

CS 414

ARTIFICIAL INTELLIGENCE

LECTURE 01

CS 512 ARTIFICIAL INTELLIGENCE

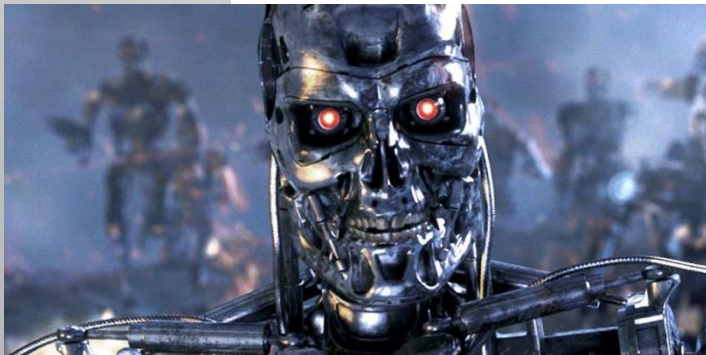
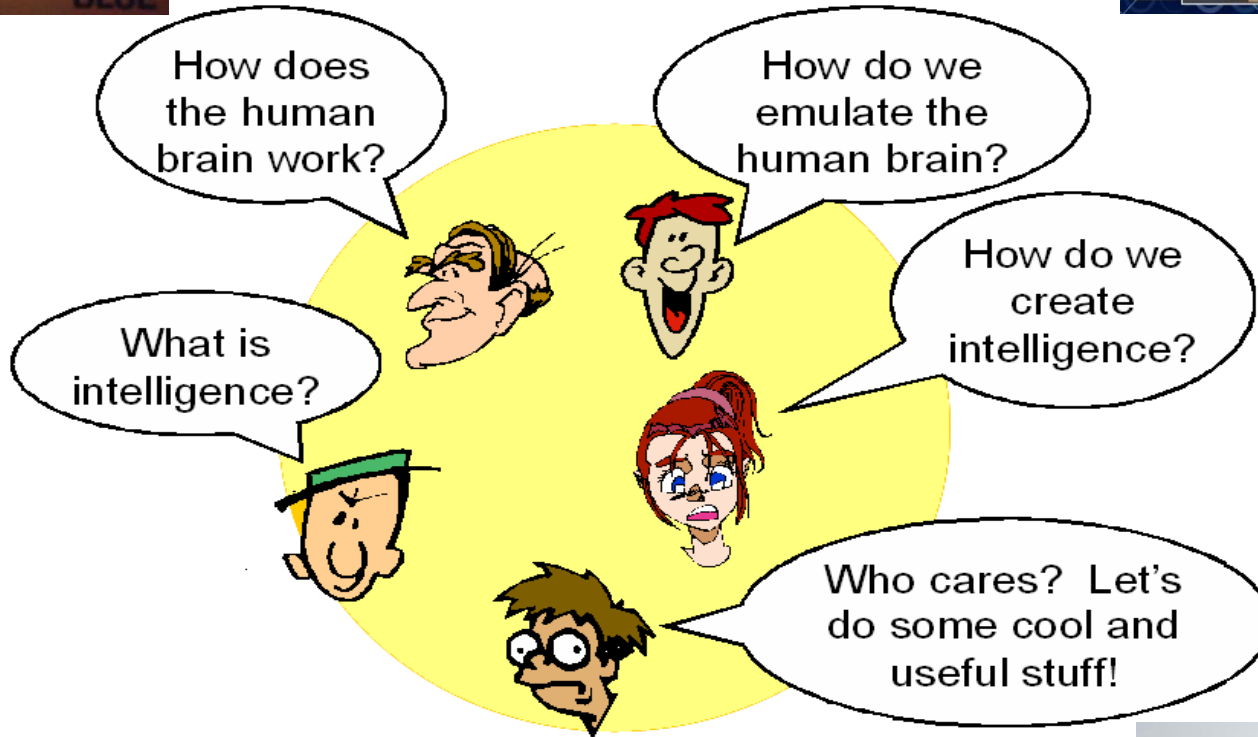
Instructor : Somchai Thangsathityangkul

You can download lecture note at

<http://kbucomsci.weebly.com/>

Class Presence	10%
Quiz	10%
Project	20%
Midterm	20%
Final	40%
Total	100%

WHAT IS AI ?



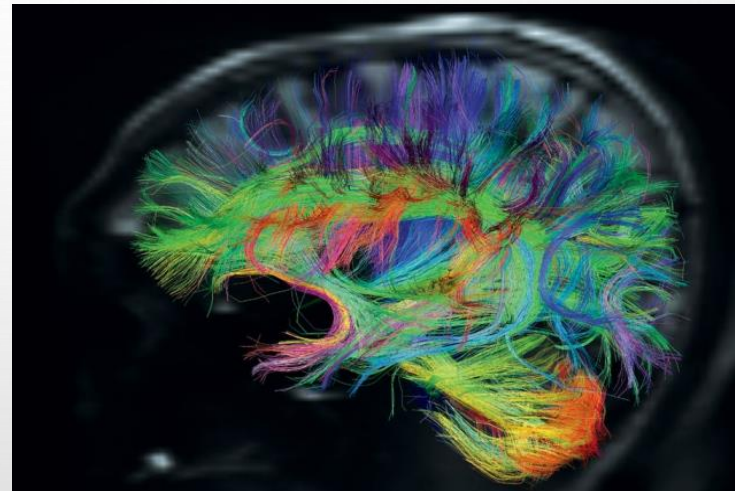
WHAT IS AI?

Views of AI fall into four categories



THINKING HUMANLY

- NEED TO STUDY THE BRAIN AS AN INFORMATION PROCESSING MACHINE: COGNITIVE SCIENCE AND NEUROSCIENCE
- REQUIRES SCIENTIFIC THEORIES OF INTERNAL ACTIVITIES OF THE BRAIN

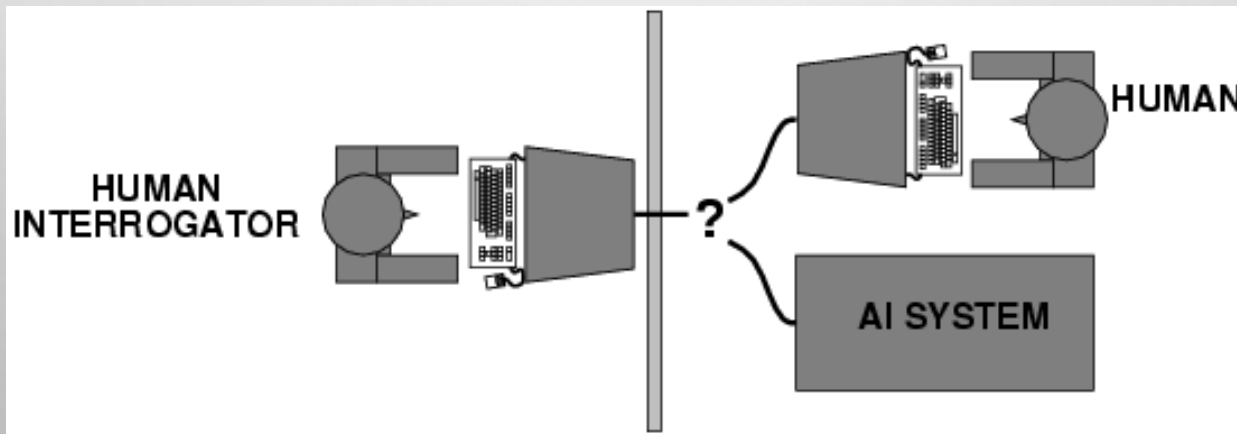


- BIG QUESTION : CAN WE BUILD A BRAIN ?

ACTING HUMANLY



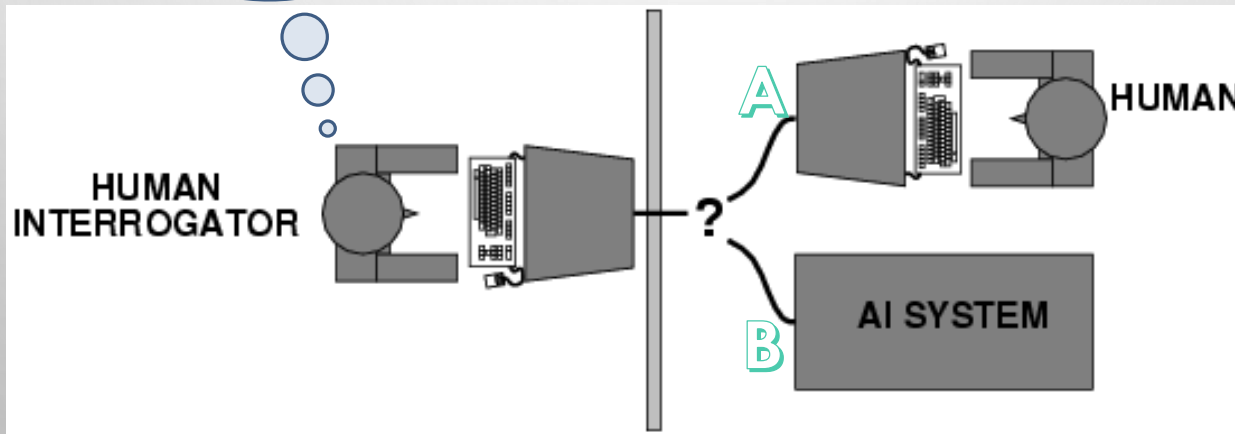
- THE TURING TEST
- A. TURING, “COMPUTING MACHINERY AND INTELLIGENCE,” 1950
- CAN MACHINES THINK? → CAN WE TELL IF A CONVERSATION IS BY A MACHINE AND NOT A HUMAN?
- TEXT IN, TEXT OUT
- OPERATIONAL TEST FOR INTELLIGENT BEHAVIOR: **THE IMITATION GAME**



ACTING HUMANLY

- THE TURING TEST: ULTIMATE TEST FOR ACTING HUMANLY
 - COMPUTER AND HUMAN BOTH INTERROGATED BY JUDGE
 - COMPUTER PASSES TEST IF JUDGE CAN'T TELL THE DIFFERENCE

A or B is a human ?

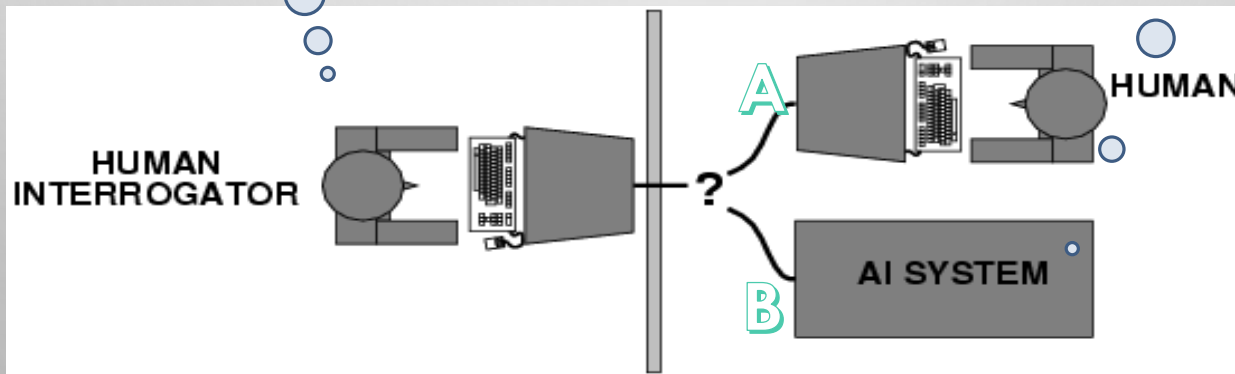


ACTING HUMANLY

- THE TURING TEST: ULTIMATE TEST FOR ACTING HUMANLY
- REQUIRES:
 - NATURAL LANGUAGE
 - KNOWLEDGE REPRESENTATION
 - AUTOMATED REASONING
 - MACHINE LEARNING

A or B is a human ?

How are you today?



ACTING HUMANLY

- THE LOEBNER PRIZE FOR ARTIFICIAL INTELLIGENCE IS THE FIRST FORMAL INSTANTIATION OF A [TURING TEST](#).
- 2008 COMPETITION: EACH OF 12 JUDGES WAS GIVEN FIVE MINUTES TO CONDUCT SIMULTANEOUS, SPLIT-SCREEN CONVERSATIONS WITH TWO HIDDEN ENTITIES (HUMAN AND CHATTERBOT). THE WINNER, ELBOT OF ARTIFICIAL SOLUTIONS, MANAGED TO FOOL THREE OF THE JUDGES INTO BELIEVING IT WAS HUMAN [[WIKIPEDIA](#)].



THINKING RATIONALLY

- IDEALIZED OR “RIGHT” WAY OF THINKING
- **LOGIC:** PATTERNS OF ARGUMENT THAT ALWAYS YIELD CORRECT CONCLUSIONS WHEN SUPPLIED WITH CORRECT PREMISES
 - “SOCRATES IS A MAN; ALL MEN ARE MORTAL; THEREFORE SOCRATES IS MORTAL.”
- **LOGICIST APPROACH TO AI:** DESCRIBE PROBLEM IN FORMAL LOGICAL NOTATION AND APPLY GENERAL DEDUCTION PROCEDURES TO SOLVE IT
- PROBLEMS WITH THE LOGICIST APPROACH
 - COMPUTATIONAL COMPLEXITY OF FINDING THE SOLUTION
 - DESCRIBING REAL-WORLD PROBLEMS AND KNOWLEDGE IN LOGICAL NOTATION
 - DEALING WITH UNCERTAINTY
 - A LOT OF “RATIONAL” BEHAVIOR HAS NOTHING TO DO WITH LOGIC¹⁰

ACTING RATIONALLY

- REQUIRE : RATIONAL AGENT
- AGENT: SOMETHING THAT ACTS
 - AGENTS ARE NOT MERELY “PROGRAM”
- **RATIONAL** BEHAVIOR: DOING THE RIGHT THING
 - THE RIGHT THING: THAT WHICH IS EXPECTED TO MAXIMIZE GOAL ACHIEVEMENT, GIVEN THE AVAILABLE INFORMATION.
- DOESN'T NECESSARILY INVOLVE THINKING – E.G., BLINKING REFLEX – BUT THINKING SHOULD BE IN THE SERVICE OF RATIONAL ACTION
- TWO ADVANTAGES: MORE GENERAL THAN “THINKING RATIONALLY”, BETTER THAN HUMAN STANDARDS

WHAT IS AI ?

- ARTIFICIAL INTELLIGENCE IS THE SYNTHESIS AND ANALYSIS OF COMPUTATIONAL AGENTS THAT ACT INTELLIGENTLY.
- AN AGENT IS SOMETHING THAT ACTS IN AN ENVIRONMENT.
- AN AGENT ACTS INTELLIGENTLY IF:
 - ITS ACTIONS ARE APPROPRIATE FOR ITS GOALS AND CIRCUMSTANCES.
 - IT IS FLEXIBLE TO CHANGING ENVIRONMENTS AND GOALS.
 - IT LEARNS FROM EXPERIENCE.
 - IT MAKES APPROPRIATE CHOICES GIVEN PERCEPTUAL AND COMPUTATIONAL LIMITATIONS.

DIFFERENT VIEWS OF AI

- PHILOSOPHY, ETHICS, RELIGION
 - WHAT IS INTELLIGENCE?
- COGNITIVE SCIENCE, NEUROSCIENCE, PSYCHOLOGY, LINGUISTICS
 - UNDERSTAND NATURAL FORMS OF INTELLIGENCE . LEARN PRINCIPLES OF INTELLIGENT BEHAVIOR
- MATHEMATICS
 - ARE THERE FUNDAMENTAL LAWS OF INTELLIGENCE?
- ENGINEERING
 - CAN WE BUILD INTELLIGENT DEVICES AND SYSTEMS?
 - AUTONOMOUS AND SEMI-AUTONOMOUS SYSTEMS FOR REPLICATING HUMAN CAPABILITIES, ENHANCING HUMAN CAPABILITIES, IMPROVING TASK PERFORMANCE, ETC.

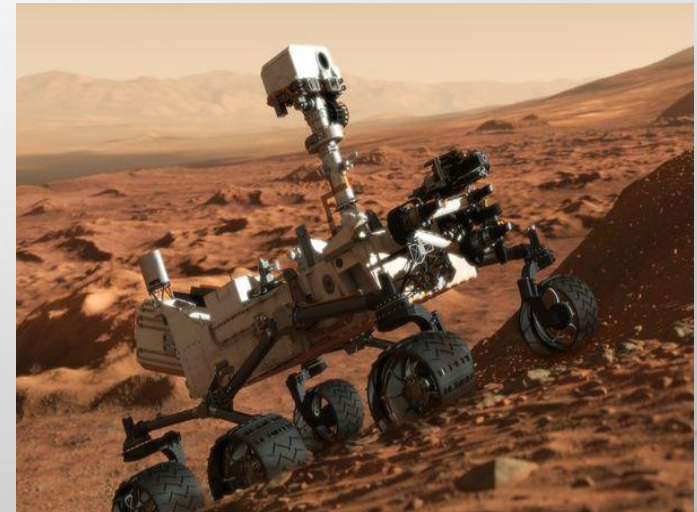


AGENTS



SOFTWARE THAT GATHERS INFORMATION ABOUT AN ENVIRONMENT AND TAKES ACTIONS BASED ON THAT INFORMATION.

- A ROBOT
- A WEB SHOPPING PROGRAM
- ADVISING SYSTEMS
- A TRAFFIC CONTROL SYSTEM
- MARS ROVER ...



NATURAL LANGUAGE UNDERSTANDING: CHATBOTS



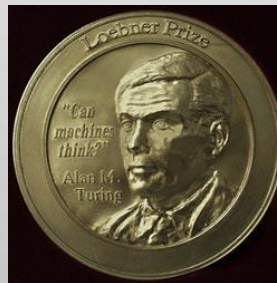
Valerie

ALICE: 2004 Loebner Prize winner

ELIZA: psychotherapist

Valerie: CMU Robot Receptionist

Natural language processing,
pattern matching



Loebner Prize gold medal,
awarded annually to best AI
program

QUESTION ANSWERING SYSTEMS

APPLE SIRI



SPEECH RECOGNITION AND LANGUAGE UNDERSTANDING

QUESTION ANSWERING

- IBM 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 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.

GAME PLAYING: ALPHAGO

- **ALPHAGO** IS A COMPUTER PROGRAM DEVELOPED BY [GOOGLE DEEPMIND](#) IN LONDON TO PLAY THE BOARD GAME [GO](#), 2014.



- IN OCTOBER 2015, THE ALPHAGO DEFEATED THE EUROPEAN [GO](#) CHAMPION [FAN HUI](#), A [2-DAN](#) PROFESSIONAL, FIVE TO ZERO. THIS WAS THE FIRST TIME A COMPUTER GO PROGRAM HAD BEATEN A PROFESSIONAL HUMAN PLAYER ON A FULL-SIZED BOARD WITHOUT HANDICAP.

GAME PLAYING: ALPHAGO

- IN MARCH 2016, IT BEAT [LEE SEDOL](#) 4-1 IN [A FIVE-GAME MATCH](#), THE FIRST TIME A COMPUTER GO PROGRAM HAS BEATEN A [9-DAN](#) PROFESSIONAL WITHOUT HANDICAPS.



NAVIGATION

- GOGGLE MAPS, BING MAPS, MAPQUEST
- FEDEX, UPS TO PLAN PACKAGE DELIVERY

The screenshot shows a web browser window with Google Maps. The address bar indicates the route from 1210 W Dayton St, Madison, WI 53706 to State St, Madison, WI 53703. The map displays a blue route starting at the start address, heading east on W Dayton St, then turning left at N Frances St, right at W Gilman St, right at N Heeny St, and finally right at W Gorham St. The right sidebar provides details for the route, including the start and end addresses, distance (1.2 mi), and a list of five steps for the directions.

Google Maps - from: 1210 W Dayton St, Madison, WI 53706 to: State St, Madison, WI 53703 - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

Google Maps 2017

Maps Local Search Directions

1210 W Dayton St, Madison, WI 53706 Start address

State St, Madison, WI 53703 End address

Search Help

Maps

Map Satellite

Print Email Link to this page

Start address: 1210 W Dayton St
Madison, WI 53706

End address: State St
Madison, WI 53703

Distance: 1.2 mi (about 2 mins)

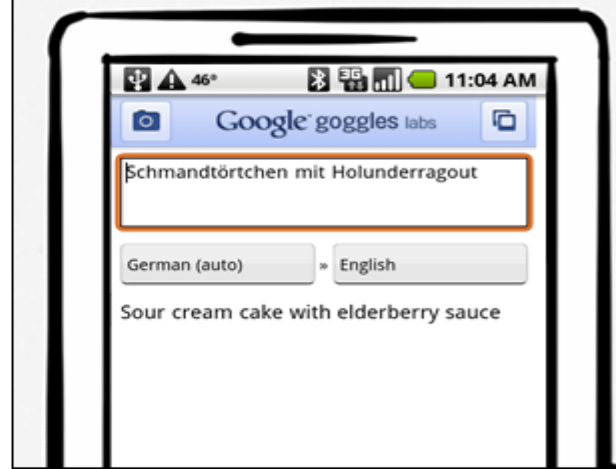
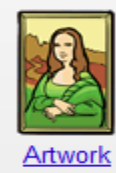
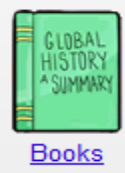
Reverse directions

- 1 Head east from W Dayton St - go 0.5 mi
- 2 Turn left at N Frances St - go 0.2 mi
- 3 Turn right at W Gilman St - go 0.3 mi
- 4 Turn right at N Heeny St - go 0.1 mi
- 5 Turn right at W Gorham St - go 0.1 mi

These directions are for planning purposes only. You may find that construction projects, traffic, or other events may cause road conditions to differ from the map results.

Map data ©2005 NAVTEQ™, Tele Atlas

VISUAL SEARCH: GOOGLE GOGGLES



HANDWRITING RECOGNITION

John Doe
123 Main St
Anywhere US 10111

Date 01/01/200

PAY TO THE
ORDER OF

The Sandwich Shop

\$ 8,150

Eight and 15/100

DOLLARS

Your Bank
456 Main St
Anywhere US 10111

MEMO Lunch with friends

John Doe

⑆ 123456789 ⑆

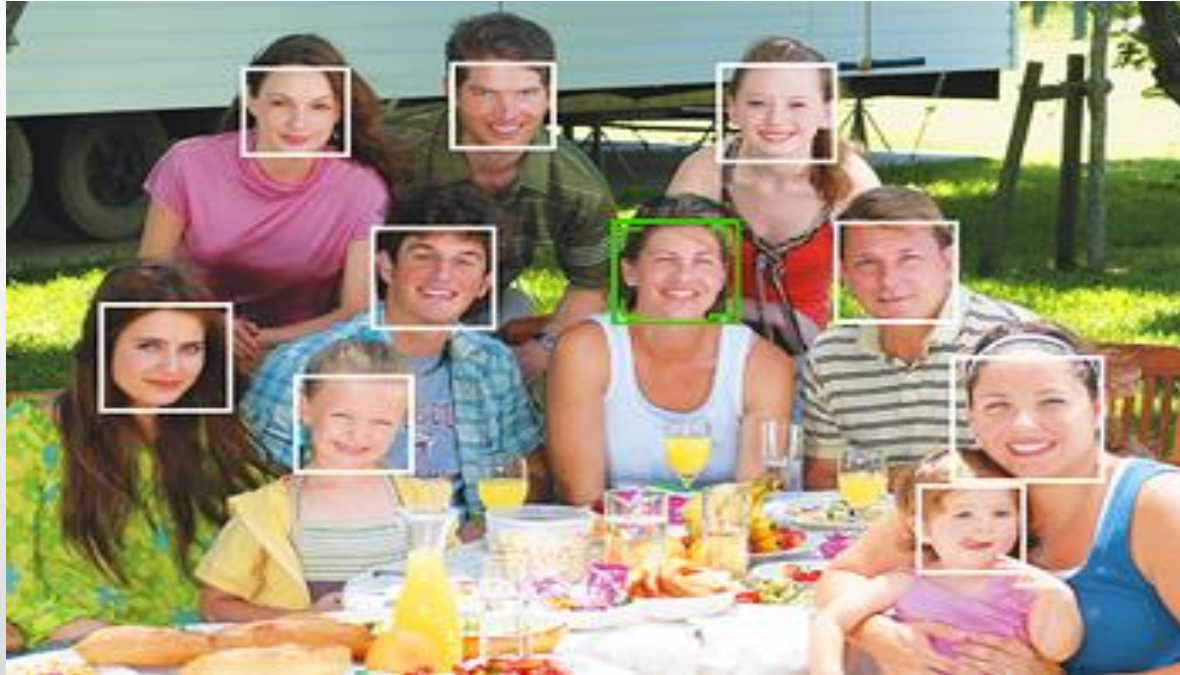
⑆001001234⑆

0790

About.com

- WHEN YOU DEPOSIT A CHECK AT AN ATM, HANDWRITING RECOGNITION IS EMPLOYED TO AUTOMATICALLY FIGURE OUT THE DEPOSIT AMOUNT.

FACE DETECTION



- WHEN YOU TAKE A PICTURE, FACE DETECTION IS EMPLOYED TO IDENTIFY FACES AND PERFORM AUTO-FOCUS OR AUTO-TAGGING.

MACHINE TRANSLATION

+You Search Images Maps Play YouTube News Gmail Drive Calendar More ▾

Google SIGN IN

Translate From: French - detected To: English Translate

English Spanish French **French - detected** English Spanish Arabic

Le premier ministre a lancé une autre piste – sans l'expliquer et beaucoup des experts présents à la conférence environnementale n'ont pu le faire - : la mobilisation d'une partie des gains financiers perçus sur le parc nucléaire français. "Pendant toute la durée de vie restante de nos centrales, et tout en assurant une sécurité maximale, a déclaré Jean-Marc Ayrault, notre parc nucléaire sera mis à contribution sans rupture d'approvisionnement".

The Prime Minister has launched another track - without explaining and many experts at the environmental conference could not do -: the mobilization of some of the financial gains earned on the French nuclear fleet. "Throughout the remaining life of our plants, and while ensuring maximum security, said Jean-Marc Ayrault, our nuclear fleet will be involved without supply disruption."

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AI TODAY: ROBOTICS: HUMANOID

- Bipedal, human-like walking



Asimo (Honda)



QRIO (Sony)

ROBOCUP TOURNAMENT



AI TODAY: ROBOTICS: MARS ROVERS

- **AUTONOMOUS DRIVING ON MARS (PART TIME)**
- **ROBOT MOTION PLANNING**



CAPTCHA

- COMPLETELY AUTOMATED PUBLIC IURING TEST TO TELL COMPUTERS AND HUMANS APART = CAPTCHA
- A CAPTCHA IS A PROGRAM THAT CAN GENERATE AND GRADE TESTS THAT MOST HUMANS CAN PASS, BUT CURRENT COMPUTER PROGRAMS CAN'T PASS.
- DEVELOPED BY CARNEGIE MELLON SCHOOL OF COMPUTER SCIENCE

CAPTCHA

- The “anti-Turing test”
- Tell human and machines apart, **automatically**
 - Deny spam-bots free email registration
 - Protect online poll from vote-bots
- By asking an “AI-complete” question

Random string

oamg



Distorted image



What do you see?

- Also audio Captcha, e.g. superimposed speakers
- <http://www.captcha.net/>

CAPTCHA



Choose a word that relates to all the images.



TIP: You can type the first letter of a word and then use the down arrow to find it.

Submit

CAPTCHA



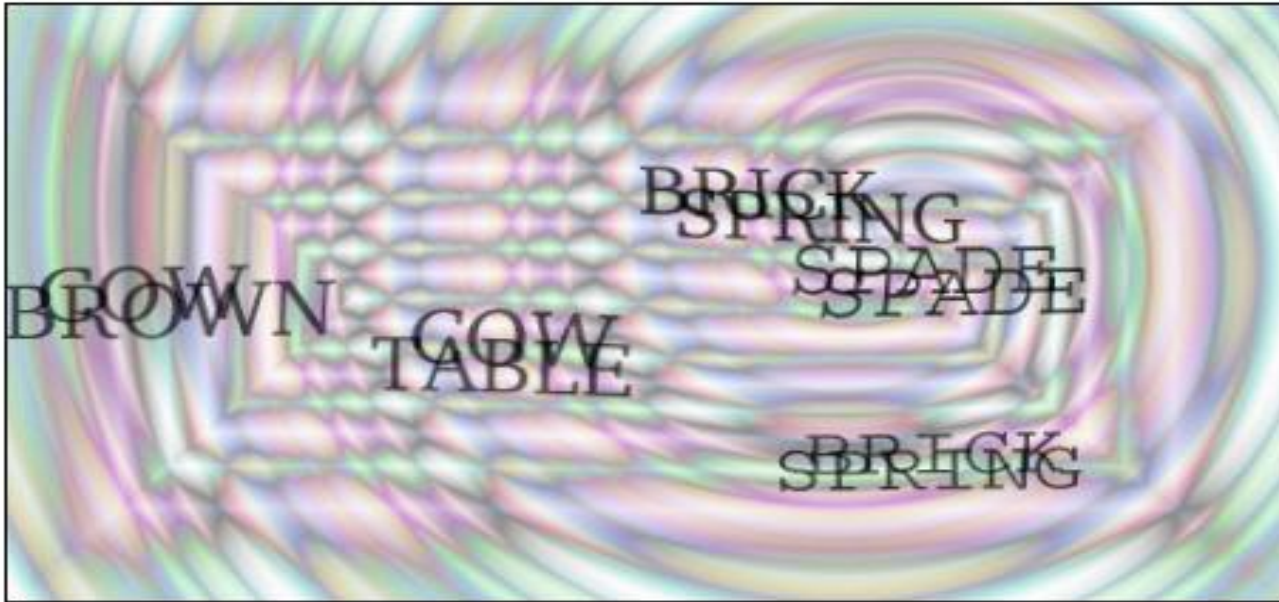
Answer:

sail

(You **passed** the test)

Take another test

CAPTCHA



In the spaces below, type three (3) different English words appearing in the picture above.

Submit

DRIVERLESS VEHICLES

CARS, AIRPLANES, HELICOPTERS, BIRDS,
INSECTS

