
1991-1994	Sun Microsystems Labs	Senior Scientist
1986-1991	University of California, Berkeley	Research Faculty Member
1985-1986	University of Southern California	Assistant Professor
1978-1980	Higher Order Software, Inc.	Member of Technical Staff
1977-1977	Woods Hole Oceanographic Institute	Summer Programming Intern

I also have served as an advisory board member for various companies, including: Root-1, Fetch, CleverSet, Ask Jeeves, Thinking Software, PersonalGenie.com.

Education

1980-1985	Ph.D. Computer Science	University of California, Berkeley
1974-1978	B.S. Applied Mathematics	Brown University

Personal Information

Citizen: U.S.
Raised: RI, MA, CA.
Status: Married with 2 children.
Erdos #: 3 (Erdos to Peter Cameron to Stuart Russell to me)

Personal Computer Science Focus

CSCI 164. Artificial Intelligence Programming

Prerequisite: CSCI 117. Introduction to problem-solving methods from artificial intelligence. Production systems. Knowledge-based systems. Machine learning. Topics chosen from fuzzy logic, neural network models, genetic algorithms. Verification, validation, testing.

Units: 3

CSCI 166. Principles of Artificial Intelligence

Prerequisite: CSCI 164. Analysis of knowledge-based and neural models, including self-organization, sequential learning models, neurally inspired models of reasoning and perception. Integration of different paradigms.

Units: 3

CSCI 126. Database Systems

Prerequisites: CSCI 124. Database concepts; hierarchical and relational network models; object-oriented data models. Data normalization, data description languages, data manipulation languages, and query design.

Units: 3
Course Typically Offered: Spring

CSCI 174. Design and Analysis of Algorithms

Prerequisites: CSCI 115, CSCI 119. Models of computation and measures of complexity, algorithms for sorting and searching, set representation and manipulation, branch and bound, integer and polynomial arithmetic, pattern-matching algorithms, parsing algorithm, graph algorithm, NP-complete problems.

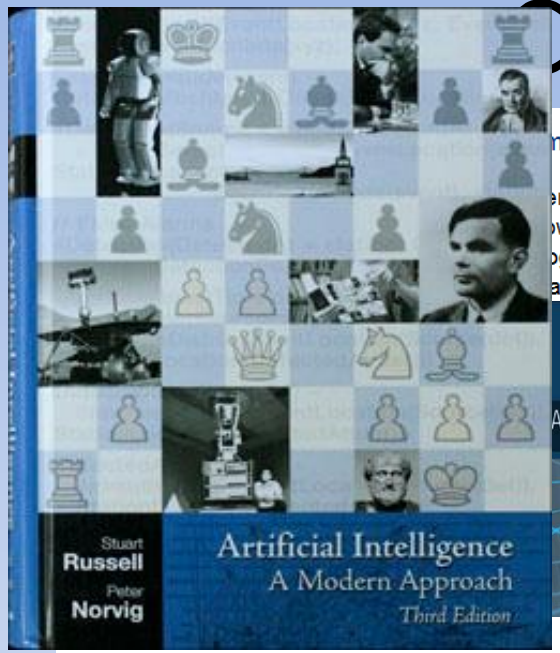
Units: 3

Personal Computer Science Focus

- Data
  - Machine Learning, Algorithms, RDMS
- Search
  - AI, Algorithms, RDMS
- Puzzles
  - AI, Algorithms

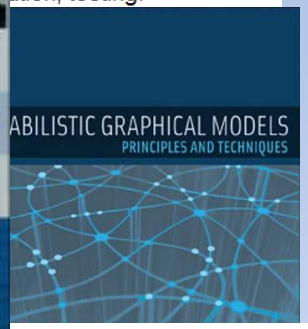
- **Books…**

Computer Science



ning

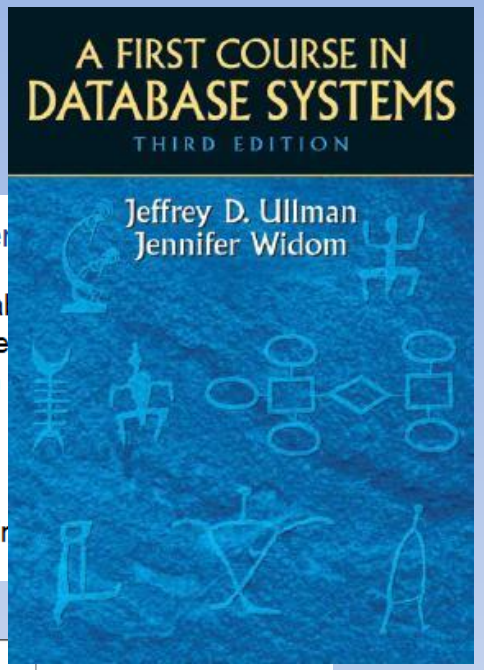
em-solving methods from
owledge-based systems.
ogic, neural network
ation, testing.



CSCI 126. Database Syste

Prerequisites: CSCI 124. Datal
relational network models; obje
normalization, data description
languages, and query design.

Units: 3
Course Typically Offered: Sprir



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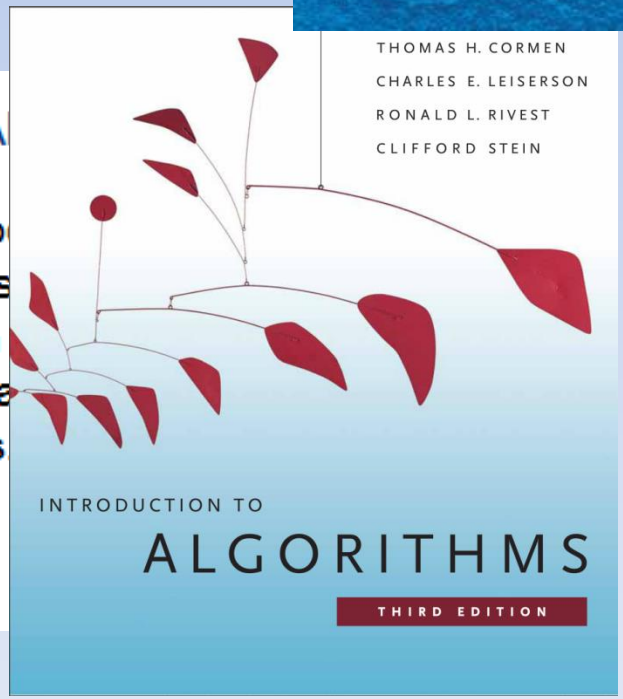
graph algorithm, NP-complete problems

Units: 3



Grading

Period	Presentations/Examinations/Assignments	Points
Various	Attendance	100
	In-Class	100
	Quizzes	100
	Qwiklabs	200
	Midterm	200
	Final	300

Tests

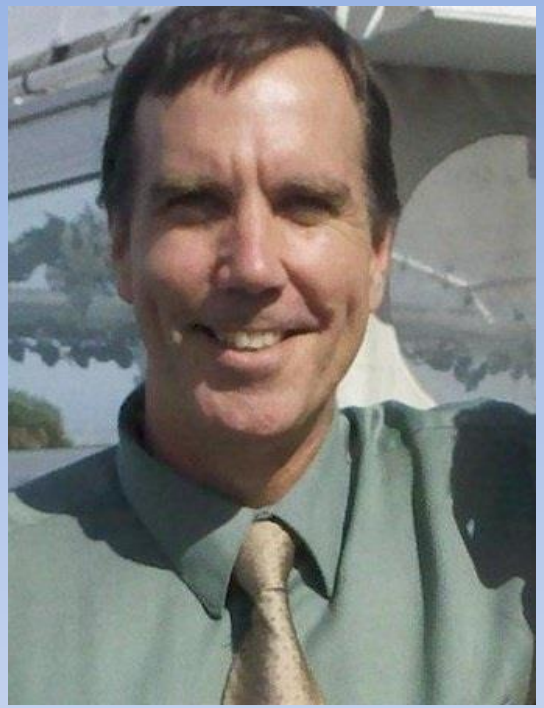
- Midterm (20%)
- Final (30%)

Laptops

- In-Class testing using laptops.

Assignments: Qwiklabs

- A chance to see AI Tools



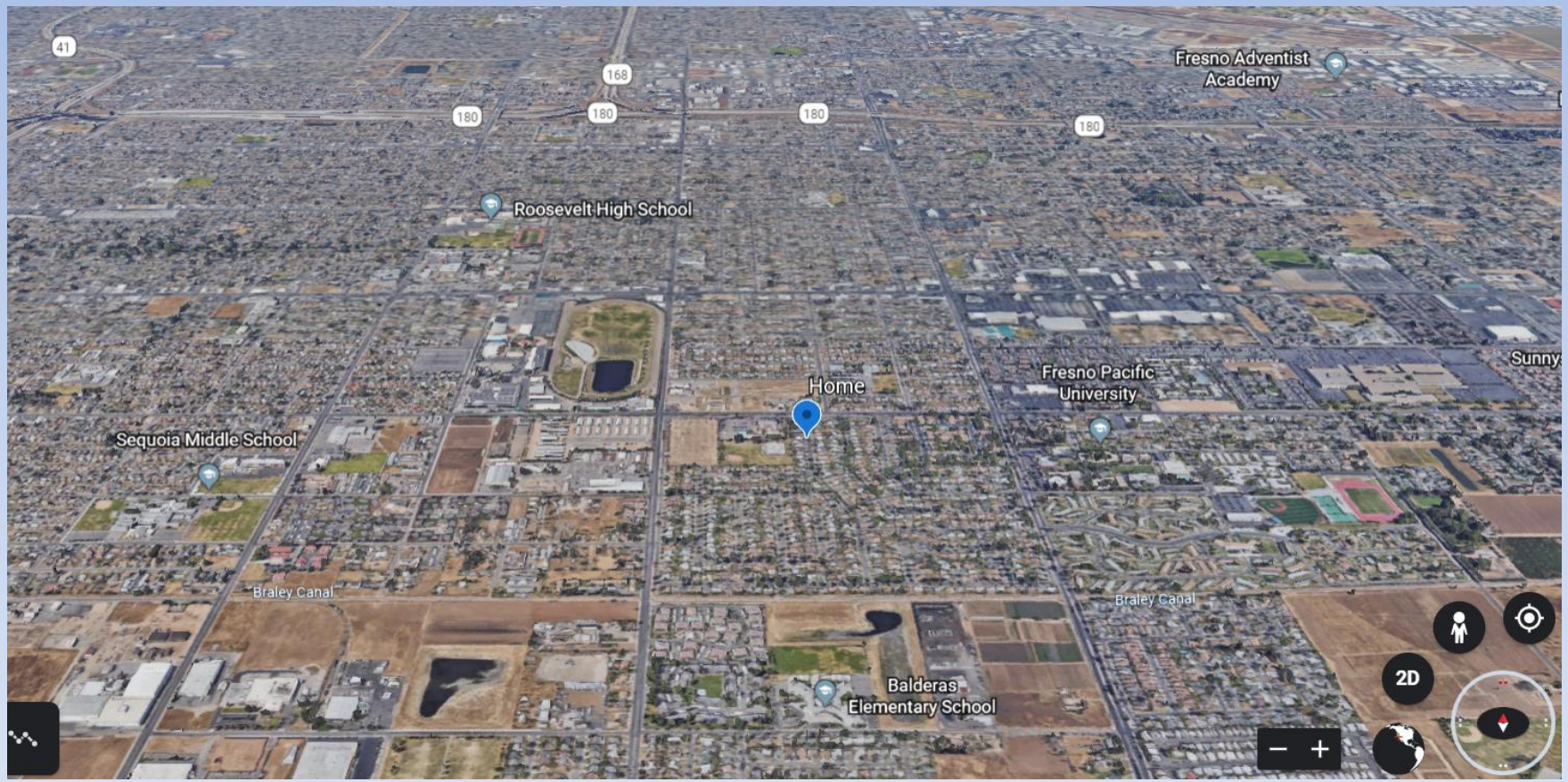
David Ruby

Class Instructor

- Office
  - Science II – 273
- Email:
  - druby@csufresno.edu

- First-Generation College Student
- How PhD?

Father Floyd Fresno Career Custodian Ending @ Sequoia Middle School



North to CSUF

Compute Science Focus: Jobs/Degrees

- Students want…
  - Jobs!
  - Advanced Degrees!!

- How???

Valley DevFest 2018

Antony Ross

Antony Ross

Machine Learning/Financial Advisor@ **Principal Financial Group**

Antony Ross has been a consultant with SportInsight in Los Angeles, specializing in data science and machine learning, and has worked with USC and UCLA analyzing sports performance. He has also worked with the Recurse Center in New York researching deep learning, music recommendations and voice recognition. Antony presently works for the Principal Financial Group in Fresno and applies machine learning in financial technology.

Carlos Moreno

Carlos Moreno

(last updated on 09/11/18)

Cornell CIS
COMPUTING AND INFORMATION SCIENCE

Home

Posts

CV

Carlos Moreno, M.S.

Ph.D. Student, Computer Science, Cornell University

Office: Gates 322

Email: cmoreno (AT) cs (DOT) cornell (DOT) edu

Welcome to the website for Carlos Moreno! I will try my best to keep this as updated as possible throughout my professional career. At the moment, I am a new Ph.D. student at Cornell University, in the Department of Computer Science. Beyond graduation, I aspire to one day become a faculty member, to give back in the way many countless professors have in the past.

In terms of research interests, I am currently intrigued by two general areas. The first is computer science education. What are good approaches to teaching computer science concepts to students? How do these techniques vary in regards to the demographics of the students? Specifically, I am interested in looking at computer science education in regards to under-represented minorities (URMs).

Second, I am interested in machine learning. How can we teach computers to learn about their environment, whether supervised or not? Moreover, what are the moral and ethical implications of machine learning, and artificial intelligence in general? Specifically, I am looking at how machine learning can be used to solve problems in the world of computational sustainability. Can we use computer science to make the world more sustainable? I believe the answer to this question is paramount for our future as a species.

Cornell CIS
COMPUTING AND INFORMATION SCIENCE

EDUCATION

Cornell University Aug. 2018 – Ongoing

Ithaca, NY

- Ph.D. student in Computer Science
- Research interests: computer science education, specifically for URMs; and machine learning, specifically for computational sustainability

California State University, Fresno Aug. 2015 — May 2017

Fresno, CA

- Master of Science (M.S.) in Computer Science with Distinction
- 4.0 GPA
- Dean's Medalist for the College of Science and Mathematics
- Outstanding Graduate Award for the Department of Computer Science
- Thesis: Supporting Quality of Service in Real-Time Video Streaming Using the Kinect

California State University, Fresno Aug. 2011 — May 2015

Fresno, CA

- Bachelor of Science (B.S.) in Computer Science with University Honors
- Magna Cum Laude, 3.82 GPA
- President's Honors Scholar
- Standard Bearer for the College of Science and Mathematics
- Outstanding Undergraduate Award for the Department of Computer Science

Dr. Joy Goto, Professor Biochemistry, Fresno State

- https://youtu.be/FXUiEPrK_II

Dr. Joy Goto, Professor Biochemistry, Fresno State

- https://youtu.be/FXUiEPrK_II

- Engaging story of discovering joy in science growing up here in the central valley.

Grad School Colleagues

David W. Aha (Bio Vitae)
Naval Research Laboratory
Navy Center for Applied Research in Artificial Intelligence
Washington, DC
david.aha@nrl.navy.mil
+1 (202) 404-4940

Education

- 1992-93 NSERC International Post-Doctoral Fellowship, University of Ottawa, Canada
- 1991-92 APL/Johns Hopkins University Post-Doctoral Fellowship, Laurel, MD
- 1990-91 SERC Post-Doctoral Fellowship, Turing Institute, Glasgow, Scotland
- 1990 Ph.D. (Computer Science), University of California, Irvine
- 1985 M.S. in Computer Science, Syracuse University
- 1983 B.S. in Computer Science, Syracuse University, Magna Cum Laude with Honors, University Scholar (the highest undergraduate honor bestowed by SU)
- 1979 Walt Whitman High School; South Huntington, New York

Employment (Non-Educational)

- (1993-) Naval Research Laboratory
- (1982) PAR Technology Corporation, Summer
- (1981) Fairchild Republic Company, Summer

U.S. NAVAL RESEARCH LABORATORY

Goal Reasoning:
Emerging Applications, Foundation, and Prospects

David W. Aha
Head, Adaptive Systems Section
Navy Center for Applied Research in Artificial Intelligence
Naval Research Laboratory (Code 5514); Washington, DC
david.aha@nrl.navy.mil

IAAI-17 | AAAI Robert S. Engelmore Memorial Lecture | 2017 February 6

U.S. NAVAL RESEARCH LABORATORY

Goal Reasoning (GR): Examples

It's a Wonderful Life, 1935 (Jimmy Stewart as George Bailey)

Clarence

Goal: Suicide

Goal: Life

The Force Awakens, 2015 (John Boyega as Finn)

Cruelty

Goal: Serve Empire

Goal: Defeat Empire

Goal Reasoning (GR): Examples (cont.)

United States, 1941

Pearl Harbor

Goal: Peace

Goal: War

A Change of Research Focus

Meeting

Goal: CBR

Goal: GR

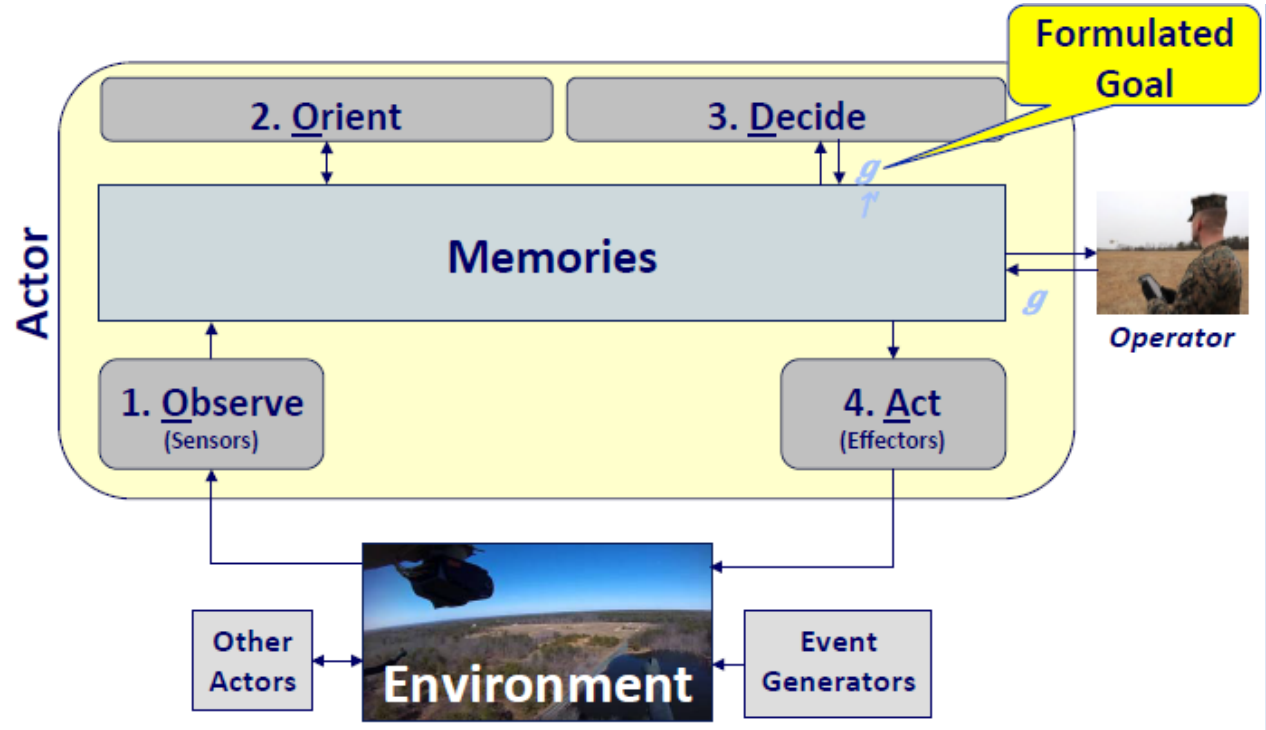
An Actor Methodology for Continuously Reasoning on Goals

Requirements

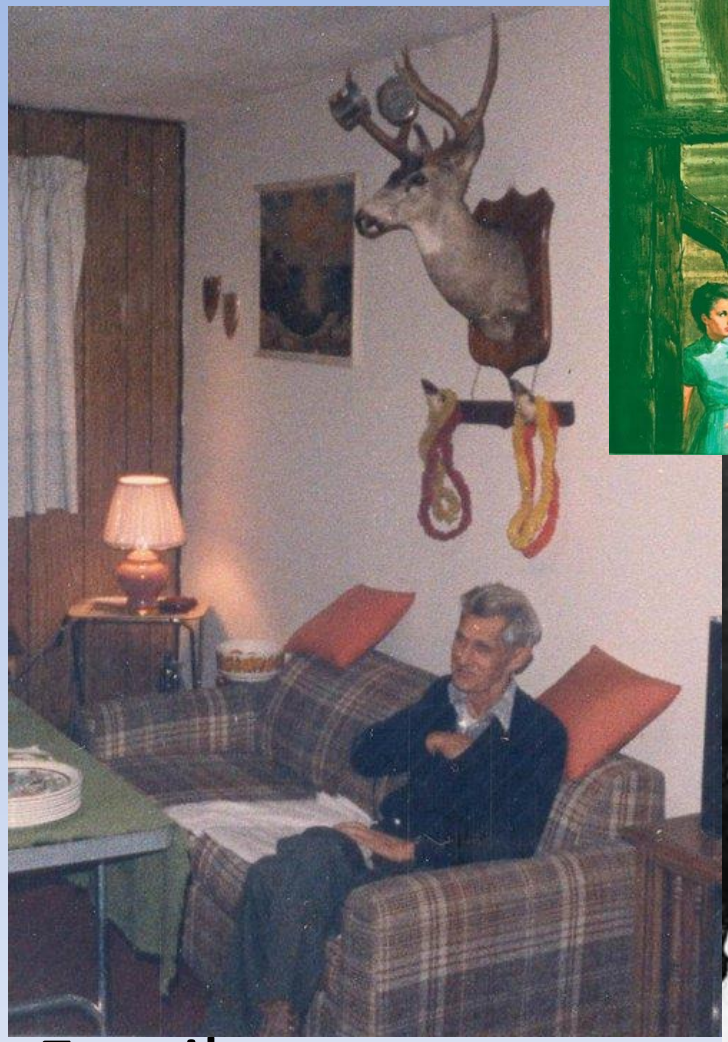
- Goal representation (explicit)
- Reasoning process

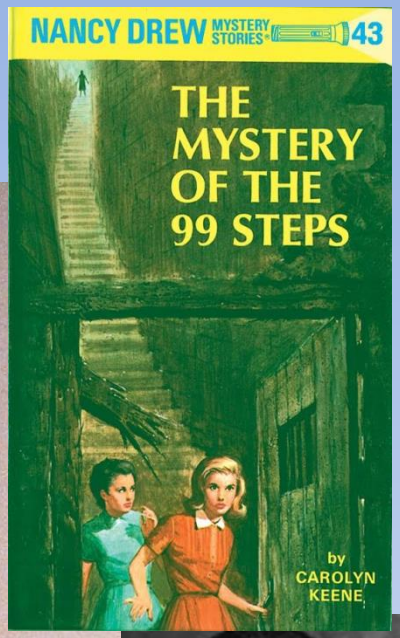
Benefit: Deliberate on changing one's *goal*

- When an impasse occurs
- When an affordance occurs
- After goal reprioritization



My Story





Interest In Puzzles

- Family Memories

Puzzles: Pacman Projects

Home & Projects Overview

Instructor's Guide

UNIX/Python Tutorial

Search Project

Multiagent Search Project

Reinforcement Learning Project

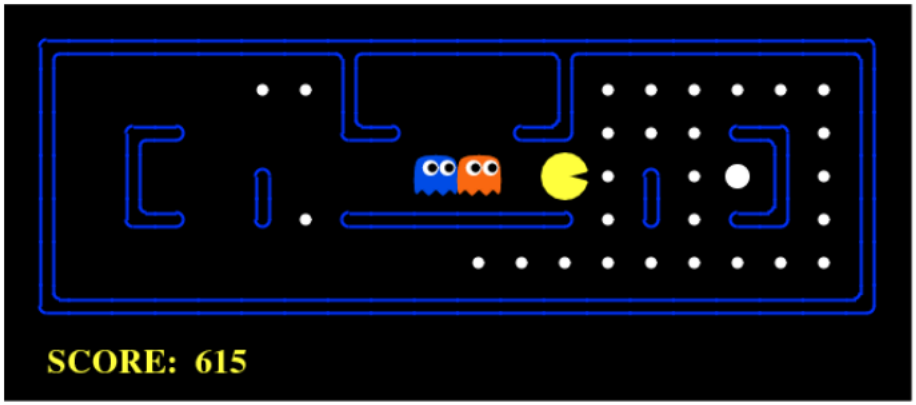
Ghostbusters Project

Classification Project

edX Pilot

Contact

The Pac-Man Projects

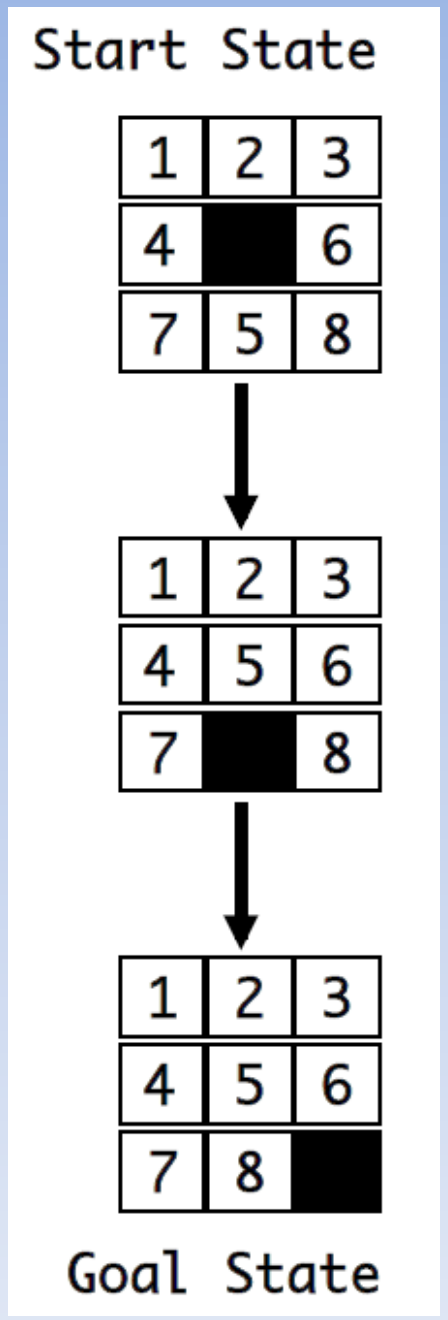


Overview

The Pac-Man projects were developed for UC Berkeley's introductory artificial intelligence course, CS 188. They apply an array of AI techniques to playing Pac-Man. However, these projects don't focus on building AI for video games. Instead, they teach foundational AI concepts, such as informed state-space search, probabilistic inference, and reinforcement learning. These concepts underly real-world application areas such as natural language processing, computer vision, and robotics.

We designed these projects with three goals in mind. The projects allow students to visualize the results of the techniques they implement. They also contain code examples and clear directions, but do not force students to wade through undue amounts of scaffolding. Finally, Pac-Man provides a challenging problem environment that demands creative solutions; real-world AI problems are challenging, and Pac-Man is too.

In our course, these projects have boosted enrollment, teaching reviews, and student



Thesis: Tile-Sliding Puzzle

Artificial Intelligence

Branch: master ▾ ics1293 / Papers / Ruby.AAAI91-082.pdf Find file Copy path

everestso paper 017b894 4 days ago

1 contributor

1000 KB Raw History

SteppingStone: An Empirical and Analytical Evaluation*

David Ruby and **Dennis Kibler**
Department of Information & Computer Science
University of California, Irvine
Irvine, CA 92717 U.S.A.
druby@ics.uci.edu

Abstract

Decomposing a difficult problem into simpler subproblems is a classic problem solving technique. Unfortunately, the most difficult subproblems can be as difficult, if not more difficult, than the original problem. This is not an obstacle to problem solving if the difficult subproblems recur in other problems. If the difficult subproblems recur often, then its solution need only be learned once and reused. SteppingStone is a learning problem solver that decomposes a problem into simple and difficult-but-recurring subproblems. It solves the

SteppingStone operates on problems defined with a state space representation consisting of a set of goals, a set of operators, and an initial state. The goal orderer takes as input a set of goals. It orders these goals so that the constrained search method will likely solve them. It does this by ordering them so as to reduce the likelihood of subgoal interactions using a domain independent heuristic we call *openness* [Ruby and Kibler, 1989]. It produces an ordered set of subgoals as output.

The constrained search component takes as input an

My Idea…

Memories are constructed.. Not stored complete!

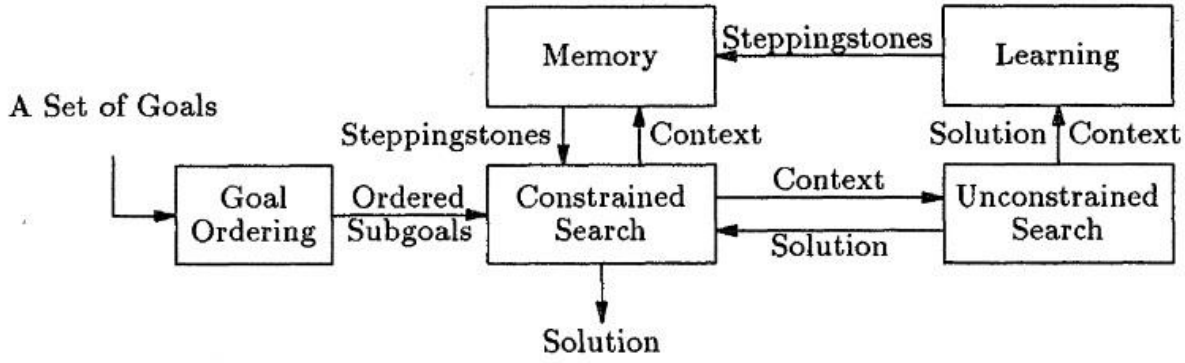


Figure 1: Overview of SteppingStone

the original impasse state.

When memory fails to return any useful stepping-stones the constrained search component calls the unconstrained search component. The unconstrained search component takes as input a context, just as the memory component did. Unconstrained search relaxes the protection on the solved subgoals in its search for a solution. If it resolves the impasse, it returns the sequence of moves found to the constrained search component. The unconstrained search component also sends its impasse solution, along with the context, to the learner.

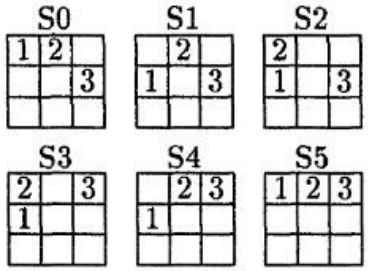
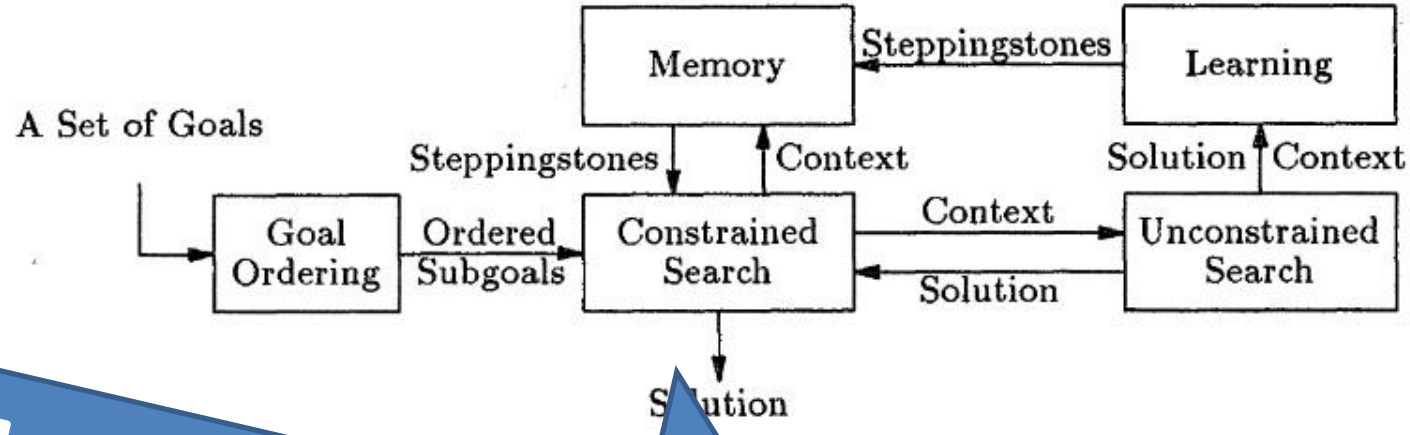


Figure 2: Steppingstones from Memory

Thesis: Tile Sliding Domain



Memories have gaps!!!

f SteppingStone

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constrained search compo
search component takes as input a co
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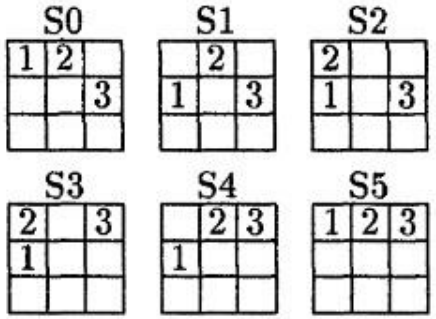
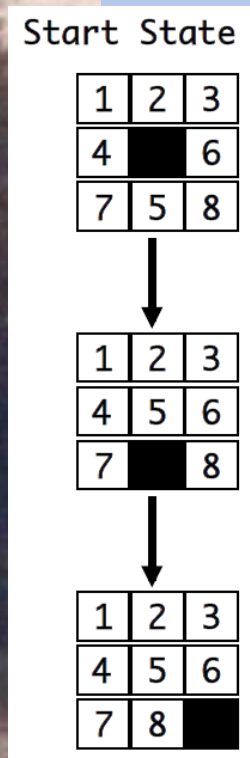


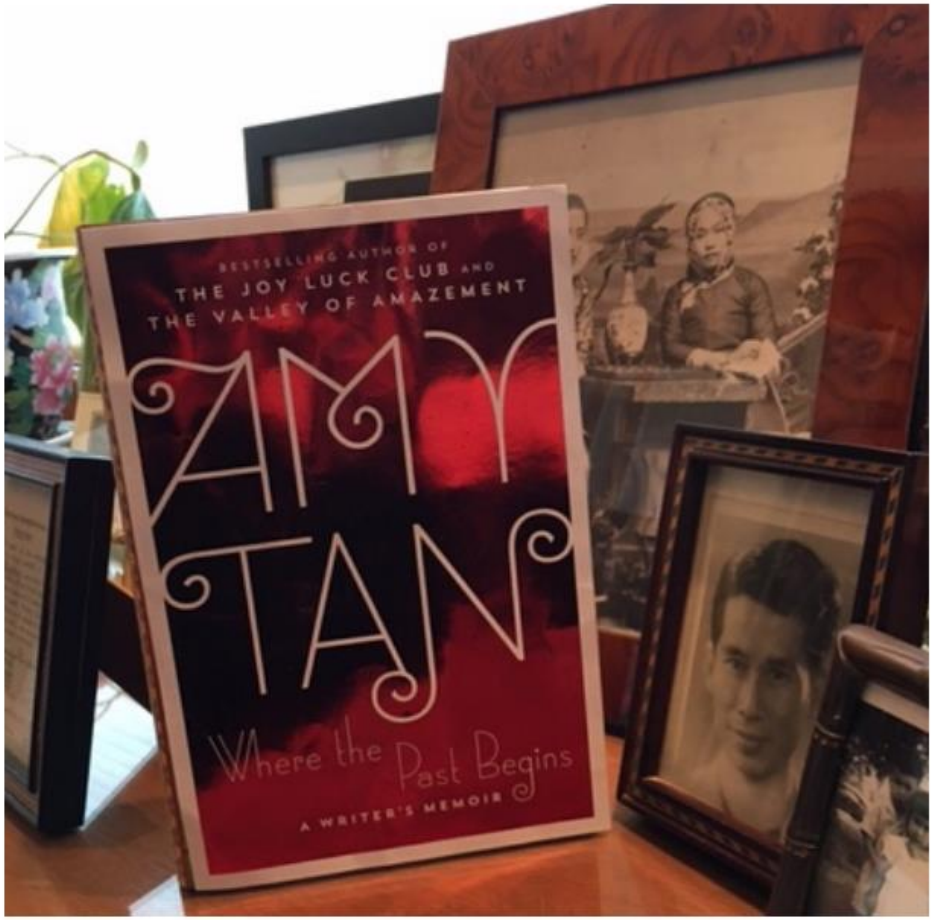
Figure 2: Steppingstones from Memory

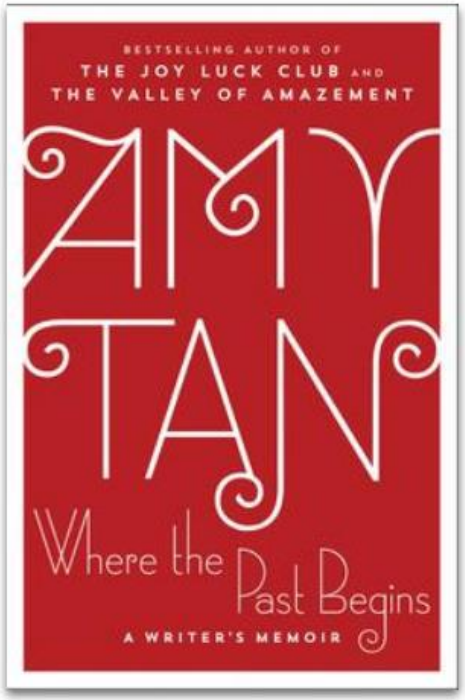
My Memories..

- Home Hedges Maze.
- Also – First time w/ Sliding Tile Puzzle



Emotional Memory: Process of a Writer





coming
Oct 17, 2017
Pre-order

Malleable Memory (Gaps)
Learning & Memory w/ Elizabeth Loftus

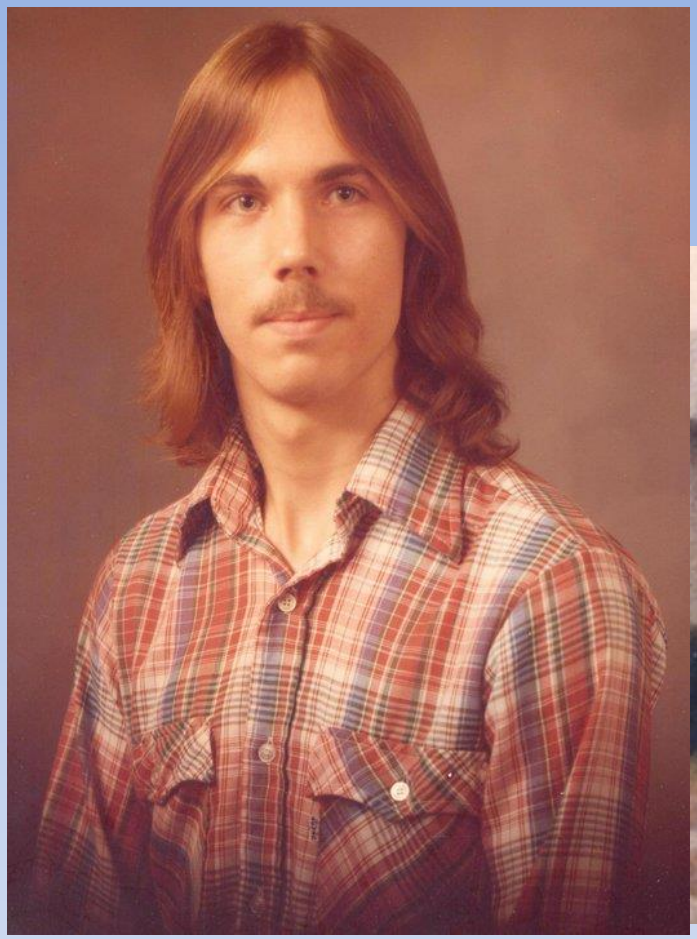
CORRUPTED MEMORY

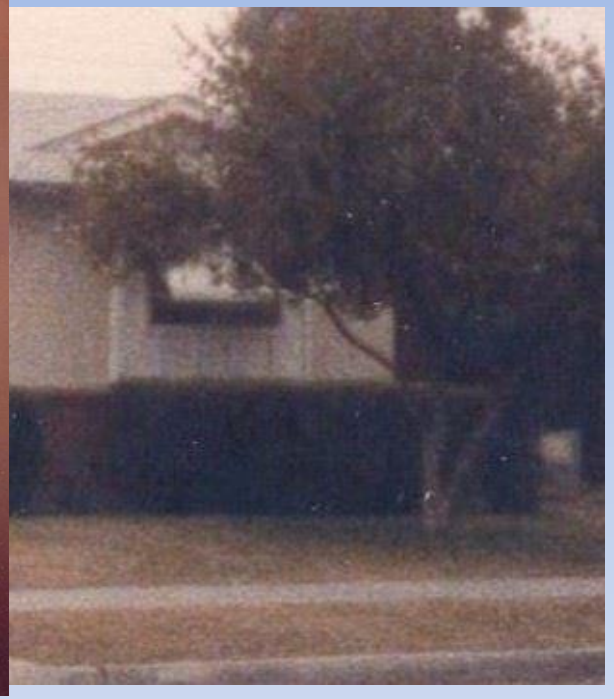
Elizabeth Loftus has spent decades exposing flaws in eyewitness testimony. Her ideas are gaining fresh traction in the US legal system.

BY MOHEB COSTANDI

Elizabeth Loftus is a cognitive psychologist at the University of California Irvine.

eXciting Mazes Memories!





- ME:
  - Do you remember the FUN maze?
- NEIGHBOR:
  - Do YOU remember this other HORRIBLE thing??
- ME:
  - Hmmm .. I guess not.
- Language influencing memory ??

Memories & Learning

JOURNAL OF VERBAL LEARNING AND VERBAL BEHAVIOR 13, 585–589 (1974)

Reconstruction of Automobile Destruction: An Example of the Interaction Between Language and Memory'

ELIZABETH F. LOFTUS AND JOHN C. PALMER

University of Washington

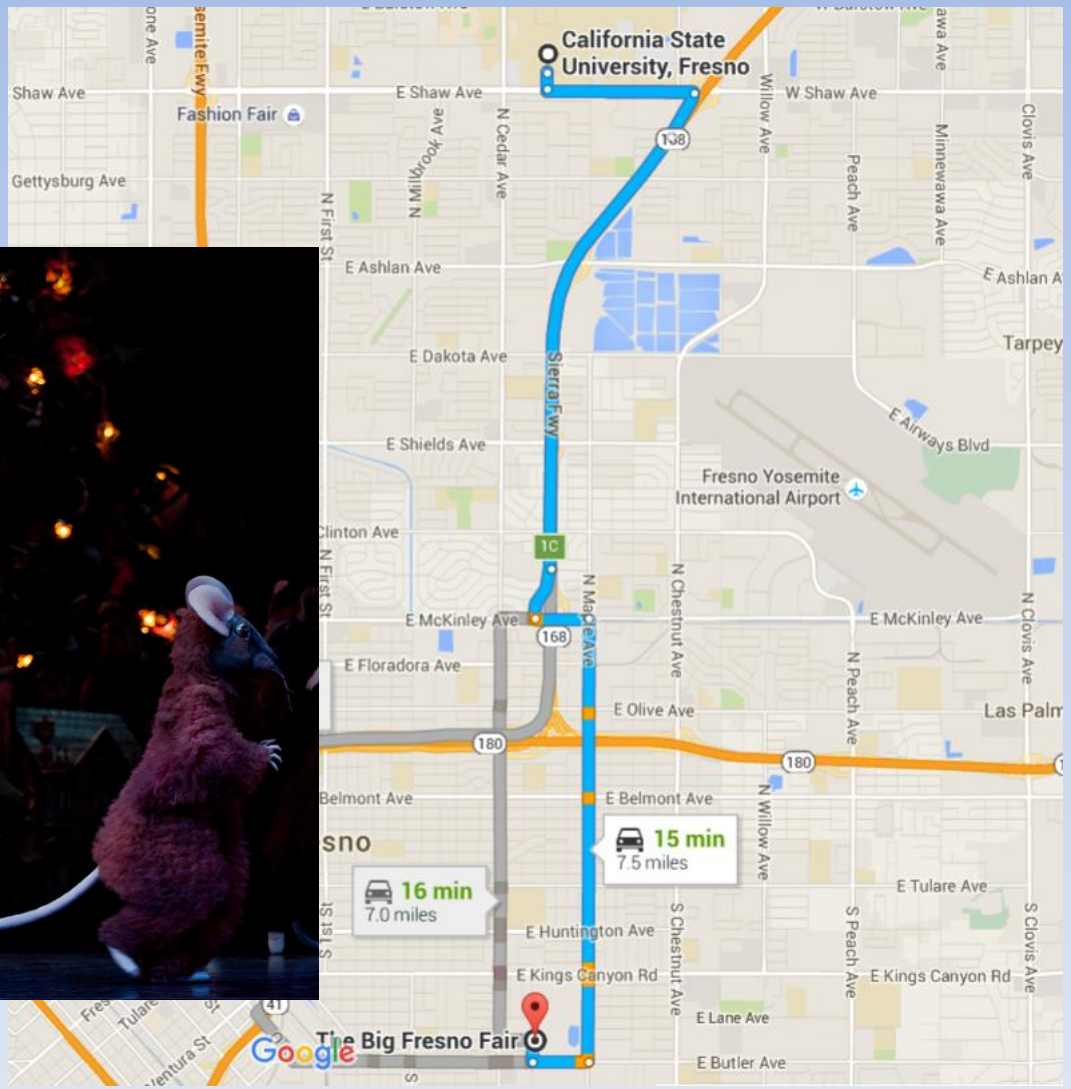
Two experiments are reported in which subjects viewed films of automobile accidents and then answered questions about events occurring in the films. The question, "About how fast were the cars going when they smashed into each other?" elicited higher estimates of speed than questions which used the verbs ***collided***, ***bumped***, ***contucted***, or ***hit*** in place of ***smashed***. On a retest one week later, those subjects who received the verb ***smashed*** were more likely to say "yes" to the question, "Did you see any broken glass?", even though broken glass was not present in the film. These results are consistent with the view that the questions asked subsequent to an event can cause a reconstruction in one's memory of that event.

Computer Science / Memories

- Puzzles
- Abstractions
- Memories

Current Interest: Abstraction

- Hello, World!



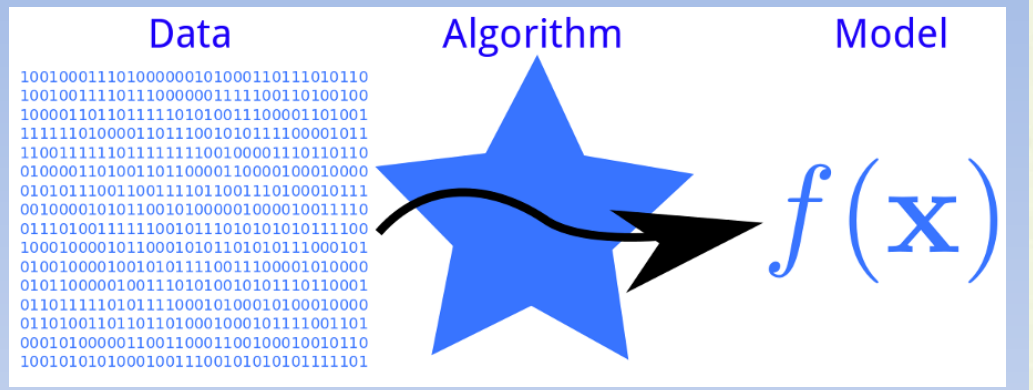
Abstraction: Computational Thinking

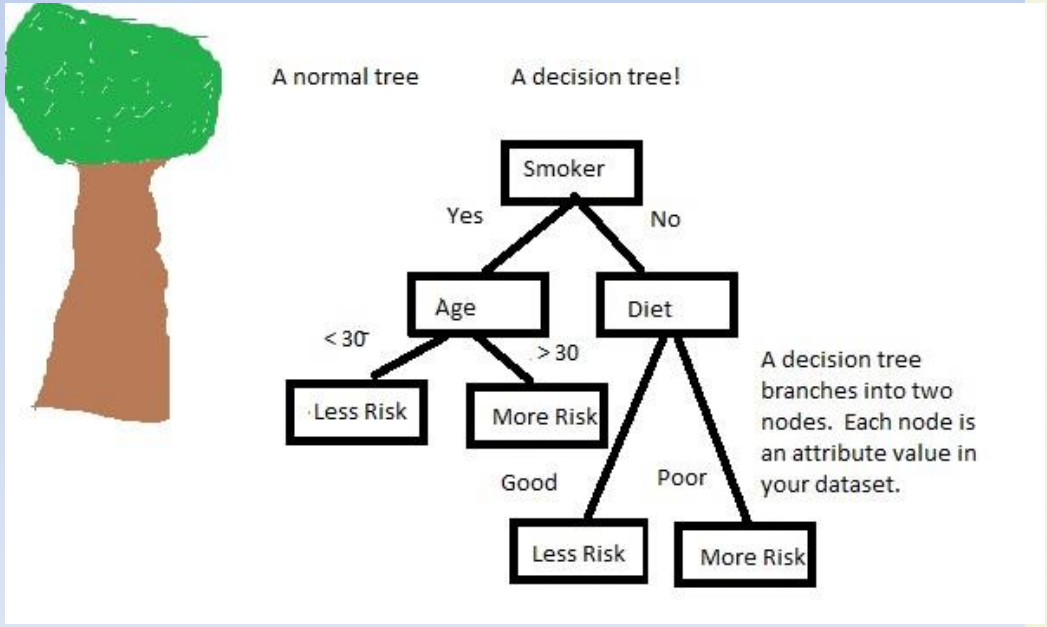
- Abstraction
- Automation
- Algorithms/Analysis

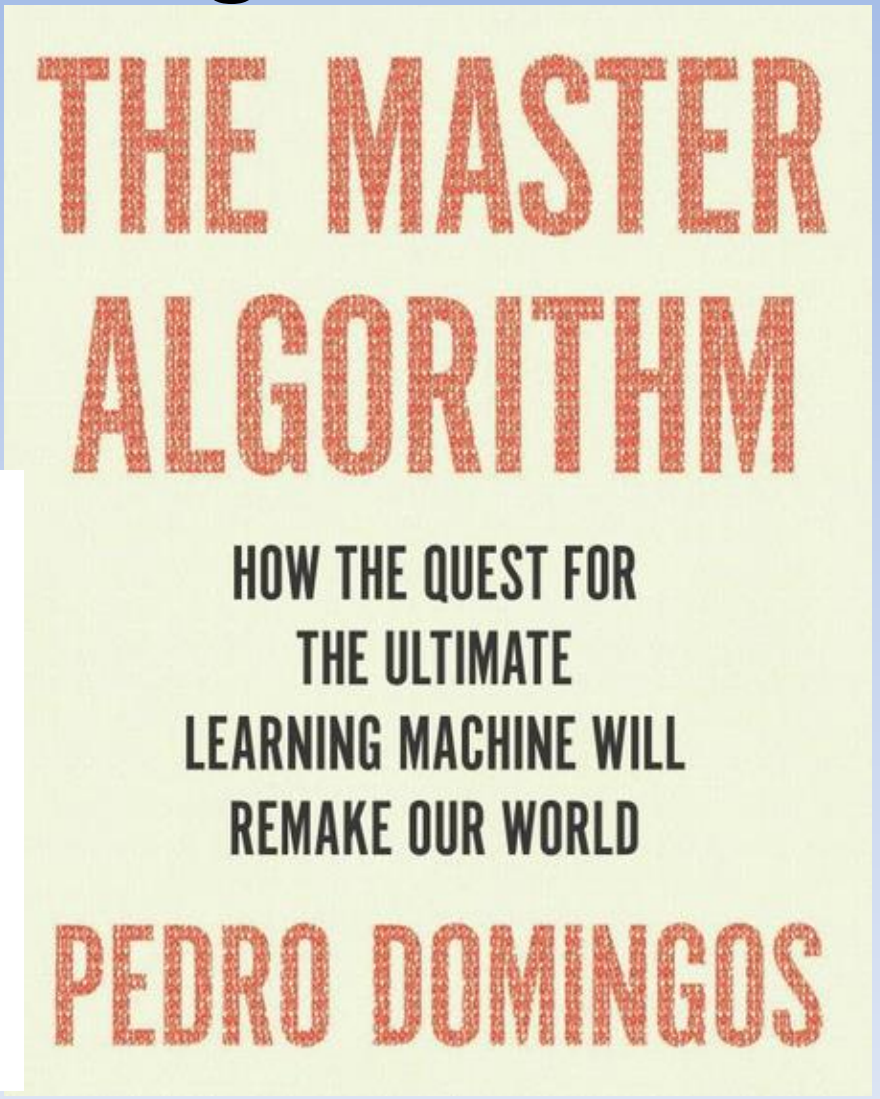
Intelligence (Problem Solving) Requires.. ..Learning from Experiences

- Intelligence requires learning from experiences.

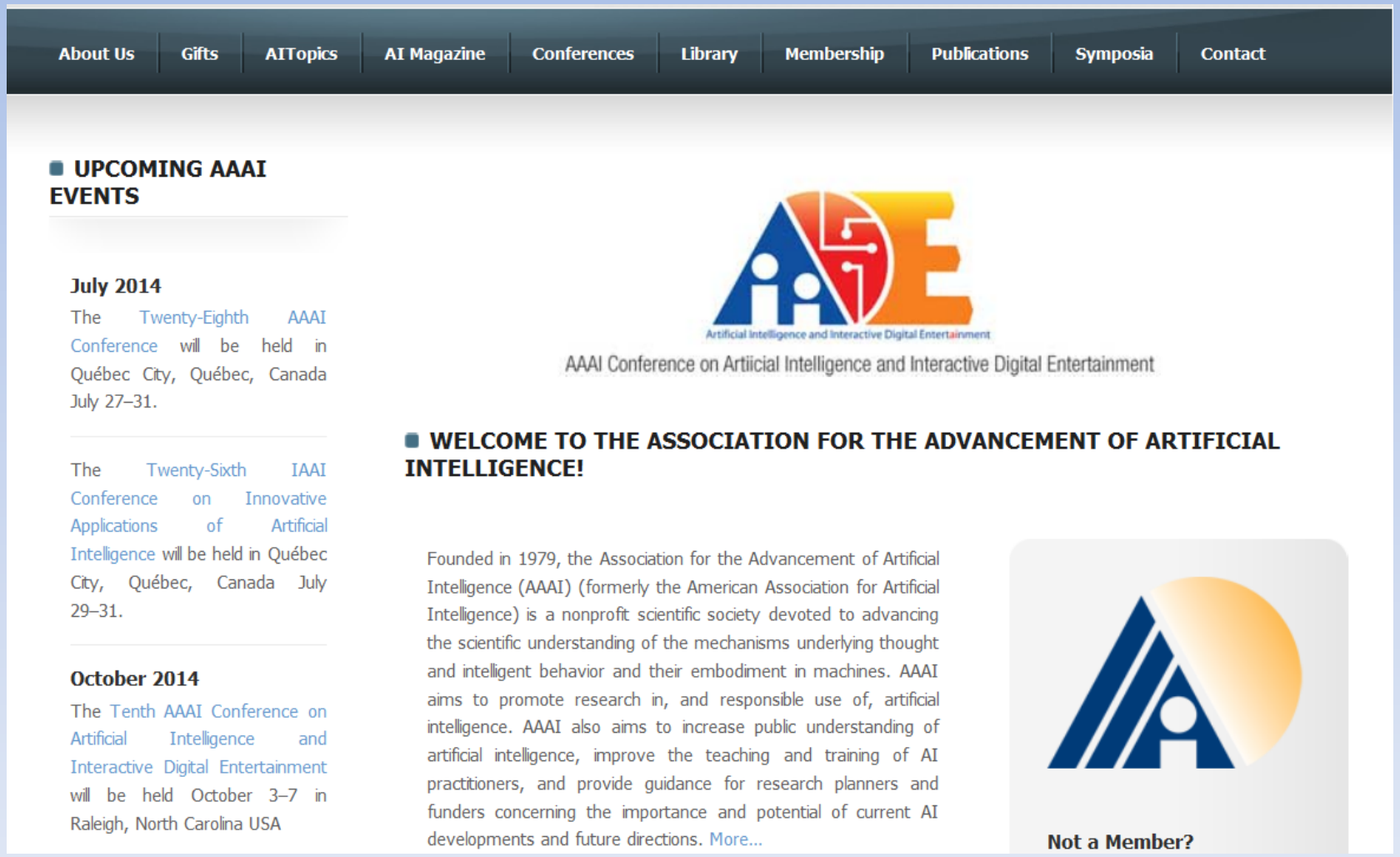
Machine Learning - AI







AAAI.ORG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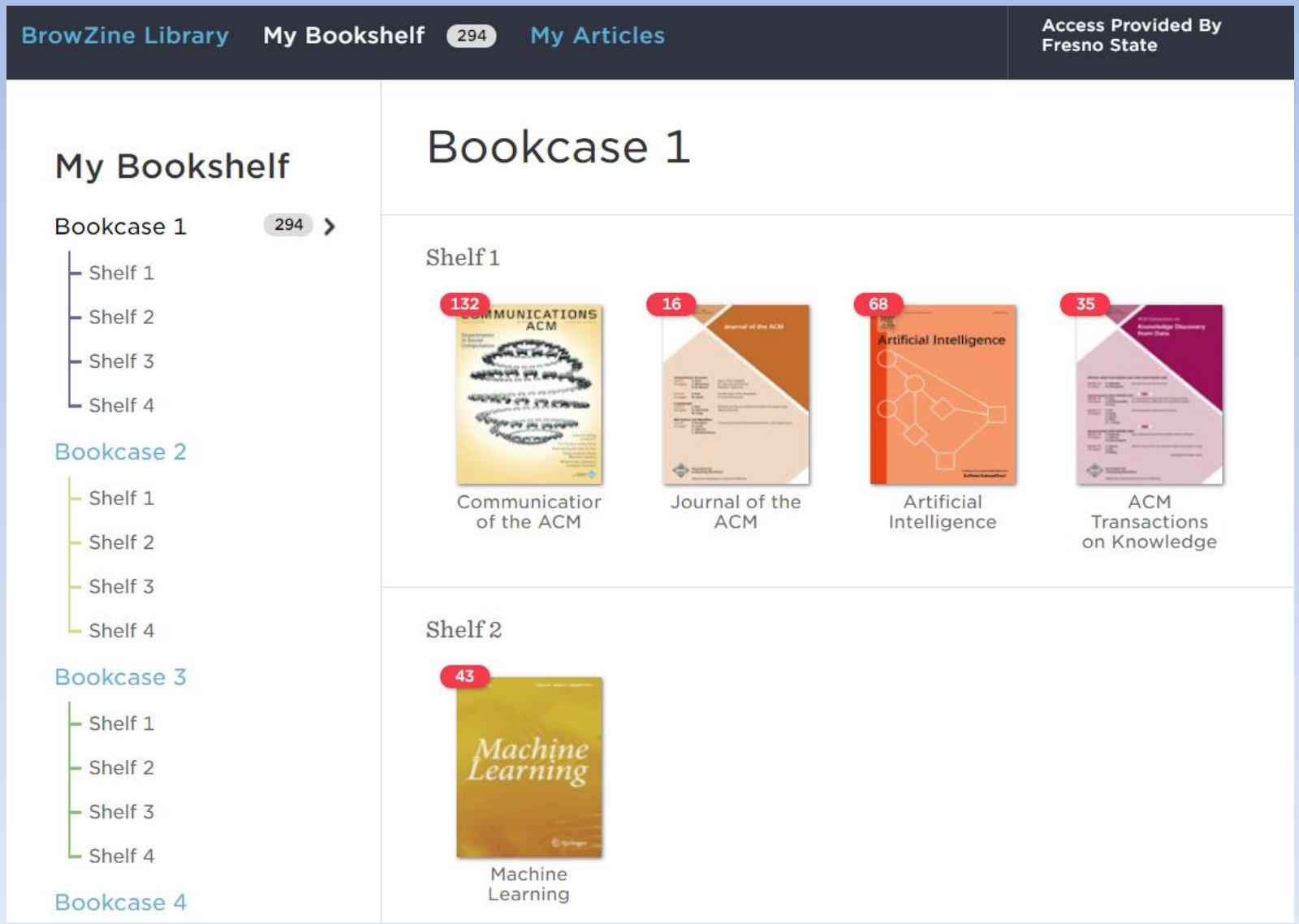
UPCOMING AAAI EVENTS
July 2014
The Twenty-Eighth AAAI Conference will be held in Québec City, Québec, Canada July 27–31.
The Twenty-Sixth IAAI Conference on Innovative Applications of Artificial Intelligence will be held in Québec City, Québec, Canada July 29–31.
October 2014
The Tenth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment will be held October 3–7 in Raleigh, North Carolina USA
Artificial Intelligence and Interactive Digital Entertainment
AAAI Conference on Artiicial Intelligence and Interactive Digital Entertainment
WELCOME TO THE ASSOCIATION FOR THE ADVANCEMENT OF ARTIFICIAL INTELLIGENCE!
Founded in 1979, the Association for the Advancement of Artificial Intelligence (AAAI) (formerly the American Association for Artificial Intelligence) is a nonprofit scientific society devoted to advancing the scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines. AAAI aims to promote research in, and responsible use of, artificial intelligence. AAAI also aims to increase public understanding of artificial intelligence, improve the teaching and training of AI practitioners, and provide guidance for research planners and funders concerning the importance and potential of current AI developments and future directions. More...
Not a Member?

Resources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My Articles
Access Provided By Fresno State
My Bookshelf
Bookcase 1 294
Shelf 1
Shelf 2
Shelf 3
Shelf 4
Bookcase 2
Shelf 1
Shelf 2
Shelf 3
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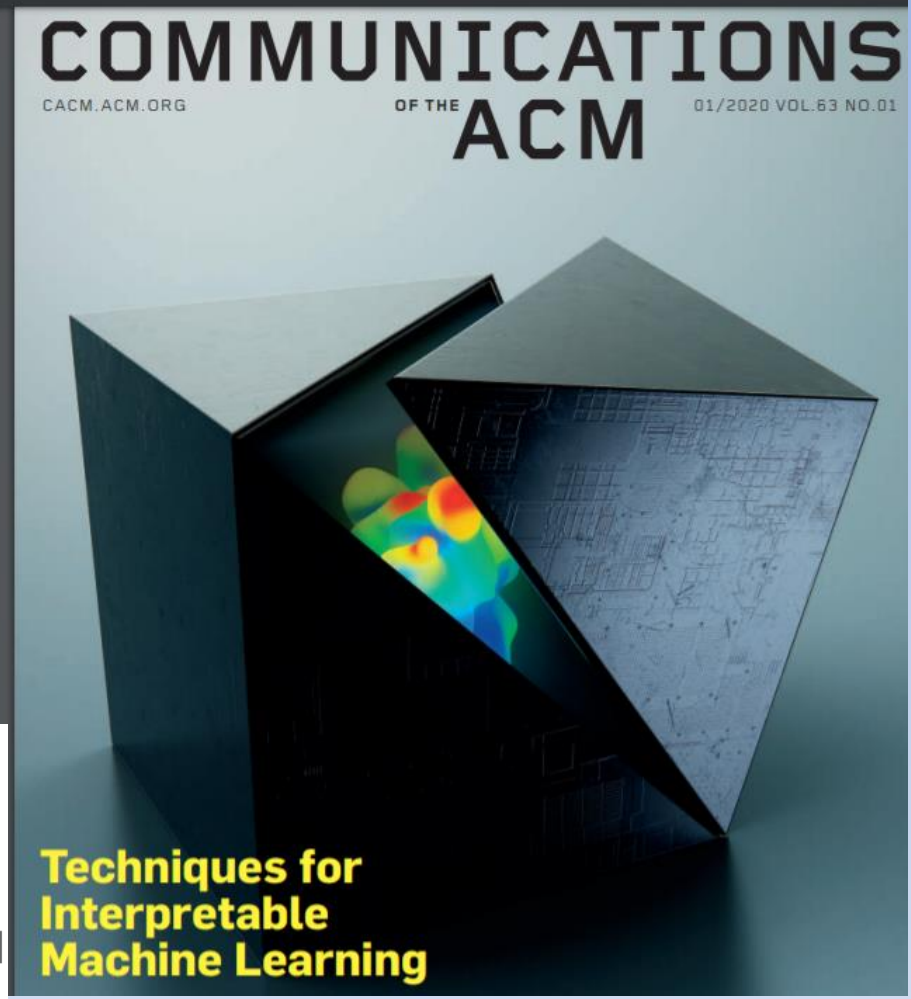
Machine Learning



viewpoints

DOI:10.1145/3326600

James W. Davis and Jeff Hachtel

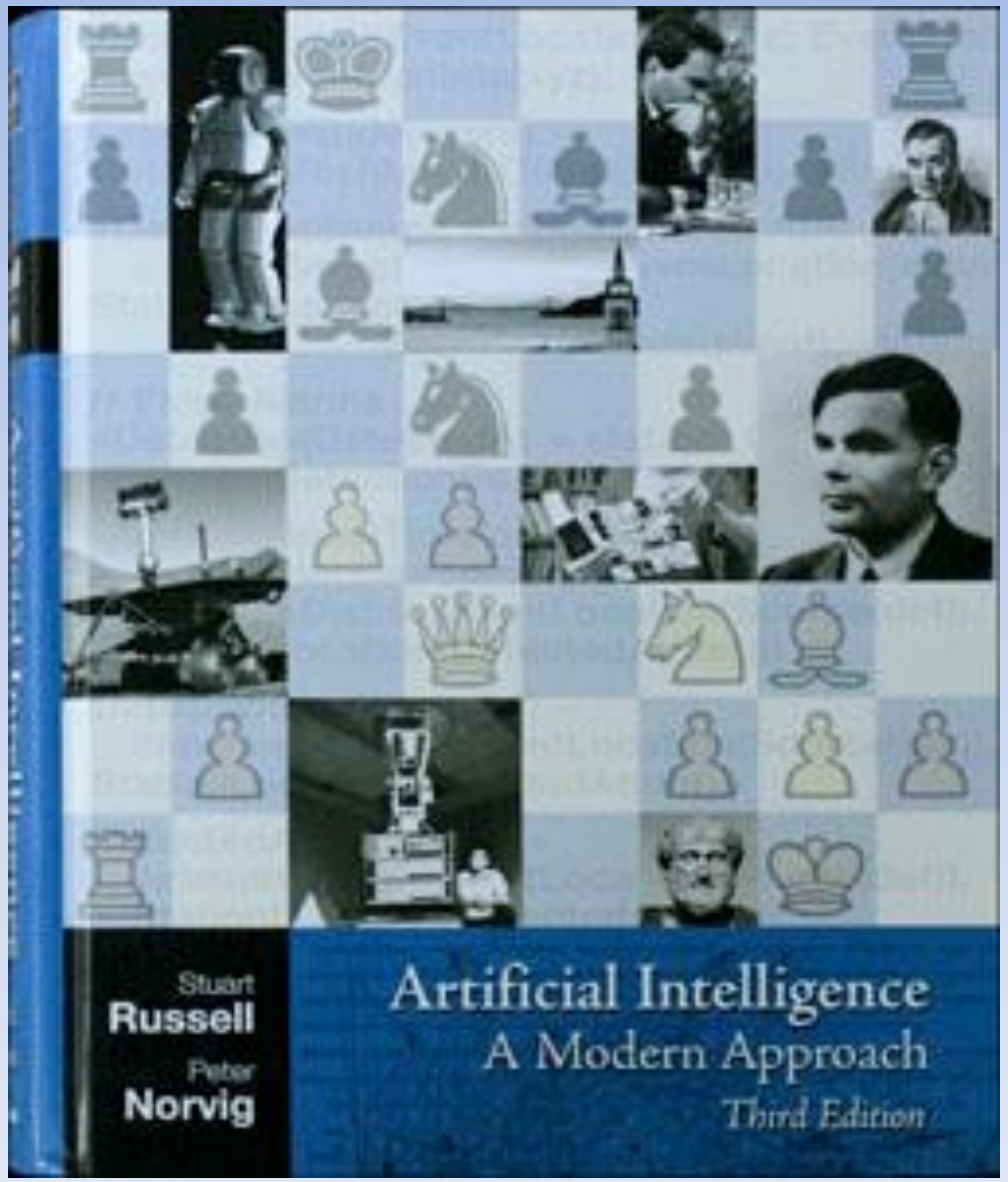
Viewpoint

A* Search: What's in a Name?

A search for algorithmic answers returns unique results.

ORIGINALLY PUBLISHED IN 1968 by Hart, Nilsson, and Raphael,[2] the well-known A* search algorithm is a foundational pathfinding

Tentative Course Schedule



- Chapters 1, 2
- Chapter 18
- Chapters 3, 5, 6
- Chapter 7
- Chapter 13, 14?

Chapter 1
What is AI?

- What is Intelligence?

Chapter 1
What is AI?

- Introduce Science of Artificial Intelligence
- History of AI

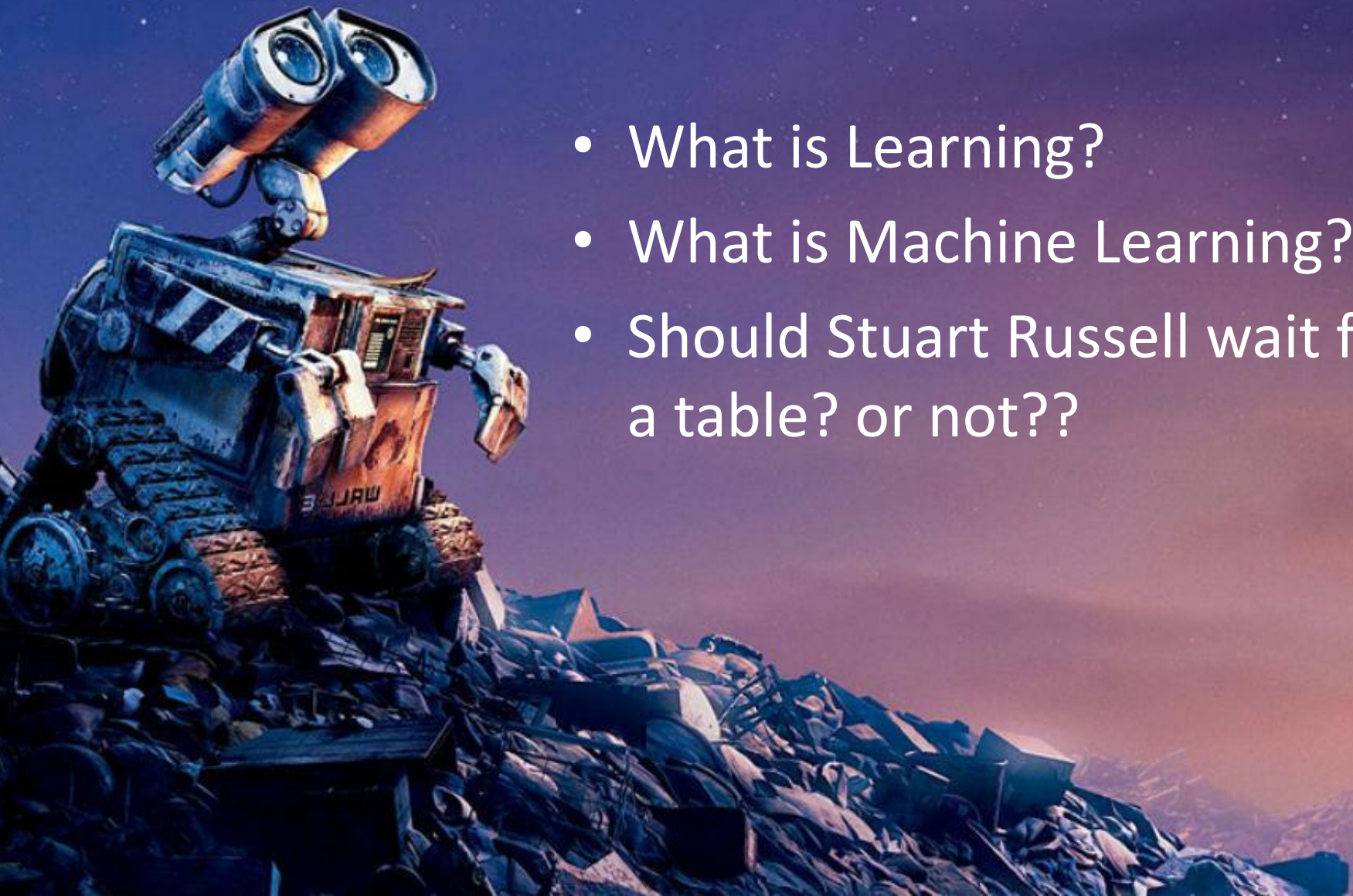
Chapter 2: Intelligent Agents

- Agents operate in world
- Is Agent Intelligent?

Chapter 2:
Problem Characteristics

- Examine problems
  - Problems people solve
  - Problems not currently solved by computers
- Develop characteristics for describing problems.

Chapter 18
Machine Learning



- What is Learning?
- What is Machine Learning?
- Should Stuart Russell wait for a table? or not??

Chapter 18: Decision Trees

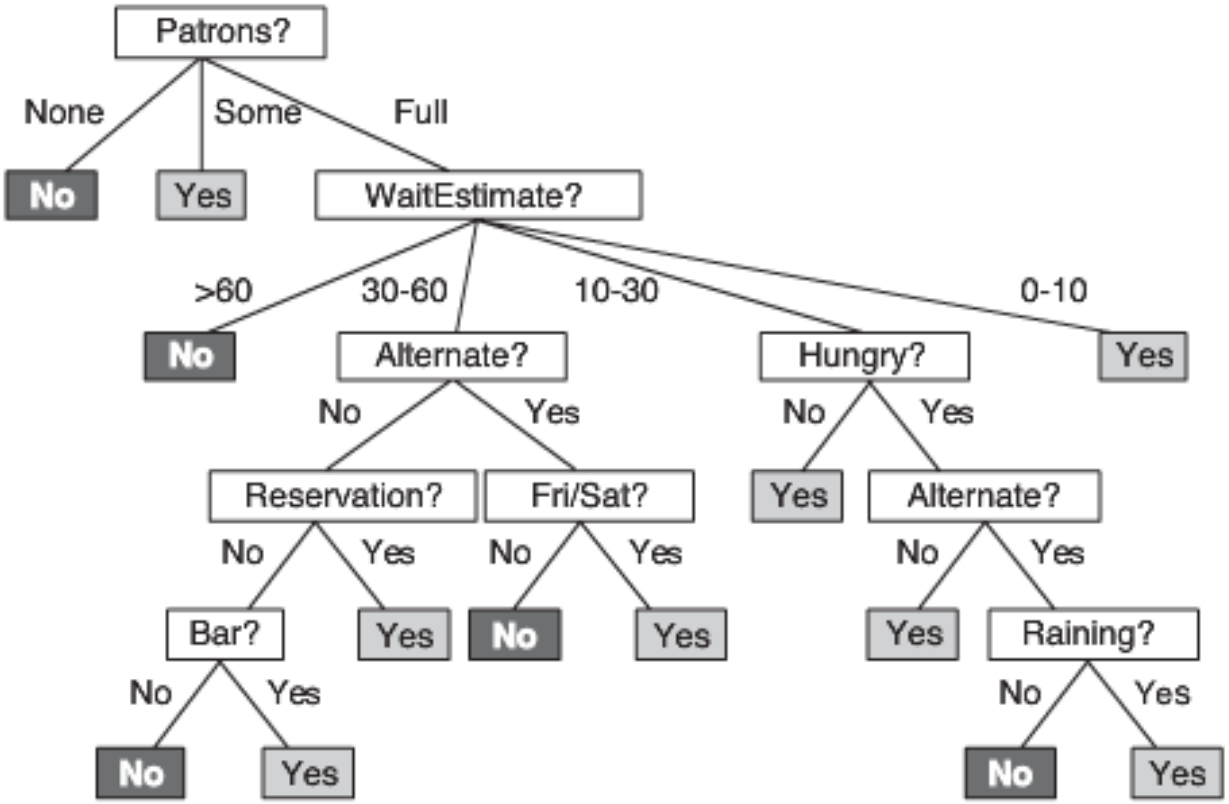


Figure 18.2 A decision tree for deciding whether to wait for a table.

Linear Models

- Gradient Descent
  - Learning Rate
- Logistic Regression
- Regularization
  - Regularization Parameter

Neural Nets

- Neural Models
- Multi-Layer Models
- Training Multi-Layer Models w/ Backpropagation
- Deep Learning

Midterm

- Chapters 1, 2, 18

Search

Chapter 3:
State-Space Search

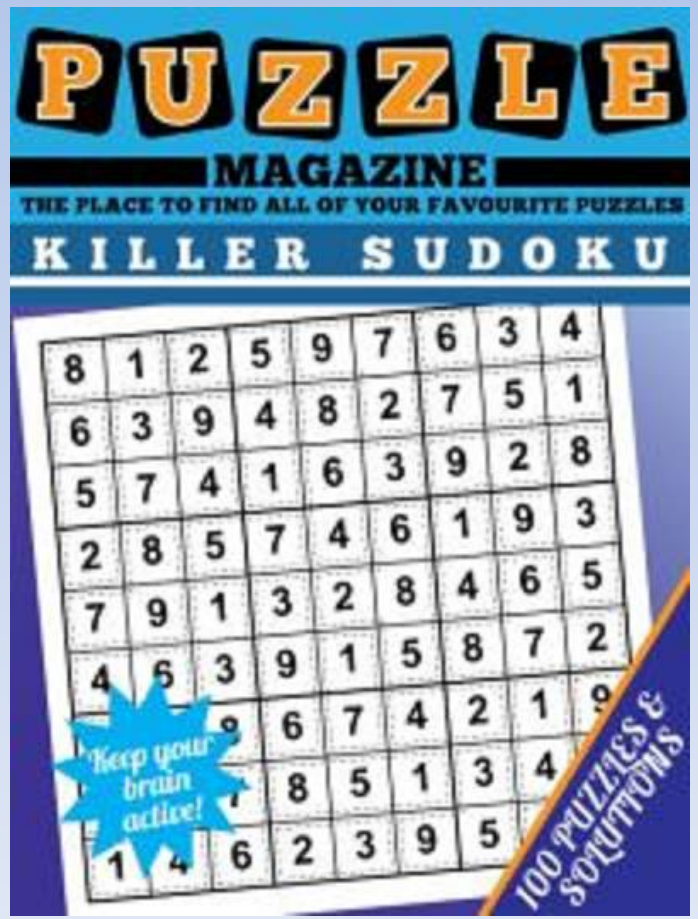
- Uniformed Search
- Heuristics
- Informed Search
  - A*

Chapter 5 Adversarial Search

- Multiplayer Games
- Minimax
- Alpha Beta Cutoff

Chapter 6: CSP

- Constraint Satisfaction Problems
- AC-3 Algorithm
- Cutsets
- Etc…



Knowledge Representation

Chapter 7: Logical Agents

- Propositional Logic

P	Q	$\neg P$	$P \wedge Q$	$P \vee Q$	$P \Rightarrow Q$	$P \Leftrightarrow Q$
false	*false*	*true*	*false*	*false*	*true*	*true*
false	*true*	*true*	*false*	*true*	*true*	*false*
true	*false*	*false*	*false*	*true*	*false*	*false*
true	*true*	*false*	*true*	*true*	*true*	*true*

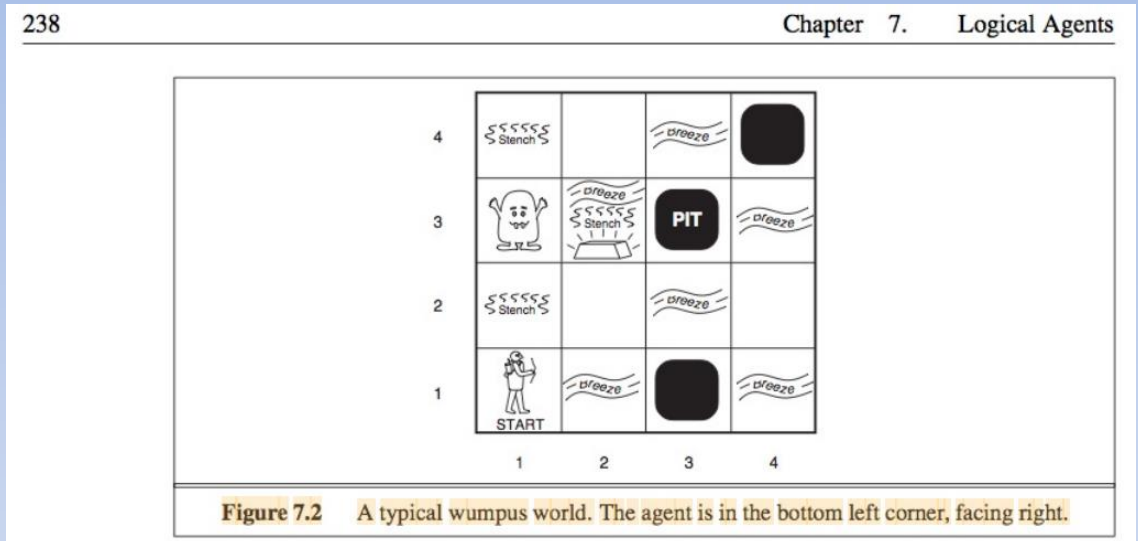
Figure 7.8 Truth tables for the five logical connectives. To use the table to compute, for

$$
\begin{aligned}
(\alpha \wedge \beta) &\equiv (\beta \wedge \alpha) && \text{commutativity of } \wedge \\
(\alpha \vee \beta) &\equiv (\beta \vee \alpha) && \text{commutativity of } \vee \\
((\alpha \wedge \beta) \wedge \gamma) &\equiv (\alpha \wedge (\beta \wedge \gamma)) && \text{associativity of } \wedge \\
((\alpha \vee \beta) \vee \gamma) &\equiv (\alpha \vee (\beta \vee \gamma)) && \text{associativity of } \vee \\
\neg(\neg\alpha) &\equiv \alpha && \text{double-negation elimination} \\
(\alpha \Rightarrow \beta) &\equiv (\neg\beta \Rightarrow \neg\alpha) && \text{contraposition} \\
(\alpha \Rightarrow \beta) &\equiv (\neg\alpha \vee \beta) && \text{implication elimination} \\
(\alpha \Leftrightarrow \beta) &\equiv ((\alpha \Rightarrow \beta) \wedge (\beta \Rightarrow \alpha)) && \text{biconditional elimination} \\
\neg(\alpha \wedge \beta) &\equiv (\neg\alpha \vee \neg\beta) && \text{De Morgan} \\
\neg(\alpha \vee \beta) &\equiv (\neg\alpha \wedge \neg\beta) && \text{De Morgan} \\
(\alpha \wedge (\beta \vee \gamma)) &\equiv ((\alpha \wedge \beta) \vee (\alpha \wedge \gamma)) && \text{distributivity of } \wedge \text{ over } \vee \\
(\alpha \vee (\beta \wedge \gamma)) &\equiv ((\alpha \vee \beta) \wedge (\alpha \vee \gamma)) && \text{distributivity of } \vee \text{ over } \wedge
\end{aligned}
$$

Figure 7.11 Standard logical equivalences. The symbols α, β, and γ stand for arbitrary sentences of propositional logic.

Chapter 7: Logical Agents w/ Wumpus World

- Wumpus World



$P_{x,y}$ is true if there is a pit in $[x, y]$.
$W_{x,y}$ is true if there is a wumpus in $[x, y]$, dead or alive.
$B_{x,y}$ is true if the agent perceives a breeze in $[x, y]$.
$S_{x,y}$ is true if the agent perceives a stench in $[x, y]$.

PROBLEMS!!!

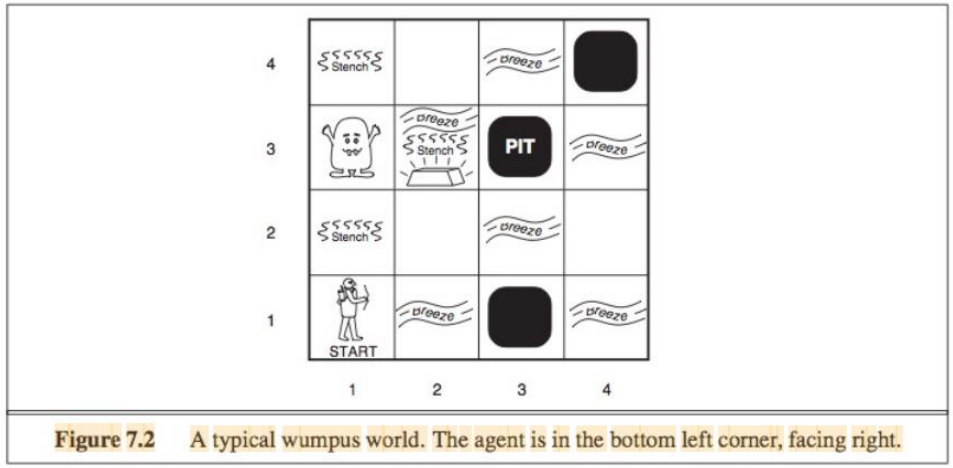
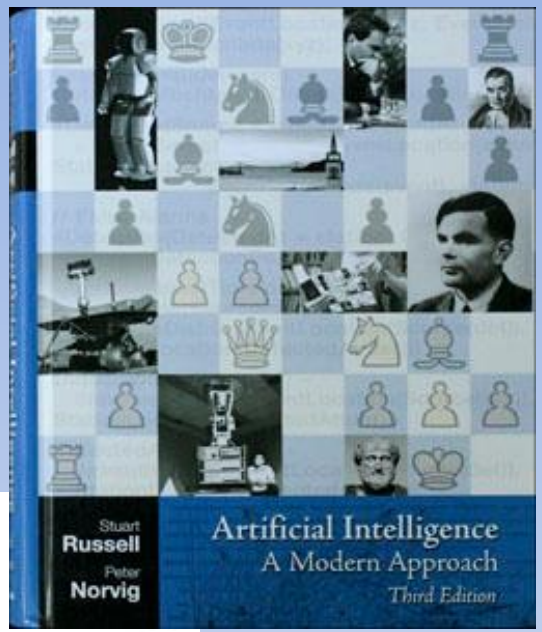


Figure 7.2 A typical wumpus world. The agent is in the bottom left corner, facing right.

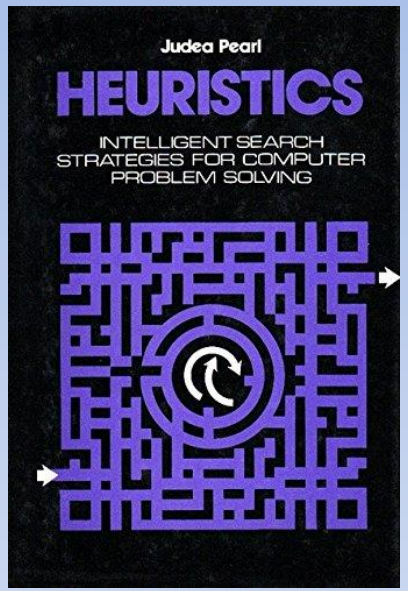
$P_{x,y}$ is true if there is a pit in $[x, y]$.
$W_{x,y}$ is true if there is a wumpus in $[x, y]$, dead or alive.
$B_{x,y}$ is true if the agent perceives a breeze in $[x, y]$.
$S_{x,y}$ is true if the agent perceives a stench in $[x, y]$.

Uncertainty

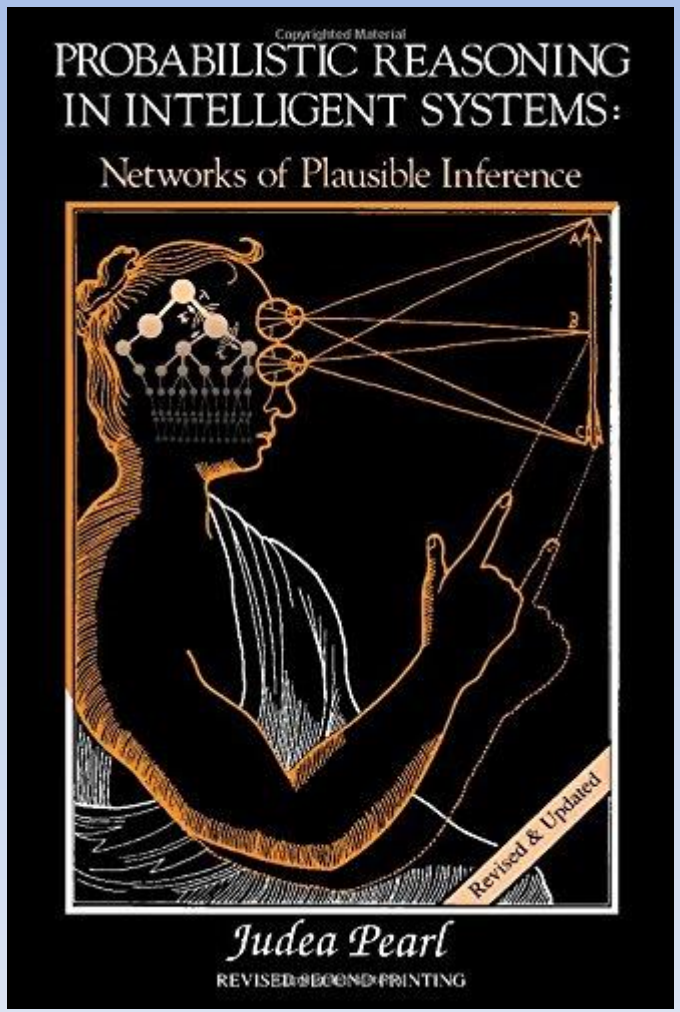
Dealing w/ Uncertainty



Judea Pearl
Heuristics -> Probabilistic Reasoning

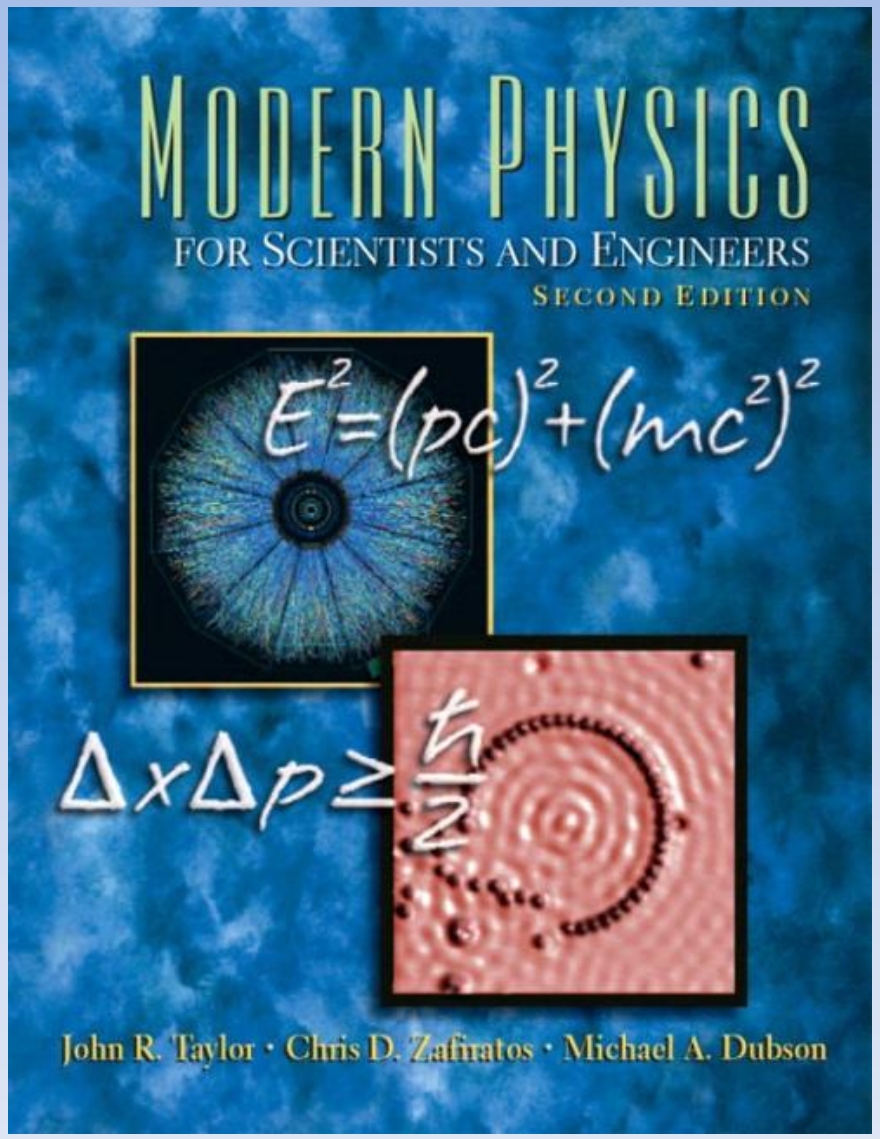


- April 1984



- September 15, 1988

Uncertainty in Science



Classical Mechanics

Probability & Physics

- Albert Einstein
- Quantum mechanics is certainly imposing. But an inner voice tells me that it is not yet the real thing. The theory says a lot, but does not really bring us any closer to the secret of the "old one." **I, at any rate, am convinced that *He* does not throw dice.**
  - Letter to Max Born (4 December 1926); *The Born-Einstein Letters* (translated by Irene Born) (Walker and Company, New York, 1971) ISBN 0-8027-0326-7.
- In a 1943 conversation with William Hermanns recorded in Hermanns' book *Einstein and the Poet*, Einstein said: **"As I have said so many times, God doesn't play dice with the world."** (p. 58).

Uncertainty in Science

Schrödinger's Equation

$$i\hbar \frac{\partial}{\partial t}\psi(\mathbf{r},t) = -\frac{\hbar^2}{2m}\nabla^2\psi(\mathbf{r},t) + V(\mathbf{r},t)\psi(\mathbf{r},t)$$

i is the imaginary number, $\sqrt{-1}$.

$\hbar$ is Planck's constant divided by 2π: 1

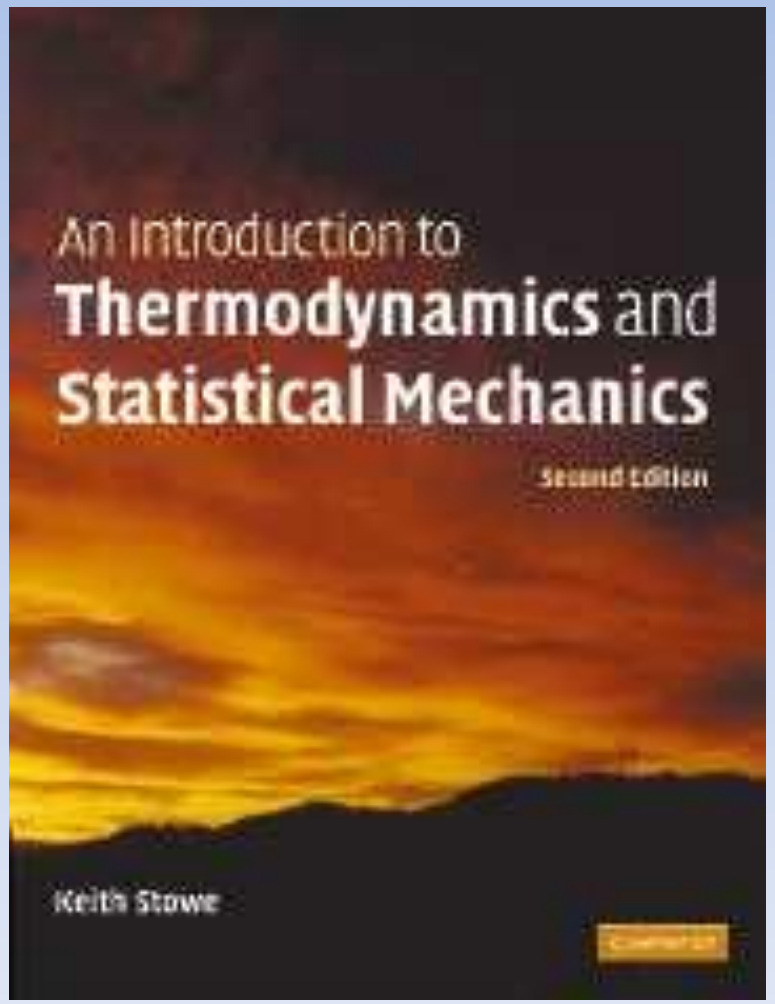
$\psi(\mathbf{r},t)$ is the wave function, defined ov

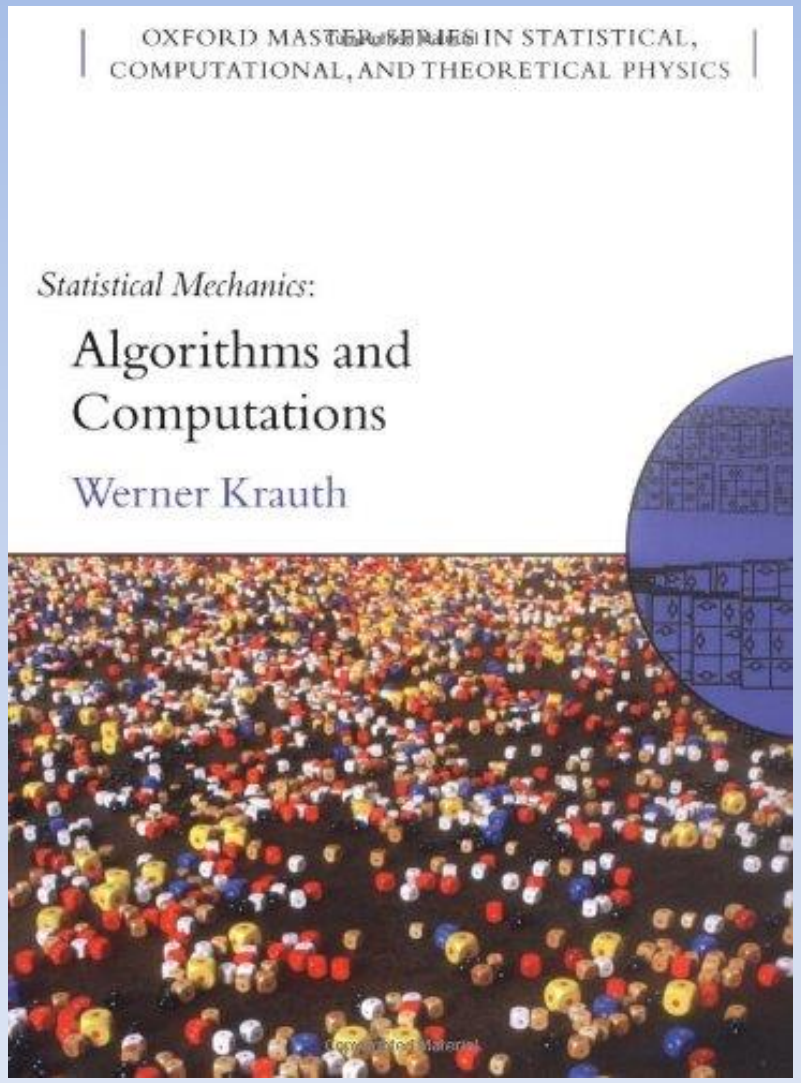
m is the mass of the particle.

∇^2 is the Laplacian operator, $\frac{\partial^2}{\partial x^2} + \frac{\partial}{\partial}$;

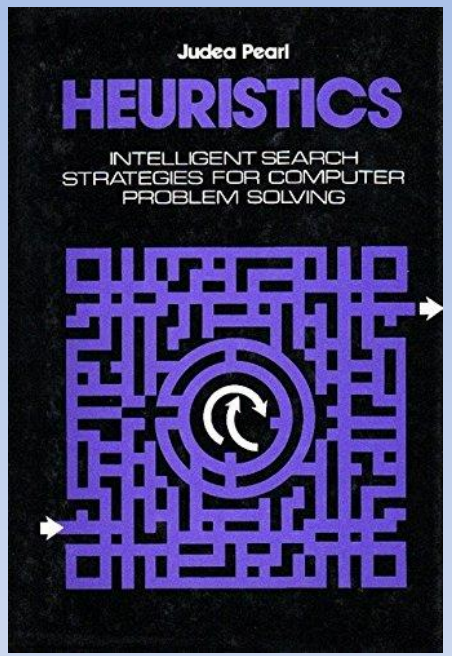
$V(\mathbf{r},t)$ is the potential energy influencin;

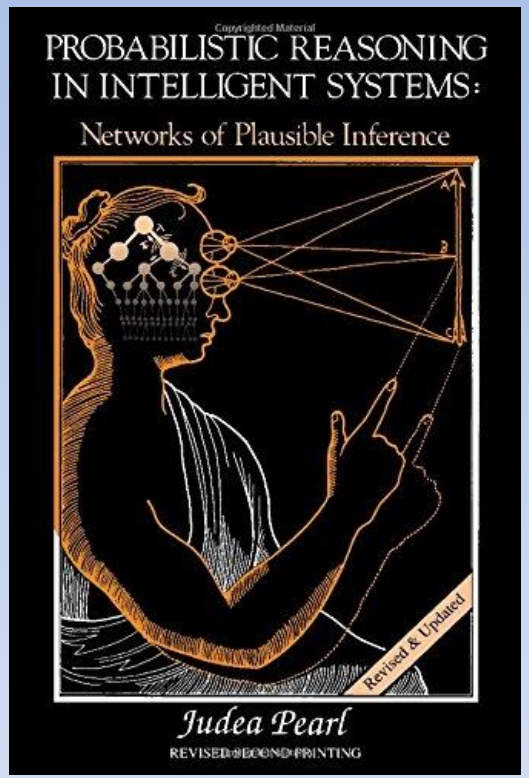
Uncertainty in Science
Classical Mechanics versus Statistical Mechanics

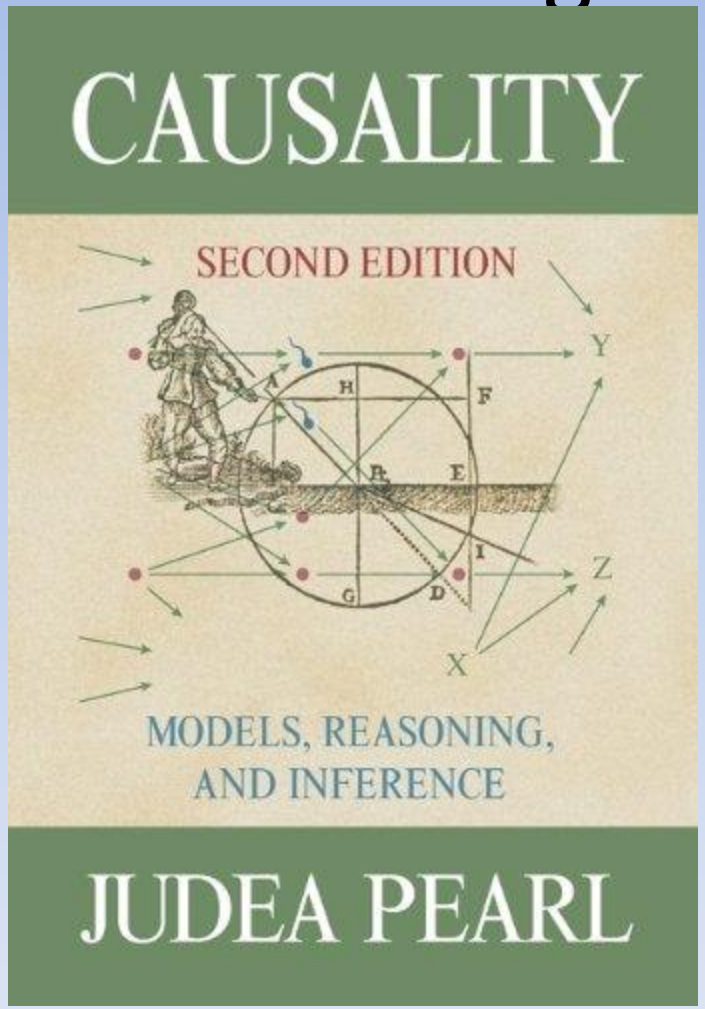




Judea Pearl
Heuristics -> Probabilistic Reasoning







- April 1984
- September 15, 1988
- September 14th, 2009

History of Probability (AI Text)

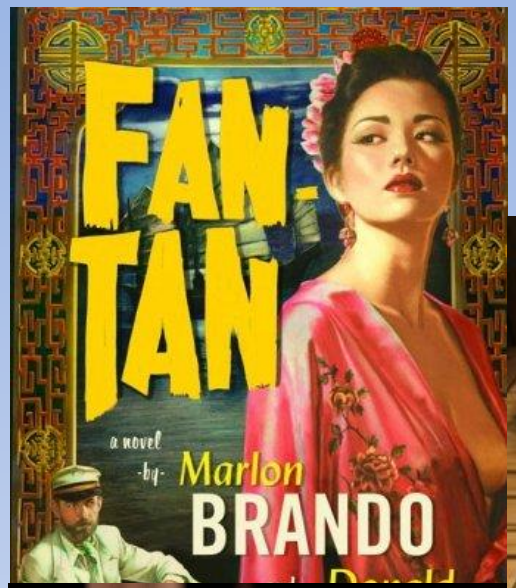
- In about 850 A.D. the Indian mathematician Mahaviracarya described how to arrange a set of bets that can't lose (what we now call a Dutch book).

Mahāvīra (mathematician)

From Wikipedia, the free encyclopedia

Mahāvīra (or **Mahaviracharya**, "Mahavira the Teacher") was a 9th-century Jain mathematician from Mysore, India.[1][2][3] He was the author of *Gaṇitasārasaṅgraha* (or *Ganita Sara Samgraha*, c. 850), which revised the Brāhmasphuṭasiddhānta.[1] He was patronised by the Rashtrakuta king Amoghavarsha.[4] He separated astrology from mathematics. It is the earliest Indian text entirely devoted to mathematics.[5] He expounded on the same subjects on which Aryabhata and Brahmagupta contended, but he expressed them more clearly. His work is a highly syncopated approach to algebra and the emphasis in much of his text is on developing the techniques necessary to solve algebraic problems.[6] He is highly respected among Indian mathematicians, because of his establishment of terminology for concepts such as equilateral, and isosceles triangle; rhombus; circle and semicircle.[7] Mahāvīra's eminence spread in all South India and his books proved inspirational to other mathematicians in Southern India.[8] It was translated into Telugu language by Pavuluri Mallana as *Saar Sangraha Ganitam*.[9]

Uncertainty w/ Gambling Games



Gambling Concepts

- Games of Chance
  - Poker
  - Roulette
  - Fan Tan
- Odds
  - Sports Book
  - Horse Racing

1565 Girolamo Cardano

- In Europe, the first significant systematic analyses were produced by Girolamo Cardano around 1565, although publication was posthumous (1663).

- Gambling Motivated

Meaning and Probability Theory

- 20 to 1 in the 5th
  - What does 20 to 1 Mean?
  - Where does 20 come from?

Joints & Marginals

		Intelligence		
		low	high	
Grade	A	0.07	0.18	0.25
	B	0.28	0.09	
	C	0.35	0.03	
			0.3	1.0

- P(Intelligence=high) = ?

More Problems…

		Intelligence		
		low	high	
Grade	A	0.07	0.18	0.25
	B	0.28	0.09	
	C	0.35	0.03	
			0.3	1.0

- P(Intelligence=high) = ?

INTRACTABILITY

Computational Thinking!!! Algorithms & Data Structures

- Representation
  - Bayesian Networks
- Algorithms
  - Exact Inference
  - Approximate Inference

PLAN
The Bayesian Network (Chapter 14)

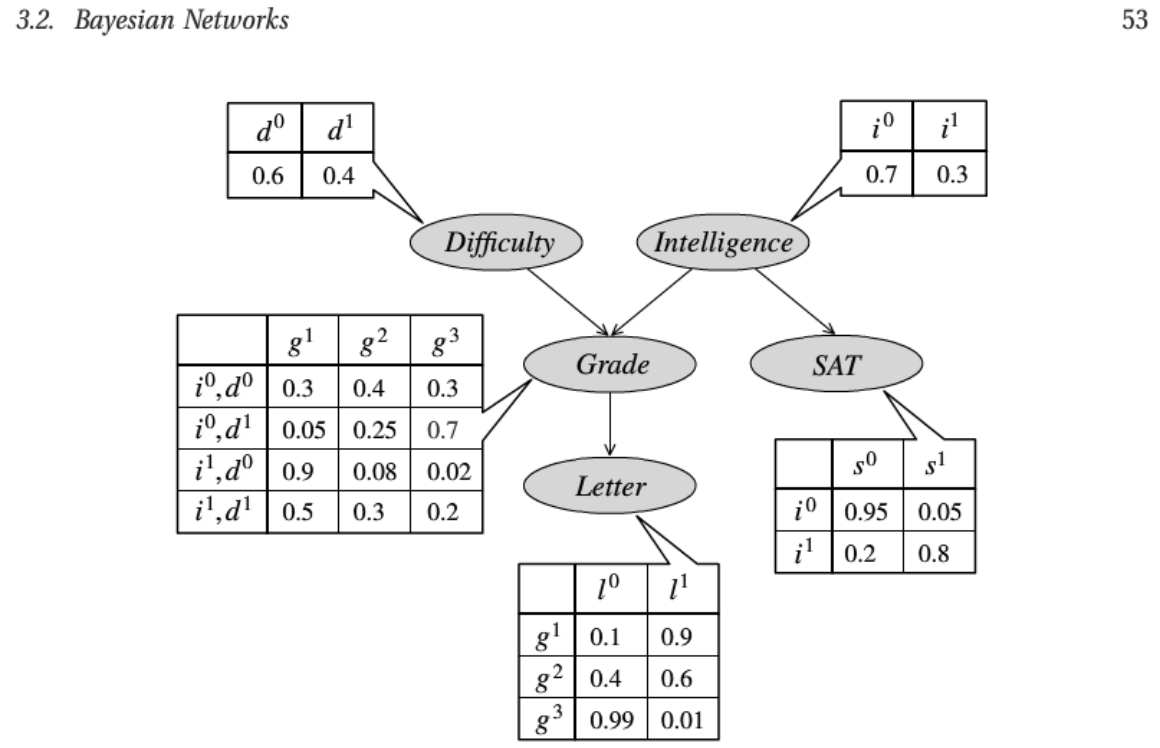
- Exploit Islands of Tractability in High Dimensional Space Probability Distributions
  - Worst Case is Intractable
  - Real World Frequently NOT Worst Case
  - Efficiently Exploit properties in Real World Probability Distributions to induce Tractability

- Primary Tool:

INDEPENDENCE!

Bayesian Networks : (CPD's)

- Each variable is associated with a conditional probability distribution (CPD) that specifies a distribution CPD over the values of X given each possible joint assignment of values to its parents in the model.
- For a node with no parents, the CPD is conditioned on the empty set of variables.



Final

- Chapters 1, 2
- Chapters 3, 5, 6
- Chapter 7
- Chapters 13, 14
- Chapter 18

Grading

Period	Presentations/Examinations/Assignments	Points
Various	Attendance	100
	In-Class	100
	Quizzes	100
	Qwiklabs	200
	Midterm	200
	Final	300