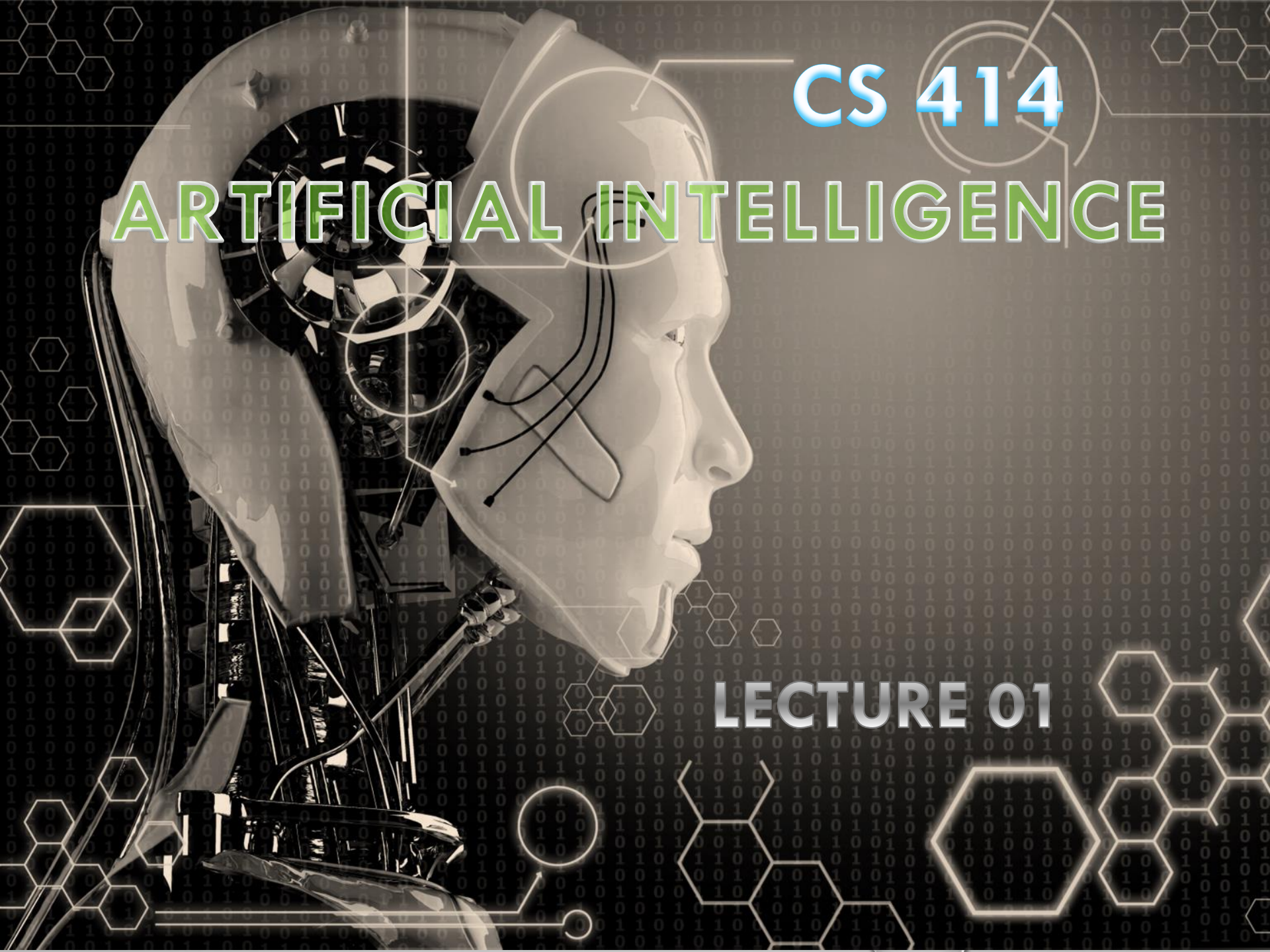

CS 414
ARTIFICIAL INTELLIGENCE
LECTURE 01

CS 512 ARTIFICIAL INTELLIGENCE

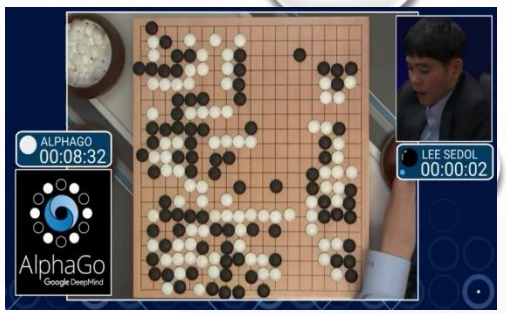
Instructor : Somchai Thangsathityangkul

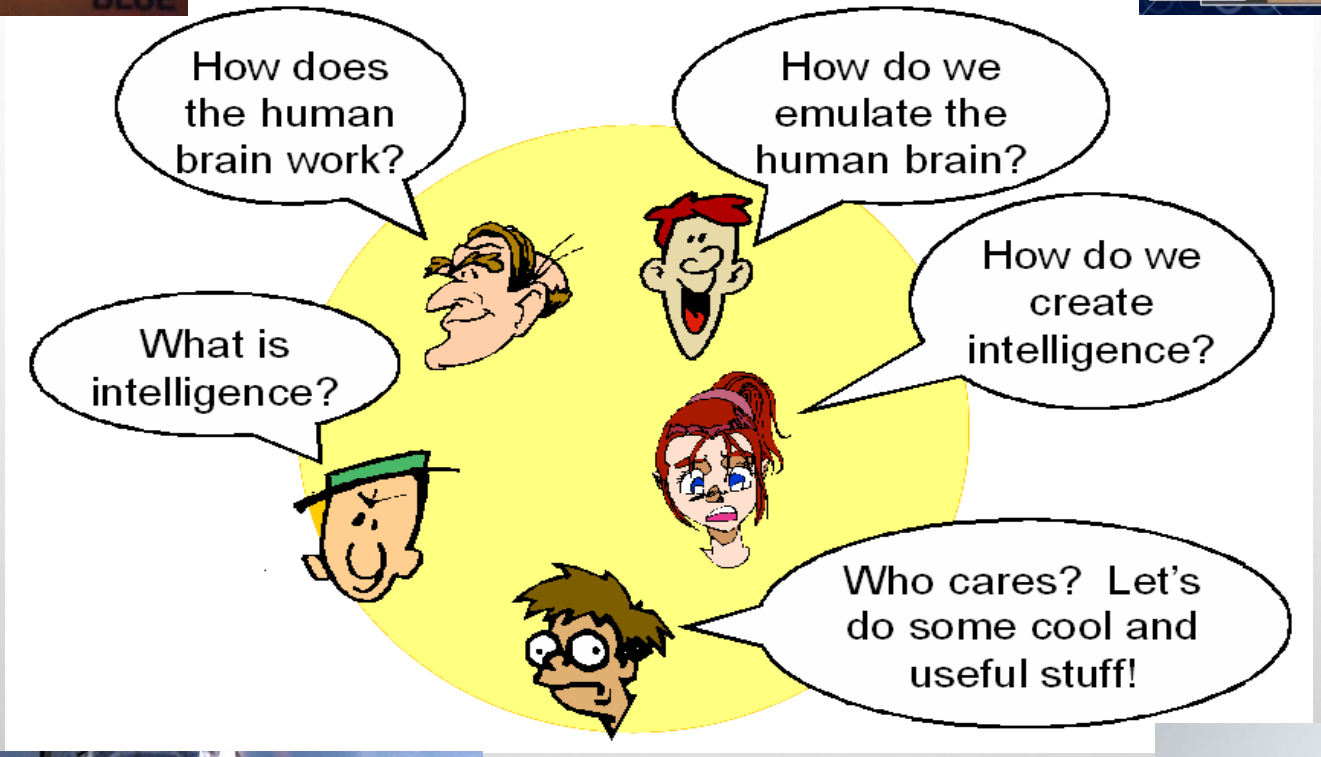
You can download lecture note at
http://kbucomsci.weebly.com/

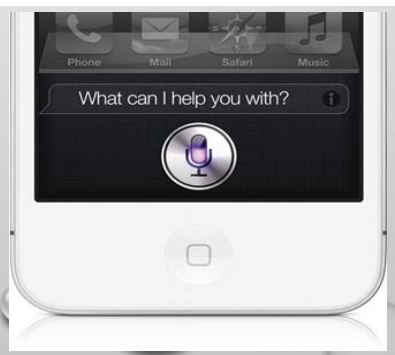
Class Presence	10%
Quiz	10%
Project	20%
Midterm	20%
Final	40%
Total	100%

WHAT IS AI ?


DEEP
BLUE


ALPHAGO
00:08:32
LEE SEDOL
00:00:02
AlphaGo


How does the human brain work?
How do we emulate the human brain?
How do we create intelligence?
What is intelligence?
Who cares? Let's do some cool and useful stuff!

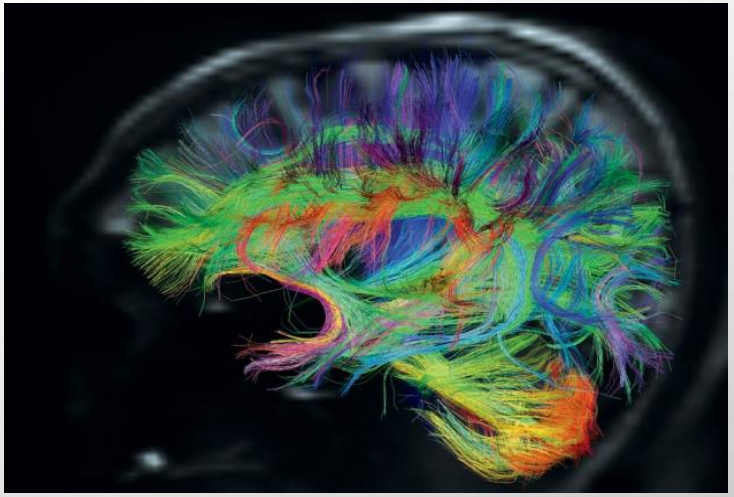

Phone
Mail
Safari
Music
What can I help you with?

WHAT IS AI?

Views of AI fall into four categories

THINKING HUMANLY

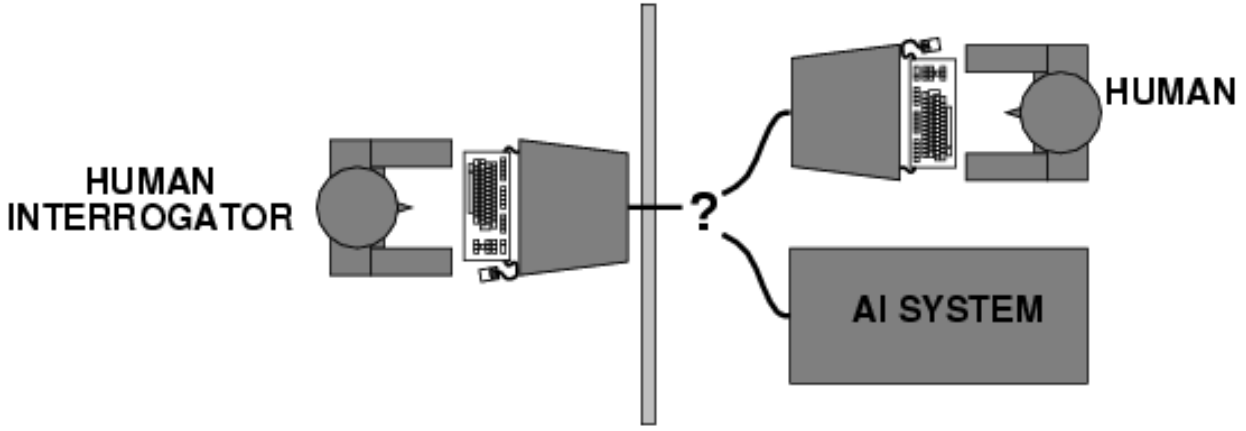
- NEED TO STUDY THE BRAIN AS AN INFORMATION PROCESSING MACHINE: COGNITIVE SCIENCE AND NEUROSCIENCE
- REQUIRES SCIENTIFIC THEORIES OF INTERNAL ACTIVITIES OF THE BRAIN



- BIG QUESTION : CAN WE BUILD A BRAIN ?

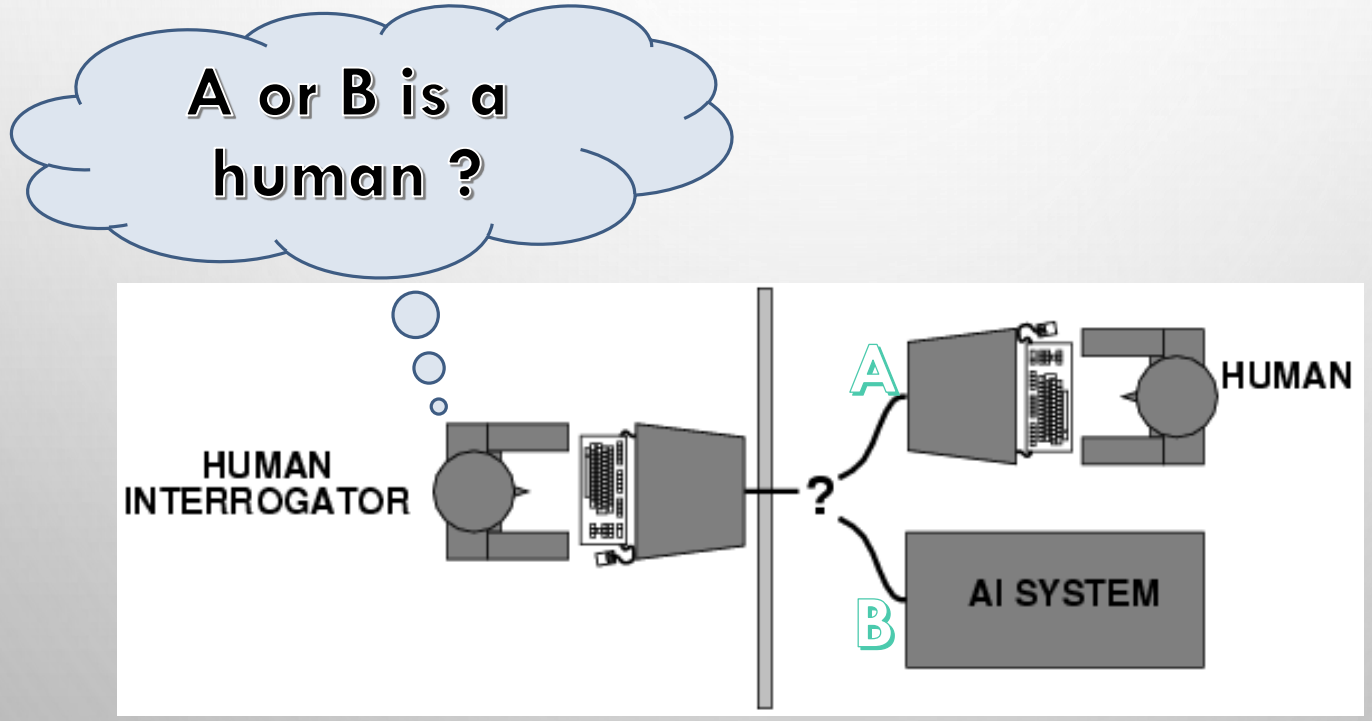
ACTING HUMANLY

- 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

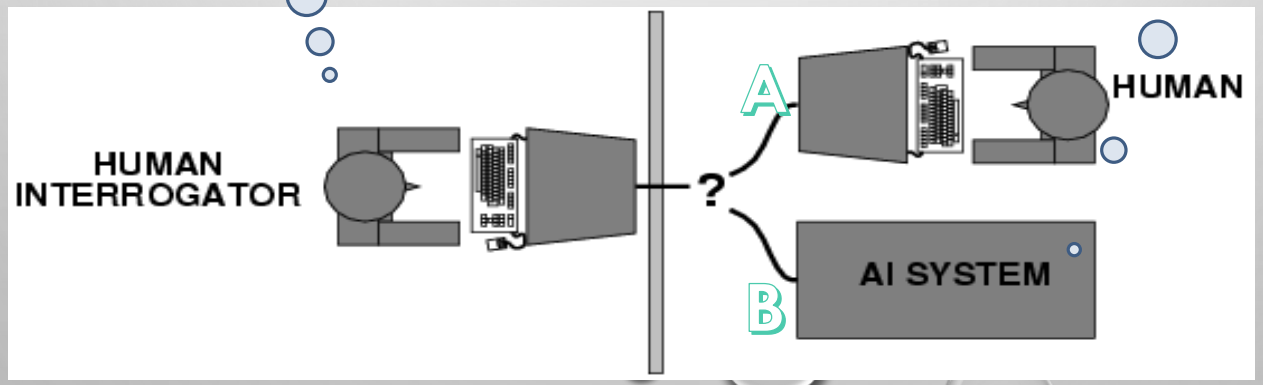


ACTING HUMANLY

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

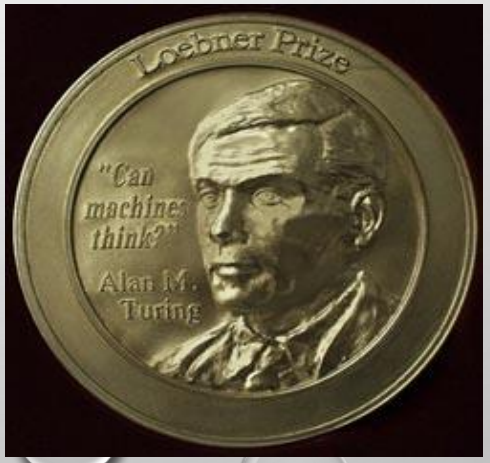
A or B is a human ?

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 LOGIC

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.

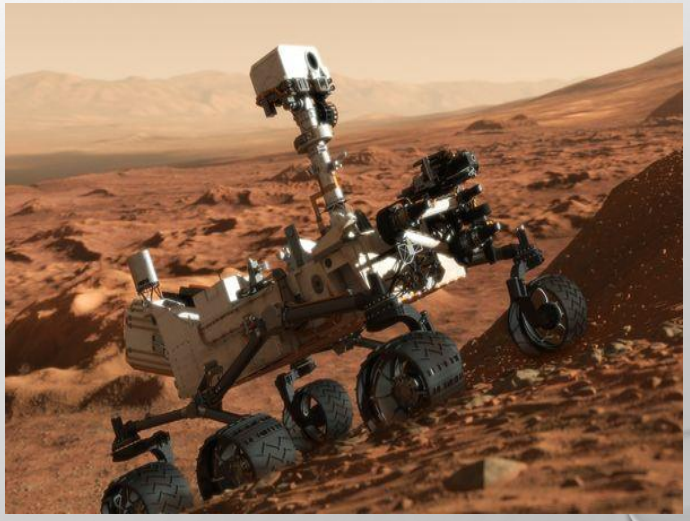
DIFFERENT VIEWS OF AI

- 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.

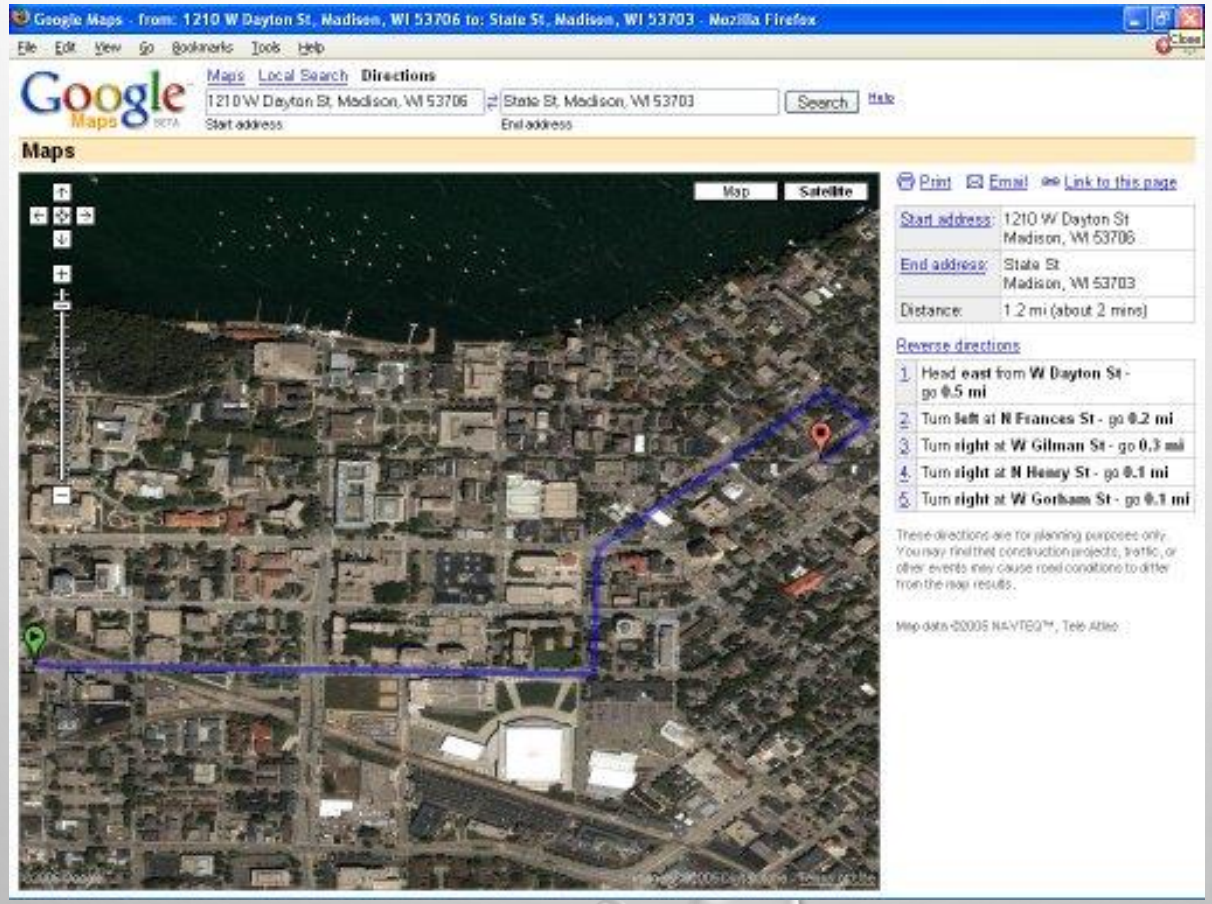
- IN OCTOBER 2015, THE ALPHAGO DEFEATED THE EUROPEAN GO CHAMPION FAN HUI, A 2-DAN PROFESSIONAL, FIVE TO ZERO. THIS WAS THE FIRST TIME A COMPUTER GO PROGRAM HAD BEATEN A PROFESSIONAL HUMAN PLAYER ON A FULL-SIZED BOARD WITHOUT HANDICAP.

GAME PLAYING: ALPHAGO

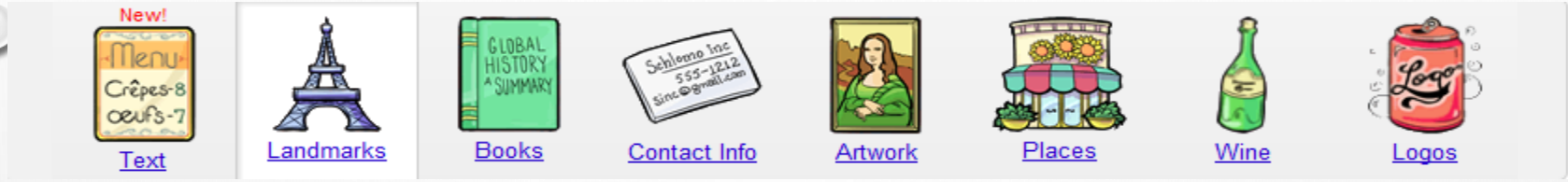
- IN MARCH 2016, IT BEAT LEE SEDOL 4-1IN A FIVE-GAME MATCH, THE FIRST TIME A COMPUTER GO PROGRAM HAS BEATEN A 9-DAN PROFESSIONAL WITHOUT HANDICAPS.

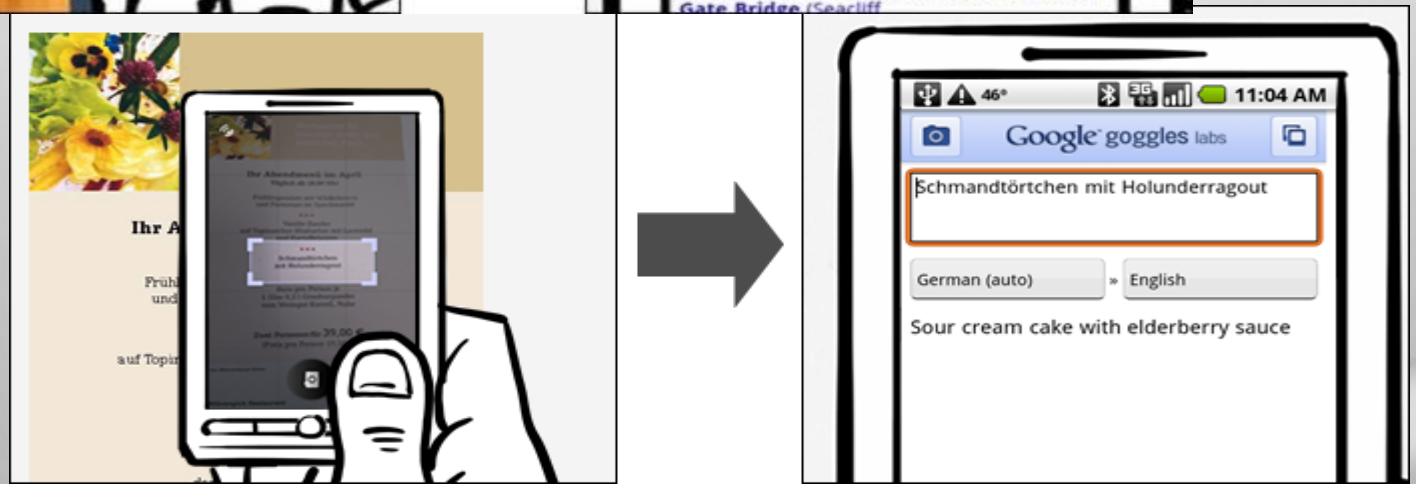
NAVIGATION

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



VISUAL SEARCH: GOOGLE GOGGLES

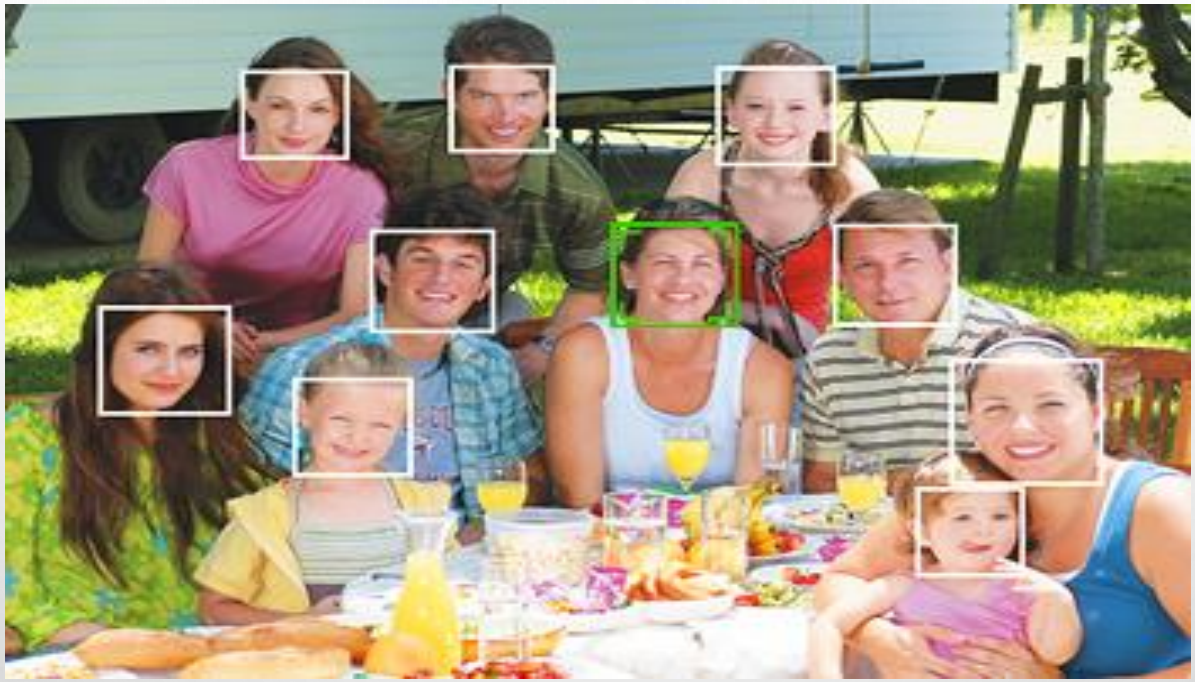




HANDWRITING RECOGNITION

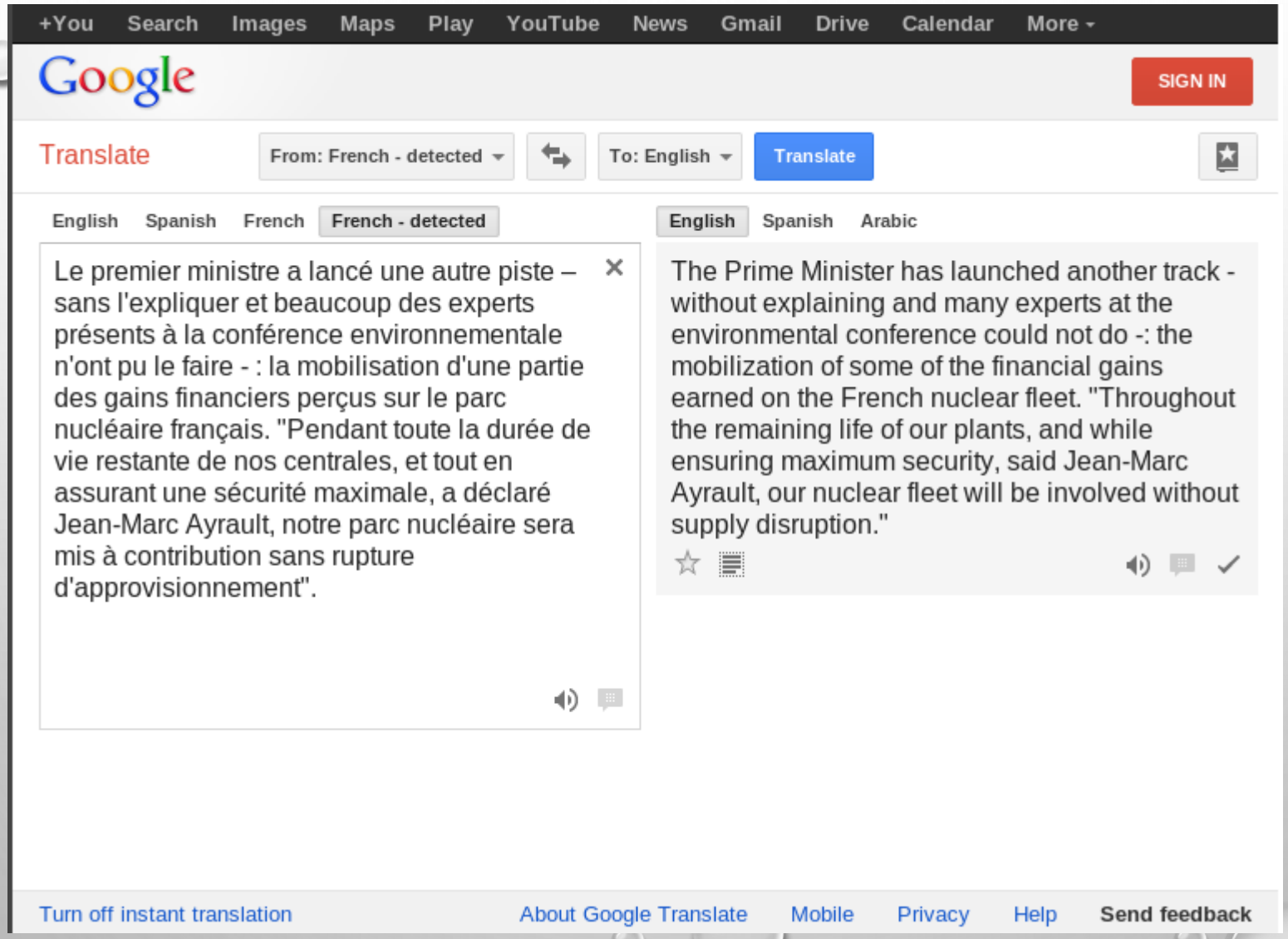
- WHEN YOU DEPOSIT A CHECK AT AN ATM, HANDWRITING RECOGNITION IS EMPLOYED TO AUTOMATICALLY FIGURE OUT THE DEPOSIT AMOUNT.

FACE DETECTION



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

MACHINE TRANSLATION



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 TURING 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

→

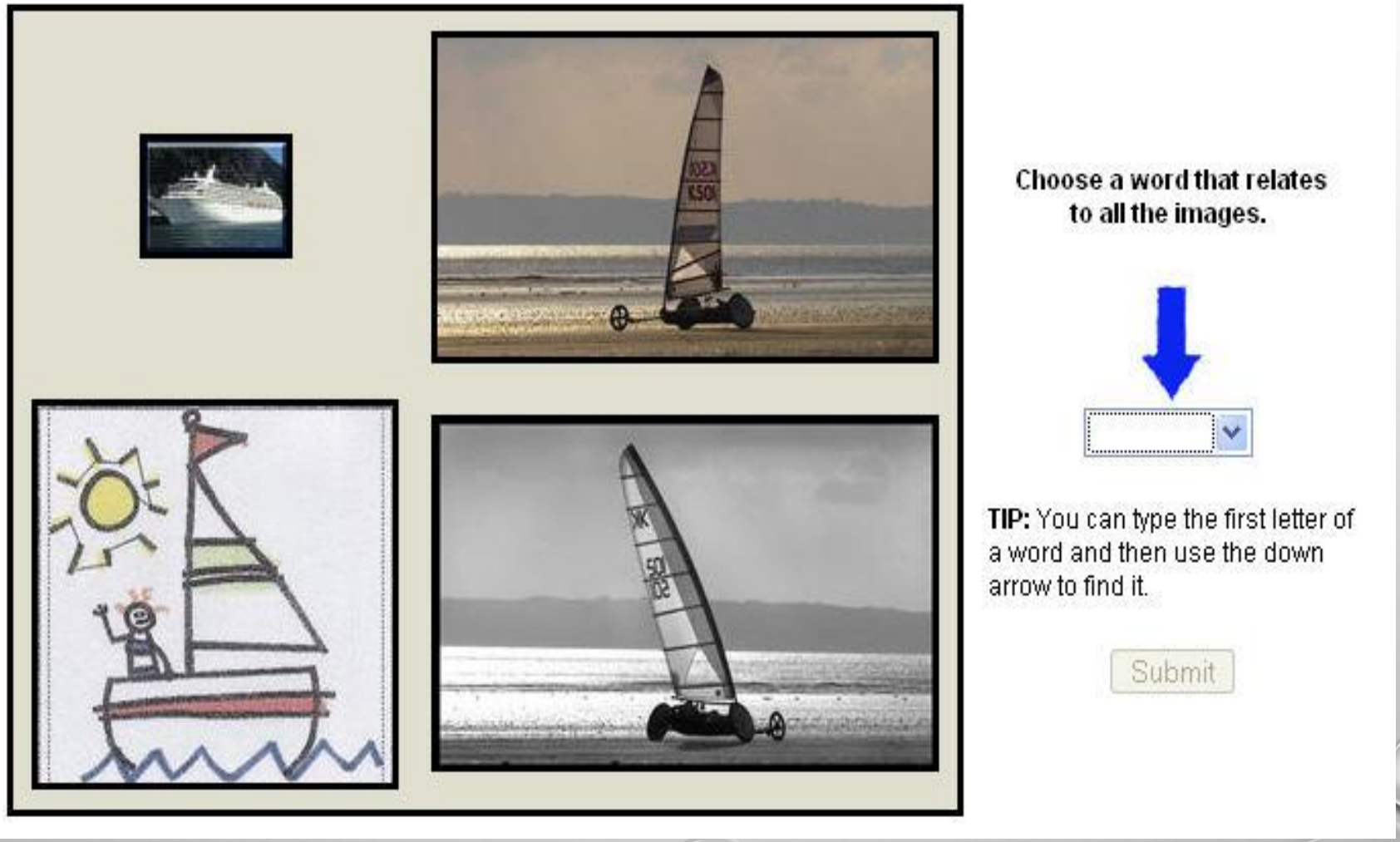
Distorted image

→

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

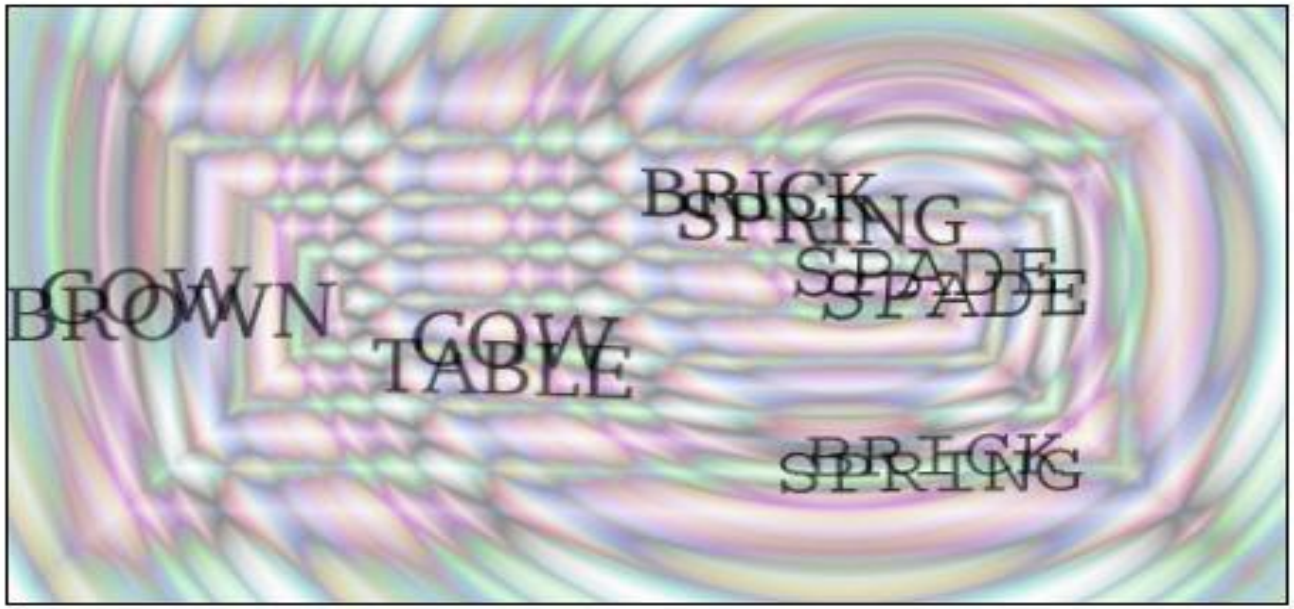
Answer:

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