Introduction to Artificial Intelligence

Contents

- Artificial Intelligence (AI)
- AI Perspectives: Acting and Thinking humanly, Acting and Thinking rationally
- History of AI
- Applications of AI
- The present state of AI
- Ethics in AI

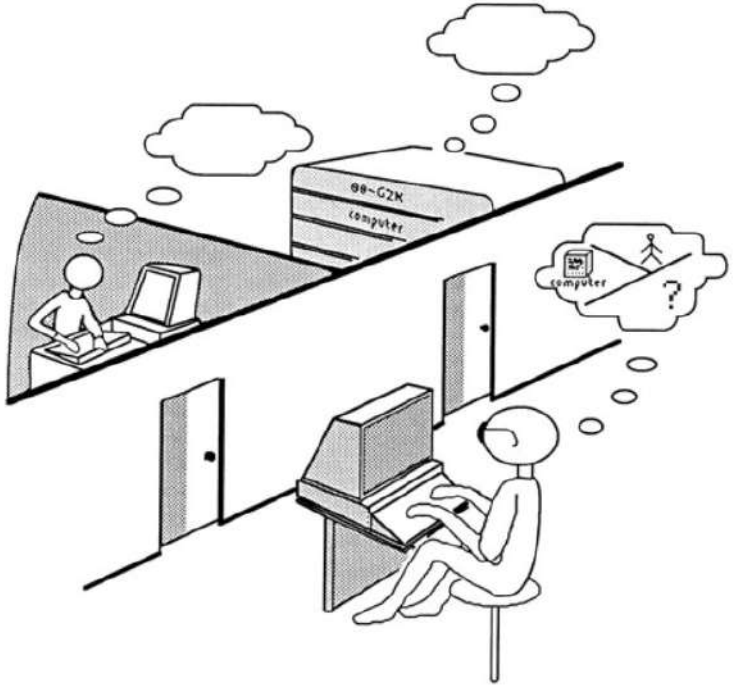
Artificial Intelligence

- **Artificial Intelligence** (AI) refers to the simulation of human intelligence in machines that are programmed to think and act like humans.
- **Intelligence:** The ability to learn and solve problems.
- **Artificial intelligence** as the “copy of something natural(i.e., human beings) ‘WHO’ is capable of acquiring and applying the information it has gained through exposure.”
- **Intelligence is composed of:**
  - Reasoning
  - Learning
  - Problem-Solving
  - Perception
  - Linguistic Intelligence

Artificial Intelligence Perspective

	Human- Like	Rationally
Think:	Cognitive Science Approach *"Machines that think like humans"*	Laws of thought Approach *" Machines that think Rationally"*
Act:	Turing Test Approach *"Machines that behave like humans"*	Rational Agent Approach *"Machines that behave Rationally"*

Systems that act like human



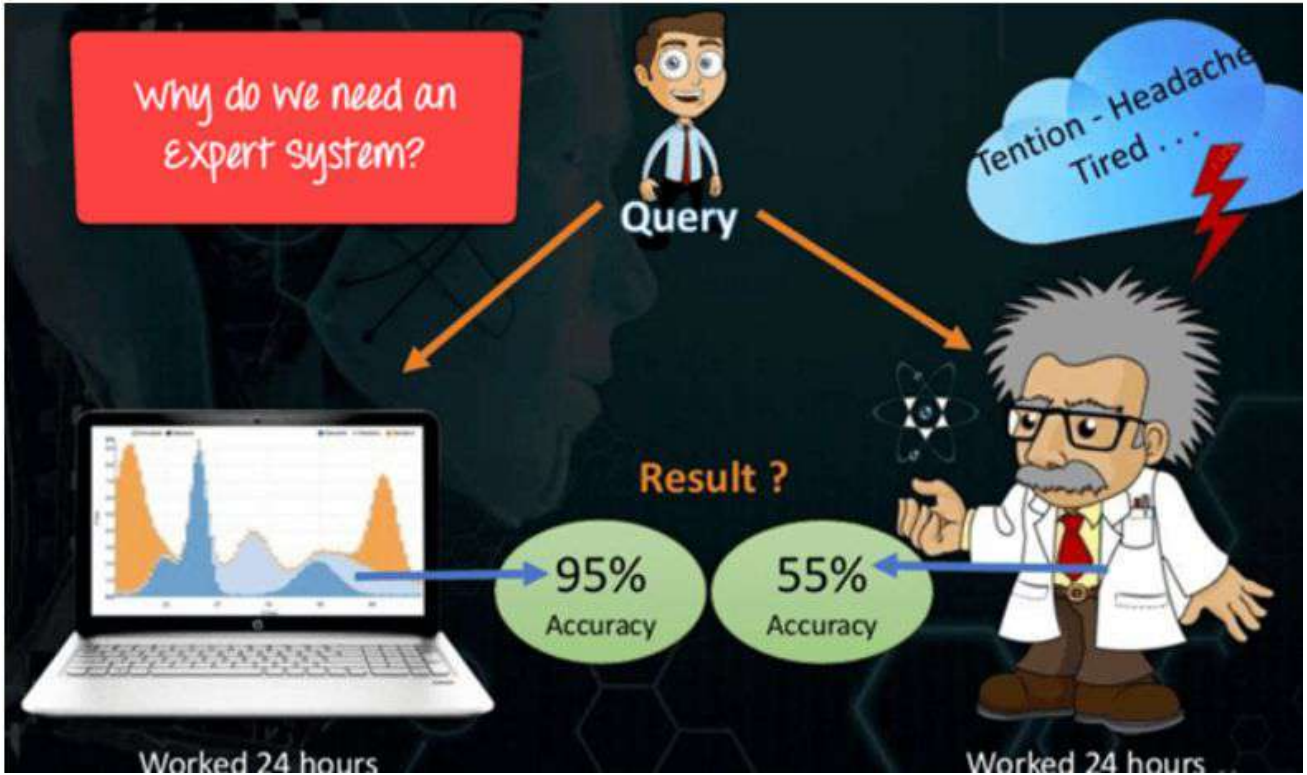
- Proposed by Alan Turing (1950)
- A Person
- A Computer
- An interrogator
- The Computer need to posses the following capabilities:
  - NLP
  - Knowledge Representation
  - Automated Reasoning
  - Machine Learning

System that think like human

Cognitive Modeling Approach

- We need to get inside the actual workings of human minds
- Two ways to do this:
  - **Trying to catch our own thoughts as they go by**
  - **Or through psychological experiments**
- Cognitive Science: the brain as an information processing machine
  - **Requires scientific theories of how the brain work**
- Applications:
  - **Expert System, NLP, VR, NN**

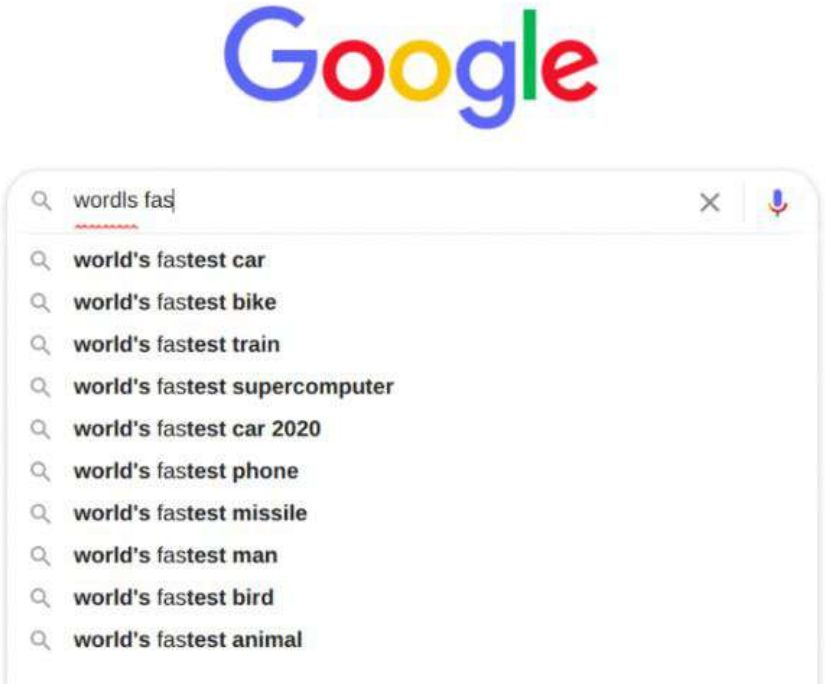
Expert System



Expert System

- **MYCIN:** It could identify various bacteria that could cause acute infections. It could also recommend drugs based on the patient's weight. It is one of the best Expert System Example.
- **DENDRAL:** Expert system used for chemical analysis to predict molecular structure.
- **PXDES:** An Example of Expert System used to predict the degree and type of lung cancer
- **CaDet:** One of the best Expert System Example that can identify cancer at early stages

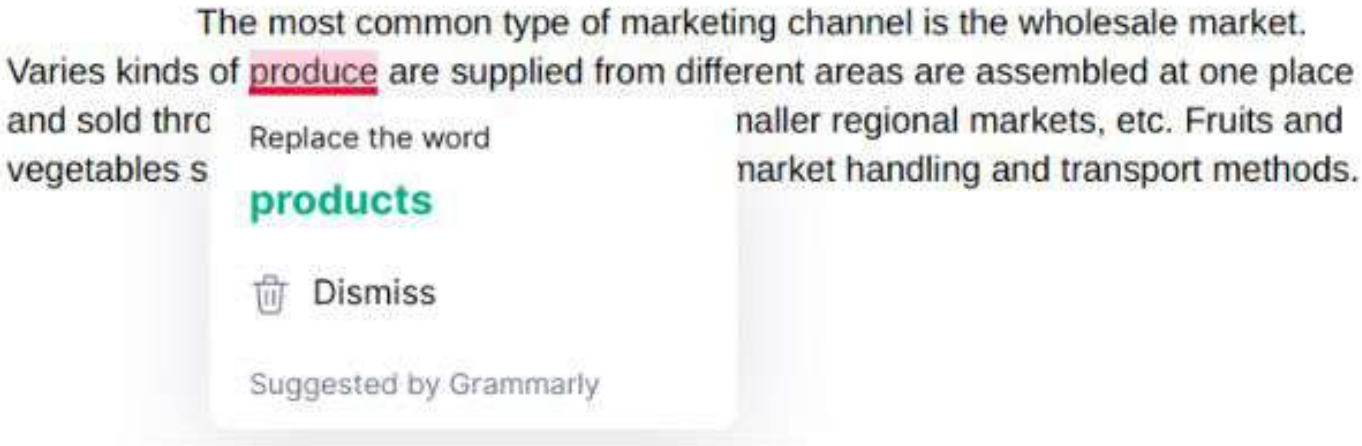
Natural Language Processing(NLP)



Search Autocorrect and Autocomplete

Natural Language Processing(NLP)

Grammar Checkers



Natural Language Processing(NLP)

Language translator

System that think rationally

The laws of thought Approach

- 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 a mortal”**

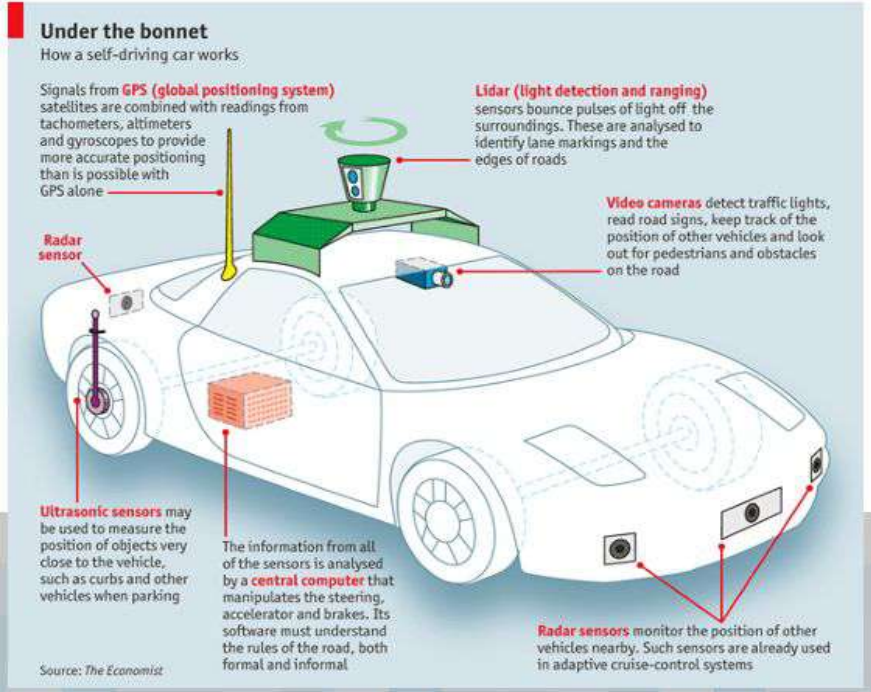
System that act rationally

Rational Agent

- Acting rationally means acting to achieve goals
- Rational agent is one that acts to achieve the best expected outcome
- Goals are application-dependent and are expressed in terms of the utility of outcomes
- Being rational means maximizing your expected utility
- Rational means more than just logically justified. It also means “doing the right thing”
- **Self driving cars, Siri, Alexa, Robots**

Self Driving Cars

Basic Physical Ecosystem of an Autonomous Vehicle

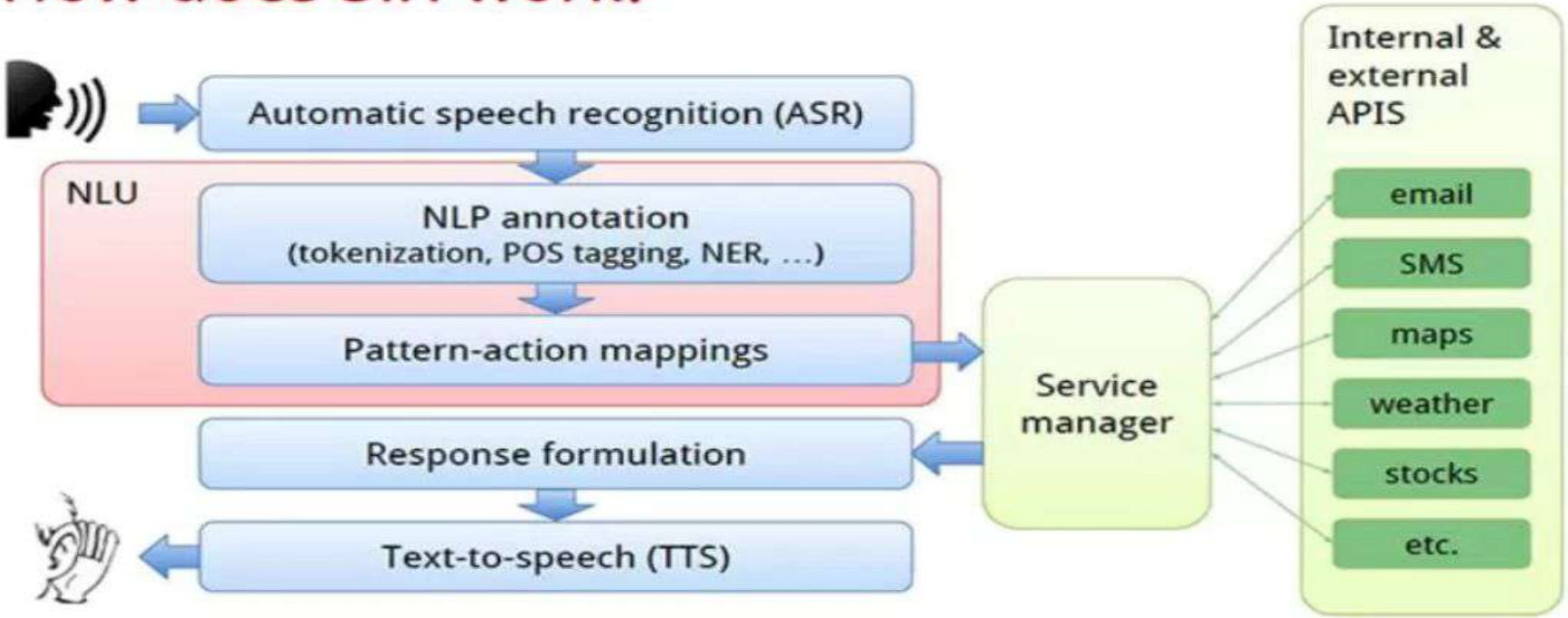


Source: The Economist, "How does a self-driving car work?"

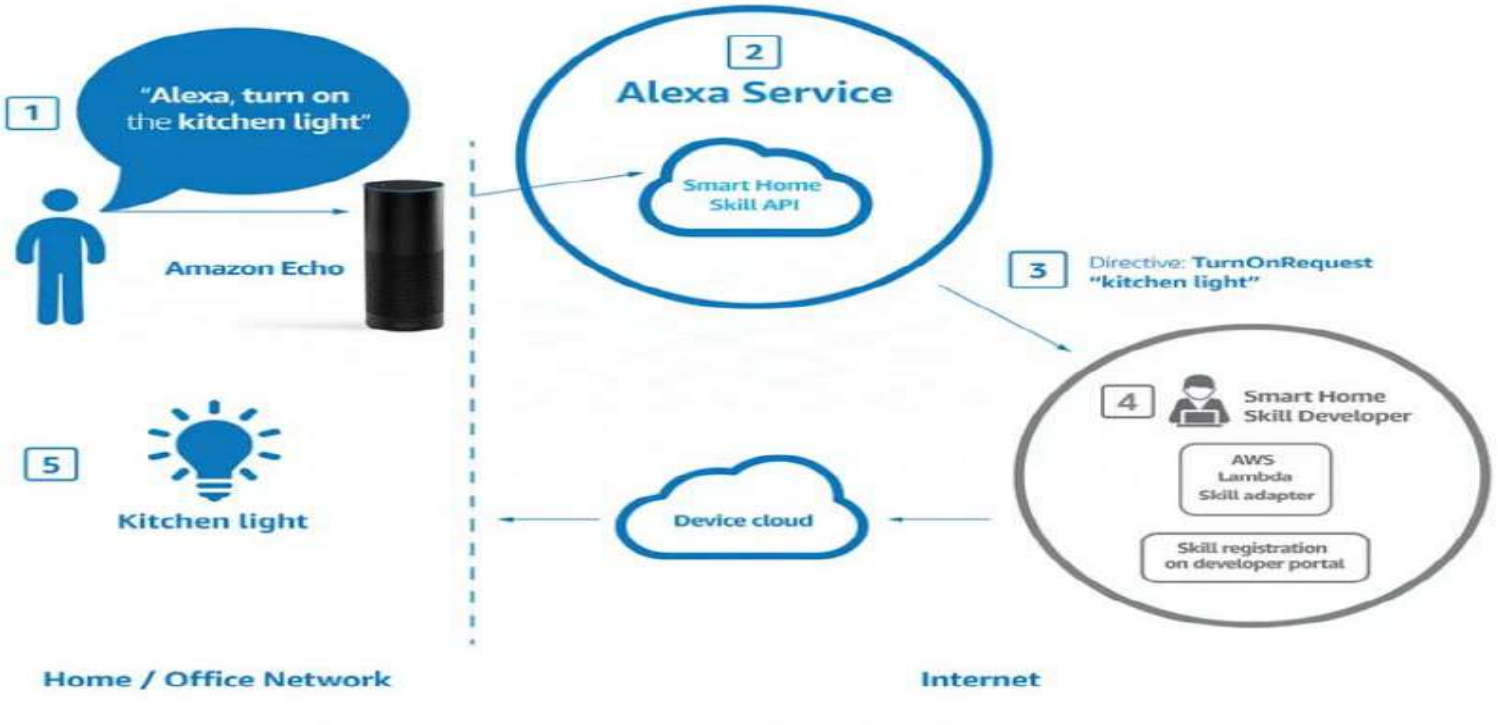
- Global Positioning System (GPS)
- Light Detection and Ranging (LIDAR)
- Cameras (Video)
- Ultrasonic Sensors
- Central Computer
- Radar Sensors
- Dedicated Short-Range Communications-Based Receiver (not pictured)

Siri

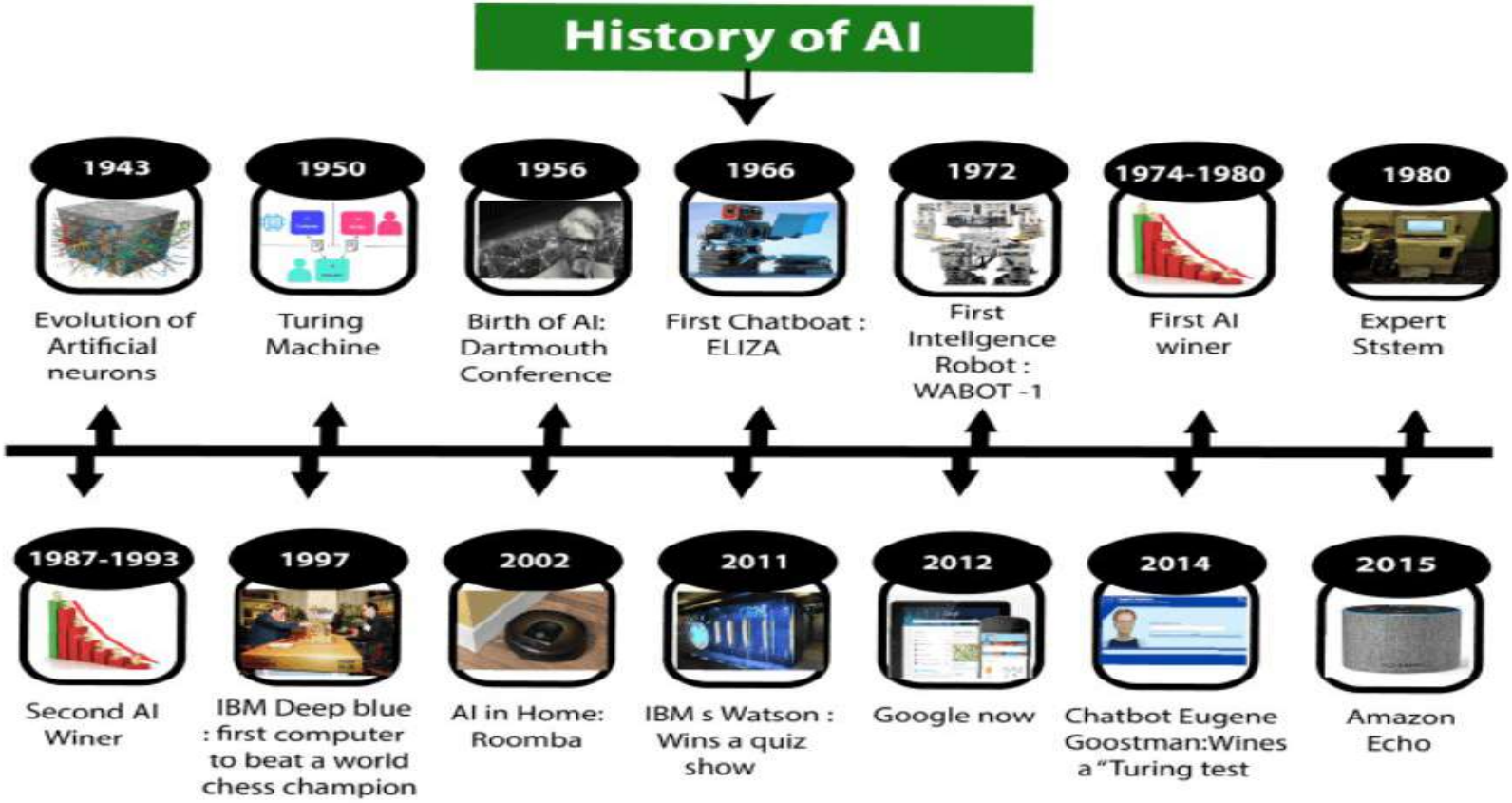
How does Siri work?



Alexa


1
"Alexa, turn on the kitchen light"
Amazon Echo
2
Alexa Service
Smart Home Skill API
3
Directive: TurnOnRequest
"kitchen light"
4
Smart Home Skill Developer
AWS Lambda Skill adapter
Skill registration on developer portal
5
Kitchen light
Device cloud
Home / Office Network
Internet

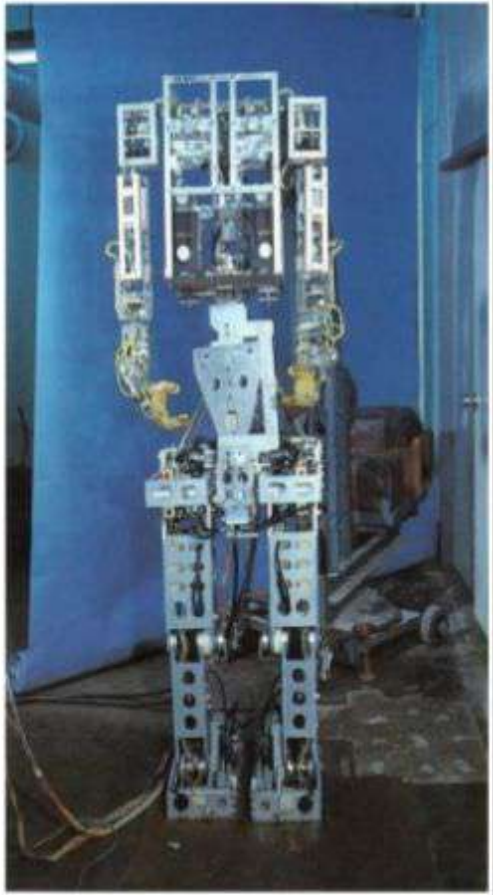
History of AI



User interface of the Eliza.

WABOT-1 (1970~1973)

- Waseda University
- The first fun-scale humanoid robot developed in the world
- Able to communicate in Japanese and measure distances and directions to objects using external receptors, artificial ears and eyes, and an artificial mouth

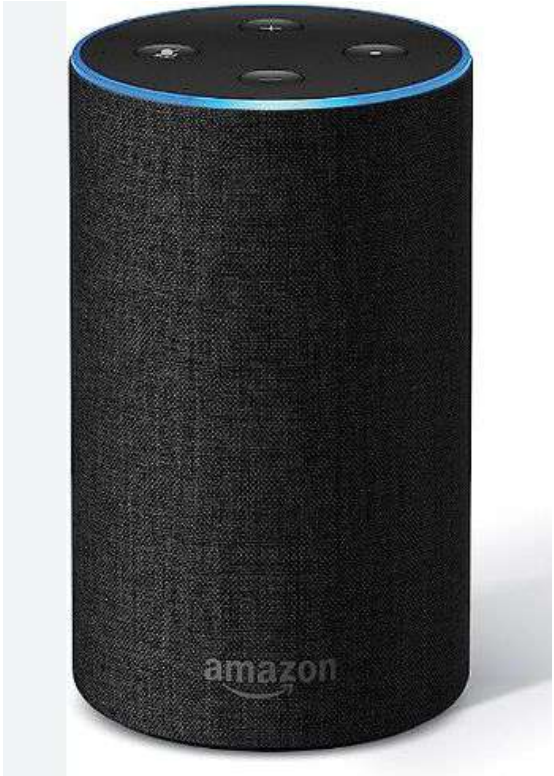


Deep Blue

Roomba

Chatbot Eugene Goostman

Amazon Echo



Working of Amazon Go

Maturation of AI [1943-1955]

- **Year 1943:** The first work which is now recognized as AI was done by Warren McCulloch and Walter pits in 1943. They proposed a model of **artificial neurons**.
- **Year 1949:** Donald Hebb demonstrated an updating rule for modifying the connection strength between neurons. His rule is now called **Hebbian learning**.
- **Year 1950:** The Alan Turing who was an English mathematician and pioneered Machine learning in 1950. Alan Turing publishes **"Computing Machinery and Intelligence"** in which he proposed a test. The test can check the machine's ability to exhibit intelligent behavior equivalent to human intelligence, called a **Turing test**.
- **Year 1955:** An Allen Newell and Herbert A. Simon created the "first artificial intelligence program"Which was named as **"Logic Theorist"**. This program had proved 38 of 52 Mathematics theorems, and find new and more elegant proofs for some theorems.

The Birth of AI [1956]

- **Year 1956:** The word "Artificial Intelligence" first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field.

The Golden Years-Early Enthusiasm[1956-1974]

- **Year 1966:** The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chatbot in 1966, which was named as ELIZA.
- **Year 1972:** The first intelligent humanoid robot was built in Japan which was named as WABOT-1.

The first AI winter [1974-1980]

- AI winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for AI researches.
- During AI winters, an interest of publicity on artificial intelligence was decreased.

A Boom of AI [1980-1987]

- **Year 1980:** After AI winter duration, AI came back with "Expert System". Expert systems were programmed that emulate the decision-making ability of a human expert.
- In the Year 1980, the first national conference of the American Association of Artificial Intelligence **was held at Stanford University**.

The Second AI Winter [1987-1993]

- Again Investors and government stopped in funding for AI research as due to high cost but not efficient result.

The Emergence of Intelligent Agents [1993-2011]

- **Year 1997:** In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.
- **Year 2002:** for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
- **Year 2006:** AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

Foundation of AI

- **Philosophy**
  - Foundational issues (can machine think?)
- **Psychology and Cognitive Science**
  - Problem solving skills
- **Neuroscience**
  - Brain architecture
- **Computer Science And Engineering**
  - Complexity theory, algorithms, logic and inference, programming languages
- **Mathematics and Physics**
  - Statistical modeling, continuous mathematics

Sub Areas of AI

- **Game Playing**
  - Deep Blue Chess Program
- **Speech Recognition**
  - PEGASUS spoken language interface to American Airlines' EAASY SABRE reservation system, which allows users to obtain flight information and make reservations over the telephone.
- **Computer Vision**
  - Face recognition programs in use by banks, government, etc.
  - Handwriting recognition, electronics and manufacturing inspection, photo interpretation, baggage inspection,
- **Expert Systems**
  - Diagnostic Systems
  - Financial Decision Making
  - Classification Systems
- **Scheduling and Planning**
- **Artificial Neural Networks**
- **Machine Learning**

Applications of AI

- Healthcare
- Gaming
- Finance
- Data security
- Social Media
- Robotics
- Agriculture
- E-Commerce
- Education

The Present states in AI

- Robotic Vehicle
- Speech Recognition
- Autonomous planning and scheduling
- Game playing
- Spam Fighting
- Logistics planning
- Robotics
- Machine translation

Ethics in AI

- **Explainability**
- **Responsibility**
- **Misuse**