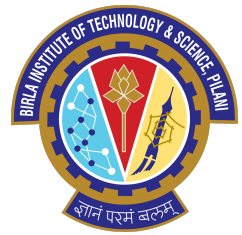
IS-ZC444: ARTIFICIAL INTELLIGENCE

Lecture-01: Introduction -2- AI



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Aug 08, 2020 FLIPPED (WILP @ BITS-Pilani Jul-Nov 2020)

Introduction: Computers

Computer

From Wikipedia, the free encyclopedia

A **computer** is a device
that can be instructed
to carry out sequences of arithmetic
or logical operations
automatically
via computer programming.

Where is the **Intelligence**?

Introduction: Computers

WIKIPEDIA
The Free Encyclopedia

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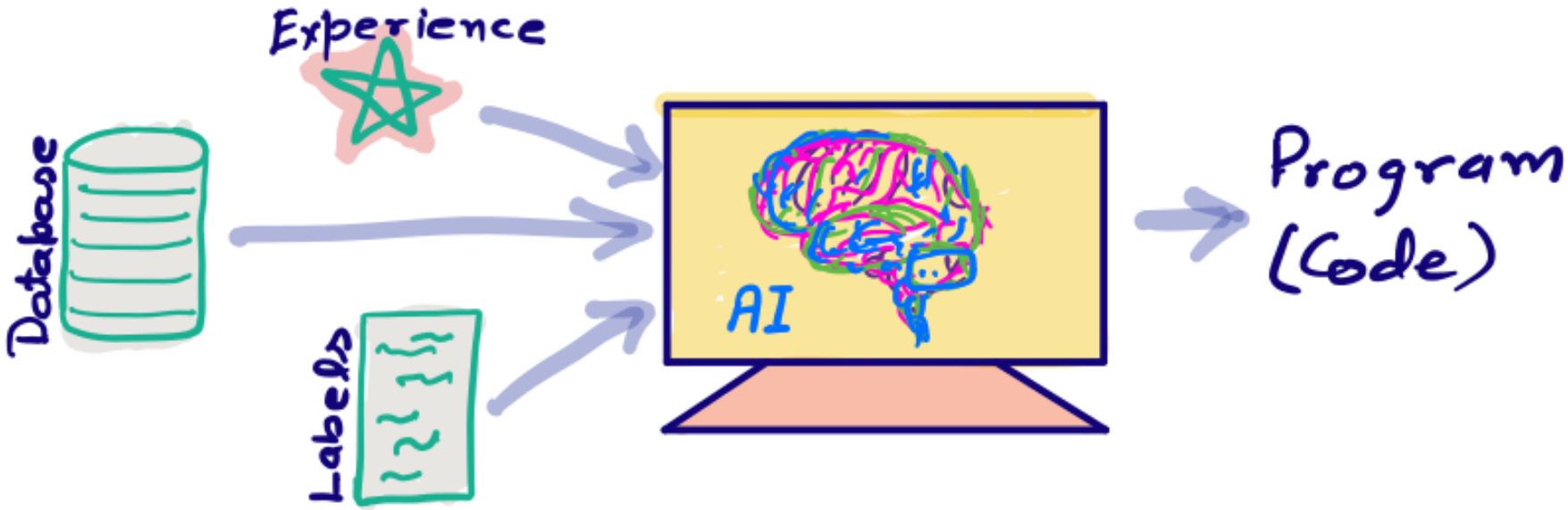
Where is the **Intelligence**? with programmer (Human).

Introduction

We want intelligence in the computer.

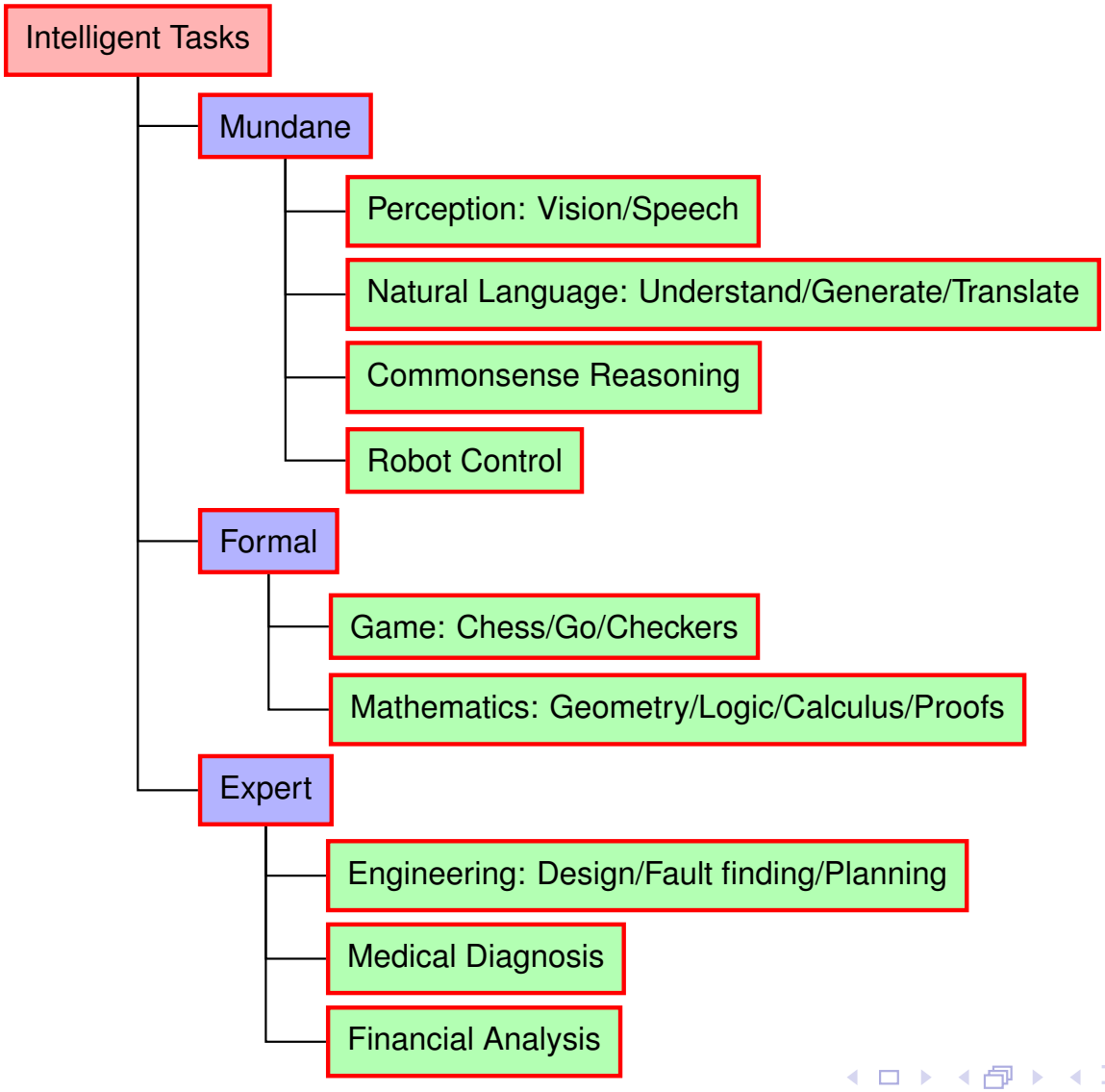
What does it mean?



- Computers should write programs

Intelligence

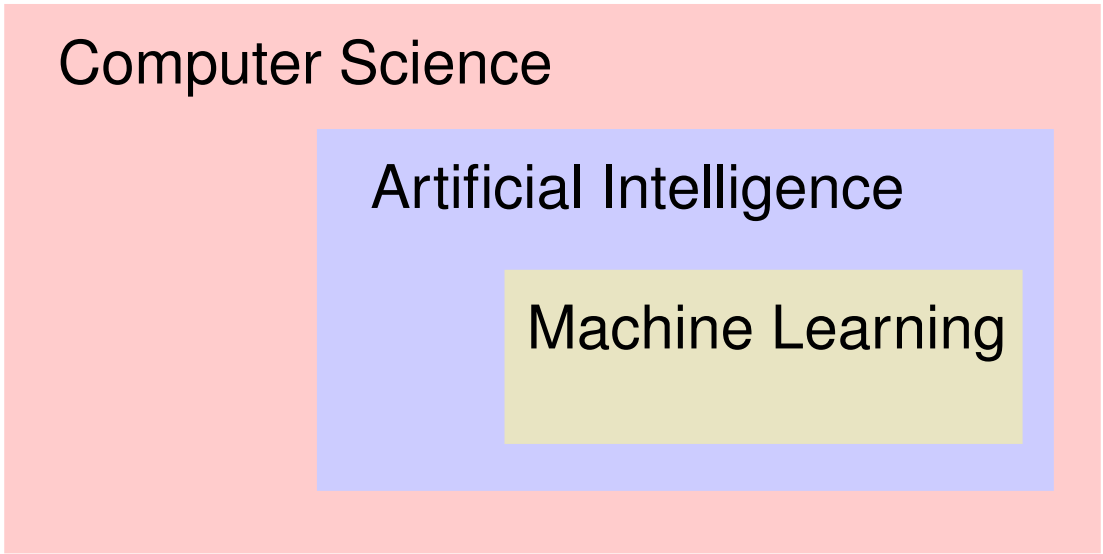
Some of the intelligent tasks that humans do includes



Introduction: Artificial Intelligence (AI)

Primary Question: How to make computers do things which at the moment, people do better [1]

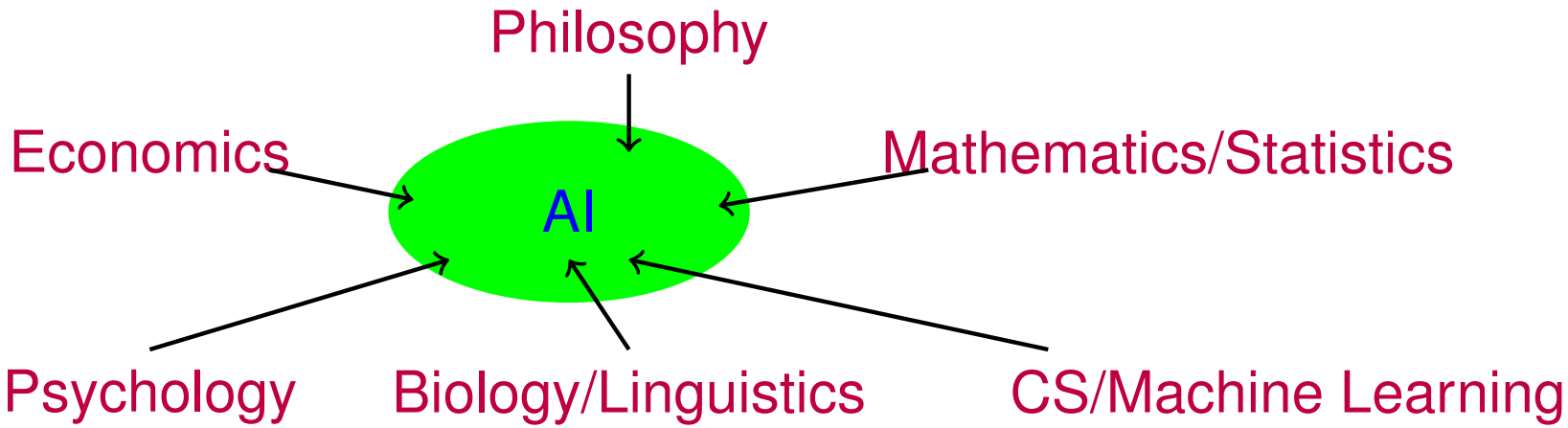
AI attempts to build such intelligent entities



[1] There could be some tasks even humans are not good at.

Artificial Intelligence

Term AI was first coined by **John McCarthy** in 1956 in Dartmouth Conference. He also developed the Lisp programming language.



Artificial Intelligence is fairly involved area, lot of things come from psychology, philosophy, mathematics, economics, linguistics, biology, and computer engineering. It includes many fields such as database, information retrieval, statistics, and machine learning.

Knowledge

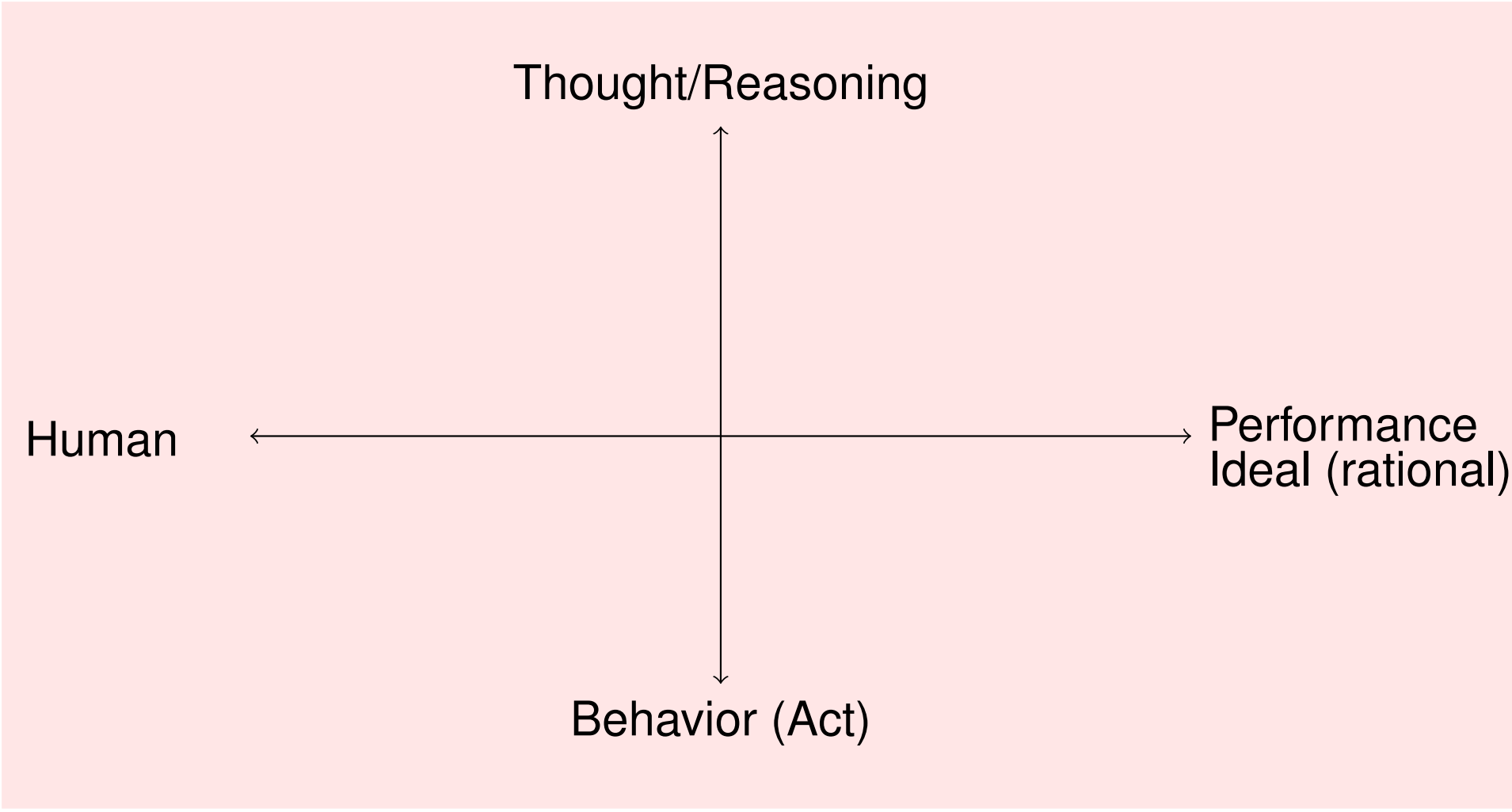
- Much of the early work focused on formal tasks such as game playing and theorem proving but
  - Russell's paradox. Does list of lists contain itself?
  - Halting problem of Turing Machine. Computers cannot do everything. Machines are bad in reading itself

Data, Information and Knowledge

- What is data? Fact or values
- What is information? Processed output of date
- What is knowledge? Understanding of information (needs intelligence)

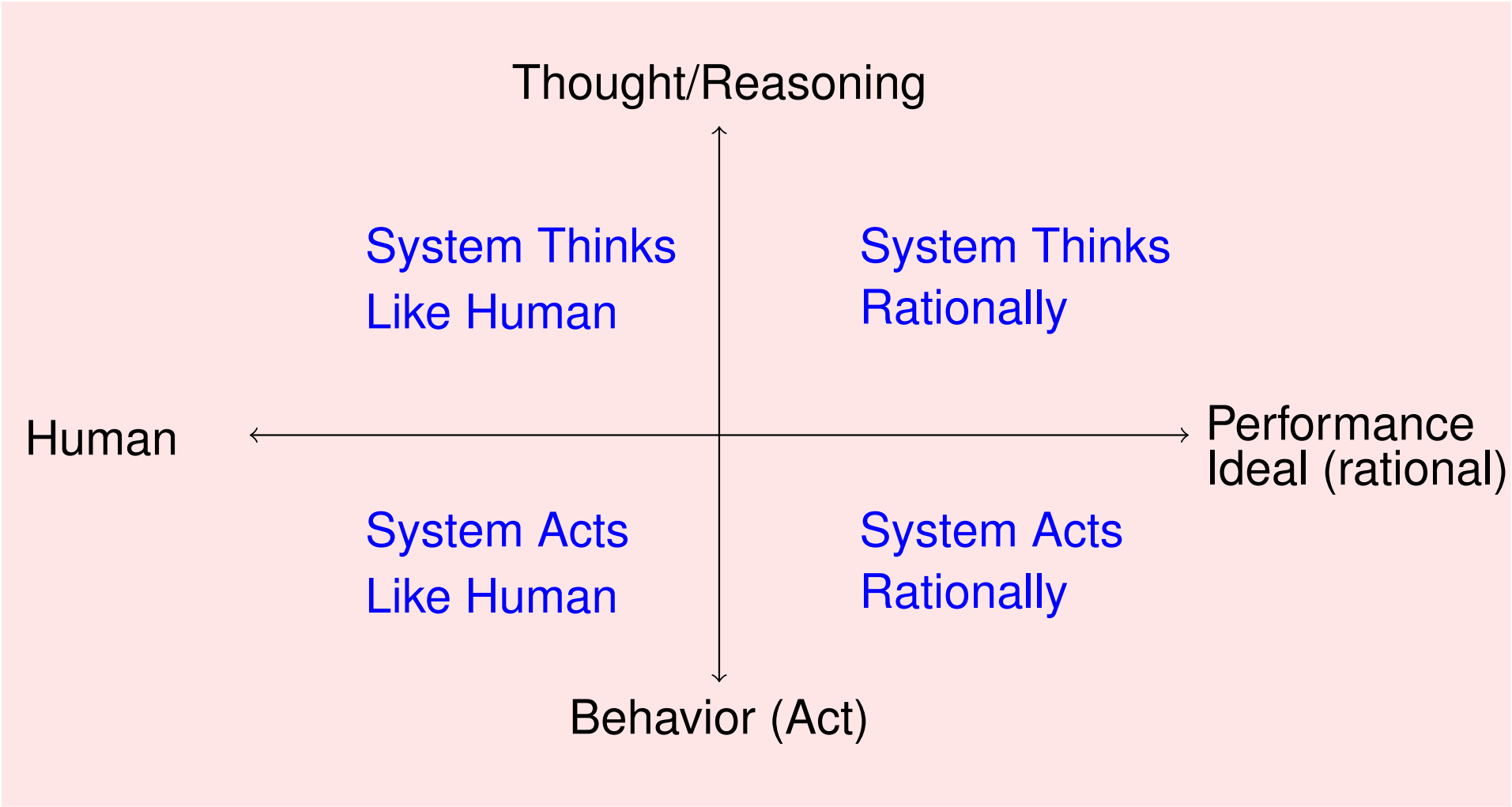
Being very fast, computers could explore all possible next steps and choose the best one, why does it need intelligence?

Rationality



Note: it is not like that the humans are necessarily irrational

Rationality



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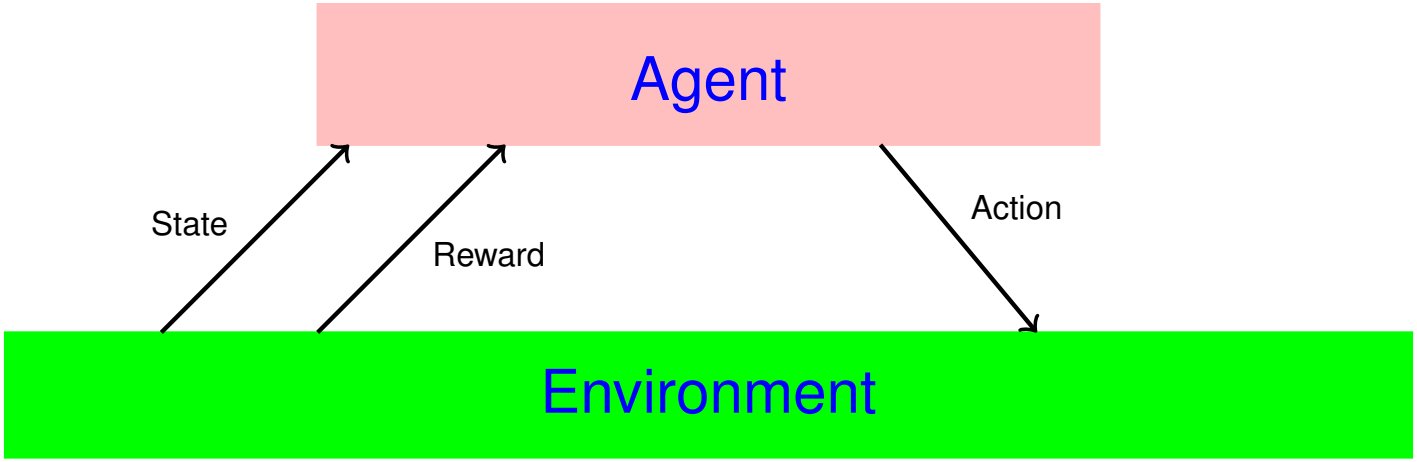
Rational Agent

Agent is an entity that perceives and act. If is a function from percept history to action.



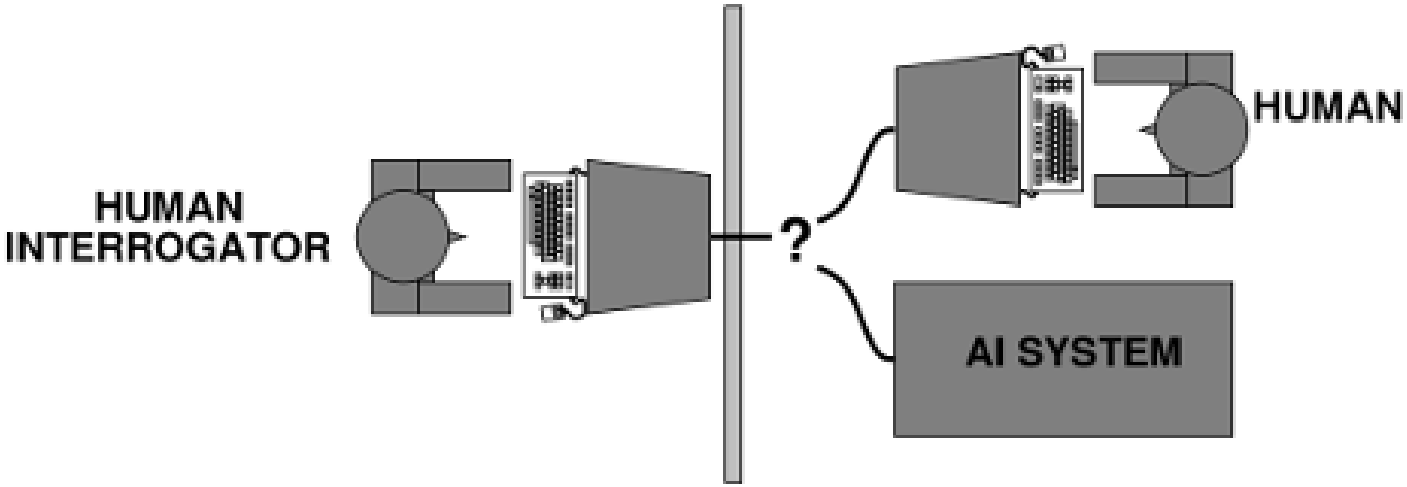
Goal is to choose a policy that maximizes rewards

Approaches

- **Strong AI:** Completely intelligent systems
- **Weak AI:** suitably programmed to act as intelligent

Turing Test

In 1950 Alan Turing introduced a test for computing intelligence



If the interrogator cannot reliably distinguish the human from the computer the test is passed

Problem: Turing test is not reproducible, constructive, or amenable to mathematical analysis. Also it can only test AI which human can do.

Total Turing test needs CV and robotics with NLP, KR, AR, ML [2]

[2] Computer Vision, Natural Language Processing, Knowledge Representation, Automated Reasoning, Machine Learning

Applications of AI

In many domains including finance, robotics, bioinformatics, vision, natural language, *etc*.

- Knowledge Representation
- Speech/handwriting recognition
- Object detection/recognition
- Reasoning
- Planing/Stock market analysis
- Search engines (e.g, Google)
- Ad placement on websites
- Spam filtering
- Credit-card fraud detection
- Webpage clustering (e.g.,Google News)
- Machine Translation (*e.g.*, Google Translate)
- Recommendation systems (*e.g.*, Netflix, Amazon)
- Classifying DNA sequences
- Automatic vehicle navigation
- Performance tuning of computer systems
- Predicting good compilation flags for programs
- Game Playing
- .. and many more

Types of Learning Systems

- **Supervised:** “right answers” are provided for sufficient training examples. Computer tells “right answers” for new input. Performance measure. (Classification and regression)
- **Unsupervised:** “right answers” are NOT provided and the computer tries to make sense of the data. How good the spread of items is. (clustering and association rule)
- **Semi-supervised:** “right answers” are provided for few training examples only
- **Active:** computer can ask questions. Needs less training. Opposite is passive learning
- **Lazy:** learner do not consolidate the findings.
- **Reinforced:** hit and trial method to minimize cost. (game playing)
- **Transfer:** Learning a task B to do A. (cycle riding for bike riding)
- **Deep:** processing like human brain

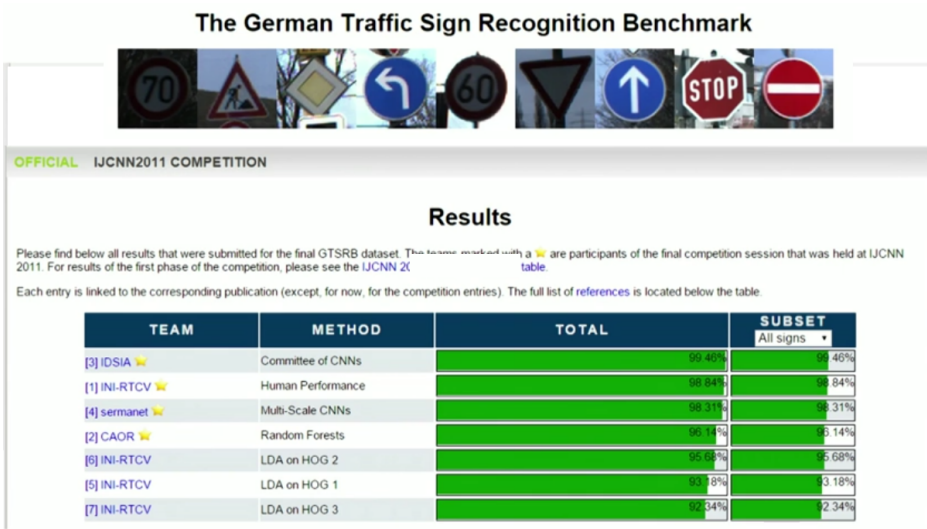
Success Stories

- Deep Blue of IBM
- In 1997 beat current chess champion Gary Kasparov
  1-Kasparov, 2-DeepBlue, 3-draw

- AlphaGo of Alphabet Inc.
- In March 2016, it beat human professional Go player Lee Sedol in a five-game match by 4/1

Success Stories

- Waymo: A safer driver that is always alert and never distracted
- First driverless ride on public roads in 2015 giving a ride to a sole blind



The German Traffic Sign Recognition Benchmark

OFFICIAL IJCNN2011 COMPETITION

Results

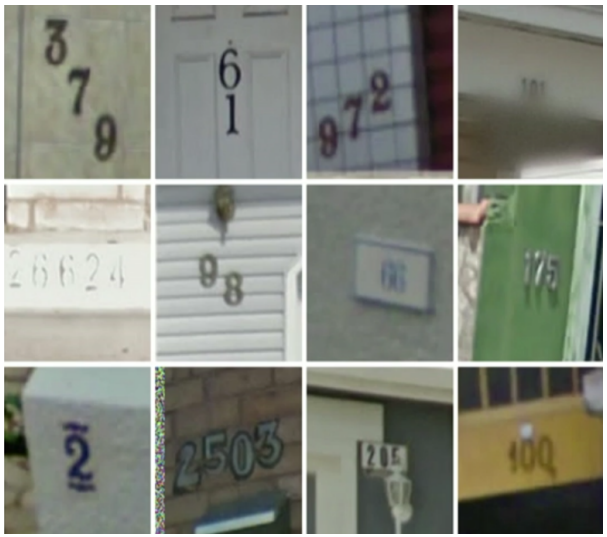
Please find below all results that were submitted for the final GTSRB dataset. The teams marked with a ★ are participants of the final competition session that was held at IJCNN 2011. For results of the first phase of the competition, please see the IJCNN 2(table.

Each entry is linked to the corresponding publication (except, for now, for the competition entries). The full list of references is located below the table.

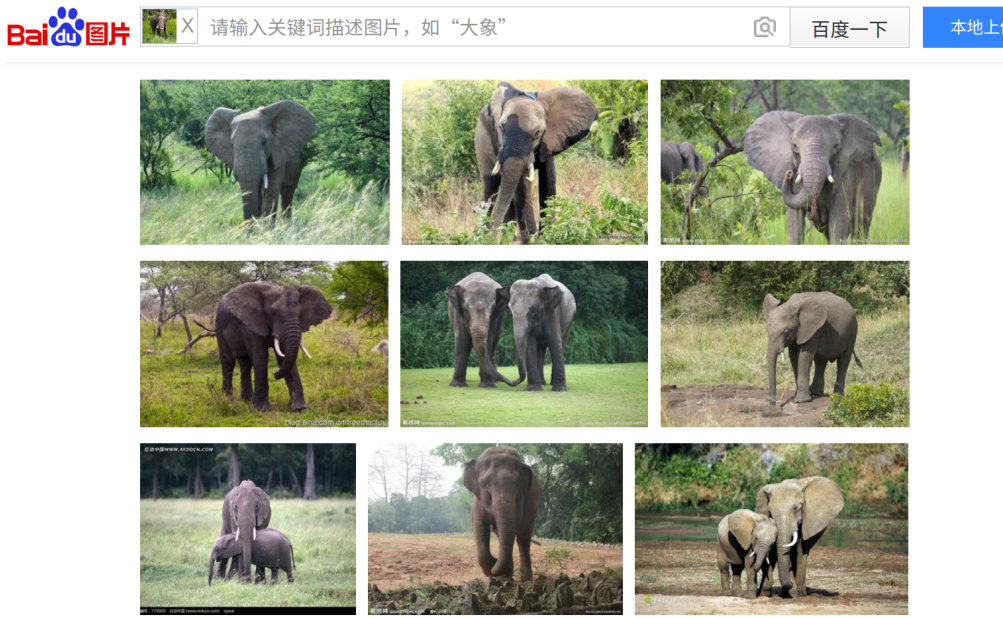
TEAM	METHOD	TOTAL	SUBSET All signs
[3] IDSIA ★	Committee of CNNs	99.46%	99.46%
[1] INI-RTCV ★	Human Performance	98.84%	98.84%
[4] sermanet ★	Multi-Scale CNNs	98.31%	98.31%
[2] CAOR ★	Random Forests	96.14%	96.14%
[6] INI-RTCV	LDA on HOG 2	95.68%	95.68%
[5] INI-RTCV	LDA on HOG 1	93.18%	93.18%
[7] INI-RTCV	LDA on HOG 3	92.34%	92.34%

- German Traffic Sign Recognition Benchmark (GTSRB)
- 99.46% against 98.84% of human

Success Stories

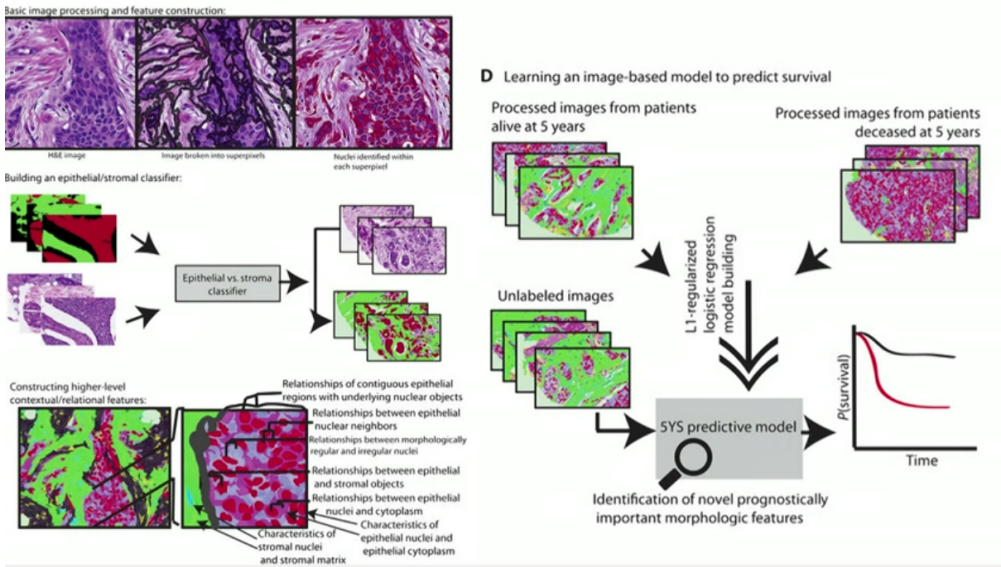


- Google mapped every single location in France in two hour
- Images acquired from Google street view



- Example of an image search
- That can taking care of color and pose of the object in the image

Success Stories

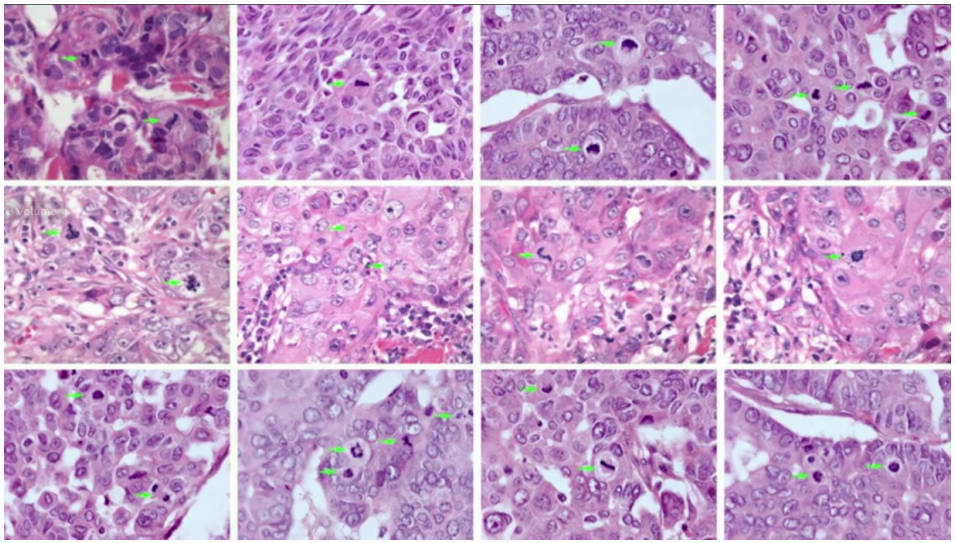


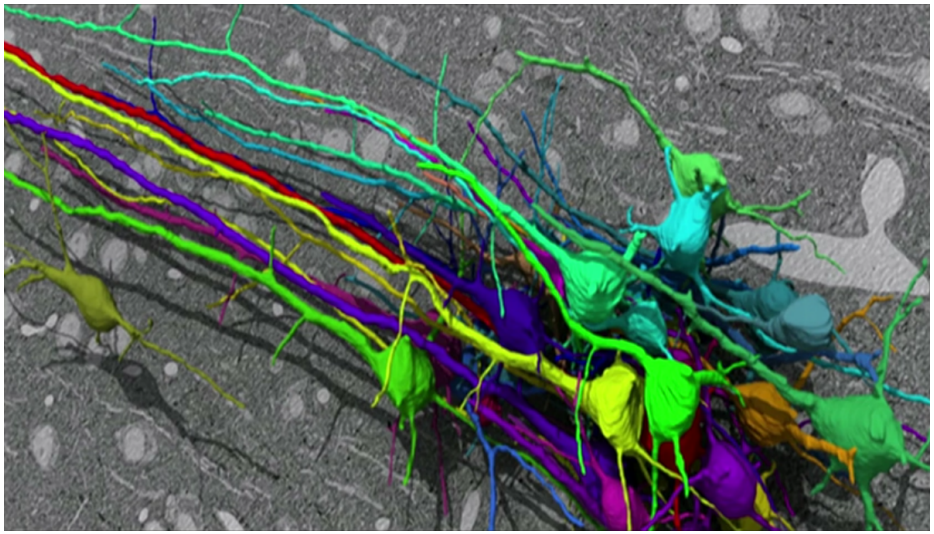
Computers can write

- Man in black shirt is playing guitar
- Two young girls are playing with Lego toy
- Black and white dog jumps over bar

- Tissues in magnification
- Stanford developed a ML algorithm that is better than human pathologist
- In predicting survival rate of cancer suffering

Success Stories

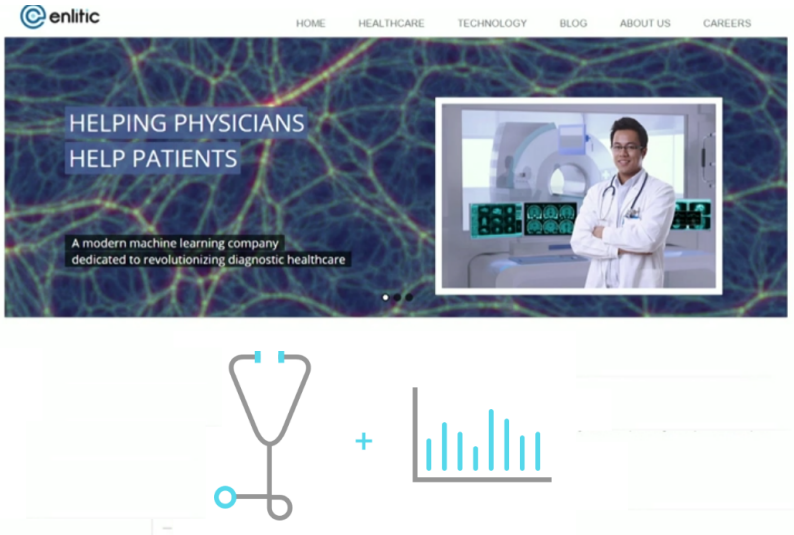


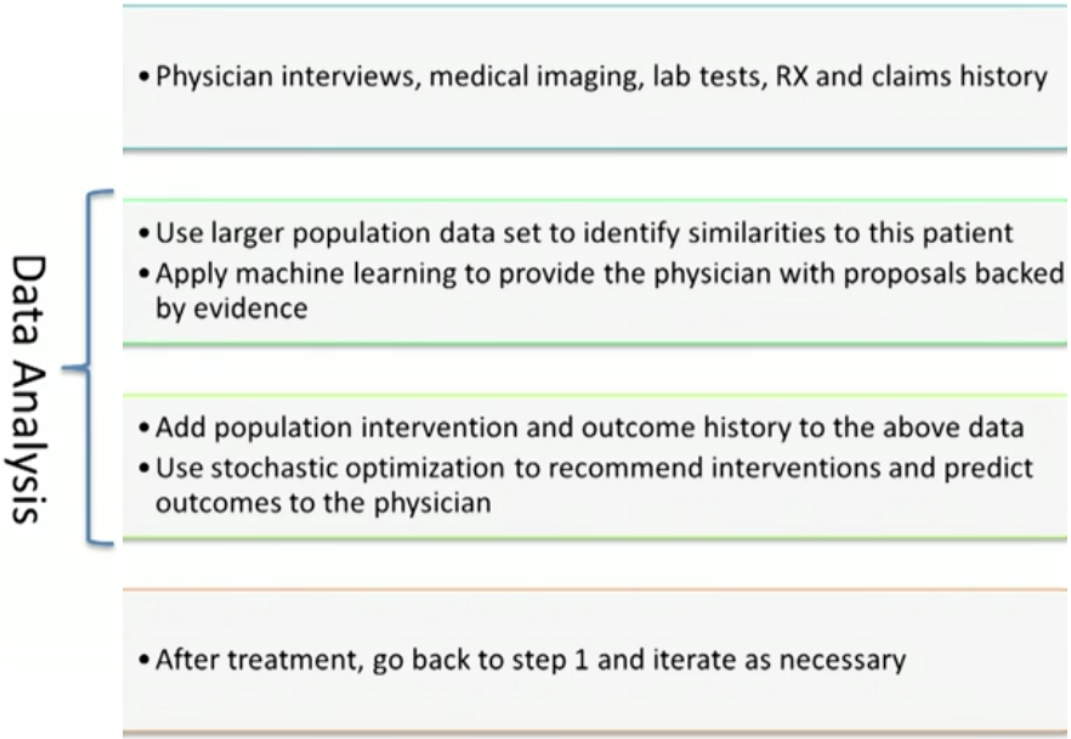


- System were developed by ML experts alone
- Without having any background in chemistry, biology or life sciences
- To identify cancerous tissues under microscope
- To perform neuron segmentation

Success Stories

It is possible to suggest very useful medicines by using just the data analytics techniques





- `Enlitic` uses deep learning to make doctors faster and more accurate
- One have to use the middle path

Success Stories

By using following **four** **capabilities**, humans can do most of the work ($\sim$ 80%) like driving cars, preparing food, diagnosing diseases, Finding legal precedents, .. *etc*.

1. Reading and writing
2. Speaking and listening
3. Looking at things
4. Integrating knowledge

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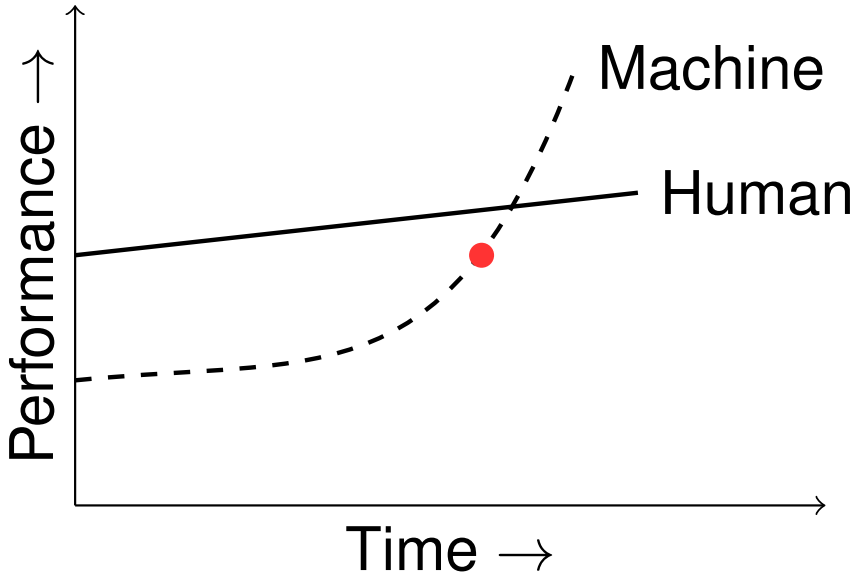

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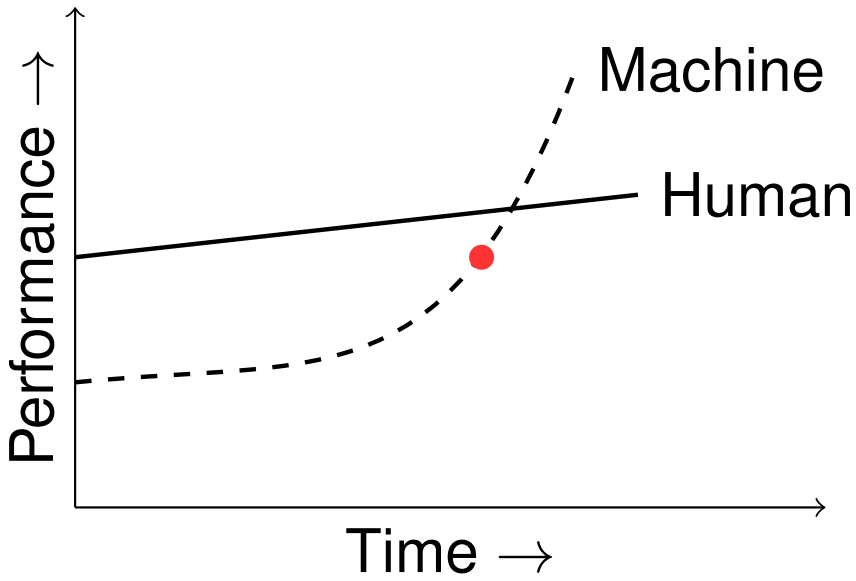
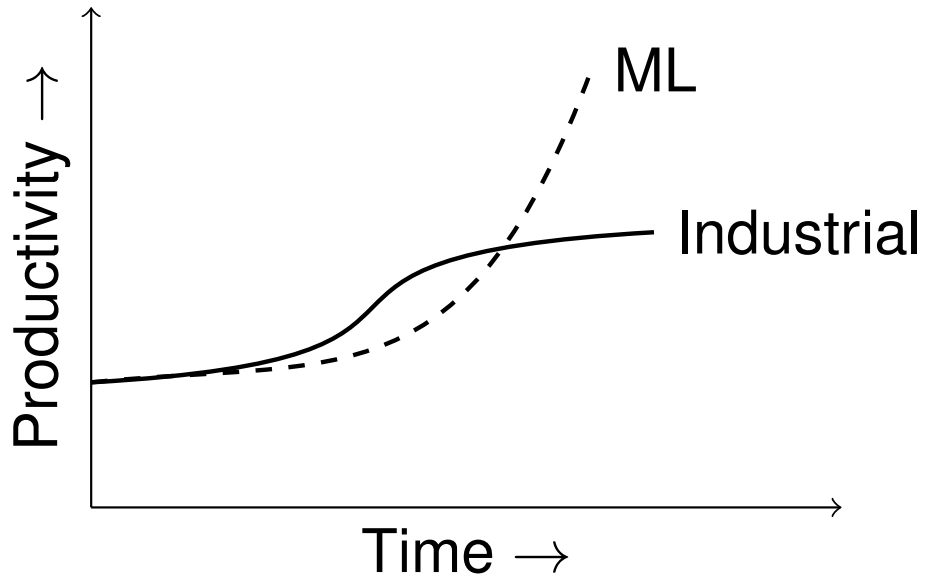




Interested in History?

1943	McCulloch & Pitts: Boolean circuit model of brain
1950	Turing's "Computing Machinery and Intelligence"
1952–69	Look, Ma, no hands!
1950s	Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
1956	Dartmouth meeting: "Artificial Intelligence" adopted
1965	Robinson's complete algorithm for logical reasoning
1966–74	AI discovers computational complexity Neural network research almost disappears
1969–79	Early development of knowledge-based systems
1980–88	Expert systems industry booms
1988–93	Expert systems industry busts: "AI Winter"
1985–95	Neural networks return to popularity
1988–	Resurgence of probability; general increase in technical depth "Nouvelle AI": ALife, GAs, soft computing
1995–	Agents, agents, everywhere ...
2003–	Human-level AI back on the agenda

Syllabus

Goal of the Course

1. To give a flavor of classical AI
2. Build the foundation to design intelligent agents
3. Give a gentle start to ML

Evaluation Scheme

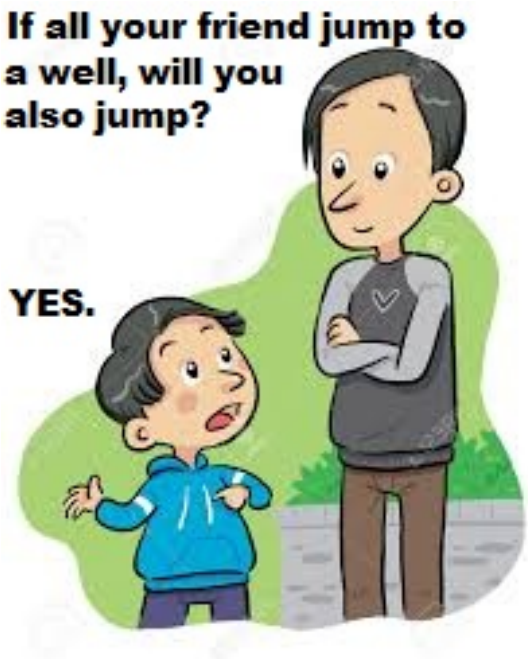
- 3 Quiz/Assignment: 5, 5 &10% respectively
  Sept 10, Oct 20, Nov 10, 2020 open for 10 days
- Mid-Semester Test: 35% (1.5H, Closed Book)
  2-4pm Oct 09, 2020
- Comprehensive Exam: 50% (2.5H, Open Book)
  2-5pm Nov 27, 2020

Text Book: (AIMA) *Artificial Intelligence: A Modern Approach* by Stuart Russell and Peter Norvig 3rd Edition

Thank You!

Thank you very much for your attention!

Queries ?[3]



[3]Reference: Book - *AIMA*, ch-01, Russell and Norvig.