A No Non-sense Introduction to Artificial Intelligence

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Administrative Matters

1. 10 webinars. Each webinar 1 hr. After the webinar you have 15 min to ask questions
2. One homework assignment each week. It is due the following week. Submit your HW to your local instructor
3. Programming knowledge is NOT required. Ability to use computer IS required
4. Learn Excel and use it to do homework/ or Use any programing language
5. I will post the slides on the class website AFTER the webinar
6. You can send questions by email with subject line AI webinars: rvemuri@gmail.com

Outline

1. Pictorial Intro to AI
2. Five AI Challenges & Ten NLP Applications
3. AI Eco System
4. Intelligence from Data
5. Search Engines & Excel Tutorial
6. Clustering with Excel
7. Perceptrons with Excel
8. Use Cases in AI and ML
9. Building Intelligent Machines

A Pictorial Introduction to AI

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Fear: Robots Enslaves Us!

- It is amazing how deeply we are afraid of AI
  - Robots that look like Mr. Arnold Schwarzenegger are going to hunt us down and kill us!
  - Intelligent machines are going to enslave us, as in the movie Matrix
  - They might lock us down for our own protection until Mr. Will Smith convinces one of them

Fear: AI Steals our Jobs

- It is amazing how many ways and how deeply we were afraid of computers in the pre-1960's
  - LIC Story in India
- Robots are going to take all our jobs
- A robot will be the passenger in a self-driving car!

The future looks bleak!

Only thing to fear is *fear* itself

- AI will come into our lives without us really understanding what AI is or what AI does.
- *Not knowing* is what is scary.
- This course is aimed at fixing that.

Definition of AI

- “The science and engineering of making intelligent machines, especially intelligent computer programs” – John McCarthy
- Artificial Intelligence is a way of making a computer, a robot, or a software to “think” intelligently, in a manner analogous to the way intelligent humans think.

How AI is Accomplished?

- AI is accomplished by studying how human brain thinks and how humans learn, decide, and work while trying to solve a problem
- Use the outcomes of this study as a basis of developing intelligent software and systems.

A Tour of AI Applications

Question Answering Systems

Apple's Siri

Speech recognition and language understanding

Question Answering

- IBM's Watson
- Jeopardy! game player in January 2011
  - 4 TB of data analyzed
- Now used as a clinical decision support system, e.g., for lung cancer treatment

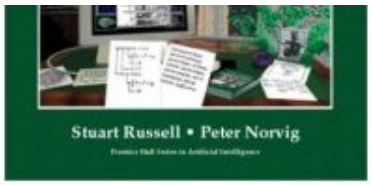
Game Playing: Chess

- IBM's Deep Blue vs. Kasparov, 1997/5
- 6 games: K, D, draw, draw, draw, D
- IBM stock up $18 billion

- Search: two-player zero-sum discrete finite games with perfect information.

Collaborative Filtering

- Recommendations based on other users' behavior
- e.g. Amazon



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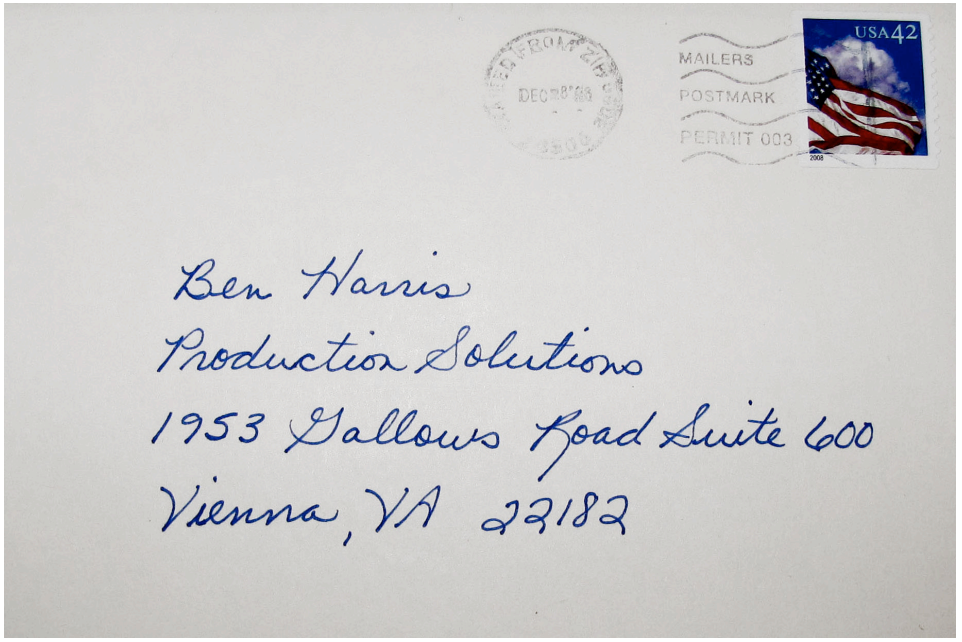
Explore Similar Items: in Books

- e.g. Netflix

- Unsupervised learning

Handwriting Recognition



- When you deposit a check at an ATM, handwriting recognition automatically “reads” the amount
- When you mail a letter, the USPS automatically reads the address and zip code

News Aggregation and Summarization

- Automatically selects, summarizes, and arranges news from multiple sources
  - http://news.google.com

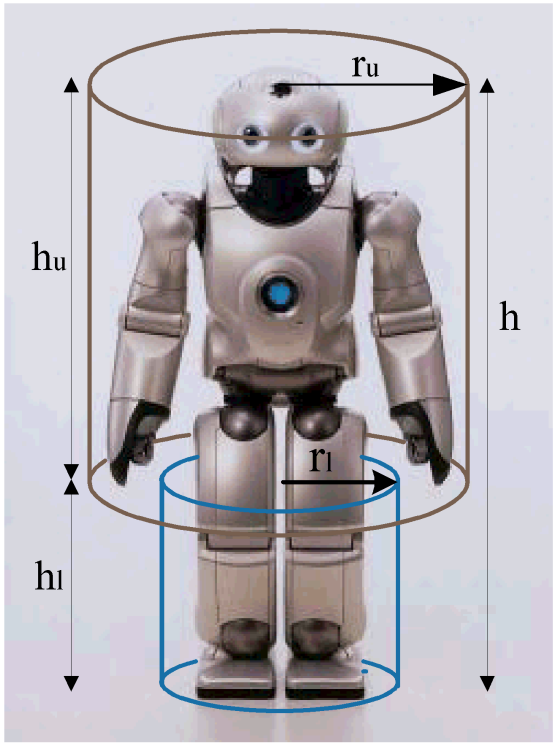
- Unsupervised machine learning: clustering

Flyable Cameras

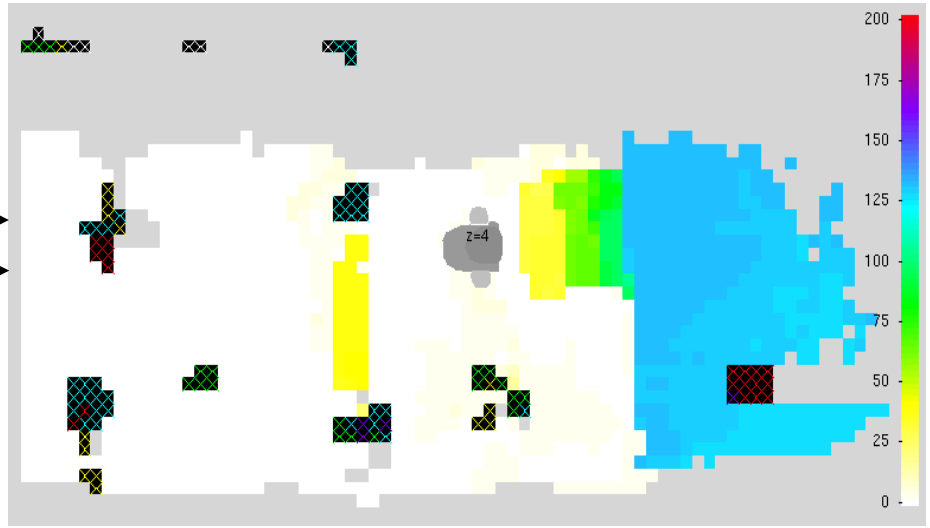
- DJI Phantom 2 Vision Quadcopter
  - $1,200 (January 2014)

Robotics = Intelligent Connection of Perception to Action

Sensor data



Robot brain



Environment

Actions

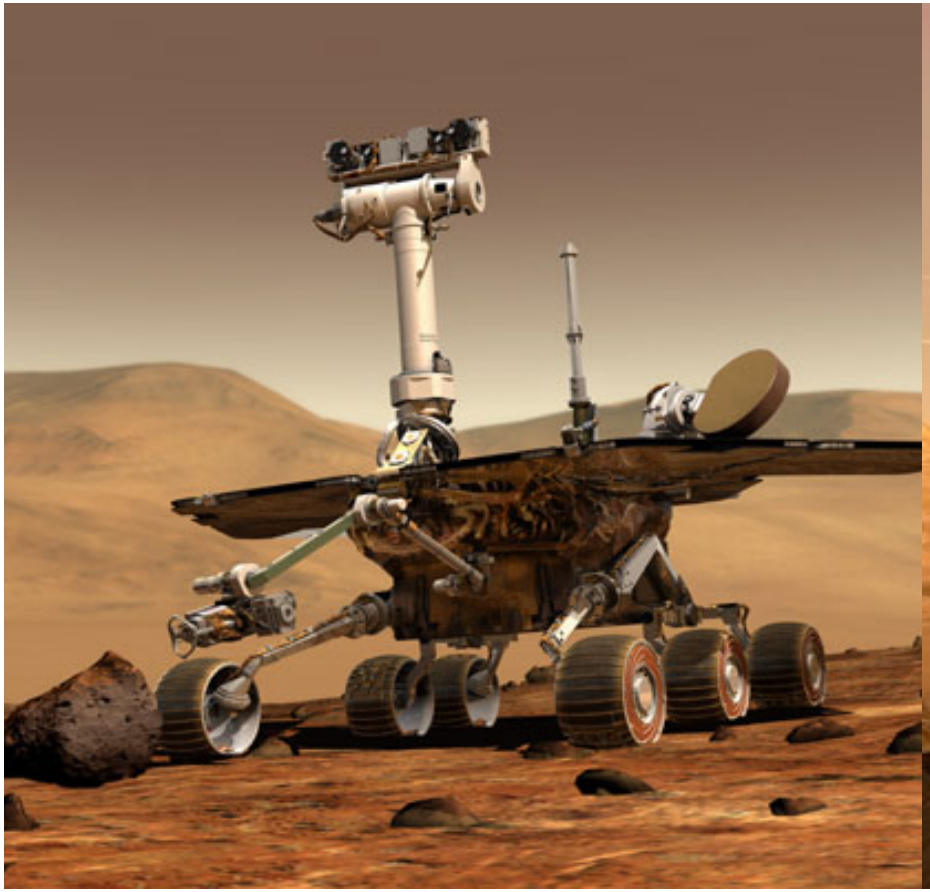
Autonomous Robots

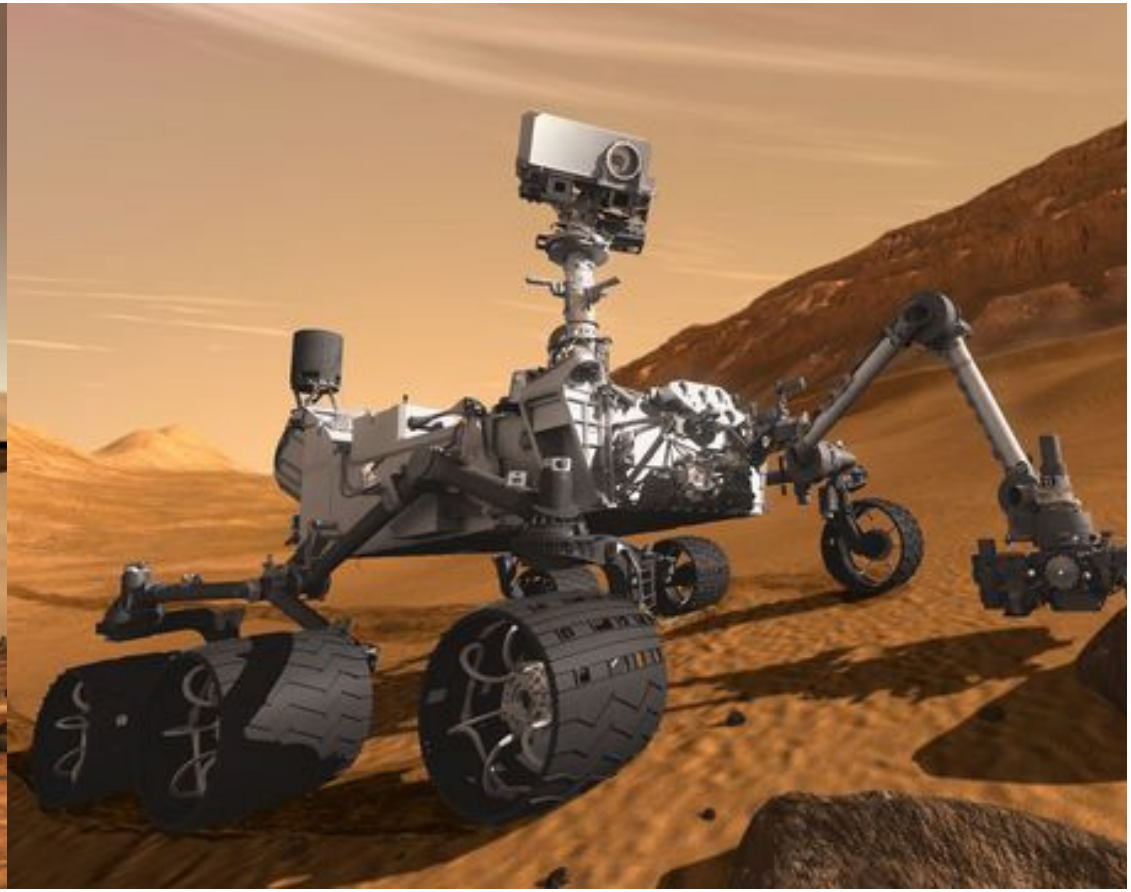
- Key questions in mobile robotics
  - What is around me?
  - Where am I ?
  - Where am I going ?
  - How do I get there ?

- Alternatively, these questions correspond to
  - **Sensor Interpretation**: What objects are in the vicinity?
  - **Position and Localization**: Find your own position on a map and your position on the road
  - **Map building**: How to integrate sensor information and your own movement?
  - **Path planning**: Decide the actions to perform for reaching a target position

Space Exploration Robots

Driving on Mars by Sojourner, Spirit, Opportunity, and Curiosity rovers





Cleaning Robots

- iRobot Roomba robot for vacuuming floors

Roomba demo

Lawn Mowing Robots

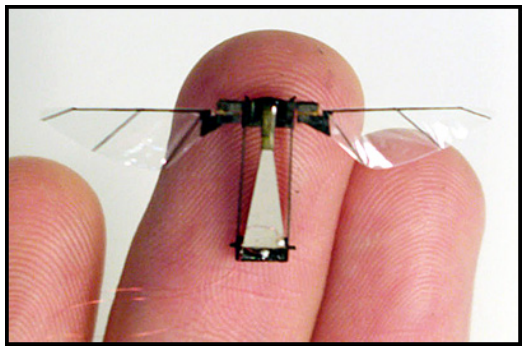
Robomow

Mine Mapping and Rescue Robots

Physical Assistants:
Robots to Help the Elderly and Impaired

Driverless Vehicles

Cars, airplanes, helicopters, birds, insects



Driverless Cars

What's Needed?

- Car Information
  - Position and orientation of car, velocity and turning rate of car
- Environment Information
  - Where is the road, curb, road signs, stop signs, other vehicles, pedestrians, bicyclists, …
- Actions
  - Velocity, steering direction, braking, …
- Sensors
  - Video cameras, radar, LIDAR, GPS, …

Driverless Car Task Characteristics

- Fully or partially observable?
  - Partially observable
- Deterministic or stochastic?
  - Stochastic (Random)
- Static or dynamic?
  - Dynamic (Changing with time)
- Discrete or continuous?
  - Continuous
- Single or multi-agent?
  - Multi-agent (many cooperating systems)

Sensors

- Video cameras
- LIDAR (depth/range) sensor
  - times how long it takes a beam of laser light to bounce off something
  - gives 3D info on environment to 5 cm accuracy
- Radar sensors on front and rear
- Position sensor on wheel
- GPS
- Inertial motion sensor (IMU)
- Position and orientation of vehicle updated in real-time with 50 cm position accuracy and 1/50 degree orientation accuracy

Strong AI

- Computers can achieve consciousness.
  - It is possible for machines to become self-aware, but they may or may not exhibit human-like thought processes. The computer is not merely a tool in the study of the mind; rather, an appropriately programmed computer really is a mind.
  - Example: HAL of 2001 Space Odyssey
  - The attempt to build robots of intelligence equaling that of humans
  - Example: Lieutenant Commander Data from Star Trek.

Weak AI

- Not as ambitious as strong AI
  - The use of software to accomplish specific problem solving or reasoning tasks that do not encompass the full range of human cognitive abilities.
  - Example: Chess program such as IBM's Deep Blue
  - Example: IBM's Watson that played the TV Game Jeopardy!

Progress in AI: 1956 – 2010

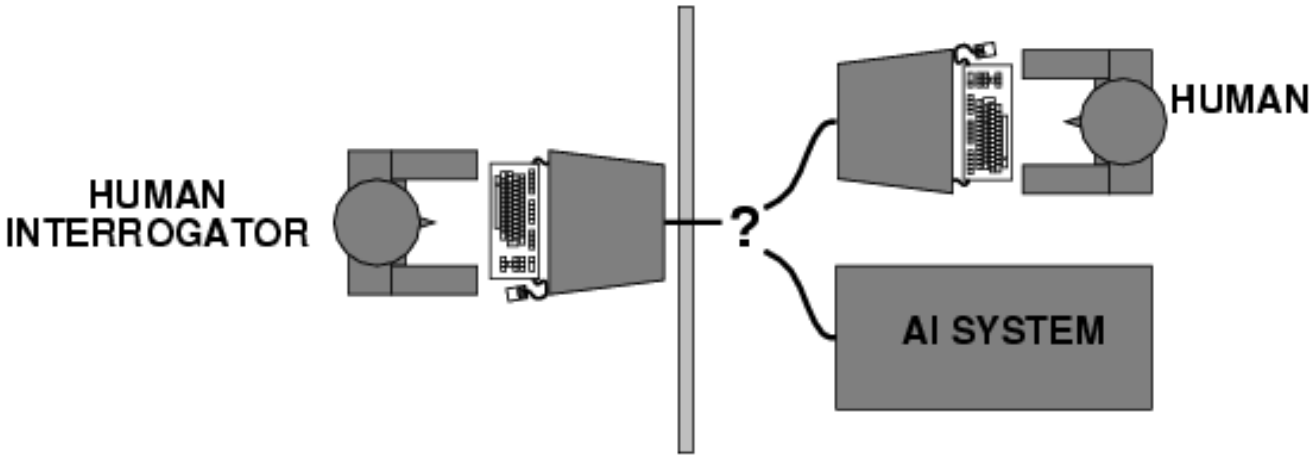
Human-Level Chess

Human-Level Dialogue

Human-Level Perception

The Turing Test

- A. Turing, “Computing machinery and intelligence,” 1950
- Can machines think? → Can we tell if a conversation is by a machine and not a human?
- text in, text out
- Operational test for intelligent behavior: aka the **Imitation Game**



- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
- Suggested major components of AI: knowledge rep., reasoning, natural language processing, learning

Homework 1A

- Look around you and identify two problem of practical interest where you think AI will play a useful role. Just like we did for the Driverless Car, make a list of sensors, actions required and a description of the environment. Is the environment fully observable? Dynamic or static? Deterministic or stochastic? Discrete or continuous? Single or multi-agent?

Homework 1B

- (a) List the names of three search engines.
- (b) What is the default search engine in your browser?
- (c) Search for Tycho Brahe in each of the search engines and discuss what you found

Homework 1C

(You need not submit your answer)

- Open Excel Spread sheet. Do you know how to use it? If not, search for a Beginner's guide to Excel Spreadsheet and study it to do some basic operations. I have prepared a brief ppt tutorial; it is available on the class website. Start there. If you develop skill using Excel, you can solve a lot of problems without programming skills.

That’s All!