Introduction to Artificial Intelligence

IICT Lecture 07

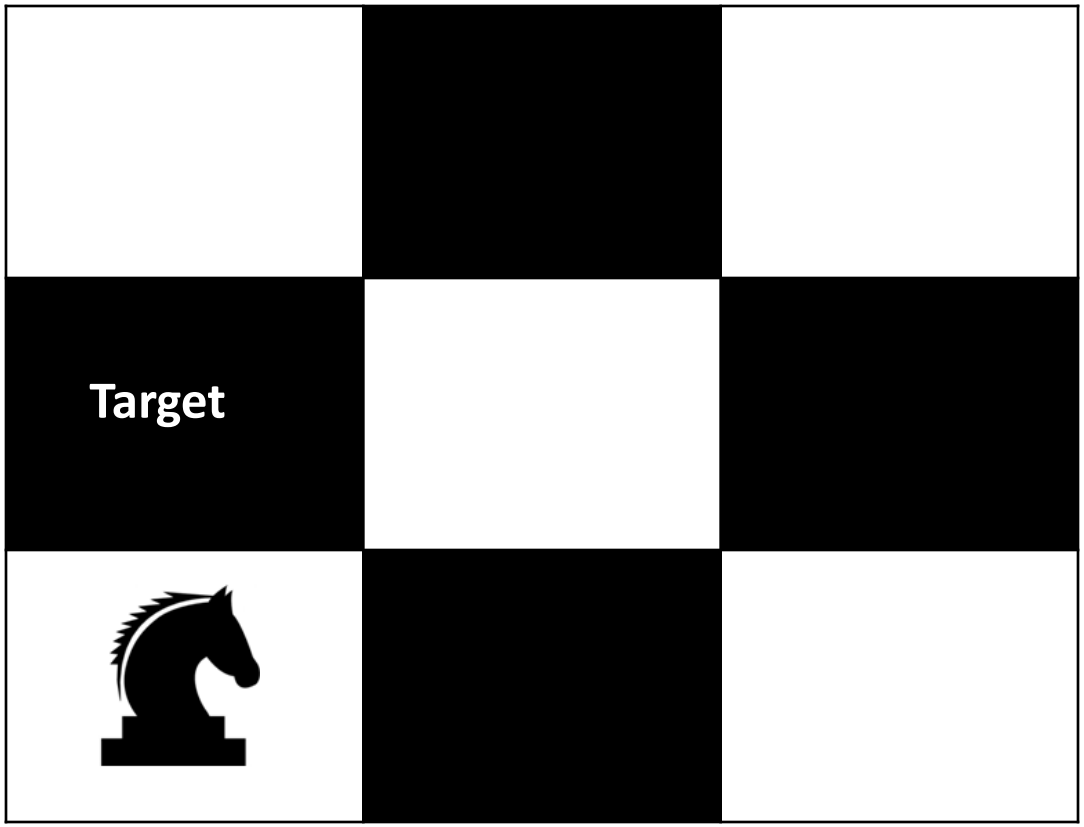
Intelligence

- A very general mental capability that involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. [1]
- Measurement of Intelligence:
  - Intelligence Quotient (IQ)
    - An intelligence quotient or IQ is a score derived from a set of standardized tests developed to measure a person's cognitive abilities ("intelligence") in relation to their age group

[1] Mainstream Science on Intelligence reprinted in Gottfredson (1997). *Intelligence* p. 13

Planning: Knight's Plight

Can we move the given knight to the "Target" location?



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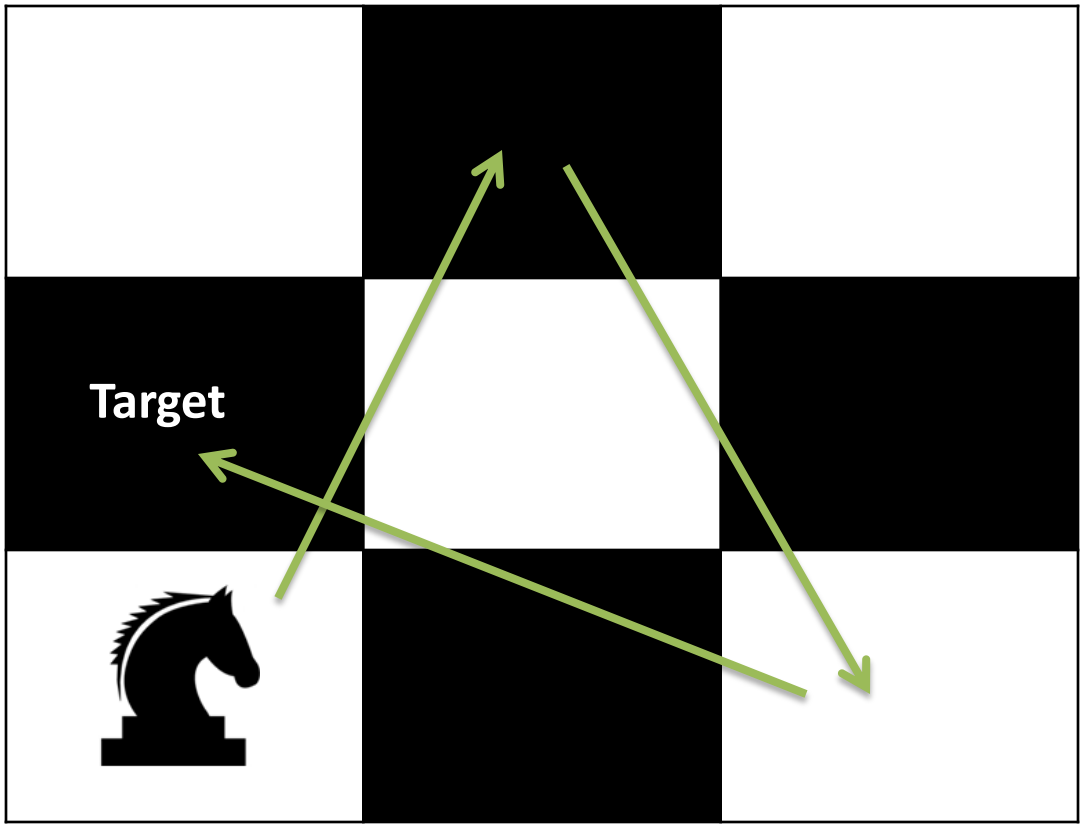

Calculative Puzzle:

Calculation, Computation, Reasoning

The number of times the digit 0 appears in this puzzle is ?.
The number of times the digit 1 appears in this puzzle is ?.
The number of times the digit 2 appears in this puzzle is ?.
The number of times the digit 3 appears in this puzzle is ?.
The number of times the digit 4 appears in this puzzle is ?.
The number of times the digit 5 appears in this puzzle is ?.
The number of times the digit 6 appears in this puzzle is ?.
The number of times the digit 7 appears in this puzzle is ?.
The number of times the digit 8 appears in this puzzle is ?.
The number of times the digit 9 appears in this puzzle is ?.

Replace **?** Sign with count of numbers?

Calculative Puzzle:

Calculation, Computation, Reasoning

The number of times the digit 0 appears in this puzzle is 1.
The number of times the digit 1 appears in this puzzle is 11.
The number of times the digit 2 appears in this puzzle is 2.
The number of times the digit 3 appears in this puzzle is 1.
The number of times the digit 4 appears in this puzzle is 1.
The number of times the digit 5 appears in this puzzle is 1.
The number of times the digit 6 appears in this puzzle is 1.
The number of times the digit 7 appears in this puzzle is 1.
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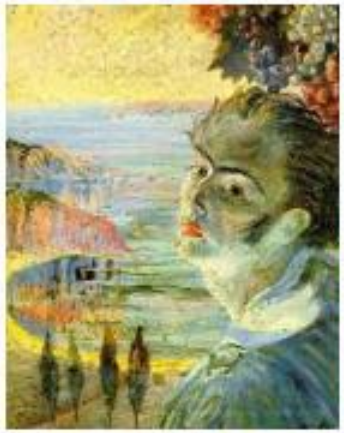
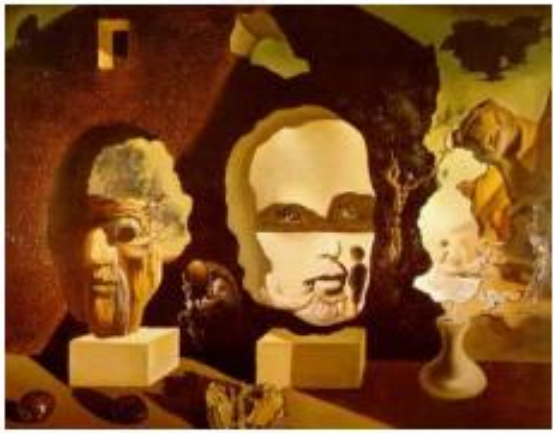
Replace **?** Sign with count of numbers?

Painting by two different painters:
Supervised Learning



Painter A

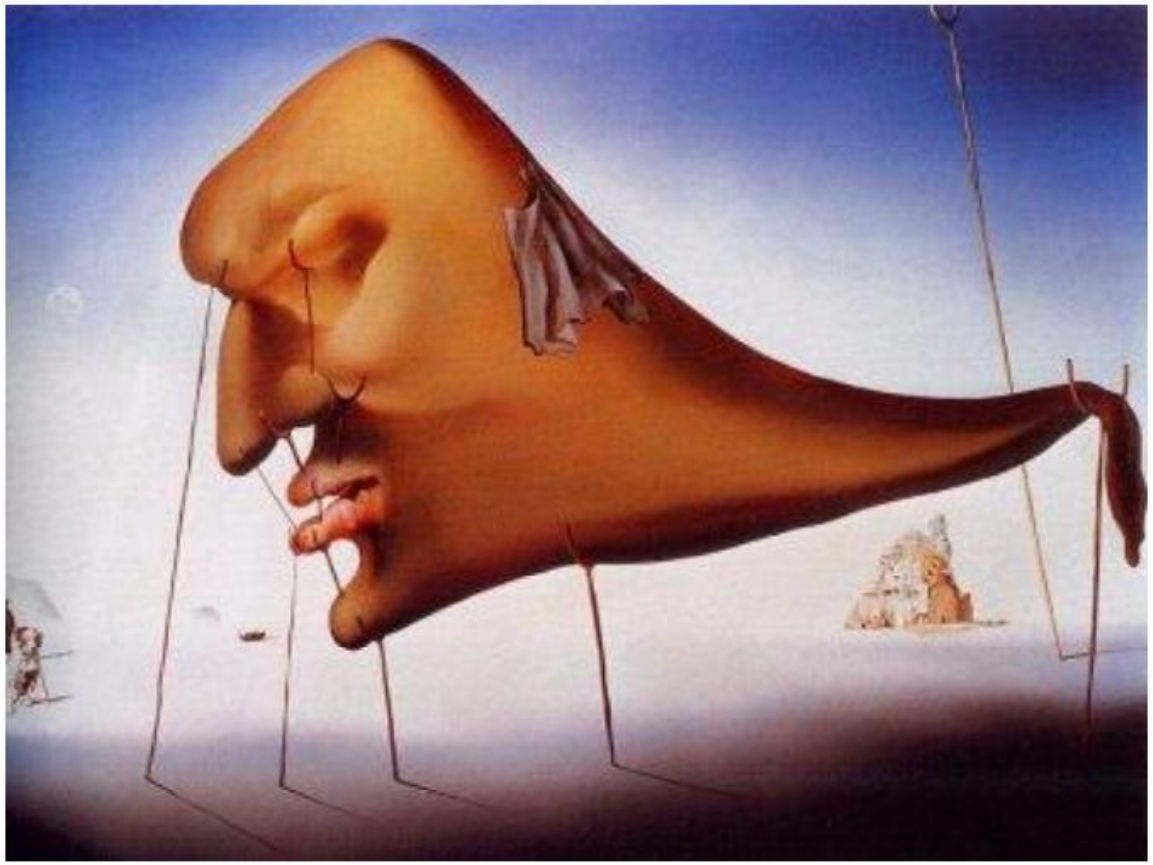




Painter B

Now your turn…

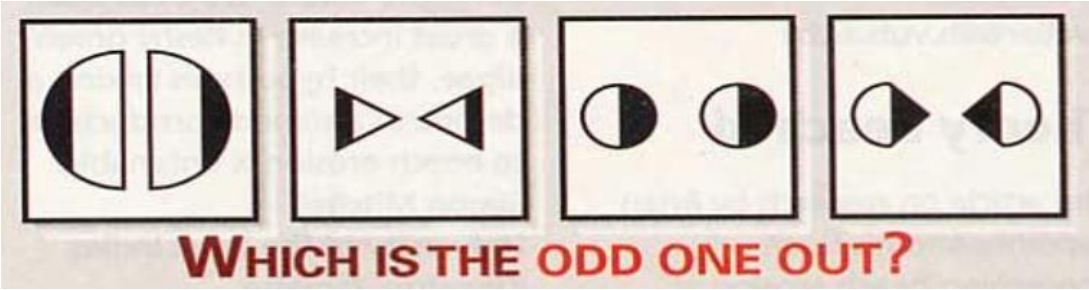
Who’s painting is this?

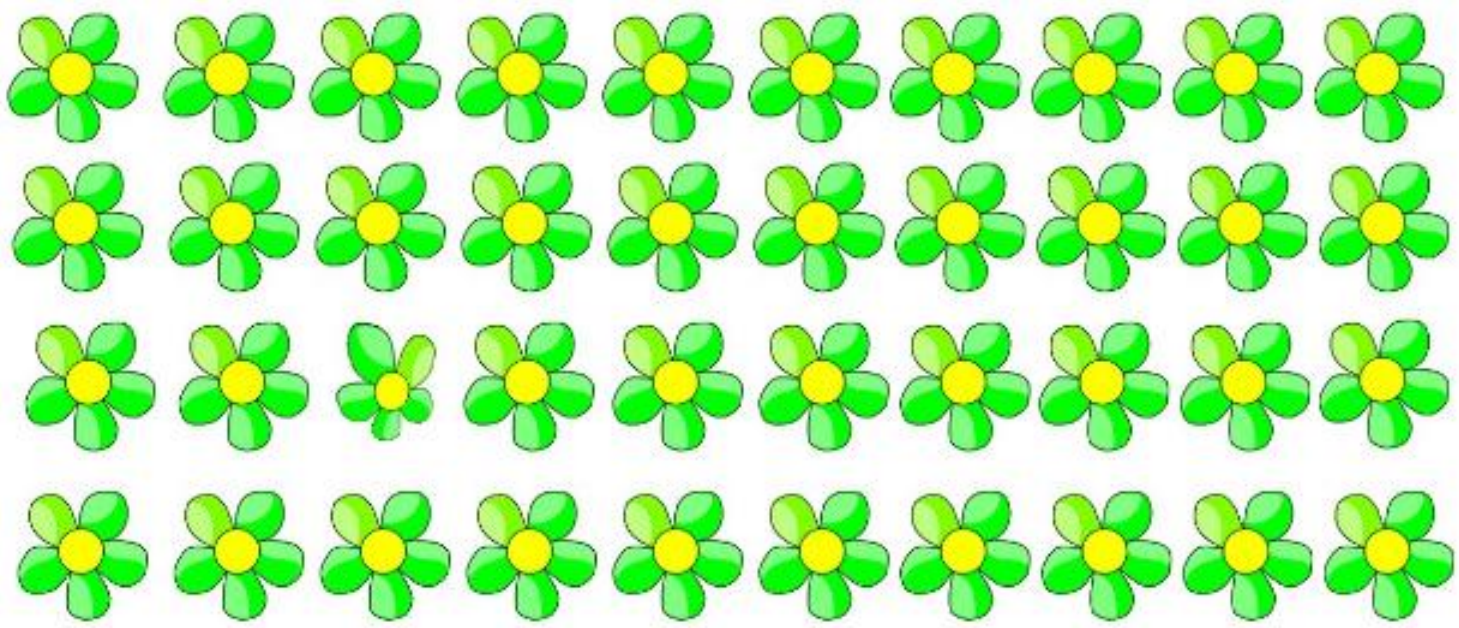
And this?



Finding the odd one out:

Unsupervised Learning



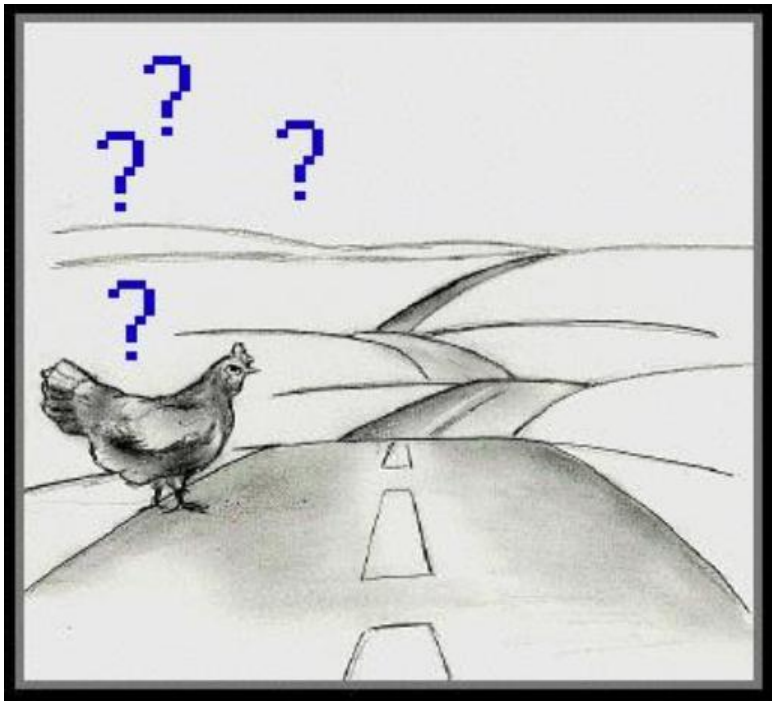


Some more…

What is the next number in this series?

- 1, 1, 2, 3, 5, ?

Would you cross a road when a fast car is approaching?



These are the very characteristics of Intelligent beings!!

Conclusion

- Knight's Plight
  - Planning
- Calculative Puzzle
  - Calculation, Computation, Reasoning
- Finding the odd one out
  - Unsupervised Learning
- Painting by two different painters
  - Supervised Learning
- Series Completion
  - Prediction
- Road Crossing
  - Rational Actions
- Process of Writing this Conclusion
  - Summarizing, Abstraction

What is Artificial Intelligence?

- Computers are Dumb.
- Making a machine (computer) to perform the same tasks which you have just done is called_____.
  - Artificial Intelligence
- If you learn to do these tasks using existing data, then this is called _____.
  - Machine Learning

Artificial Intelligence

- Artificial Intelligence takes the problem of understanding *how we think* a step further
  - It attempts not just to understand it – but – also to build intelligent entities
- A more proper definition of Artificial Intelligence
  - *The art of creating machines that perform functions that require intelligence when performed by people [1]*
- Measurement of Artificial Intelligence
  - Turing Test

[1] Rich E., and Knight K., (1991). *Artificial Intelligence (2e),* McGraw-Hill, NewYork.

Artificial Intelligence

- Artificial Intelligence has many subfields. For example, machine learning, natural language processing, computer vision, big data, data mining, robotics, etc.

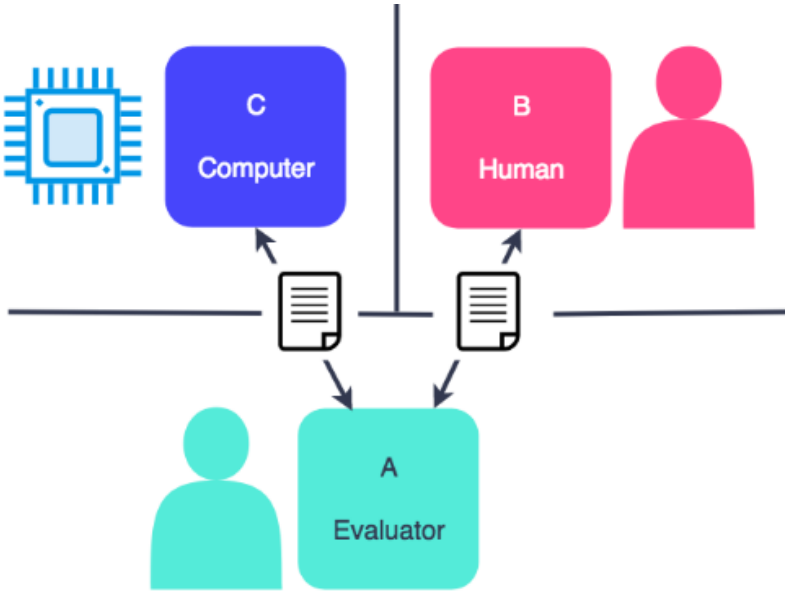
- Many of these subfields have a huge overlap.

Turing Test

- A method proposed by Alan Turing to determine whether a machine can demonstrate human intelligence.
- The machine will engage in a conversation with a human. The conversation will not be face to face.
- If after the human cannot detect that the other person is actually a machine, then the machine has human intelligence.

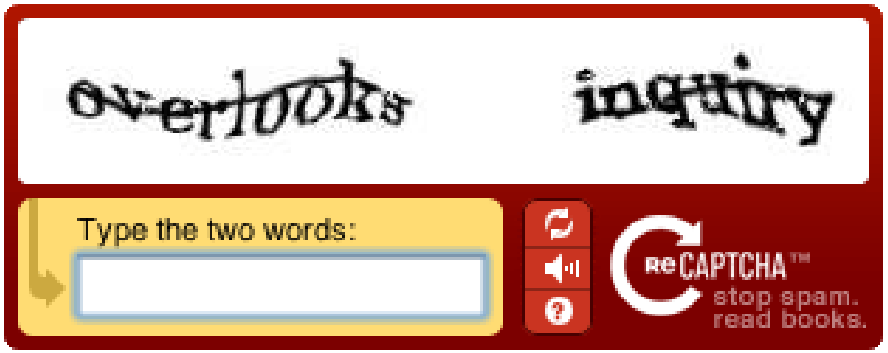
Turing Test

- Turing Test
  - Suggested major components of AI: knowledge, reasoning, language understanding, learning
- Application of the Turing Test
  - CAPTCHA: Completely Automated Public Turing test to tell Computers and Humans Apart



CAPTCHA

- Completely Automated Public Turing Test To Tell Computers and Humans Apart
- CAPTCHA protects websites against bots by generating and grading tests that humans can pass but computer programs cannot. For example, humans can read distorted text as the one shown below, but current computer programs can't:



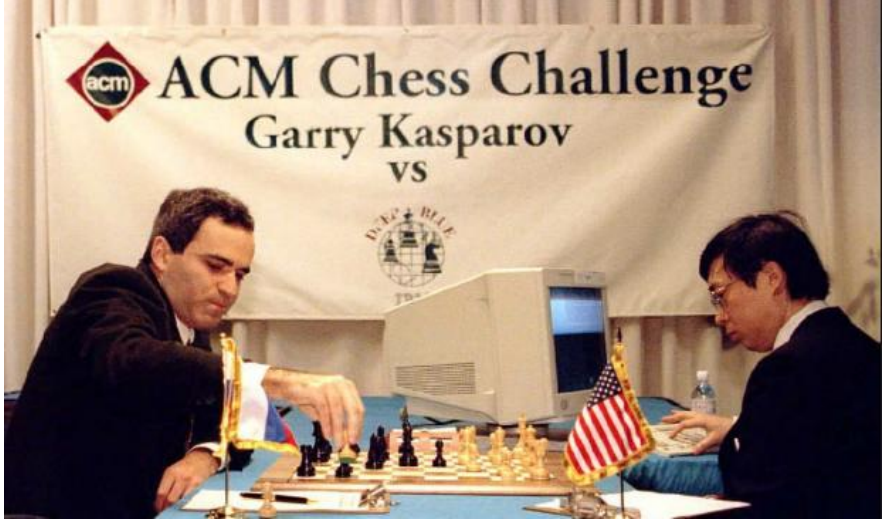
CAPTCHA

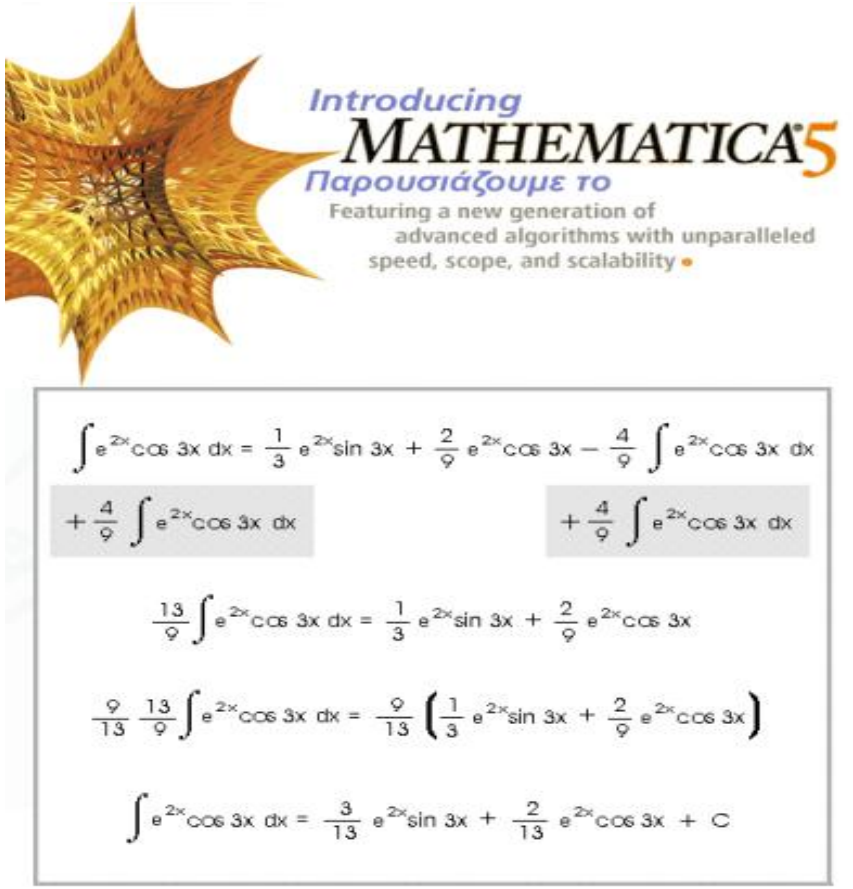
- USES:

1. Preventing Comment Spam
2. Preventing Automated Registrations
3. Protecting online voting/polls.

Is AI intelligent?

- Planning
  - Kasparov Vs. IBM Blue (1997)
- Calculation
  - Symbolic Integration in Mathematica
  - Theorem Provers



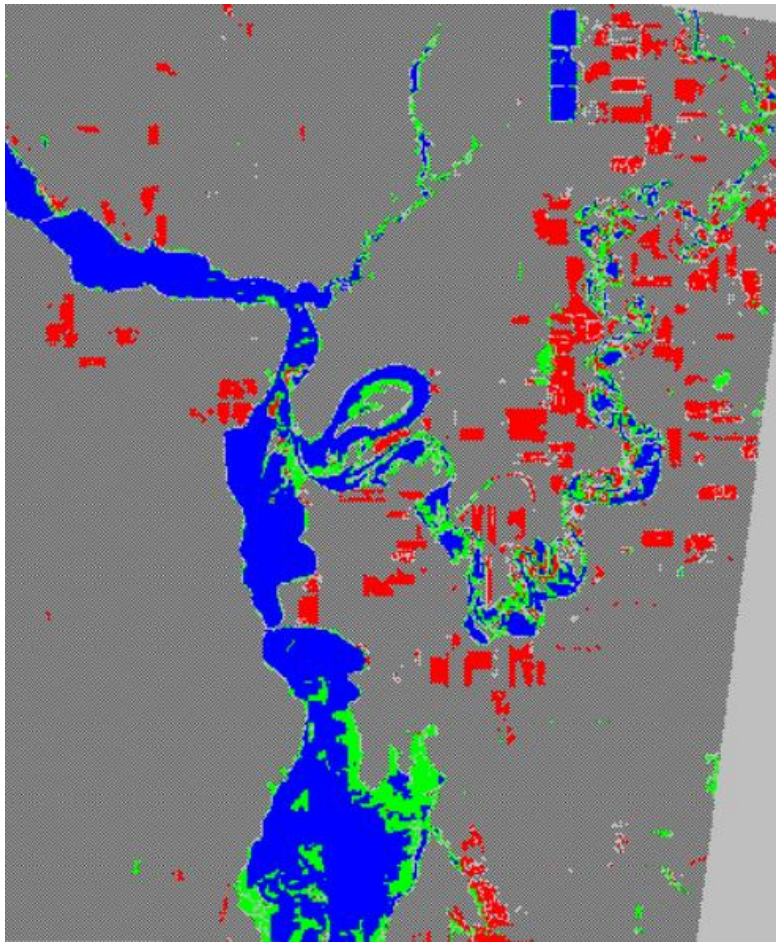


Is AI intelligent?

- Learning without a Teacher
  - ERDAS Imagine
  - Classification of Land Use

ERDAS:

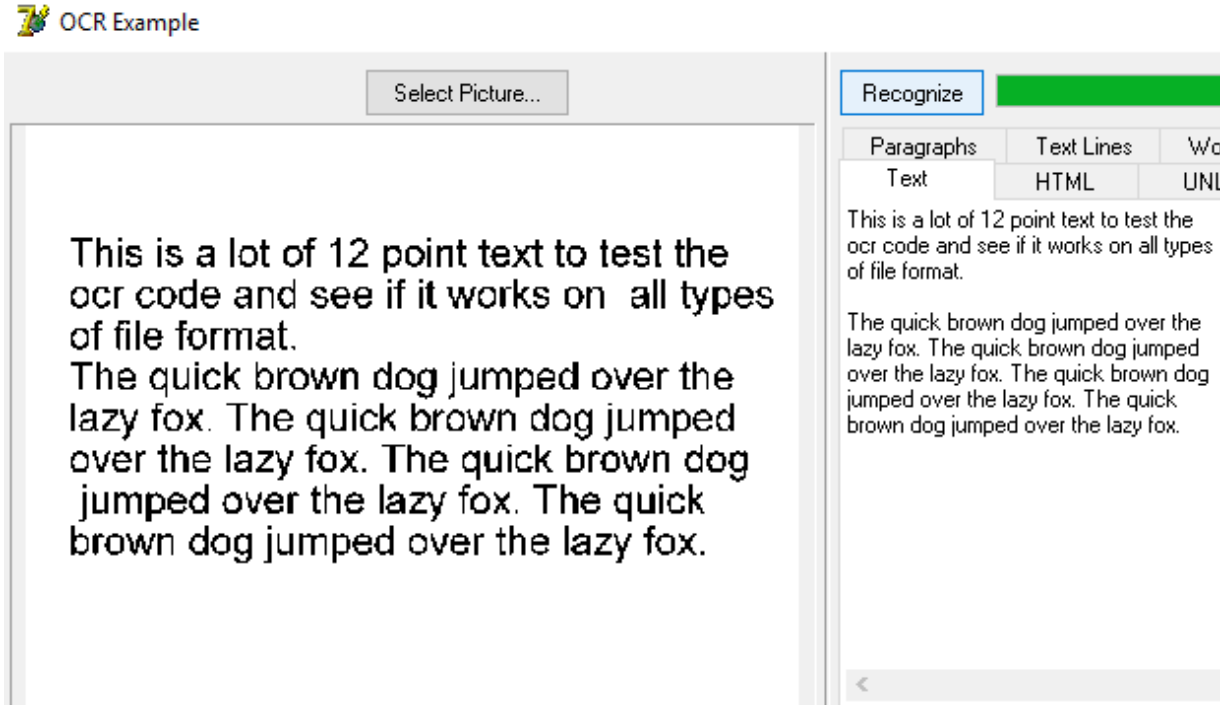
  - World Class Remote Sensing Software



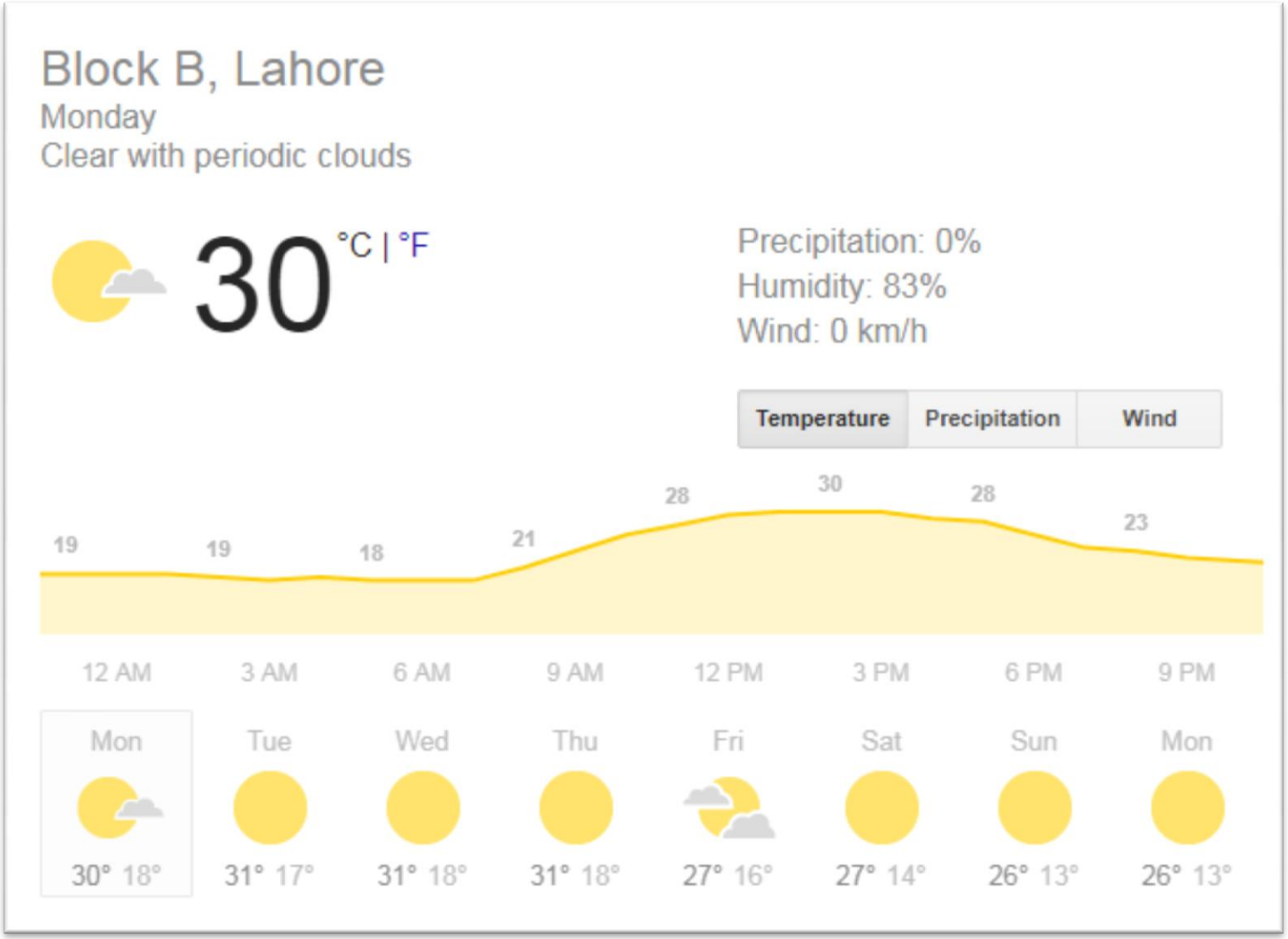
= water; = wetland; = marginal habitats; = upland (non-useable habitats).

Is AI intelligent?

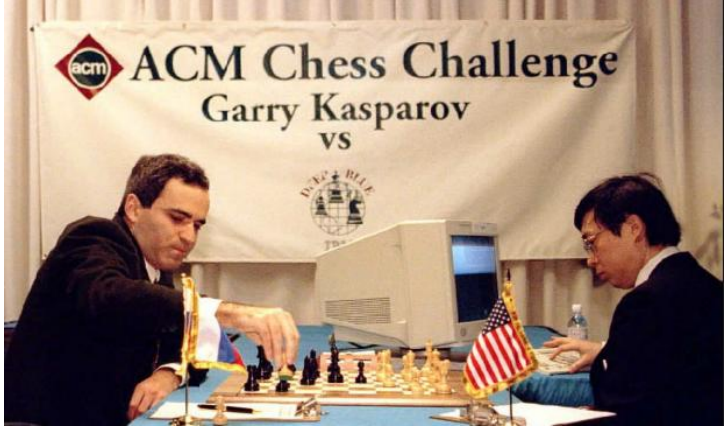
- Learning with a teacher
  - No Hands Across America!
  - Optical Character Recognition



Forecasting and Prediction



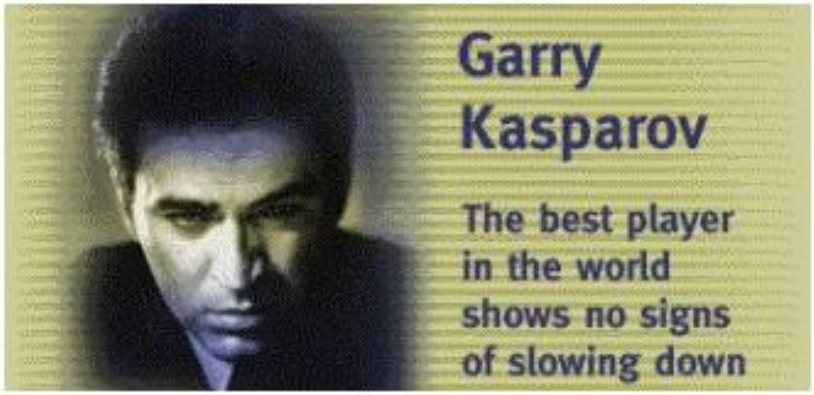
Is deep blue Intelligent?



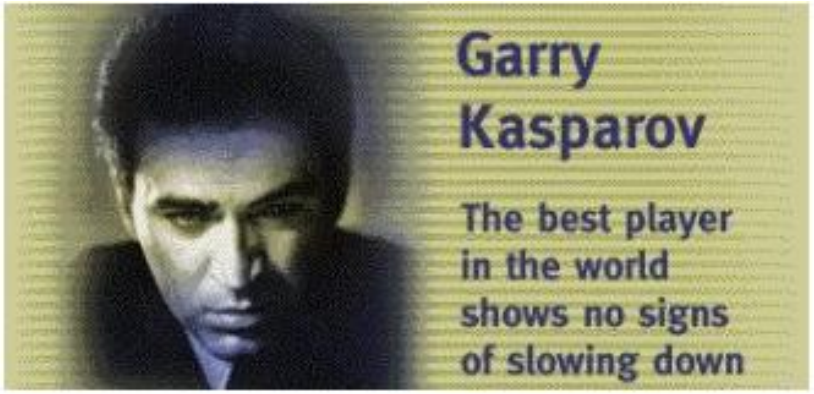
Deep Blue defeated the world chess champion Garry Kasparov. Does this make Deep Blue **an intelligent machine**?

- Think about it for a few seconds and take a stance
- **Write down at least two items** that support your claim either way
- Pair up with your neighbor and Exchange opinions
- Try to argue for your stance
- Listen carefully to the arguments of your neighbor
- Try to reach an agreement, if possible
- Make your verdict: YES (machine is intelligent) or NO (machine is not intelligent) or X (no agreement)

Deep Blue Vs Garry Kasparov



200,000,000 board configurations per second	**3 board configurations** per second
Has **small knowledge** about chess, but **a huge computational capacity**	Has **huge knowledge** about chess, but a considerably **smaller computational capacity**
A machine **has no emotions nor intuition**, it does not forget, cannot be confused or feel uncomfortable	Has feelings and **brilliant intuition**, but can experience **fatigue and boredom** and loss of concentration



Deep Blue **does not learn**, therefore it can't use artificial intelligence to learn from its opponent

Garry Kasparov can learn and **adapt quickly** based on his success or failure

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Deep Blue is incredibly efficient in **solving problems from the domain of chess** but is less "intelligent" even compared to a small child

Garry Kasparov is **generally very intelligent**: he authored several books and speaks many languages

Natural Language Processing

- *A branch of AI*
- *The man tried to take a picture of a man with a turban.*
  - Did the man try to take a picture with a turban, or
  - take a picture of a man who is wearing a turban?
- *The man saw the boy with the telescope*
- Communicating in natural language assumes **world knowledge** and **the understanding of context**, both of which are required to resolve the ambiguities

Natural Language Processing

- Google Now, Apple's Siri, Microsoft's Cortana, Amazon Alexa, etc. are examples of natural language processing.

- They help to find useful information when we ask for using speech.

- They can also perform other tasks when you ask, such as setting the alarm, making a phone call, etc.

Computer Vision

- A branch of AI that enables computer to understand the content of images and videos.
- Applications:

1. Optical character recognition (OCR)
2. Traffic Rule Violation
3. Object Detection and Recognition

Case Study: Self-driving Car