

Artificial Intelligence (AI)

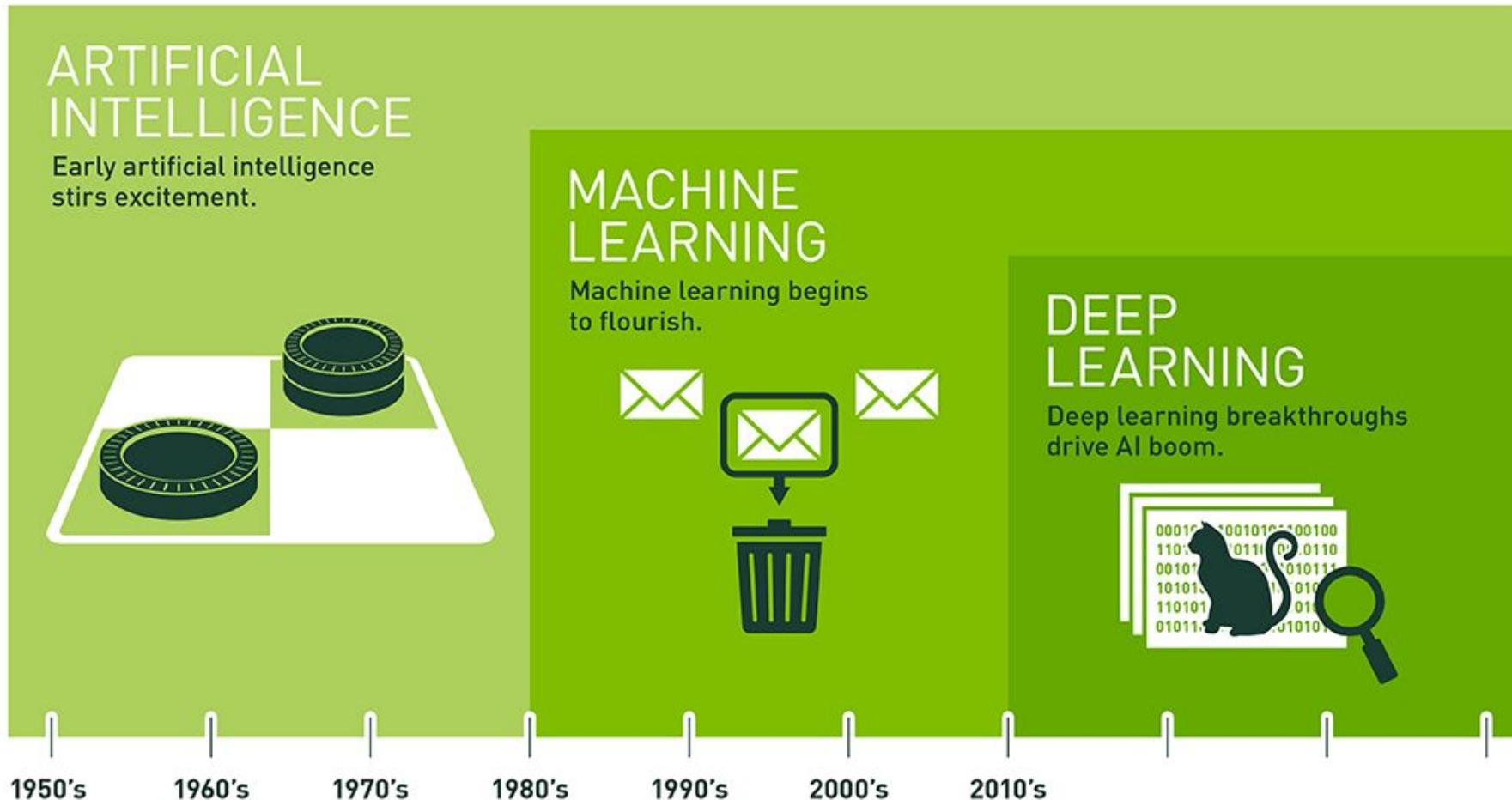
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Objectives Applications Inspiration

History Biological



Application 1. Self-driving cars





Social Networks: Facebook, Twitter, Instagram, and other social media content

Music recommendations on Spotify

Movie recommendations on Netflix, HBO, and other streaming services

Online publishers, Google also personalize the content they offer.

Application 2. Content recommendation

Content recommendation



technology



image processing

exchange step chart
social inspiration world
color environment dramatic
environment professional creative
label tech search engineering reusable
data design website nature

internet future people
employment casual options information presentation job
illustration business process innovation advertising solution
digital travel exploration choice laptop
media shape work success devices concept software
computer layout element occupation art share web

A blue airplane is shown flying diagonally upwards across a background of a blue printed circuit board. The board is covered in binary code (0s and 1s) and various electronic components like resistors and capacitors. The airplane's body follows the curve of the circuit board.

Aerospace

-Aircraft autopilote, flight path simulations

- Aircraft control systems

-Autopilot enhancements

-Aircraft component simulations,

-Aircraft component fault detectors



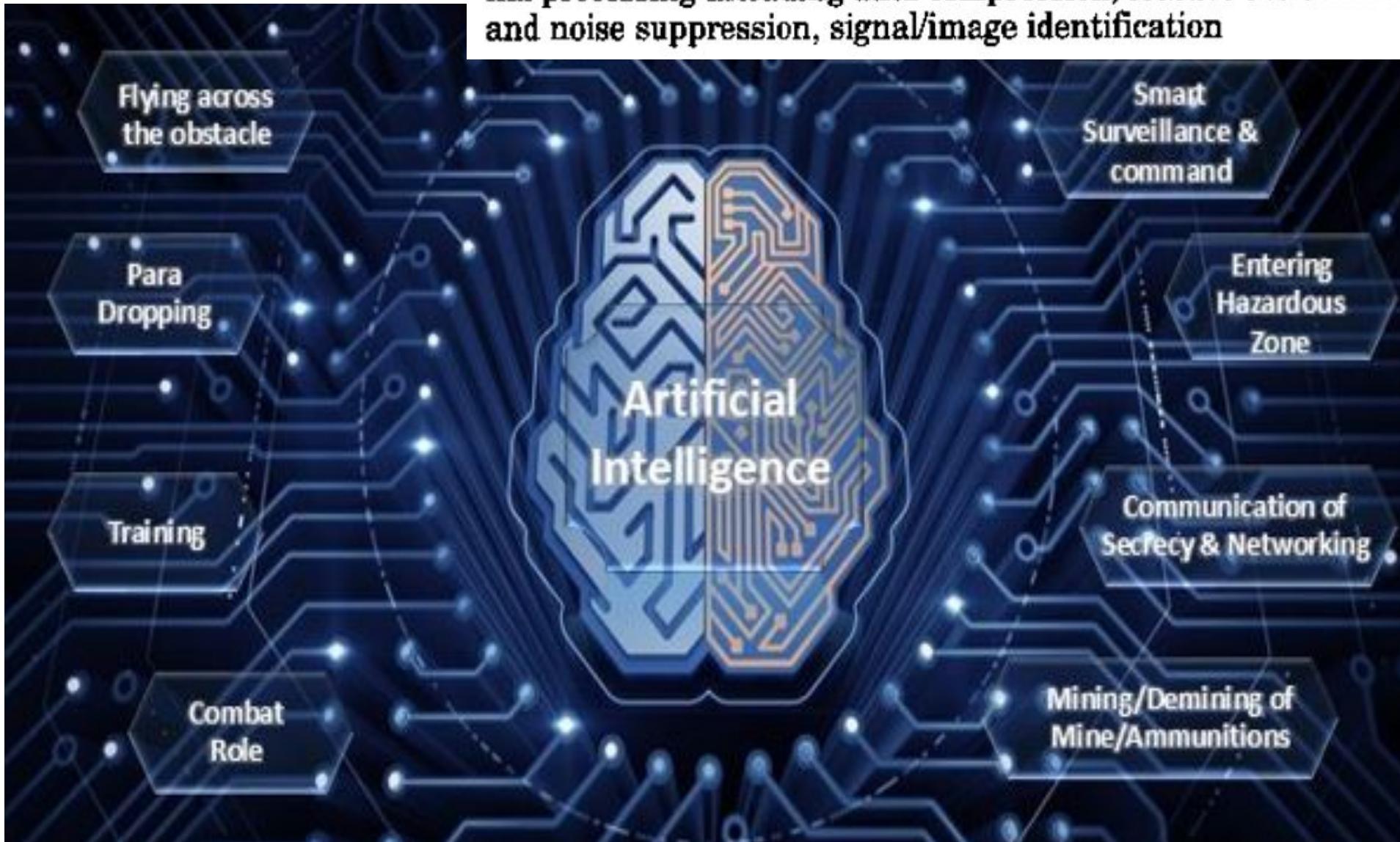
Automobile automatic guidance systems, warranty activity analyzers

A composite image on a teal background. On the left, a woman's profile is shown in white against a dark background. Overlaid on her head is a black key. To the right of the woman is a white rectangular box containing the text 'BANKING WITH ARTIFICIAL INTELLIGENCE'. The bottom half of the image features a dark teal background with a grid of binary code (0s and 1s). Superimposed on this are several light blue hexagonal shapes of varying sizes.

BANKING WITH ARTIFICIAL INTELLIGENCE

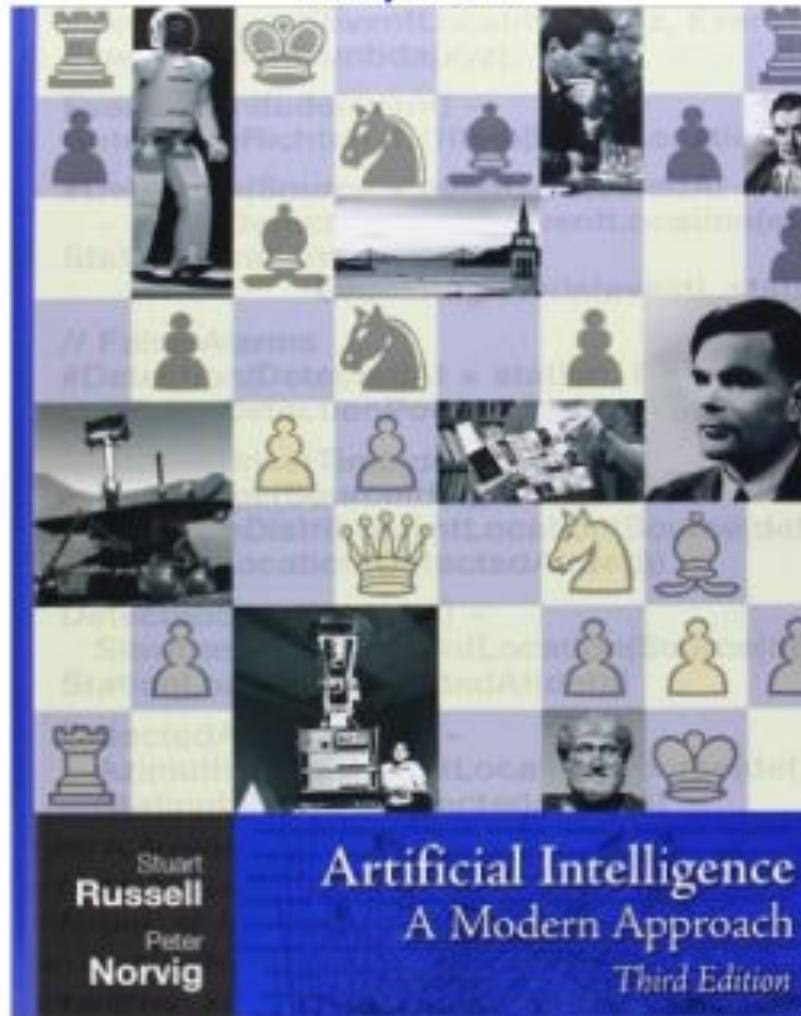
Defense

Weapon steering, target tracking, object discrimination, facial recognition, new kinds of sensors, sonar, radar and image signal processing including data compression, feature extraction and noise suppression, signal/image identification



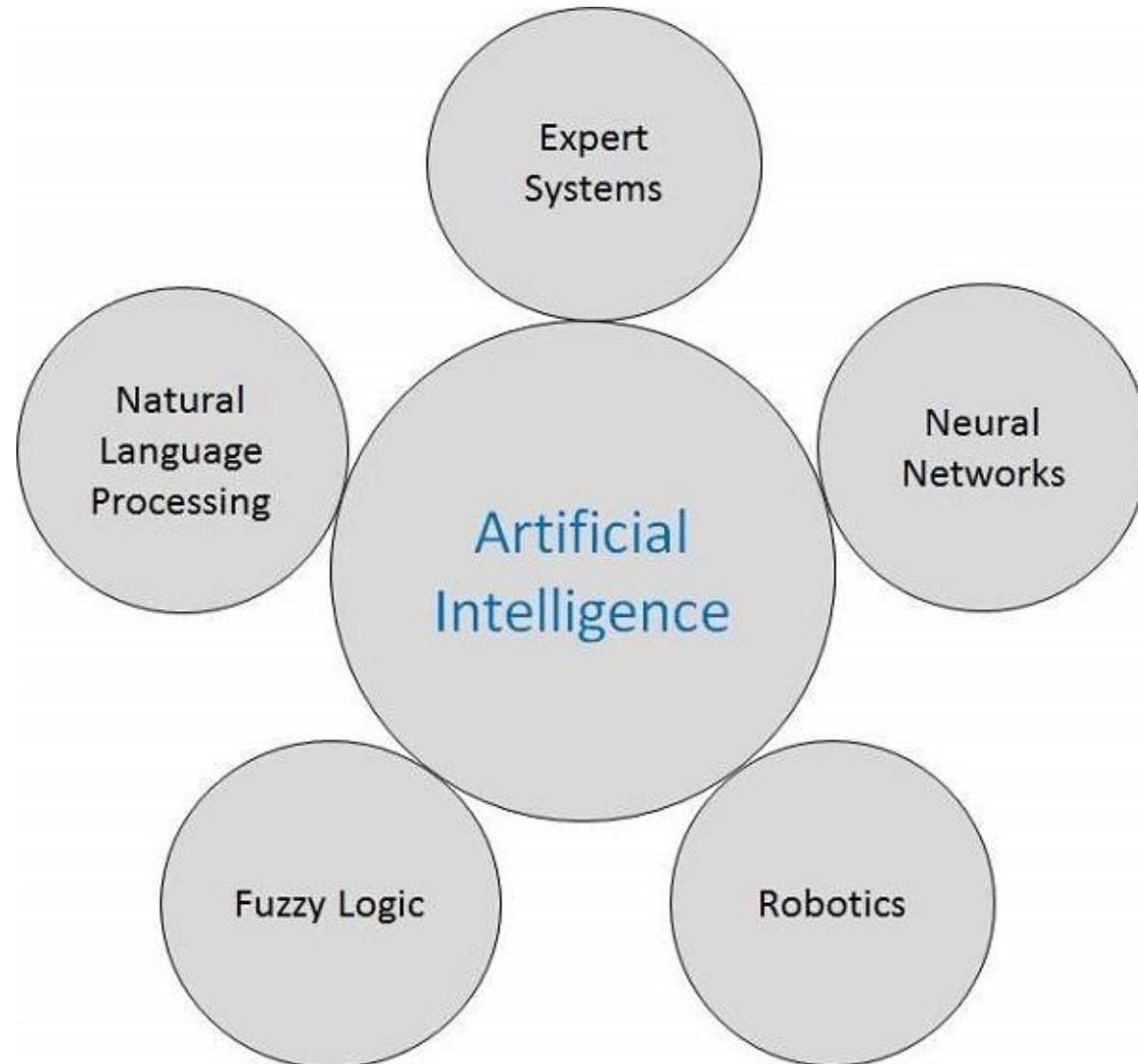
Textbook

Required:

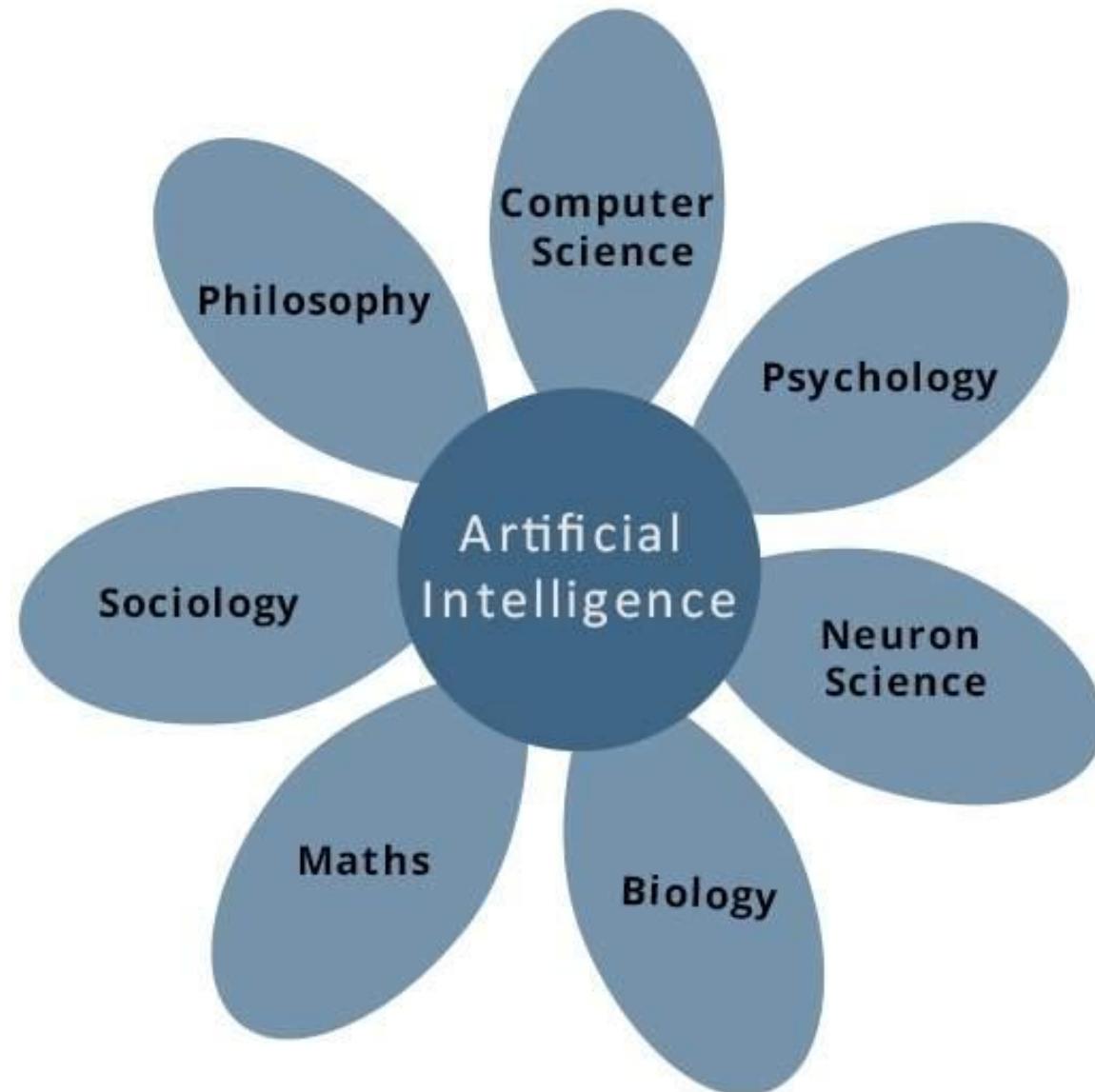


Many online supplemental materials posted on the class syllabus.

Artificial Intelligence - Research Areas



What Contributes to AI?



Programming Without and With AI

Programming Without AI	Programming With AI
A computer program without AI can answer the specific questions it is meant to solve.	A computer program with AI can answer the generic questions it is meant to solve.
Modification in the program leads to change in its structure.	AI programs can absorb new modifications by putting highly independent pieces of information together. Hence you can modify even a minute piece of information of program without affecting its structure.
Modification is not quick and easy. It may lead to affecting the program adversely.	Quick and Easy program modification.

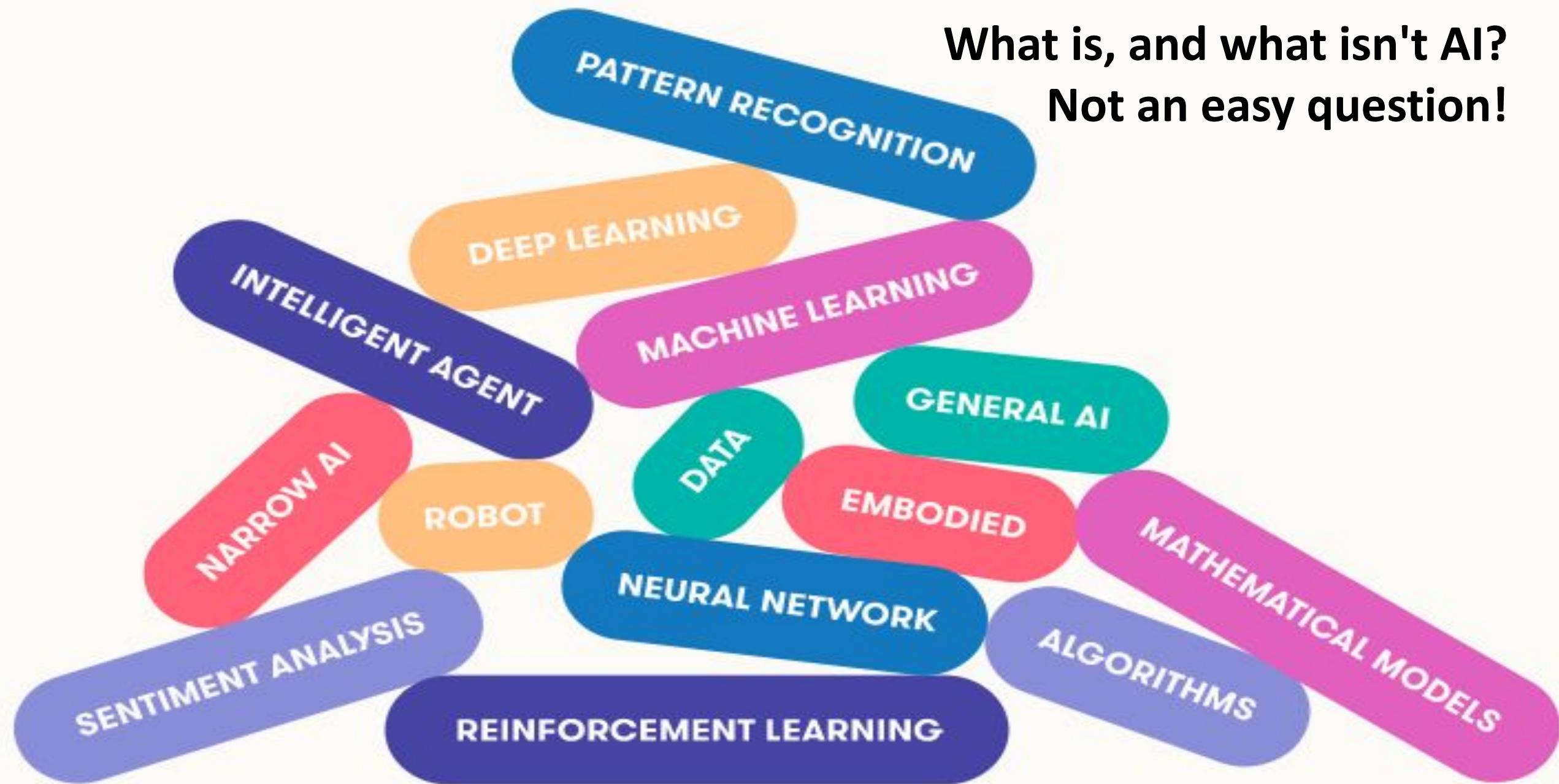
Real Life Applications of AI Research Areas

Sr.No.	Research Areas
1	Expert Systems Examples – Flight-tracking systems, Clinical systems.
2	Natural Language Processing Examples: Google Now feature, speech recognition, Automatic voice output.
3	Neural Networks Examples – Pattern recognition systems such as face recognition, character recognition, handwriting recognition.
4	Robotics Examples – Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, carving, etc.
5	Fuzzy Logic Systems Examples – Consumer electronics, automobiles, etc.

Task Domains of Artificial Intelligence

Mundane (Ordinary) Tasks	Formal Tasks	Expert Tasks
Perception <ul style="list-style-type: none">• Computer Vision• Speech, Voice	<ul style="list-style-type: none">• Mathematics• Geometry• Logic• Integration and Differentiation	<ul style="list-style-type: none">• Engineering• Fault Finding• Manufacturing• Monitoring
Natural Language Processing <ul style="list-style-type: none">• Understanding• Language Generation• Language Translation	Games <ul style="list-style-type: none">• Go• Chess (Deep Blue)• Checkers	Scientific Analysis
Common Sense	Verification	Financial Analysis
Reasoning	Theorem Proving	Medical Diagnosis
Planning		Creativity
Robotics Locomotive		

What is, and what isn't AI?
Not an easy question!



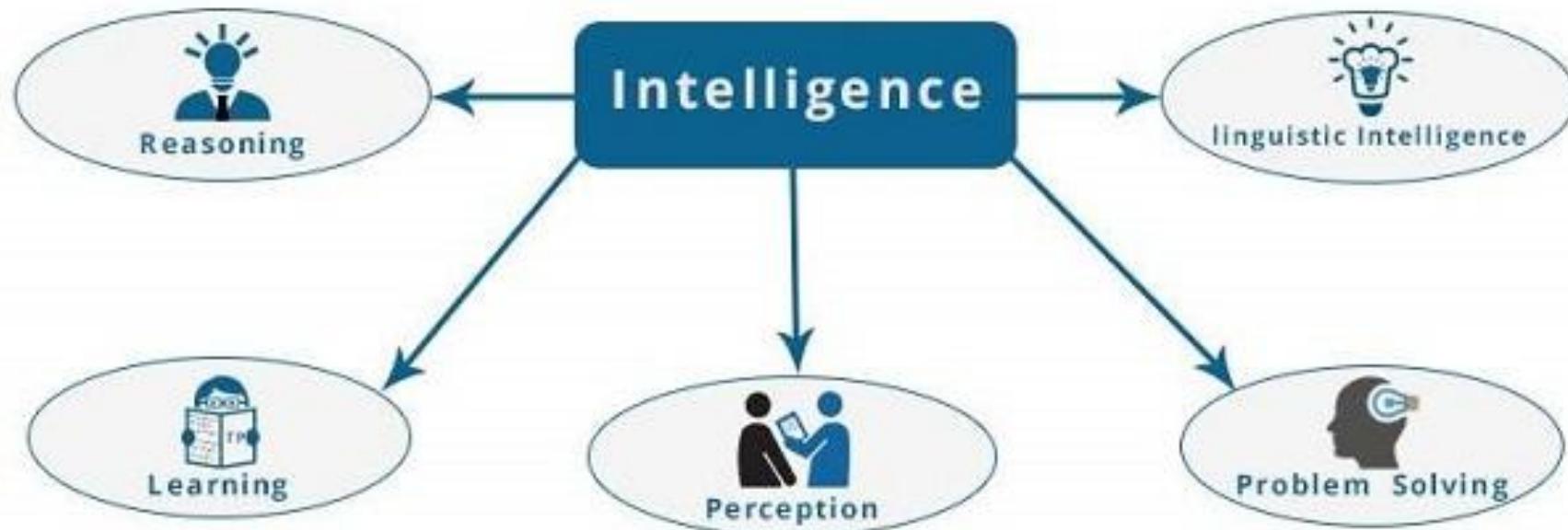
Types of Intelligence

Intelligence	Description
Linguistic intelligence	The ability to speak, recognize, and use mechanisms of phonology (speech sounds), syntax (grammar), and semantics (meaning).
Musical intelligence	The ability to create, communicate with, and understand meanings made of sound, understanding of pitch, rhythm.
Logical-mathematical intelligence	The ability of use and understand relationships in the absence of action or objects. Understanding complex and abstract ideas.
Spatial intelligence	The ability to perceive visual or spatial information, change it, and re-create visual images without reference to the objects, construct 3D images, and to move and rotate them.

Types of Intelligence

Intelligence	Description
Bodily-Kinesthetic intelligence	The ability to use complete or part of the body to solve problems or fashion products, control over fine and coarse motor skills, and manipulate the objects.
Intra-personal intelligence	The ability to distinguish among one's own feelings, intentions, and motivations.
Interpersonal intelligence	The ability to recognize and make distinctions among other people's feelings, beliefs, and intentions.

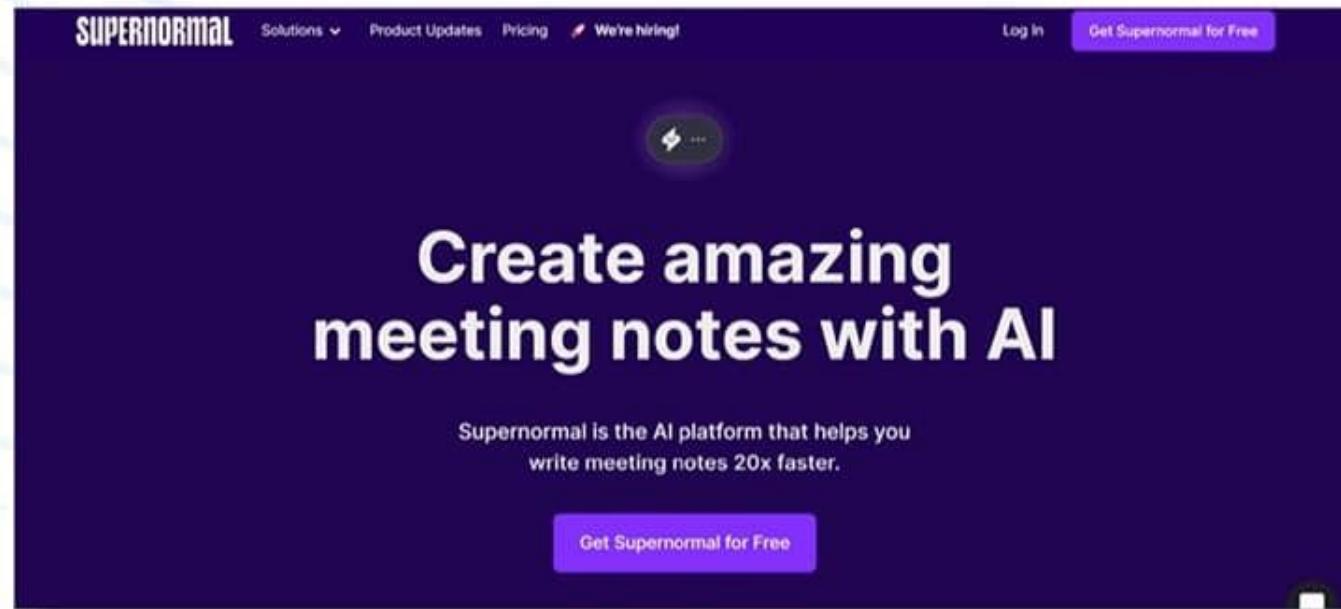
What is Intelligence Composed of?



Supernormal

Supernormal is an AI that helps you write your meeting notes 20x faster

Online meetings have now become an irreplaceable part of our professional routine. Supernormal is your go-to option to get download of your meetings in simple and streamlined format.

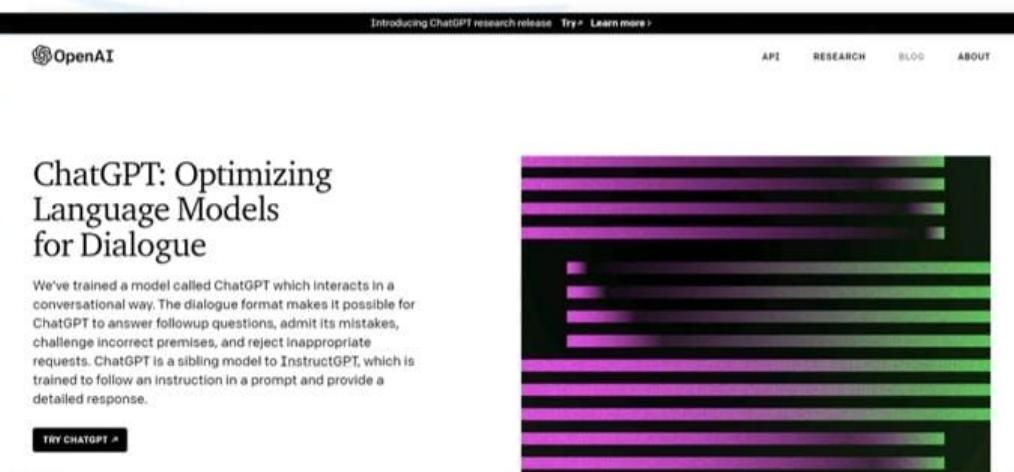


ChatGPT

ChatGPT is a great AI bot capable of producing human-like responses

It can be leveraged by businesses to answer customer service enquiries, draw outlines for meetings or presentations and generate product descriptions as well.

It can save minutes of your time taken to read those lengthy articles to get solutions for your queries on the internet.



The screenshot shows the official ChatGPT website. At the top, there's a dark header bar with the text "Introducing ChatGPT research release" and "Try it Learn more". Below the header, the OpenAI logo is on the left, and navigation links for "API", "RESEARCH", "BLOG", and "ABOUT" are on the right. The main content area features a large title "ChatGPT: Optimizing Language Models for Dialogue". Below the title is a detailed paragraph explaining the model's capabilities, mentioning its conversational nature, ability to handle follow-up questions, and adherence to instructions. A prominent "TRY CHATGPT" button is located at the bottom of this section. To the right of the text is a vertical decorative graphic consisting of many horizontal bars of varying lengths, colored in a gradient from purple to green.



An AI-powered personal assistant that helps schedule meetings and manage email communication

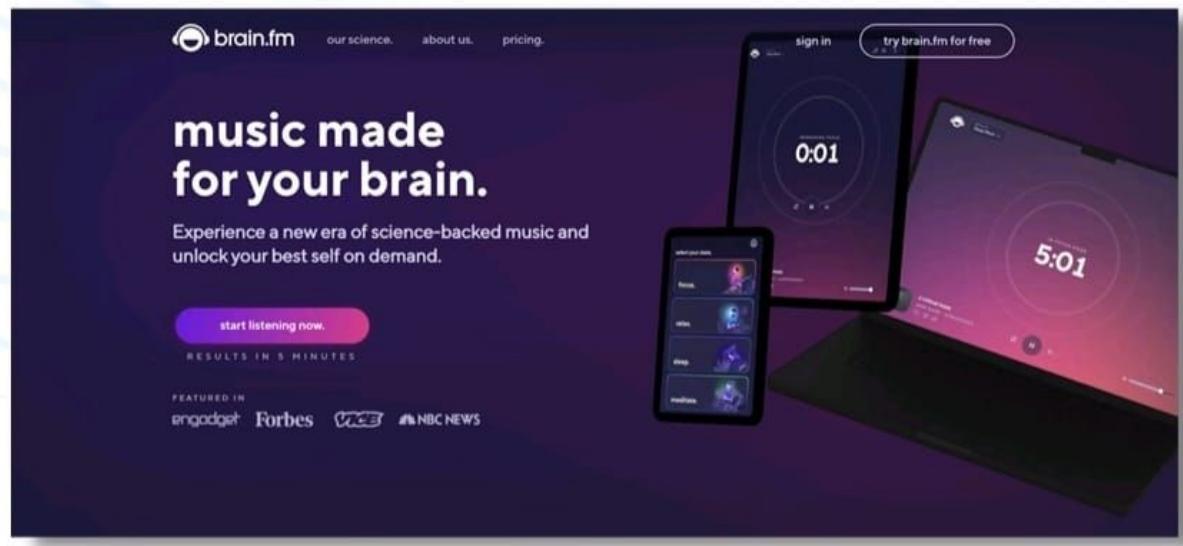
Connect all of your calendars with x.ai and it will instantly review your availability and accordingly find and schedule ideal meeting times.

The screenshot shows the homepage of Sizzabo, a platform for event management. The header features the Sizzabo logo, a navigation bar with links for Products, Solutions, Customers, Resources, and About Us, and buttons for Get a Demo, Login, and a search icon. The main visual is a yellow graphic with a white spiral line, overlaid with the tagline "The Modern, Hassle-free Way to Build Better Events". Below this, a sub-tagline reads "Find everything you need to create more immersive, successful experiences with the Event Experience OS."

Brain.fm

Brain.fm uses AI and provides you with a range of tracks that improves your focus, productivity, meditation, and sleep.

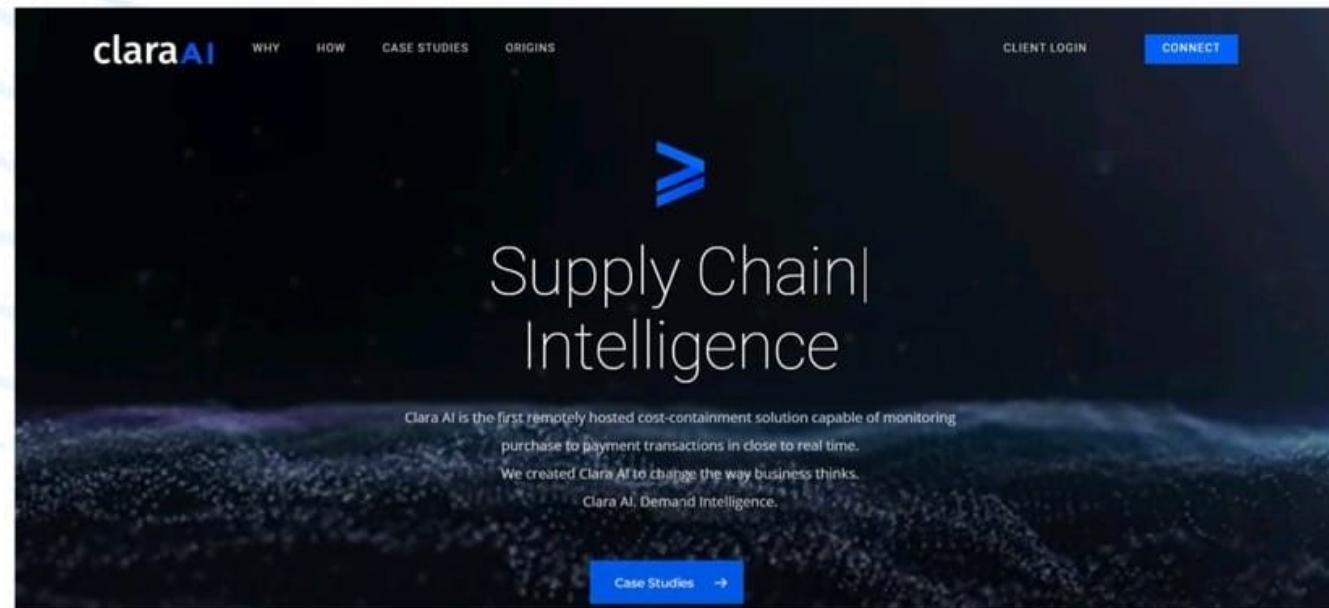
It starts playing music tracks according to your mood and choices.



Clara AI

Clara AI is a remotely hosted AI as a Service (AlaaS) that has the ability to learn specific business requirements and provide suggestions for improvement.

It learns, analyzes, interprets and delivers insights for audit, supply chain, and recovery.



J

you can write articles, essays, courses, product descriptions. the list is probably very long. can you provide 20 such examples ?



Sure, here are 20 examples of things I can write:



1. News articles
2. Research papers
3. Blog posts
4. Product descriptions
5. Technical manuals
6. Business plans
7. Marketing materials
8. Scripts for videos or podcasts
9. Social media posts
10. Resumes and cover letters
11. E-mails
12. Speeches
13. Poems and short stories
14. Book and movie reviews
15. Scripts for video games
16. Legal documents
17. Music lyrics
18. Code documentation
19. Cooking recipes
20. Travel guides

Please note that the quality of the output will vary based on the complexity and specificity of the task, as well as the quality of the input provided to my model.

Nếu $a > b$ và $b < c$, vậy a và c là như thế nào?

< 1 / 1 >

Merlin Says:

Nếu $a > b$ và $b < c$, thì a sẽ lớn hơn b và c sẽ lớn hơn b .

1. Blog posts
2. Poems
3. News articles
4. Short stories
5. Book reviews
6. Website content
7. Press releases
8. Social media posts
9. Video scripts
10. Tutorials
11. Product Descriptions
12. Technical manuals
13. Magazine articles
14. Manuals
15. eBooks
16. Brochures
17. Reports
18. Interviews
19. White papers
20. Reviews

Poem by Chat GPT!

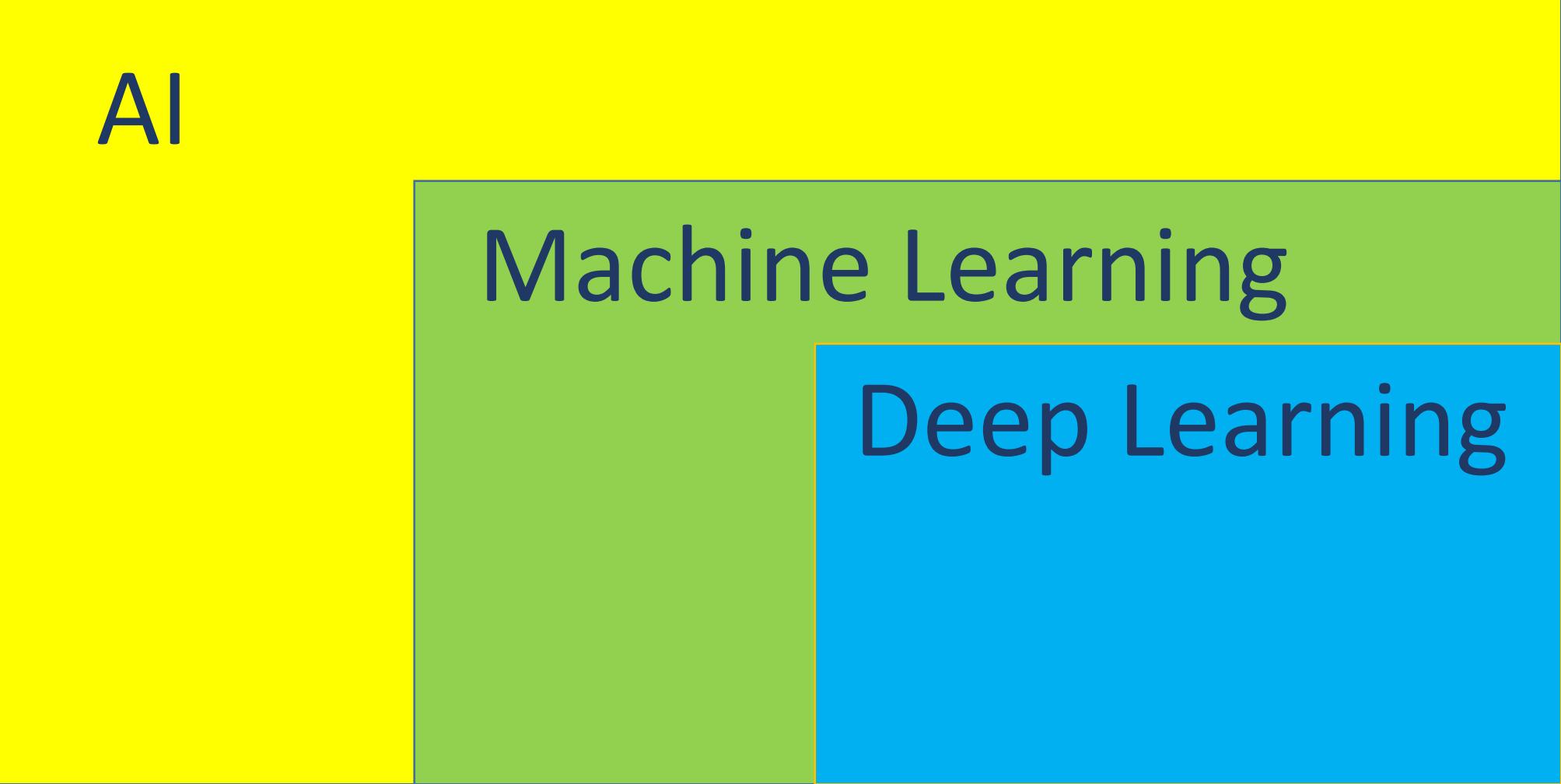
Cuộc đời như sắc hoa,
Lấp lánh trong ánh sáng mới.
Tình yêu trăng sang,
Tự do về tâm hồn.

với mỗi giây phút,
Cố gắng cải thiện tâm trí.
Tăng thêm năng lượng,
Cho những ngày sắp đến.

Cuộc đời như sức mạnh,
Trong trái tim bền lâu.
Kết liễu những khó khăn,
Và ngày mới đến ngay.

Cuộc đời là hành trình,
Tìm hiểu bí ẩn thế giới.
Nắm giữ những kỷ niệm,
Và ôm những giấc mơ.

The relationship between AI, ML, DL



AI

Machine Learning

Deep Learning

1950

1980

2010

A brief history of AI

Year	Landmark
1956	The concept AI was proposed at the Dartmouth Conference
1959	Arthur Samuel proposed Machine Learning
1956-1976	The First Booming Period: The definition and development target of AI was clarified at the Dartmouth Conference
1976	The failure of projects such as machine translation and the negative influence of some academic reports led to the reduction of investment in AI in all spheres
1976-1982	The first AI Winter: AI was under criticism and question, insufficient computing power, complicated operation, and hard to realize common sense and inference
1985	The decision tree models with better visualization and multi-layer ANNs which overcame the limit of early perceptron was introduced
1982-1987	The second Booming Period: The expert system with inference capacities based on logic and rules and can answer questions of certain fields prevailed. The fifth generation computers developed
1987	The market of ISP (Internet Service Providers) collapsed

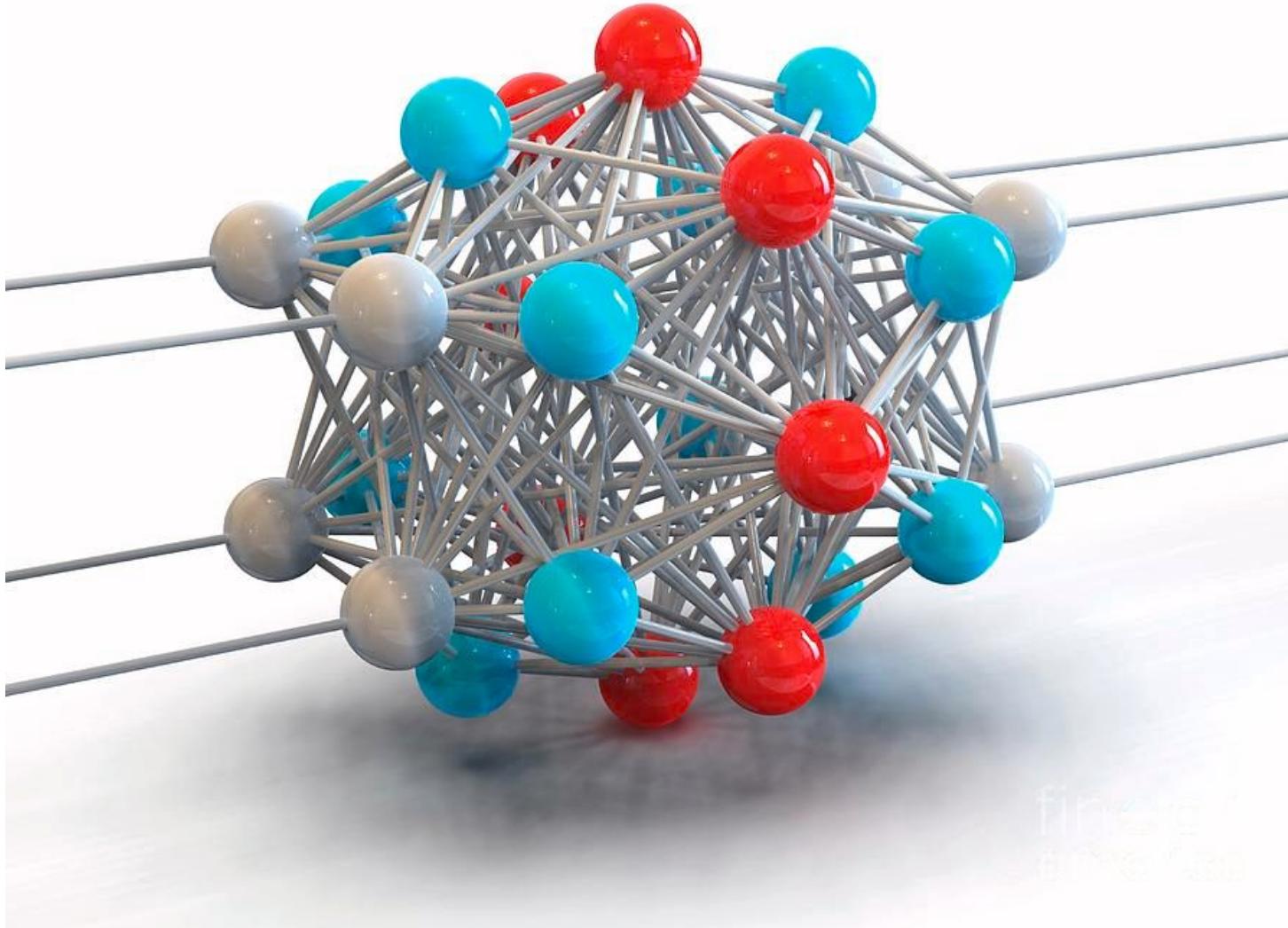
A brief history of AI

Year	Landmark
1987-1997	The second AI winter: the Technical fields ran into bottleneck once again. The abstract inference was no longer the focus of people and the models based on processing were not welcomed
1997	Deep Blue defeated the world chess Champion Garry Kasparov
2006	Geoffrey Hinton and his students prompted the wave of deep learning
1997-2010	Recovery Period: Computing performance was improved, and the Internet technologies got popularized very quickly.
2010	The world ushered into the era of big data
2014	Microsoft released the world's first personal AI assistant Cortana
2016	AlphaGo defeated the world Go Champion Lee sedol by 4:1
2017	Deep Mind launched the strongest version of the program- AlphaGo zero
2010-Now	Rapid Growth Period: The new generation of information technology triggered the revolution in information environment and data foundations. The multi-model data built on massive images, voices and texts emerged. The computing power was greatly enhanced.

Three Main Schools of AI - Symbolism



Three Main Schools of AI - Connectionism



Three Main Schools of AI - Behaviorism

WHAT IS BEHAVIORISM?

The theory that psychology can be objectively studied through observable action.

Operant Conditioning

Subject learns behavior by associating it with consequences.

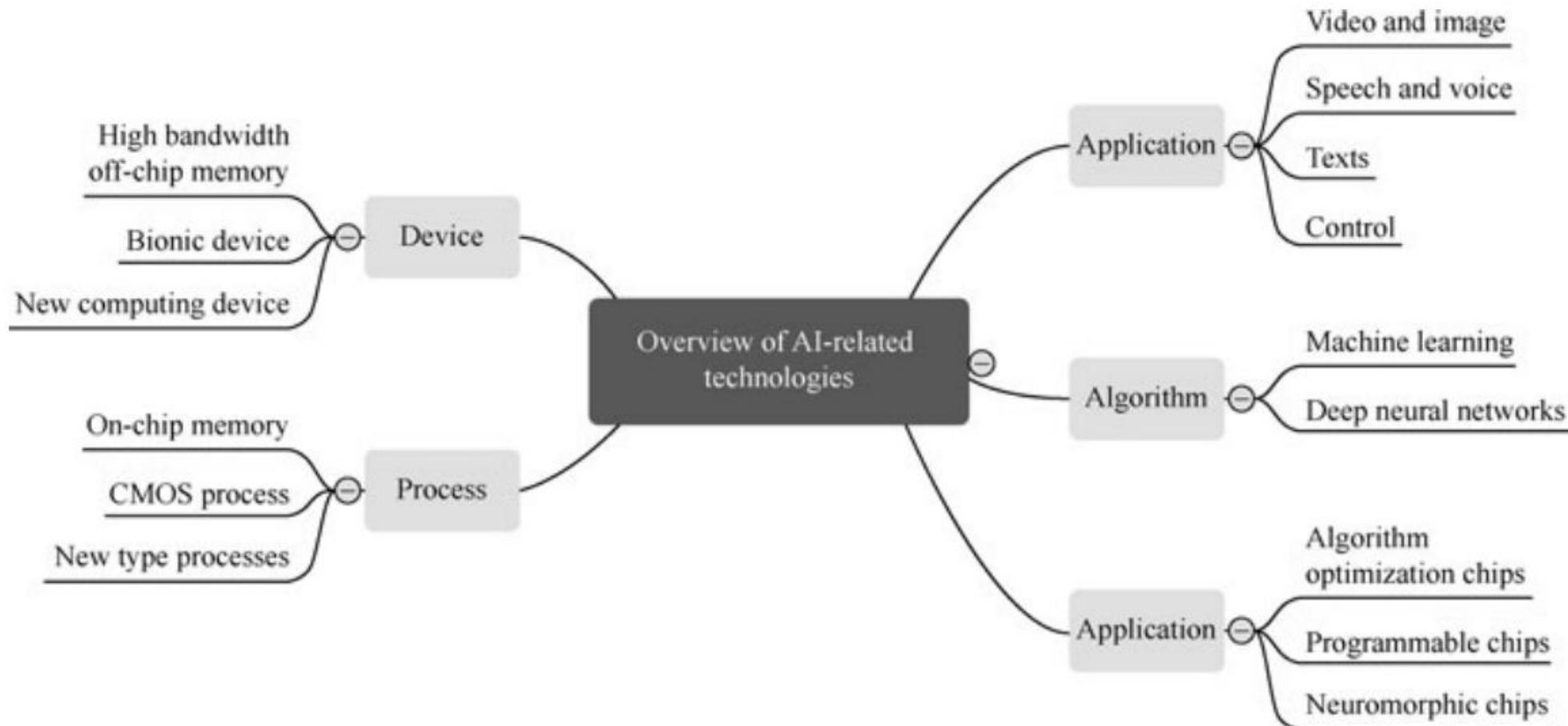


Classical Conditioning

Subject learns to associate two unrelated stimuli with each other.



AI-Related Technologies



AI Processor

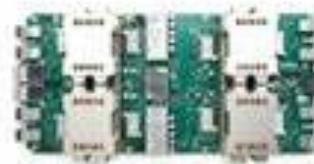
- Central processing unit (CPU)
- Graphics processing unit (GPU)
- Application specific integrated circuit (ASIC)
- Field programmable gate array (FPGA)



CPU



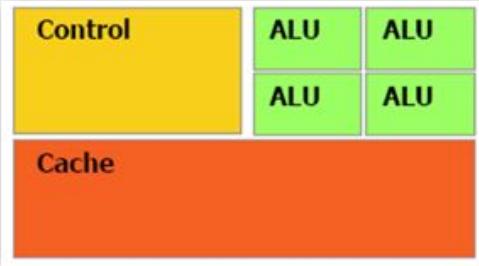
GPU



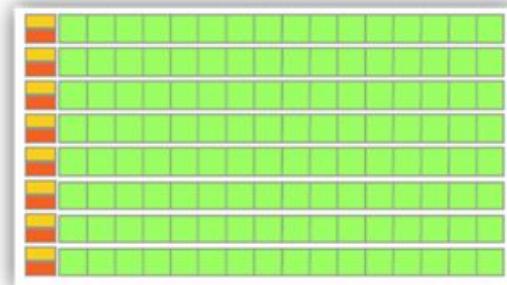
TPU

AI Processor

CPU



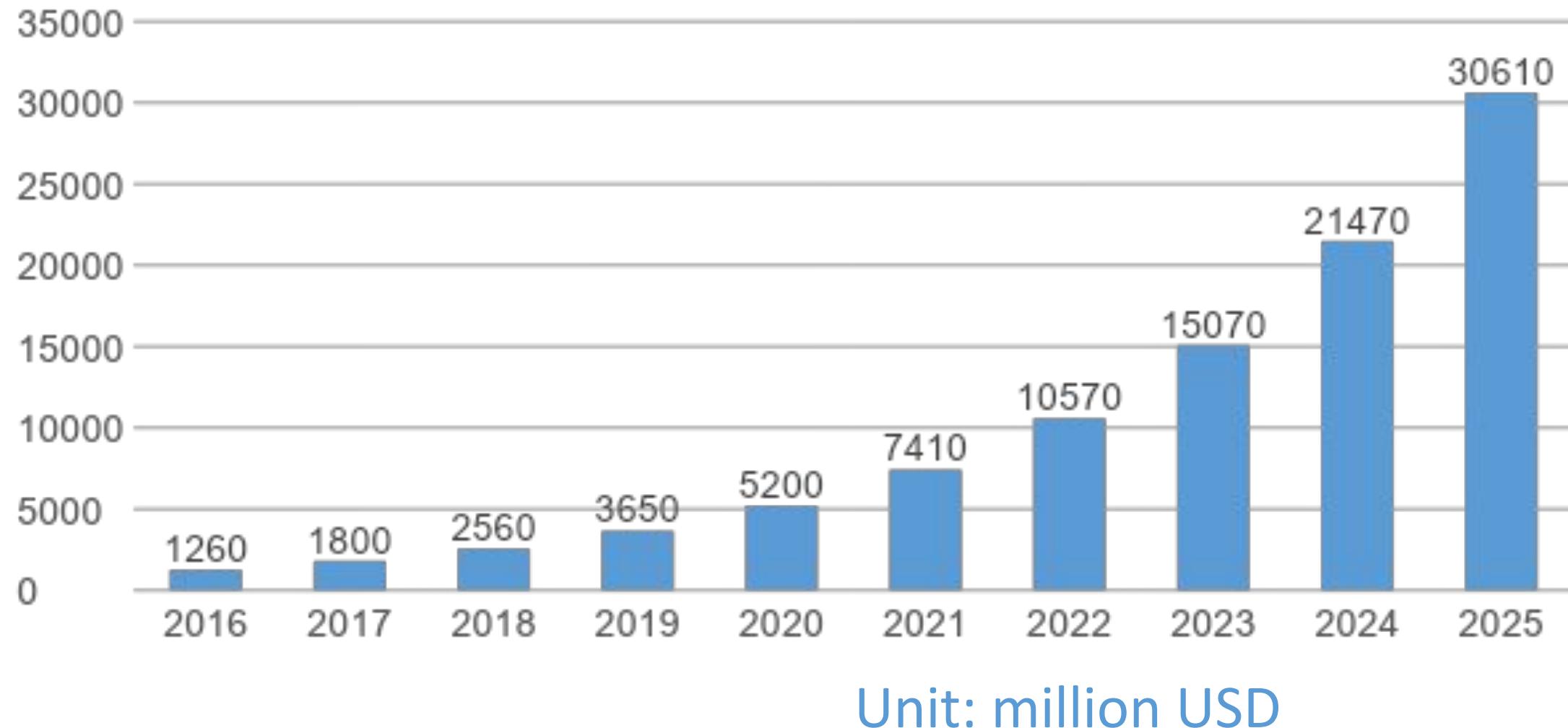
GPU



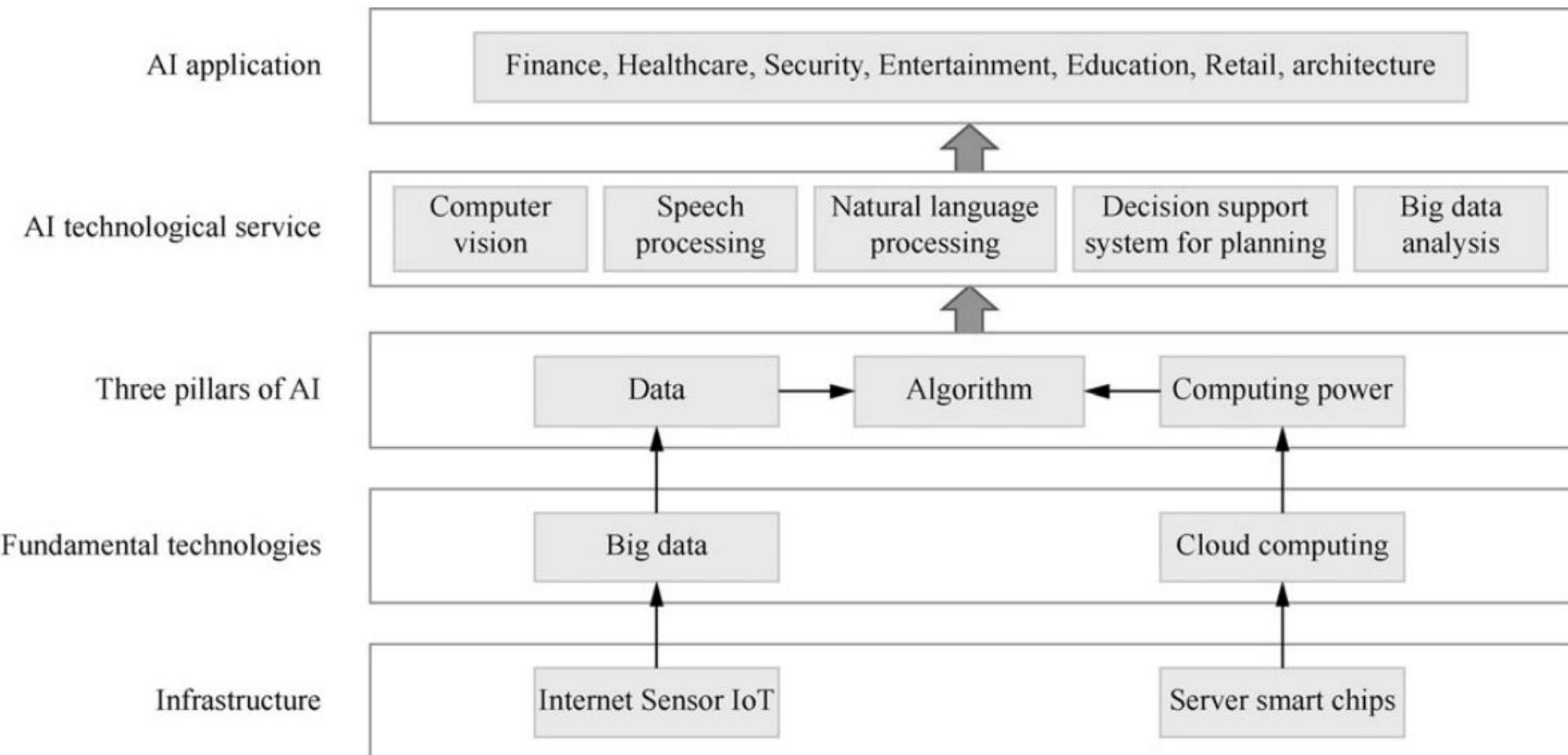
- * Low compute density
- * Complex control logic
- * Large caches (L1\$/L2\$, etc.)
- * Optimized for serial operations
 - Fewer execution units (ALUs)
 - Higher clock speeds
- * Shallow pipelines (<30 stages)
- * Low Latency Tolerance
- * Newer CPUs have more parallelism

- * High compute density
- * High Computations per Memory Access
- * Built for parallel operations
 - Many parallel execution units (ALUs)
 - Graphics is the best known case of parallelism
- * Deep pipelines (hundreds of stages)
- * High Throughput
- * High Latency Tolerance
- * Newer GPUs:
 - Better flow control logic (becoming more CPU-like)
 - Scatter/Gather Memory Access
 - Don't have one-way pipelines anymore

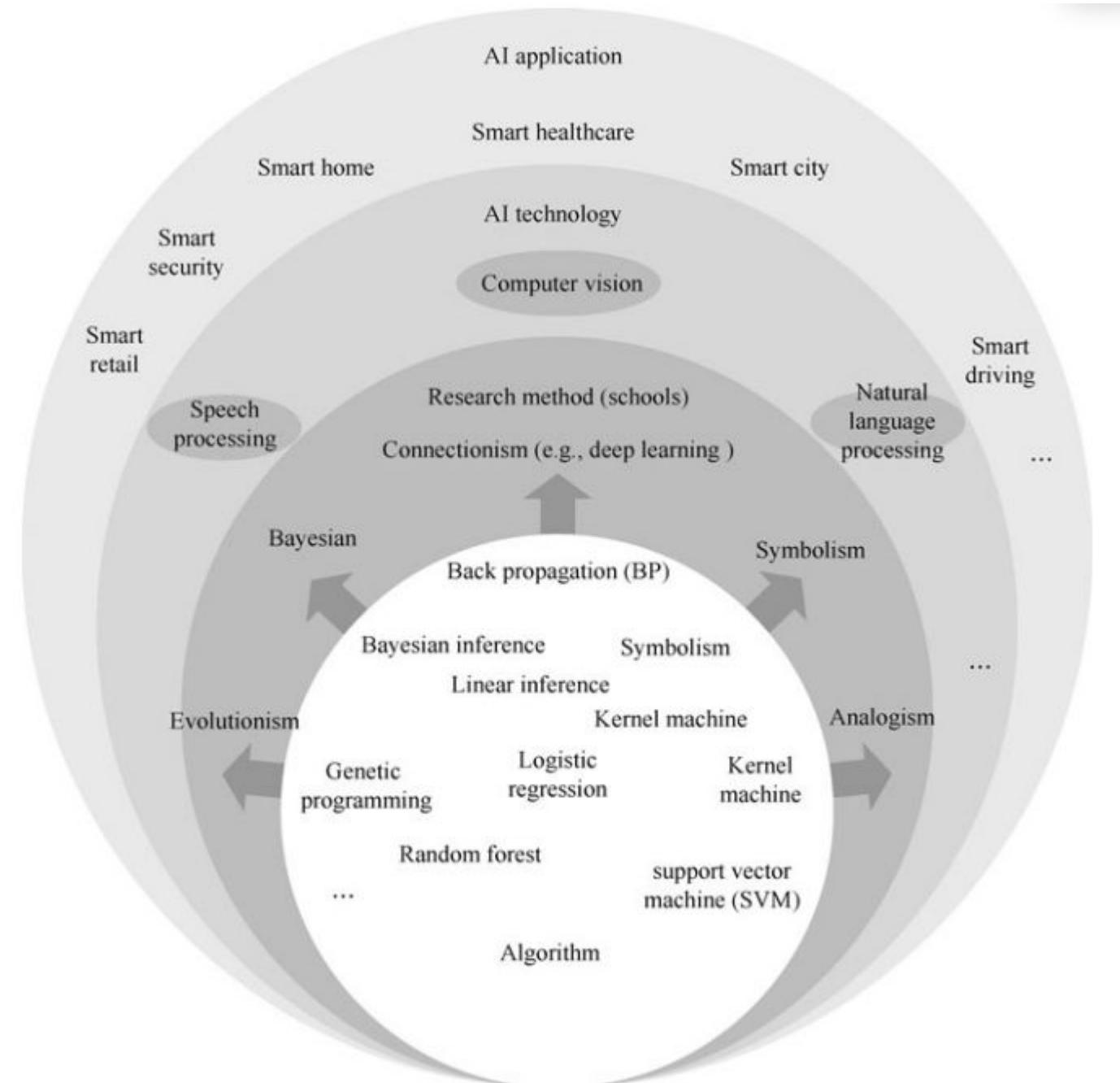
Ecosystem of AI Industry



Platform Architecture for AI Applications



Technologies of AI



I. Search and problem solving



Knowledge

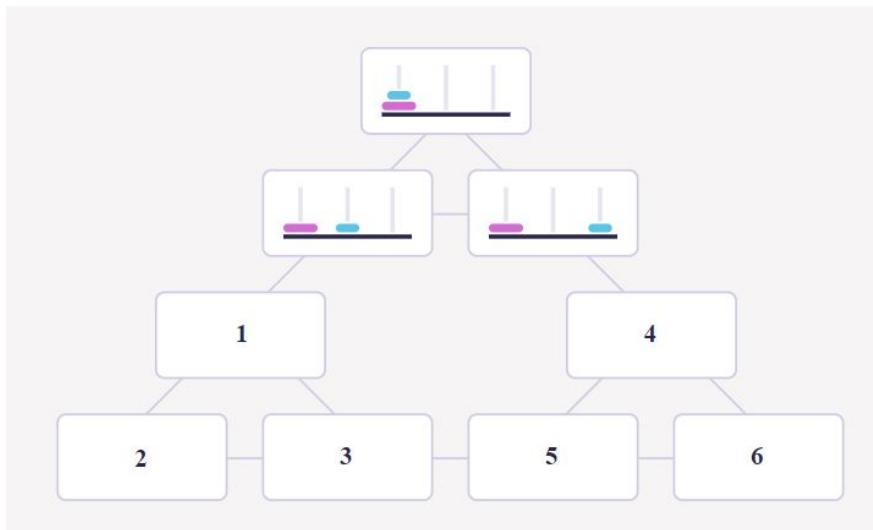
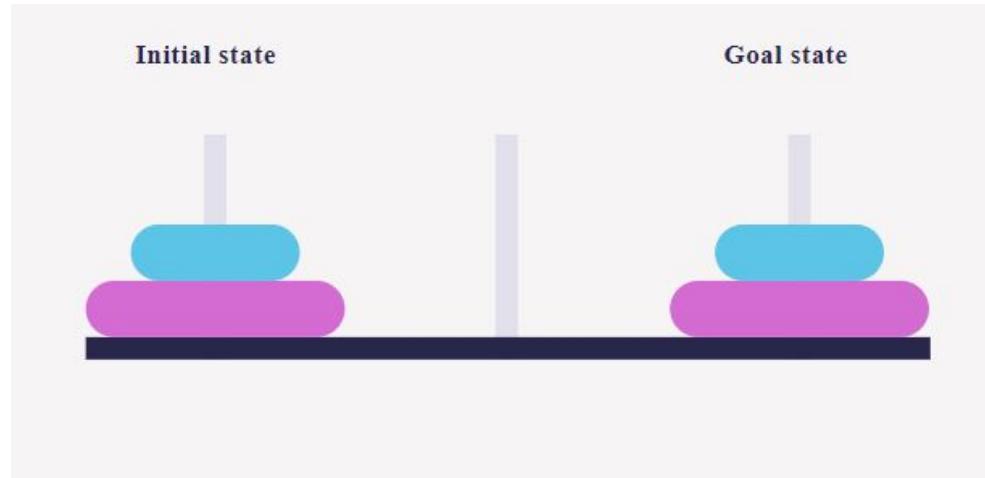
Data

Natural Language

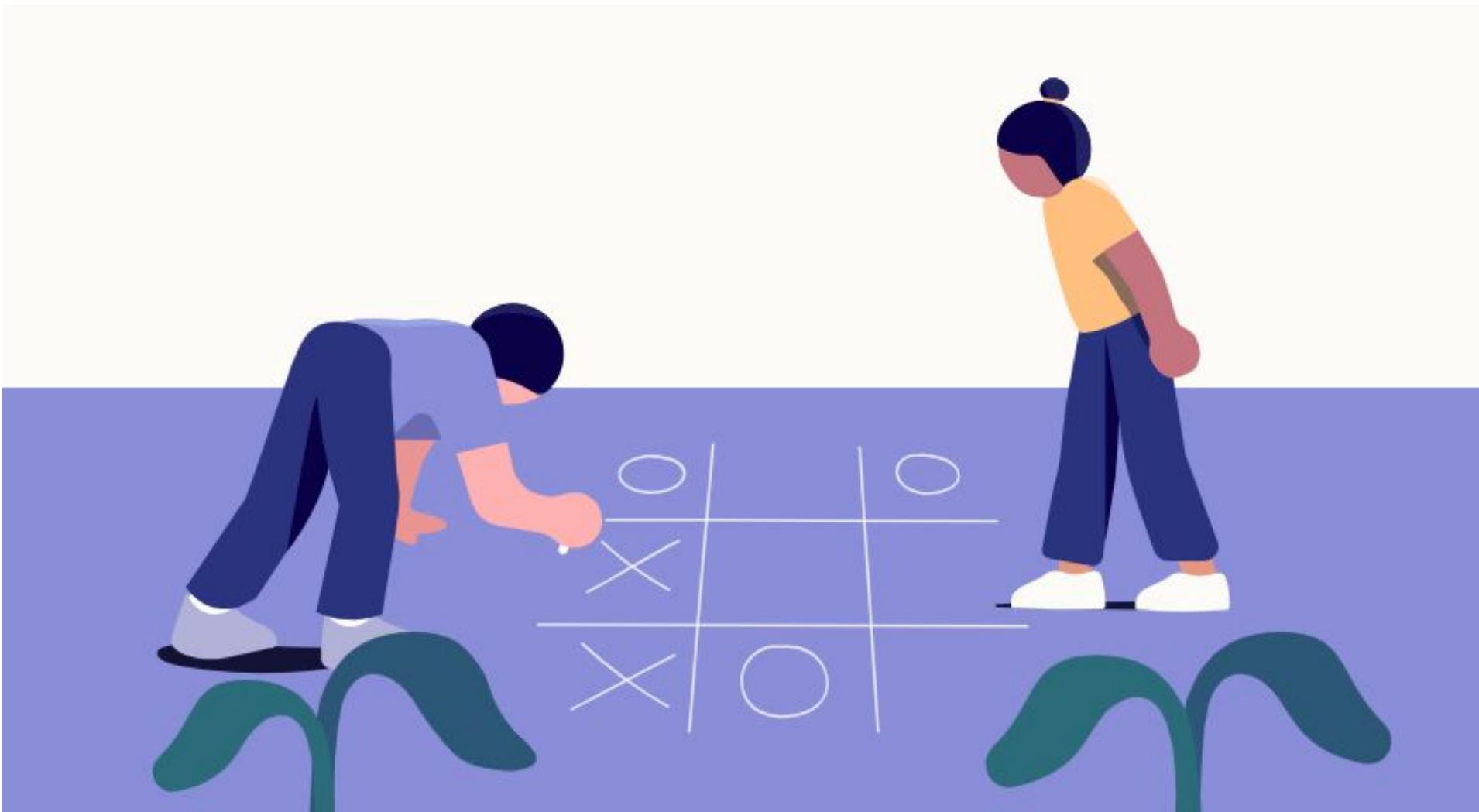
Context

Indexed Facts

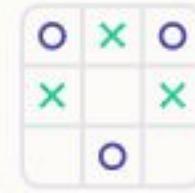
Hanoi Tower



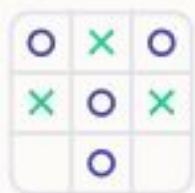
Playing tic tac toe



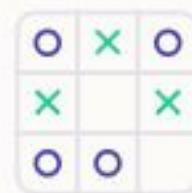
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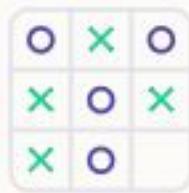


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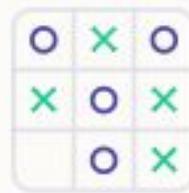


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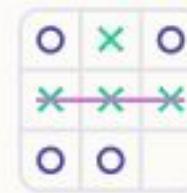
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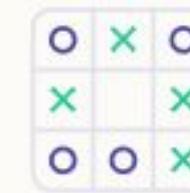
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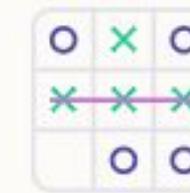
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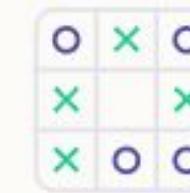
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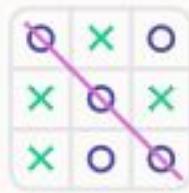


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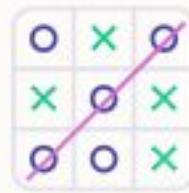


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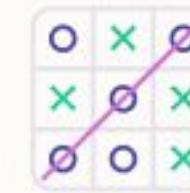
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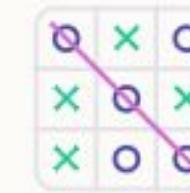
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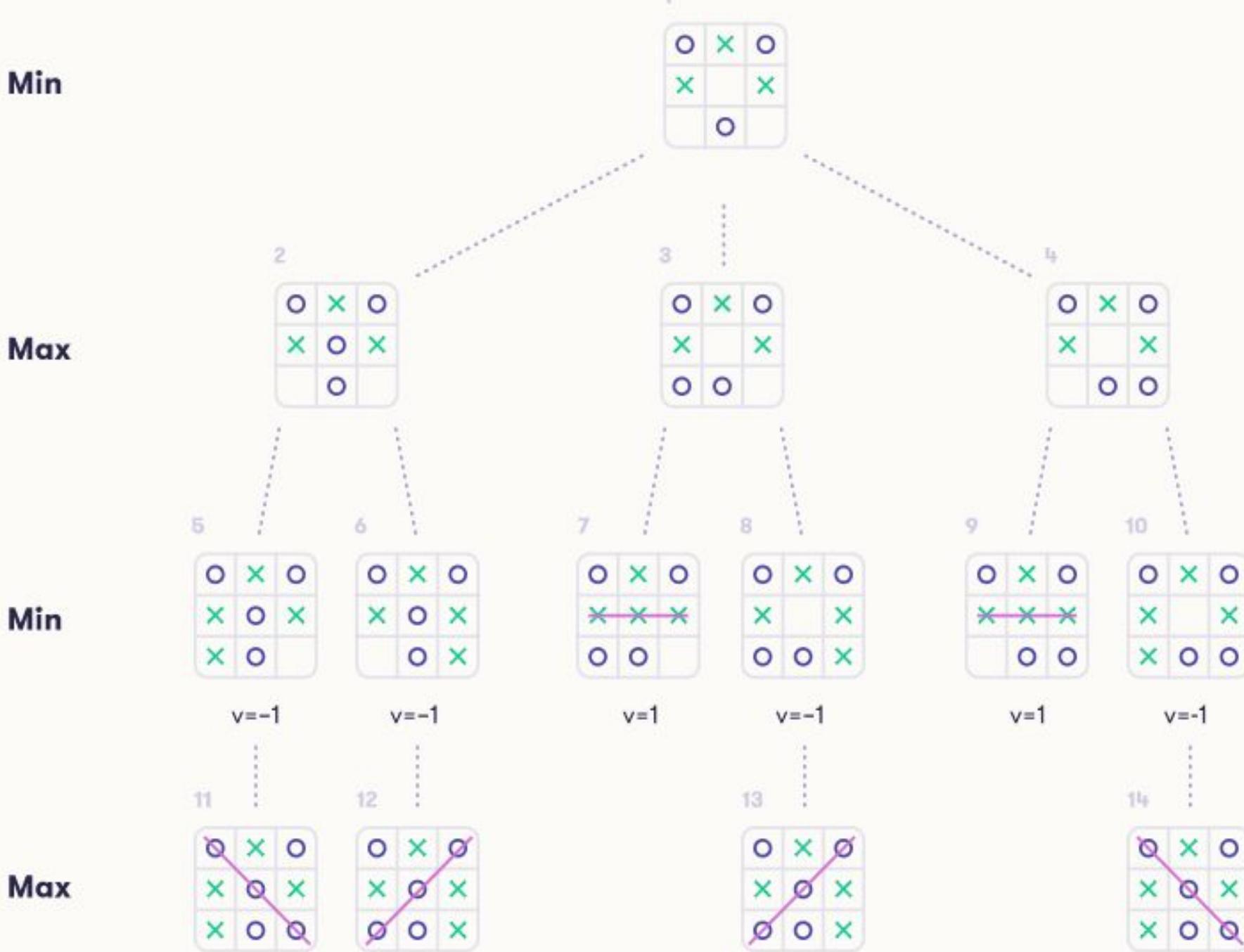


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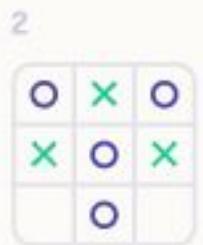
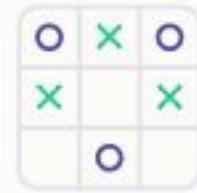


Max

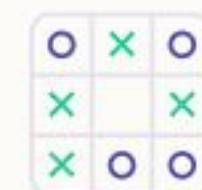
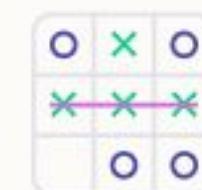
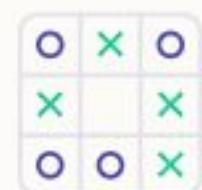
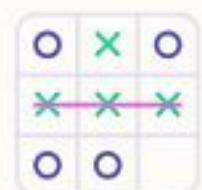
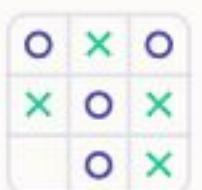
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Min



Max



Min

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$v = -1$

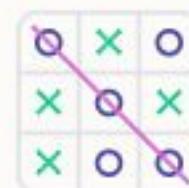
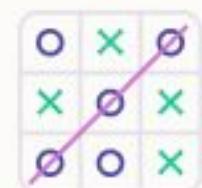
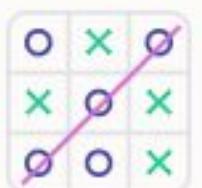
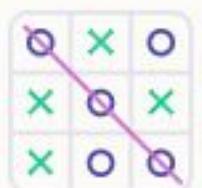
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$v = 1$

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Max



$v = -1$

$v = -1$

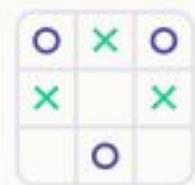
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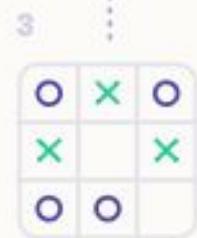
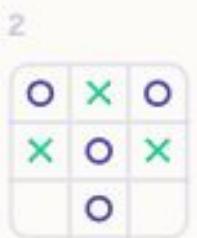
$v = 1$

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Min



Max

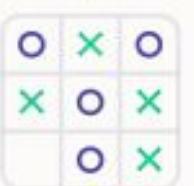
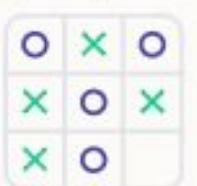


$v = -1$

$v = 1$

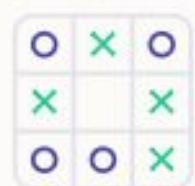
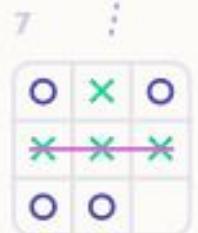
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Min



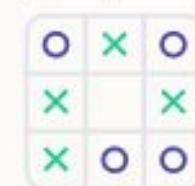
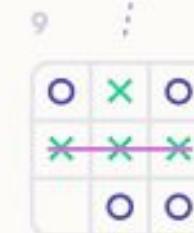
$v = -1$

$v = -1$



$v = 1$

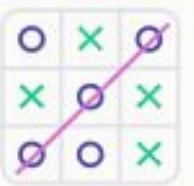
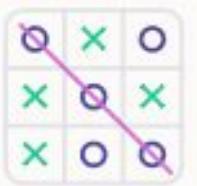
$v = -1$



$v = 1$

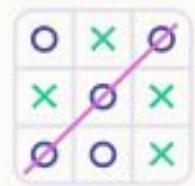
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Max

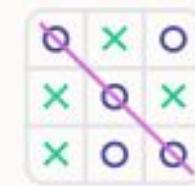


$v = -1$

$v = -1$

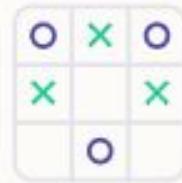


$v = -1$



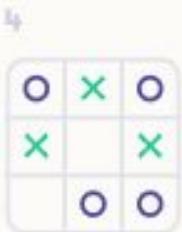
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Min



Optimal route

Max

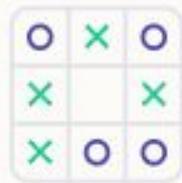
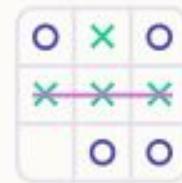
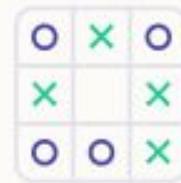
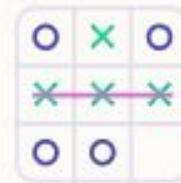
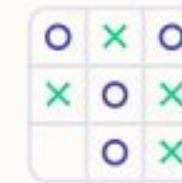
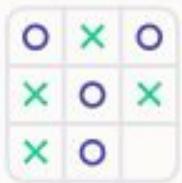


$v=-1$

$v=1$

$v=1$

Min



$v=-1$

$v=-1$

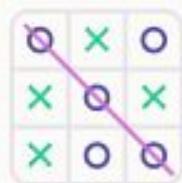
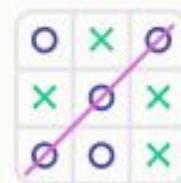
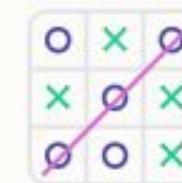
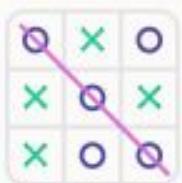
$v=1$

$v=-1$

$v=1$

$v=-1$

Max



$v=-1$

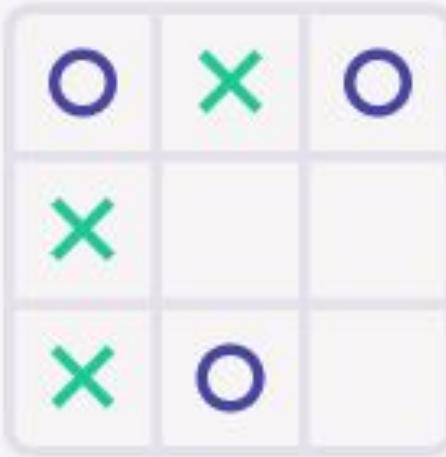
$v=-1$

$v=-1$

$v=-1$

Why so pessimistic, Max?

Let's return to the tic-tac-toe game described in the beginning of this section. To narrow down the space of possible end-games to consider, we can observe that Max must clearly place an X on the top row to avoid imminent defeat:



Now it's Min's turn to play an O. Evaluate the value of this state of the game as well as the other states in the game tree where the above position is the root, using the Minimax algorithm.

Min

o	x	o
x		
x	o	

Max

o	x	o
x	o	
x	o	

o	x	o
x		o
x	o	

o	x	o
x		
x	o	o

Min

o	x	o
x	o	x
x	o	

o	x	o
x	o	
x	o	x

o	x	o
x	x	o
x	o	

o	x	o
x	o	
x	o	x

o	x	o
x	x	
x	o	o

o	x	o
x	x	
x	o	o

Max

o	x	o
x	o	x
x	o	o

o	x	o
x	o	
x	o	x

o	x	o
x	x	o
x	o	o

o	x	o
x	o	x
x	o	x

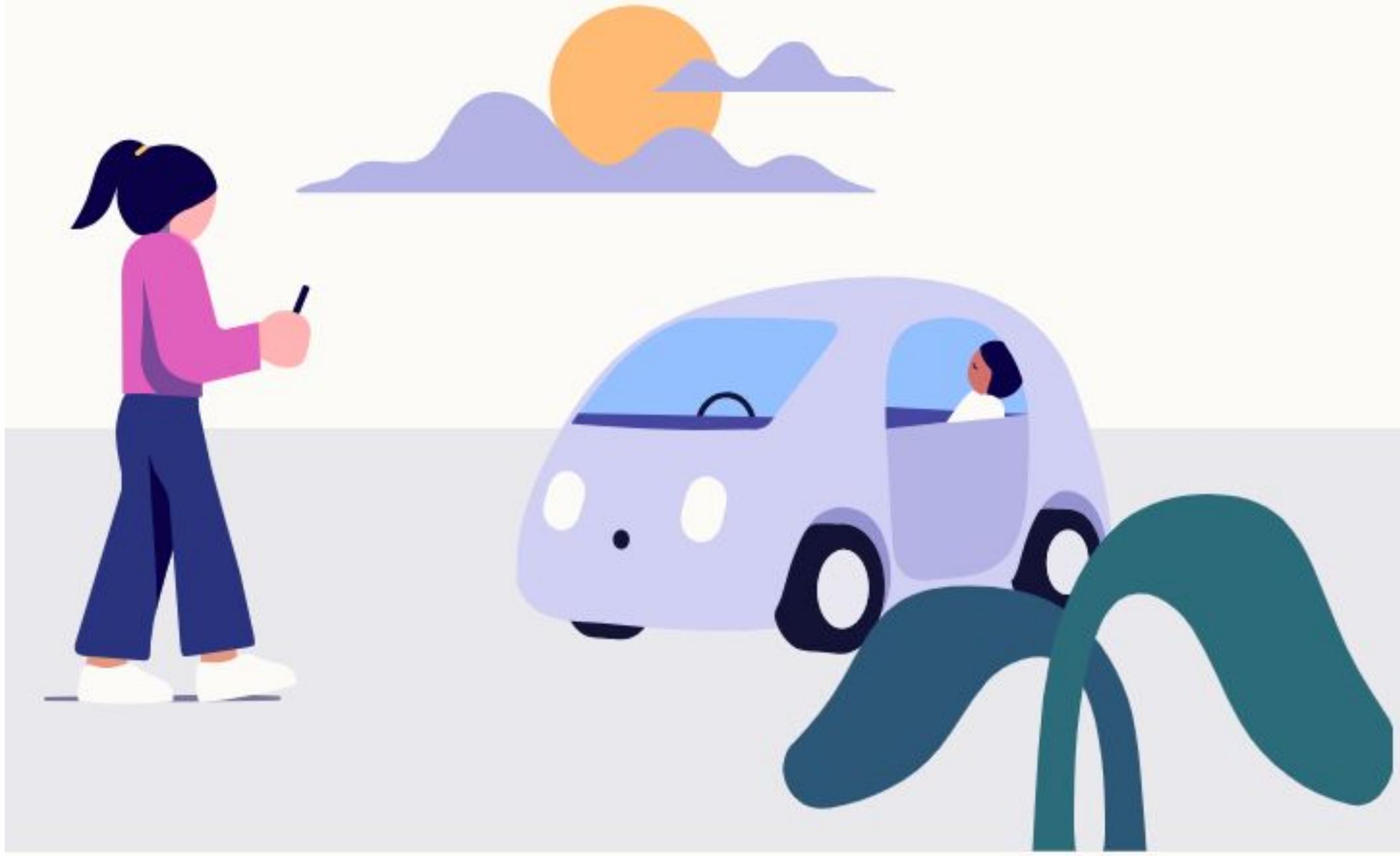
o	x	o
x	x	o
x	o	o

o	x	o
x	x	
x	o	x

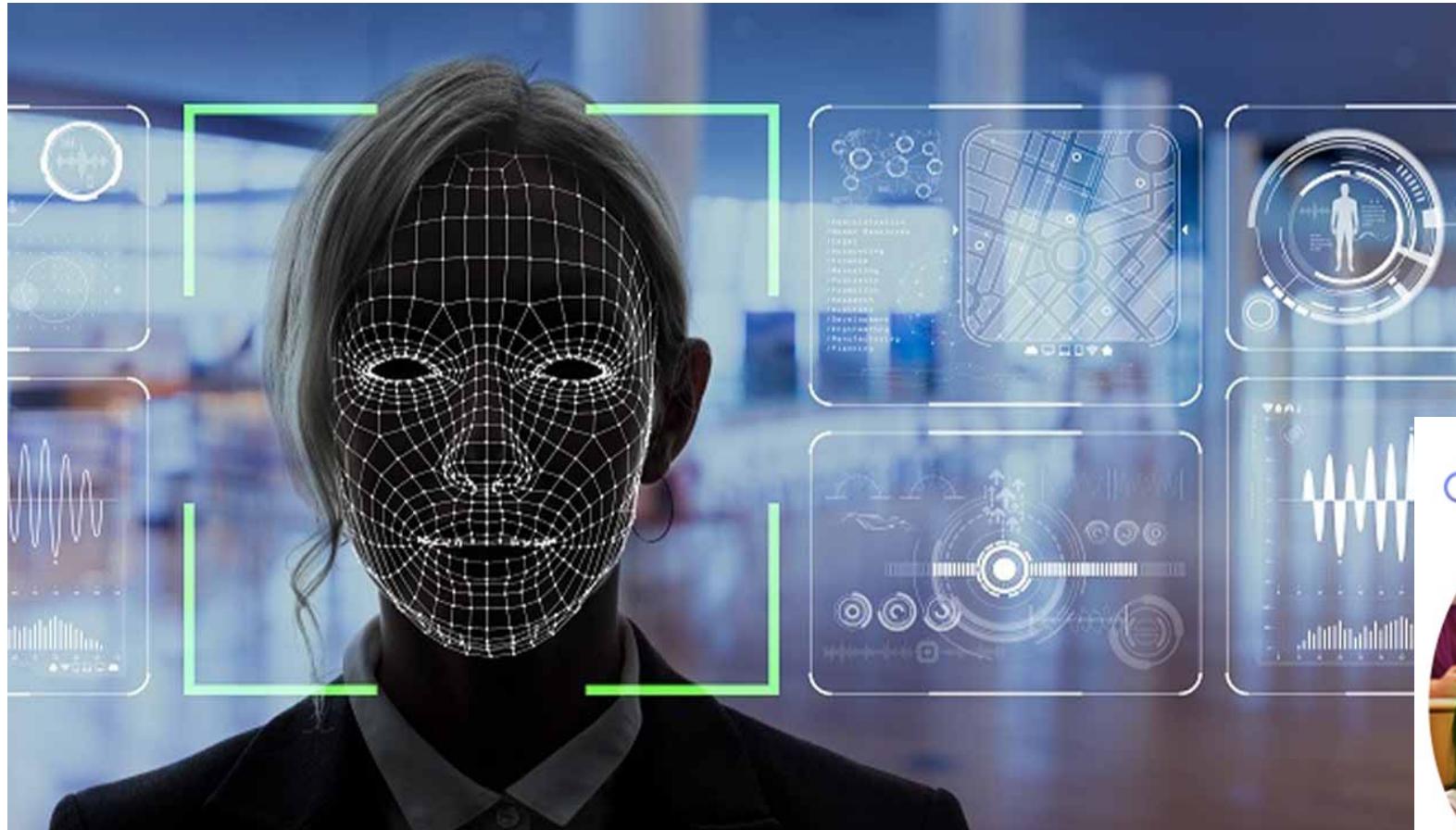
Real world AI



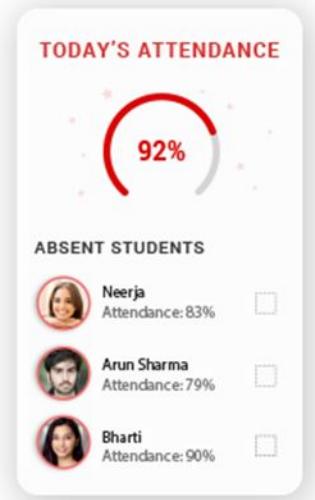
I. Odds and probability



Technologies of AI – computer Vision

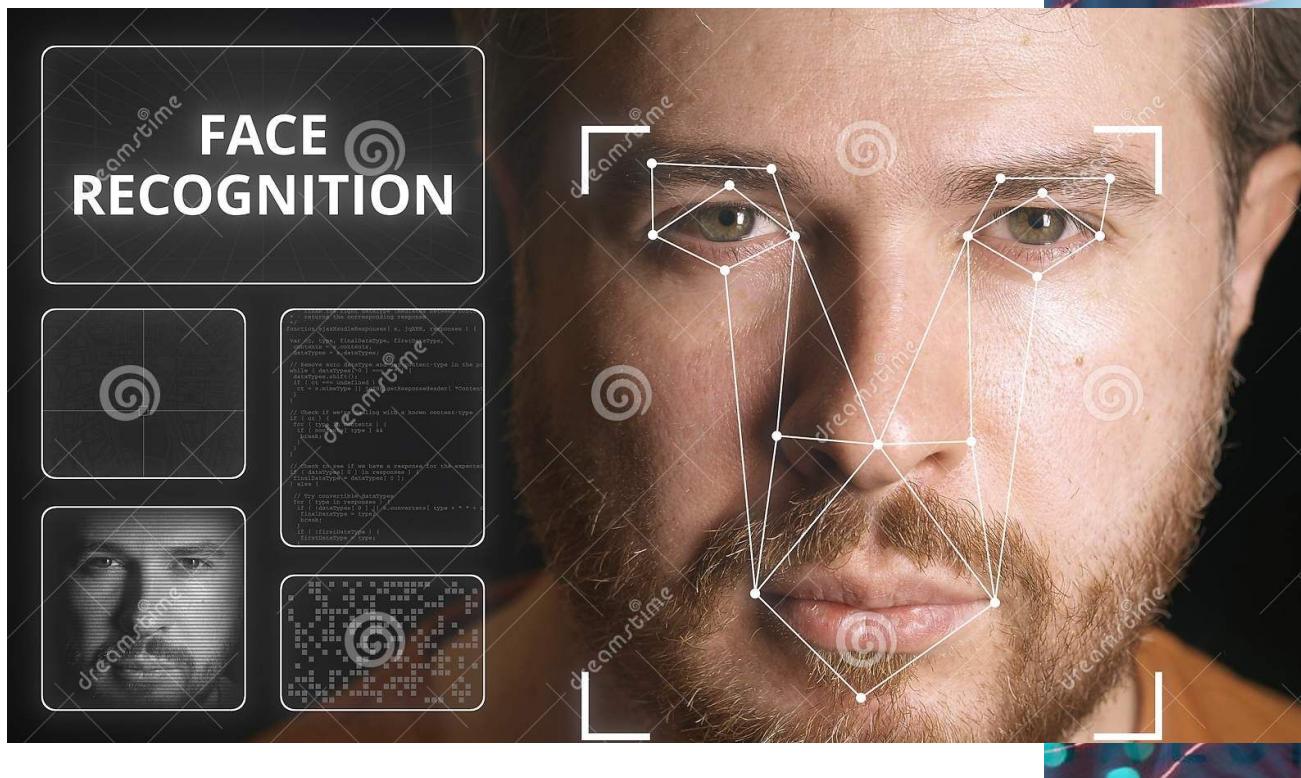


Electronic attendance

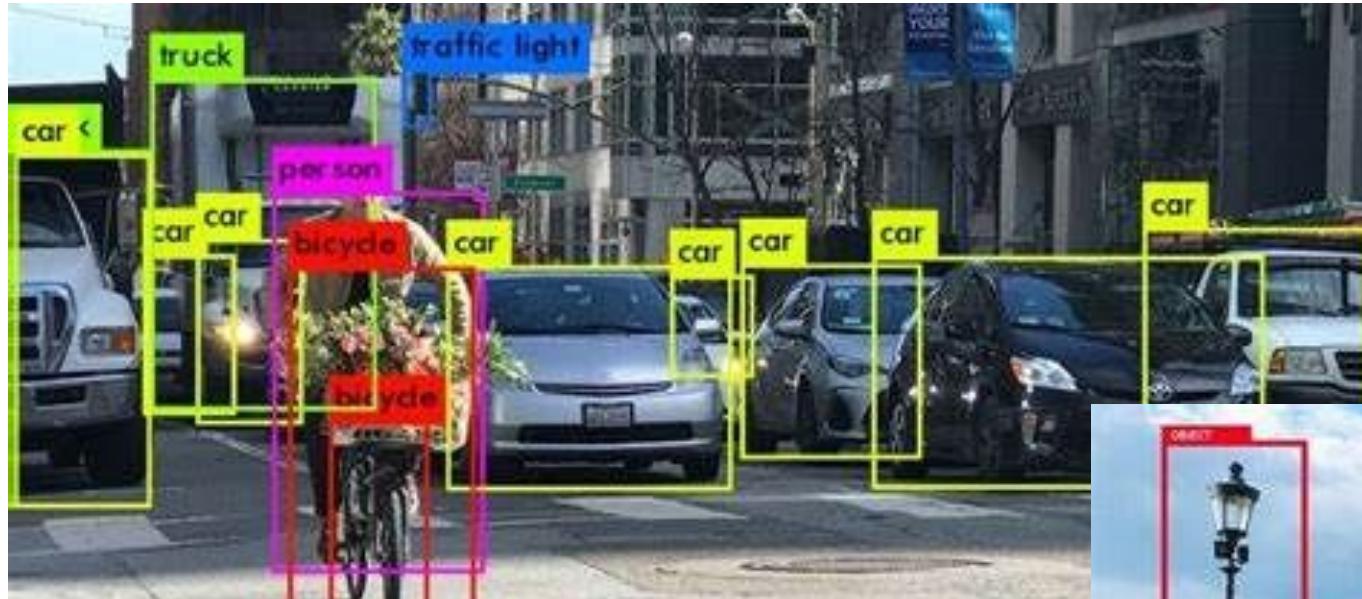


Technologies of AI – computer Vision

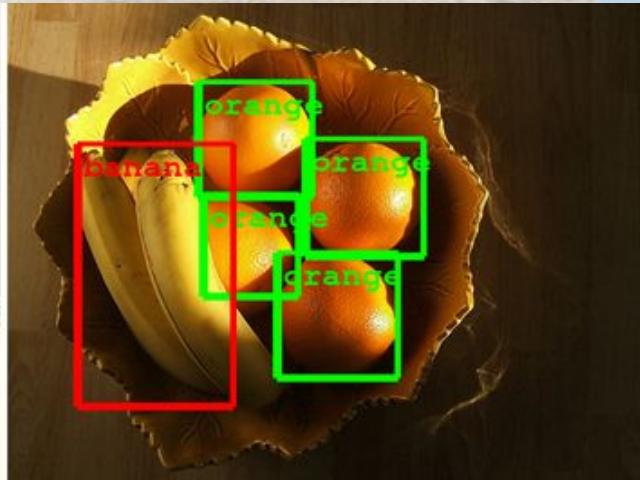
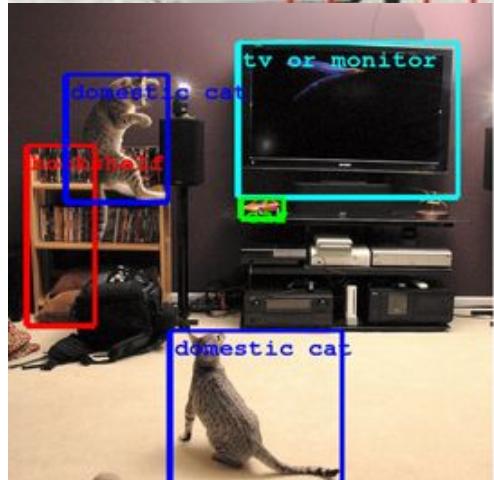
Identity verification

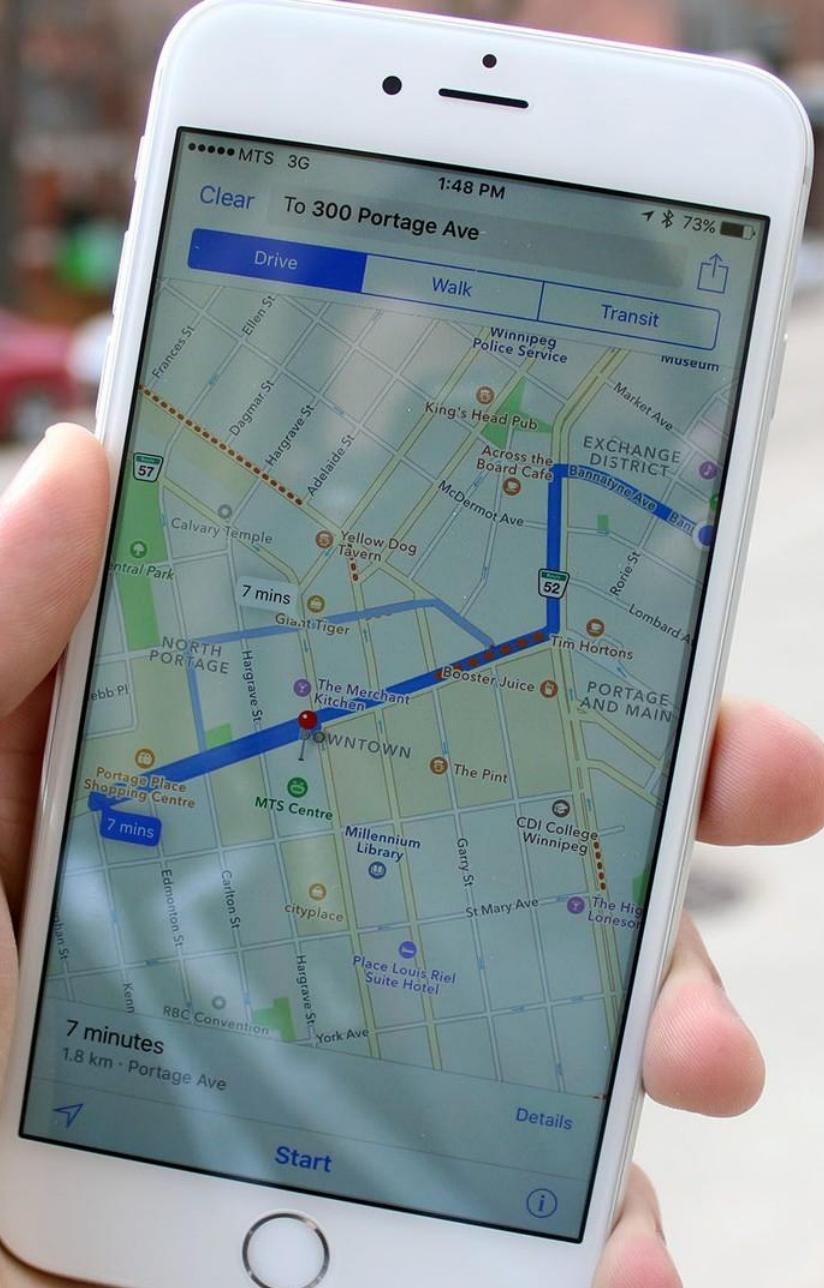


Technologies of AI – computer Vision



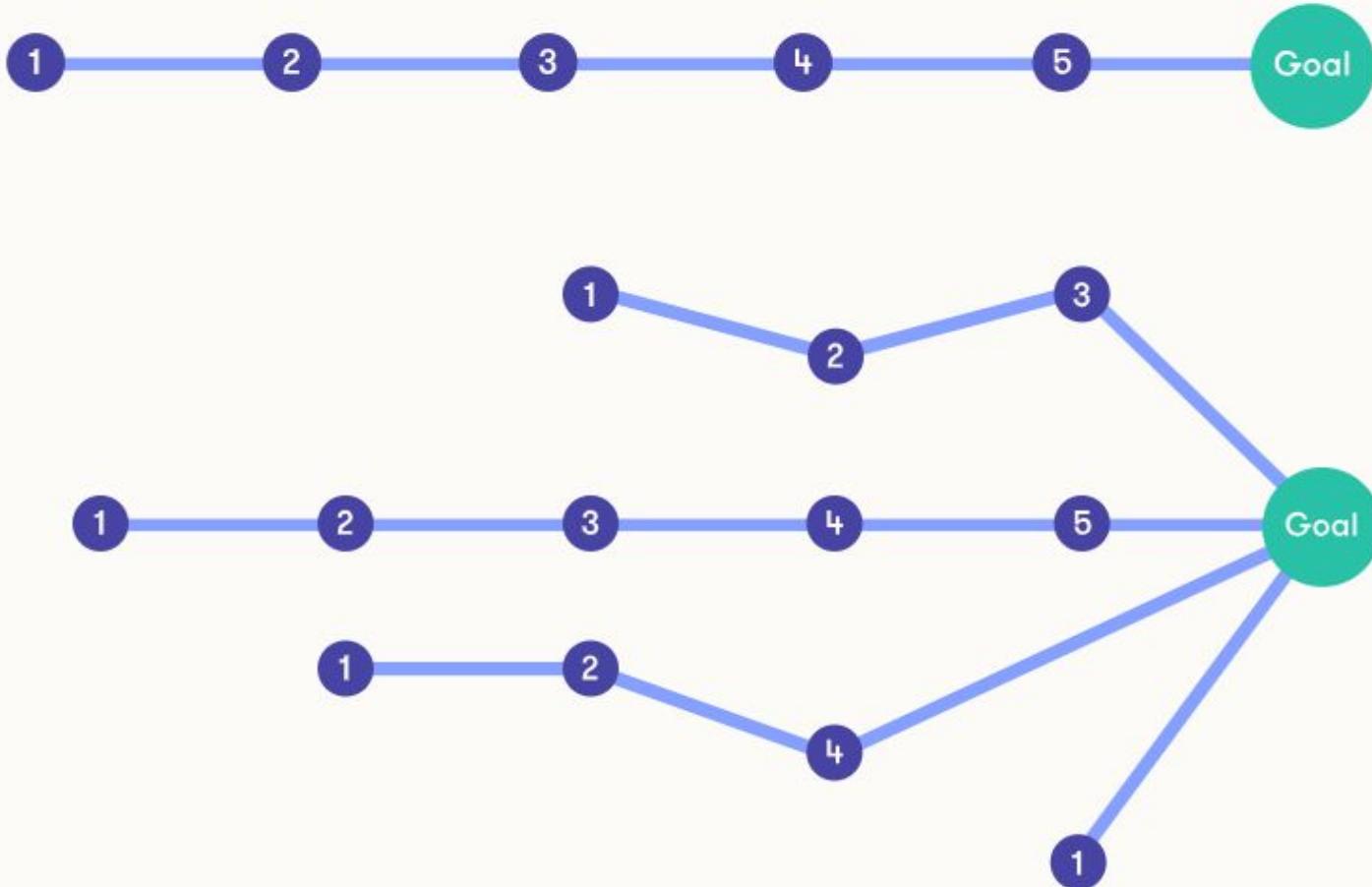
Identity Image recognition





iMore Search in practice: getting from A to B

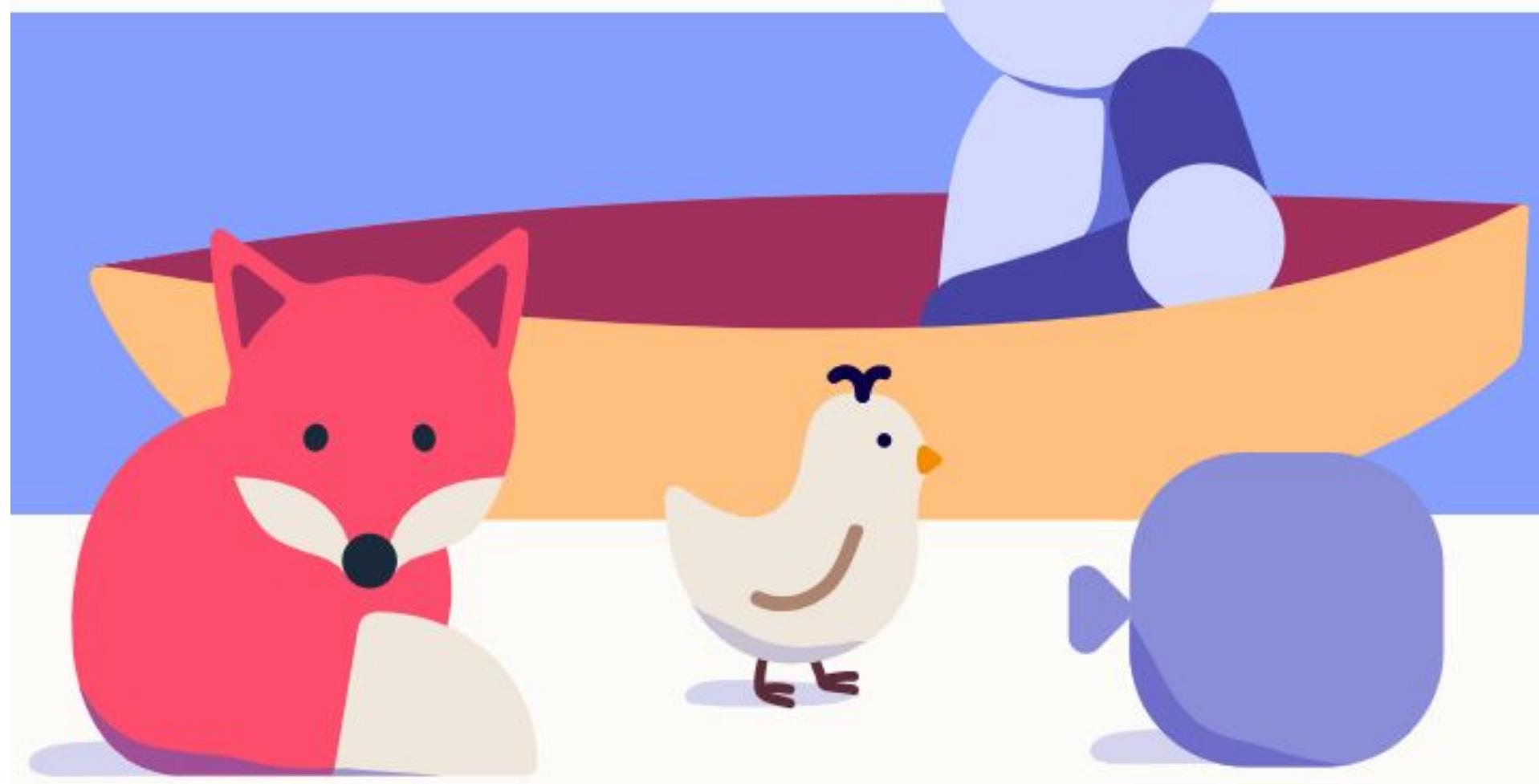
Search in practice: getting from A to B



Toy problem: chicken crossing



We'll start from a simple puzzle to illustrate the ideas. A robot on a rowboat needs to move three pieces of cargo across a river: a fox, a chicken, and a sack of chicken-feed. The fox will eat the chicken if it has the chance, and the chicken will eat the chicken-feed if it has the chance, and neither is a desirable outcome. The robot is capable of keeping the animals from doing harm when it is near them, but only the robot can operate the rowboat and only two of the pieces of cargo can fit on the rowboat together with the robot. How can the robot move all of its cargo to the opposite bank of the river?

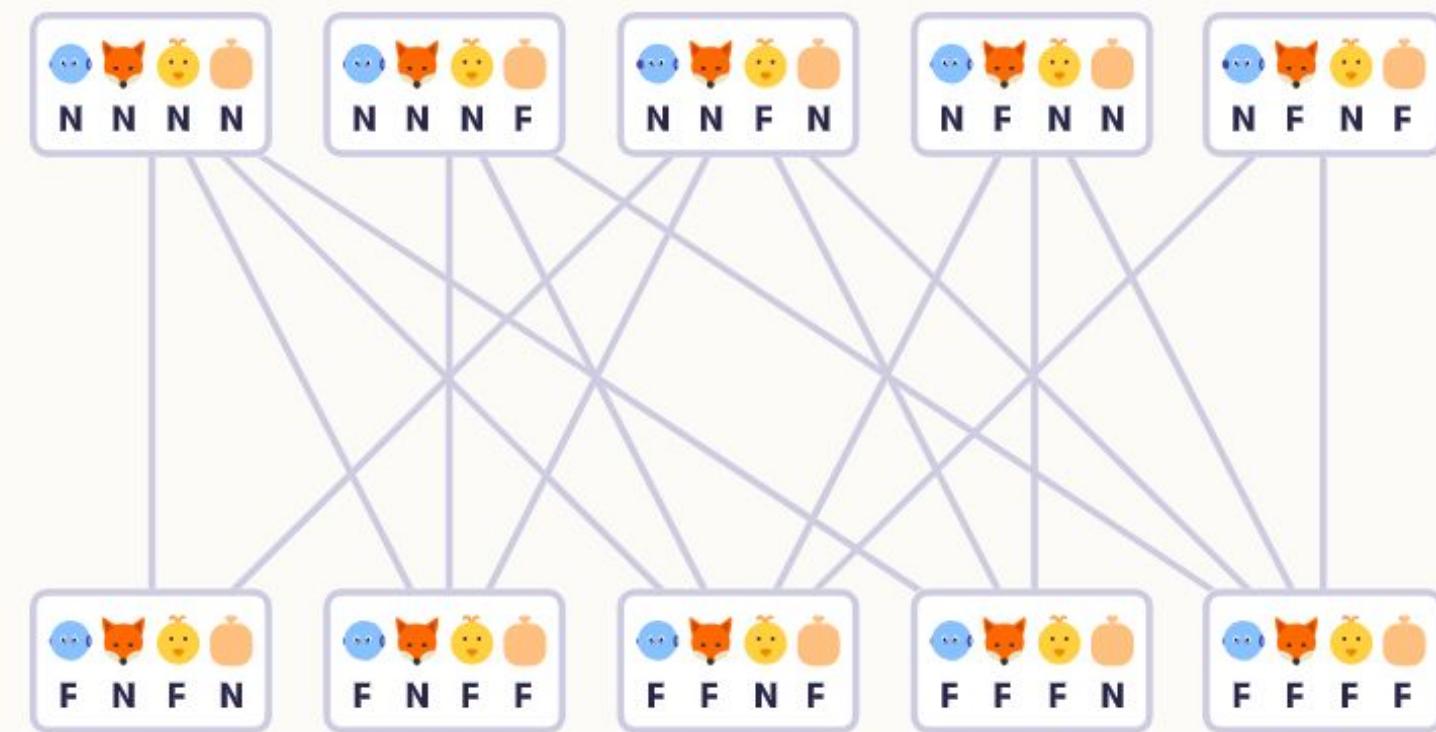
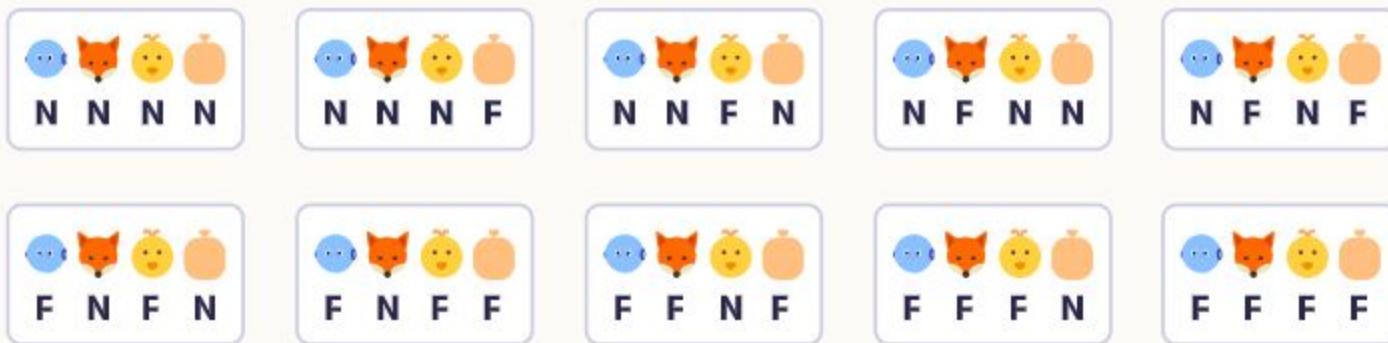


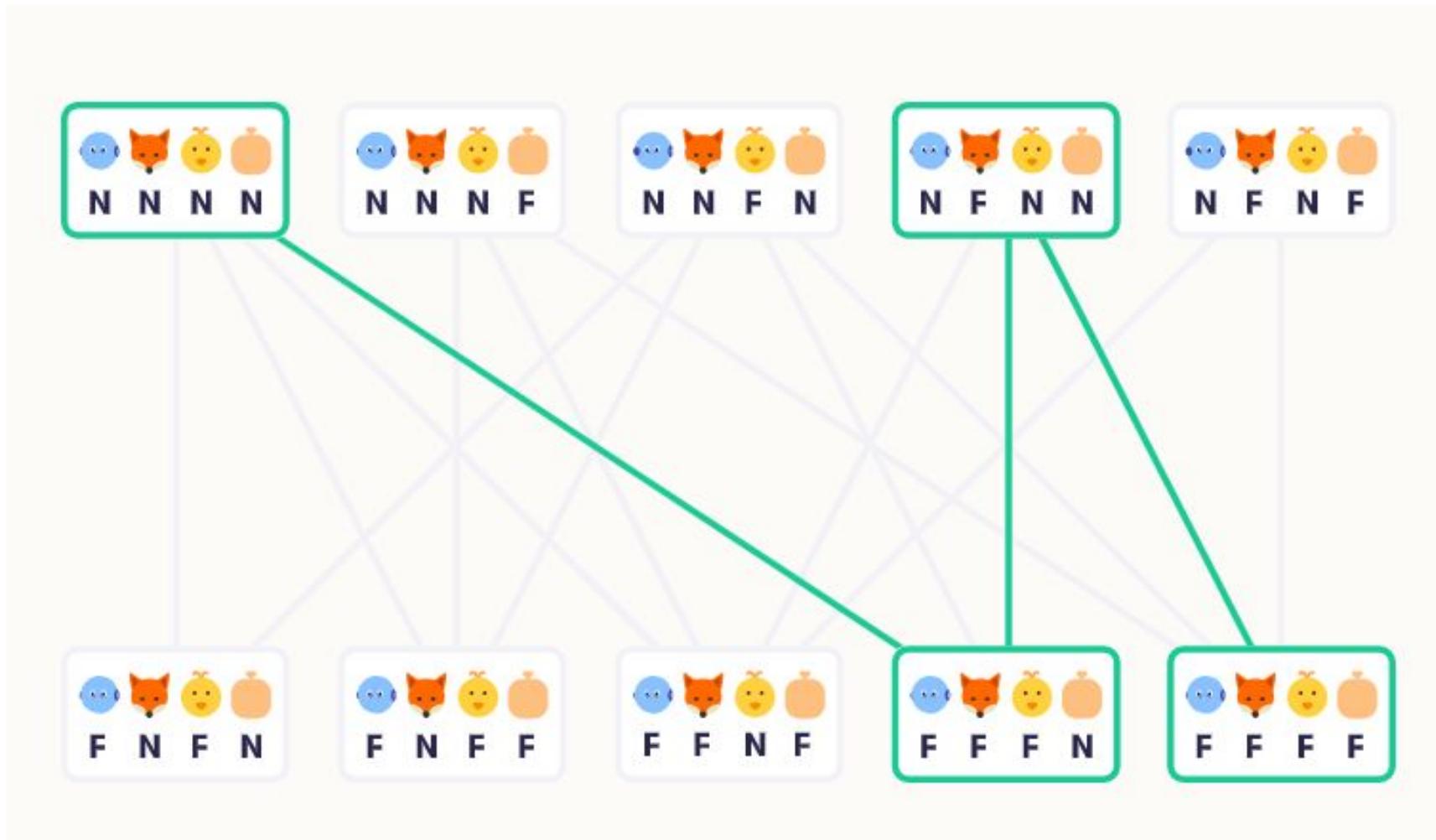
States of the chicken crossing puzzle

State	Robot	Fox	Chicken	Chicken-feed
NNNN	Near side	Near side	Near side	Near side
NNNF	Near side	Near side	Near side	Far side
NNFN	Near side	Near side	Far side	Near side
NNFF	Near side	Near side	Far side	Far side
NFNN	Near side	Far side	Near side	Near side
NFNF	Near side	Far side	Near side	Far side
NFFN	Near side	Far side	Far side	Near side
NFFF	Near side	Far side	Far side	Far side
FNNN	Far side	Near side	Near side	Near side
FNNF	Far side	Near side	Near side	Far side
FNFN	Far side	Near side	Far side	Near side
FNFF	Far side	Near side	Far side	Far side
FFNN	Far side	Far side	Near side	Near side
FFNF	Far side	Far side	Near side	Far side
FFFN	Far side	Far side	Far side	Near side
FFFF	Far side	Far side	Far side	Far side

10 Left states

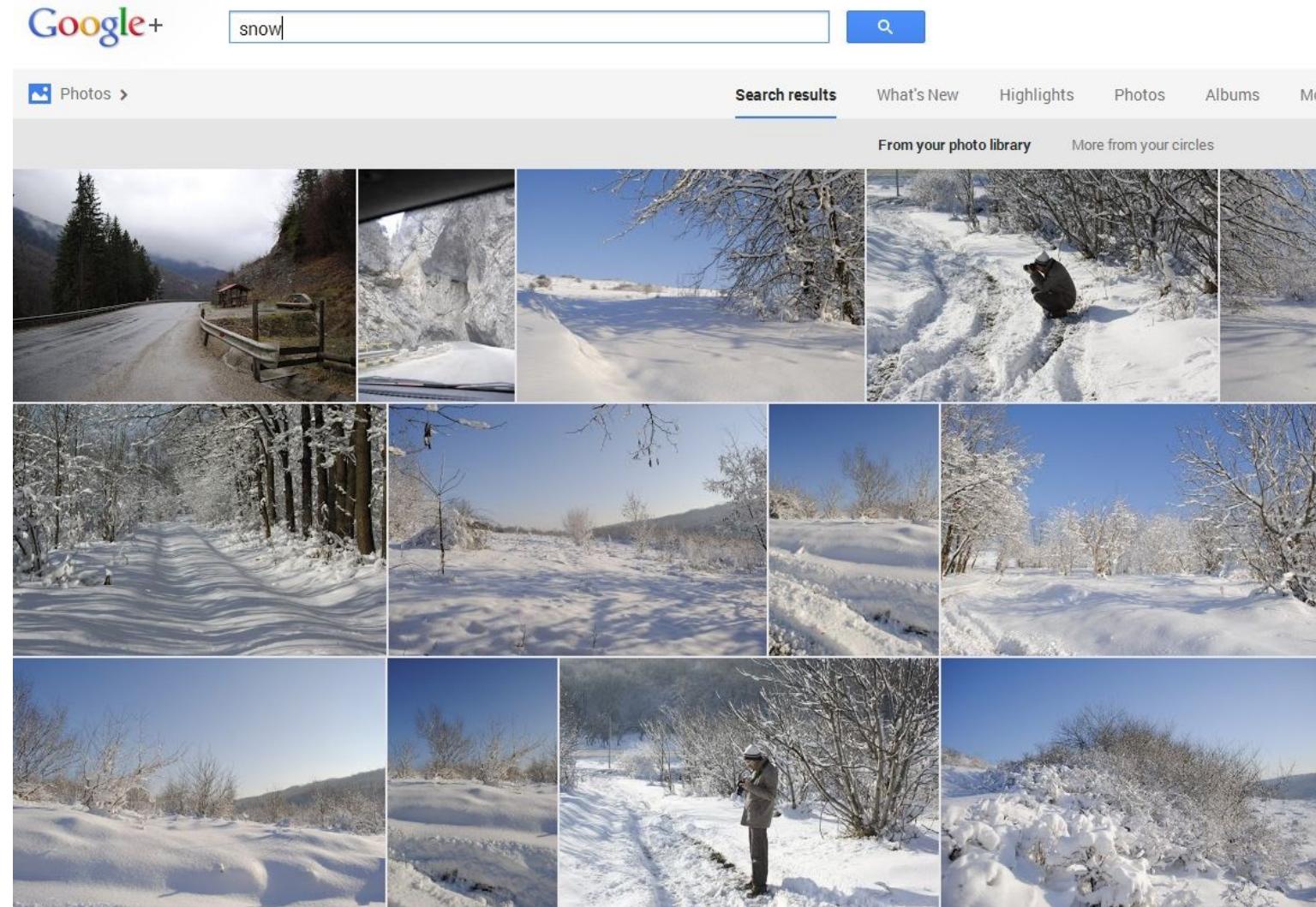
State	Robot	Fox	Chicken	Chicken-feed
NNNN	Near side	Near side	Near side	Near side
NNNF	Near side	Near side	Near side	Far side
NNFN	Near side	Near side	Far side	Near side
NFNN	Near side	Far side	Near side	Near side
NFNF	Near side	Far side	Near side	Far side
FNFN	Far side	Near side	Far side	Near side
FNFF	Far side	Near side	Far side	Far side
FFNF	Far side	Far side	Near side	Far side
FFFN	Far side	Far side	Far side	Near side
FFFF	Far side	Far side	Far side	Far side



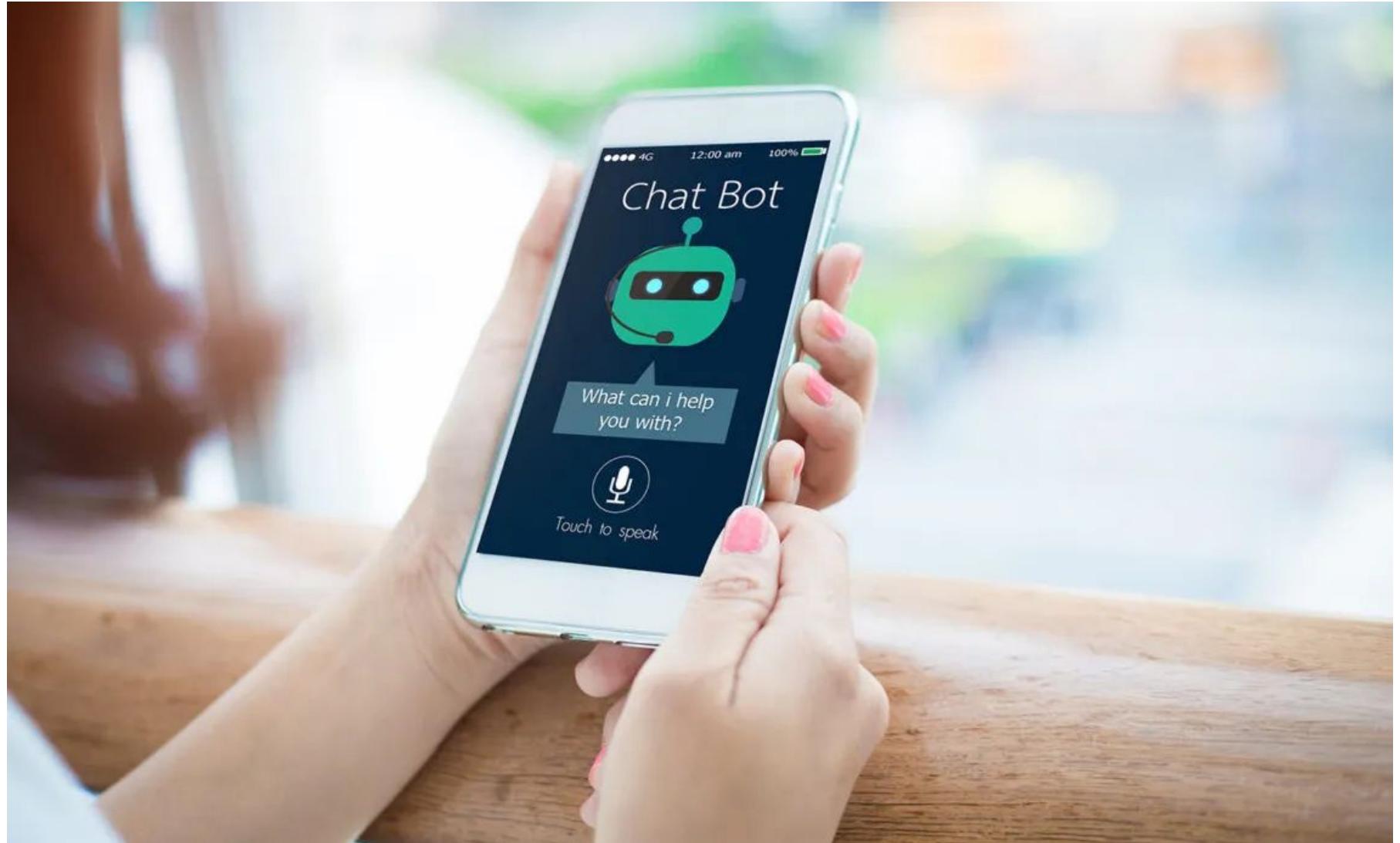


Technologies of AI – computer Vision

Image recognition



Technologies of AI – Speech Processing



Intelligent Q&A

Speech and Voice Recognition

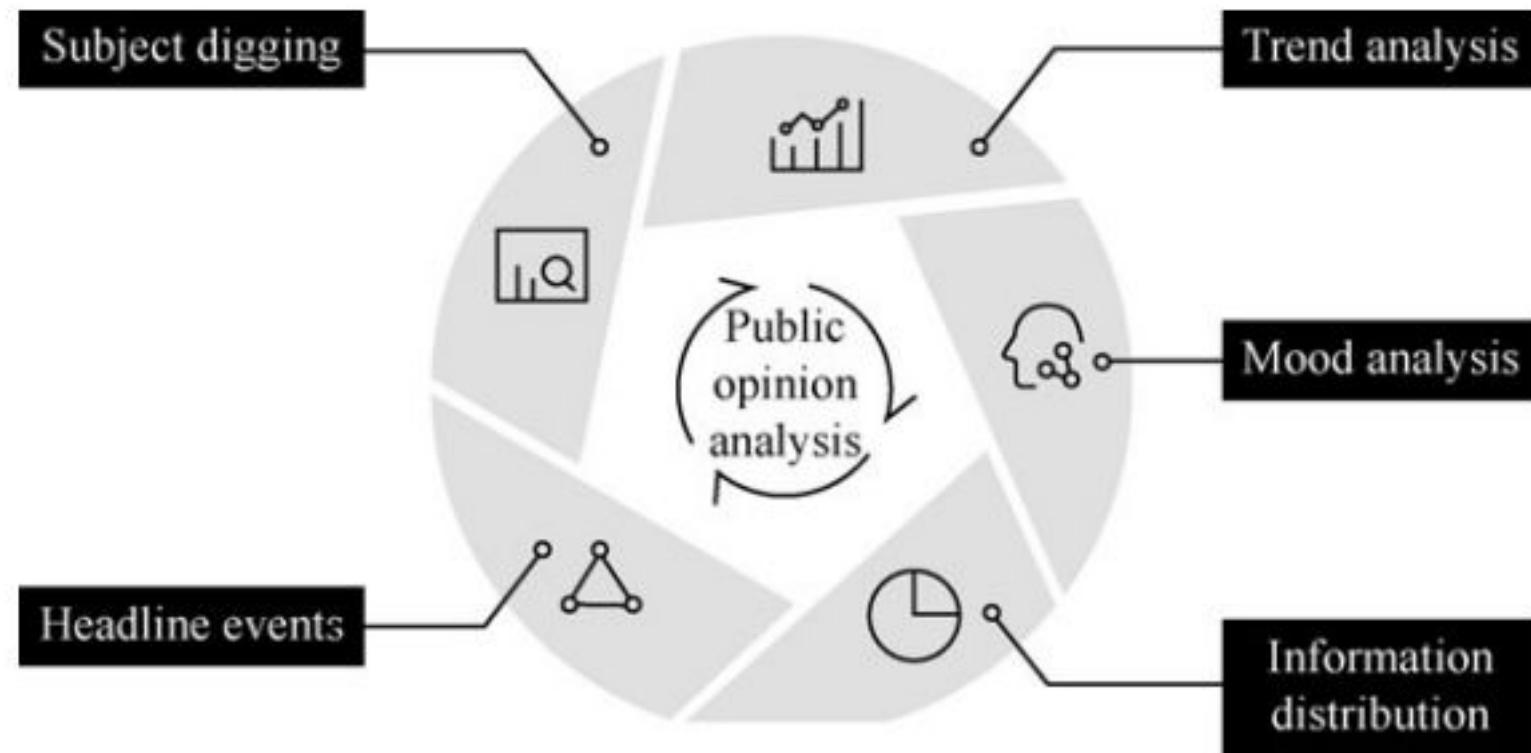
Speech Recognition	Voice Recognition
The speech recognition aims at understanding and comprehending WHAT was spoken.	The objective of voice recognition is to recognize WHO is speaking.
It is used in hand-free computing, map, or menu navigation.	It is used to identify a person by analysing its tone, voice pitch, and accent, etc.
Machine does not need training for Speech Recognition as it is not speaker dependent.	This recognition system needs training as it is person oriented.
Speaker independent Speech Recognition systems are difficult to develop.	Speaker dependent Speech Recognition systems are comparatively easy to develop.

Technologies of AI – Speech Processing



Intelligent navigation

Technologies of AI – Natural Language Processing



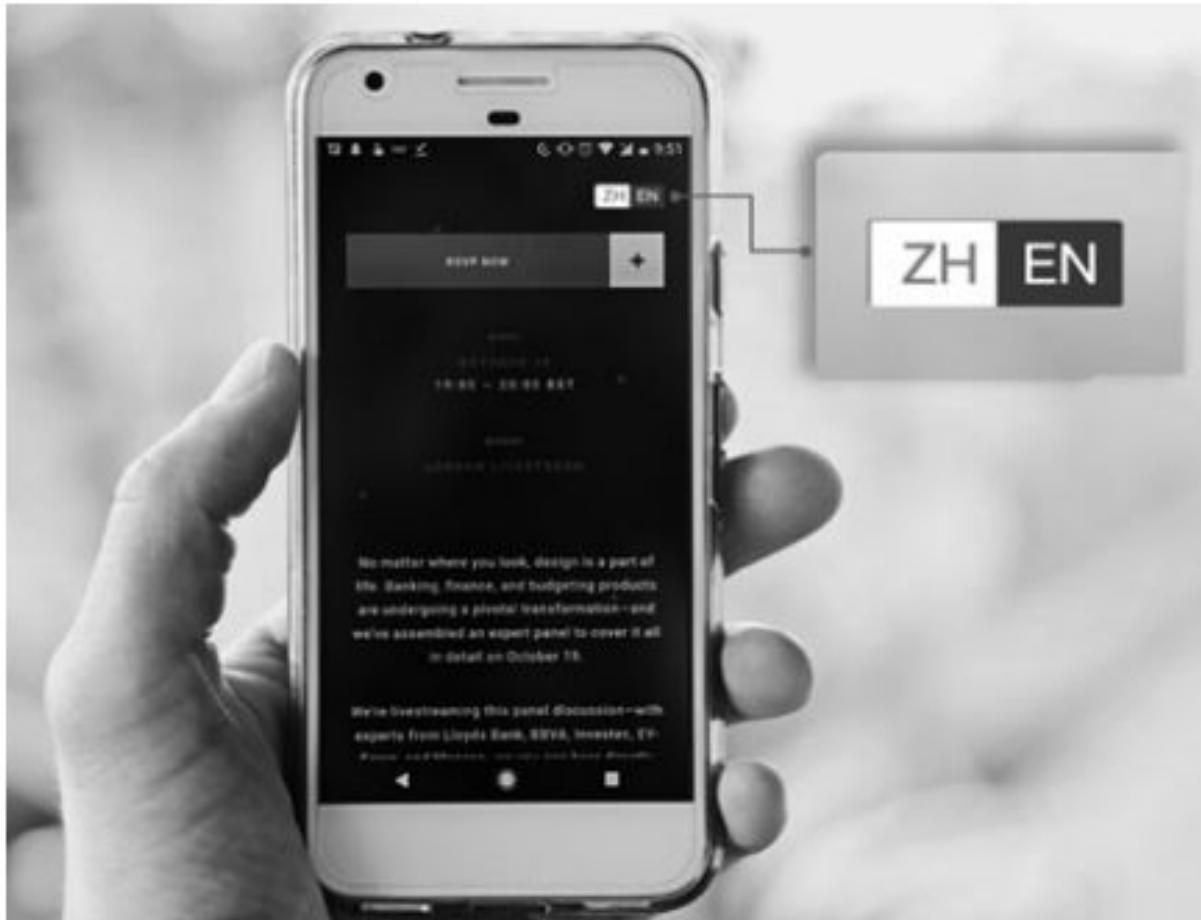
Public opinion analysis

Technologies of AI – Natural Language Processing



Comment analysis

Technologies of AI – Natural Language Processing



Machine translation

Real Life Applications of AI Research Areas

Expert Systems

Examples – Flight-tracking systems, Clinical systems.



Natural Language Processing

Examples: Google Now feature, speech recognition, Automatic voice output.



Neural Networks

Examples – Pattern recognition systems such as face recognition, character recognition, handwriting recognition.



Robotics

Examples – Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, carving, etc.

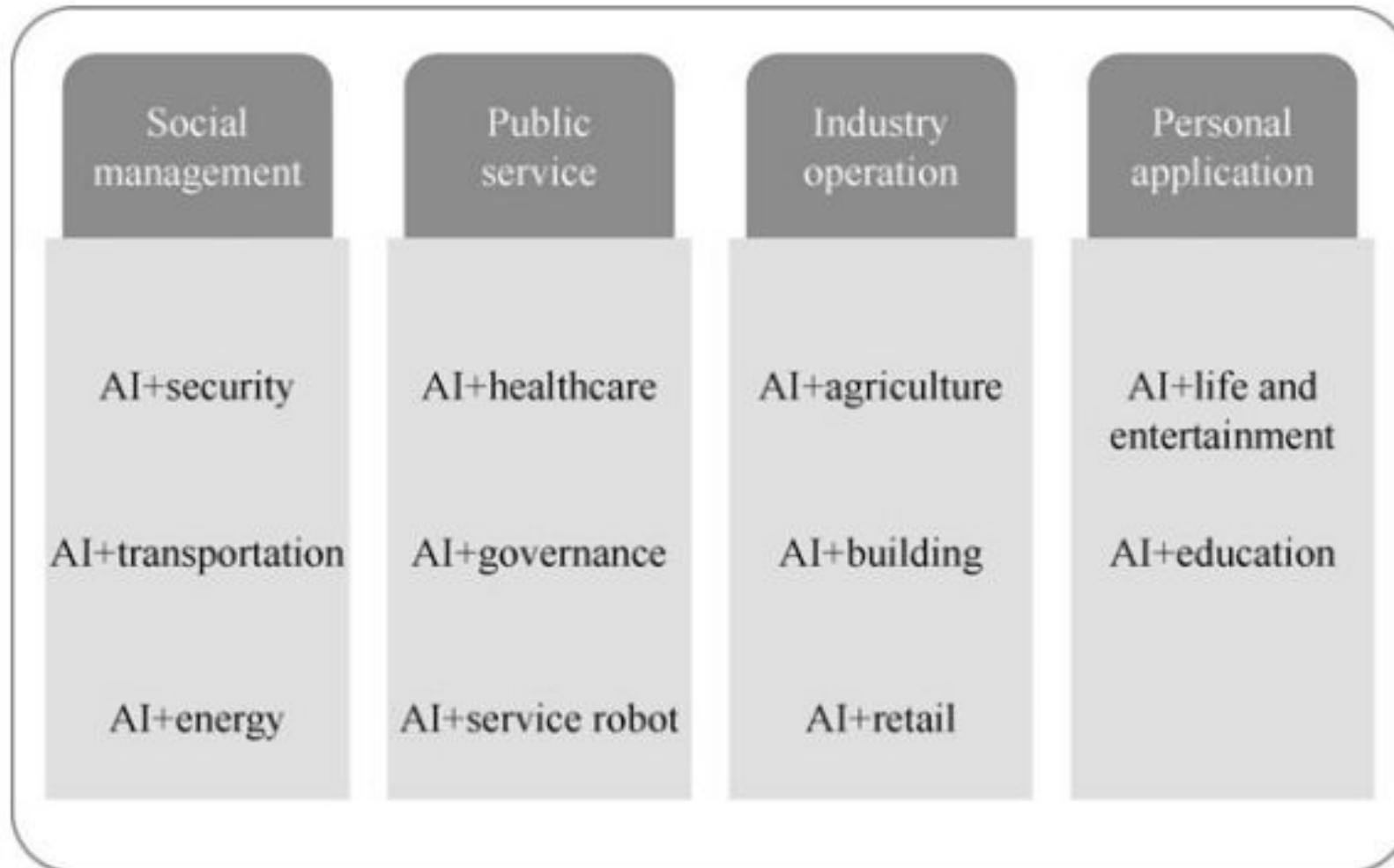


Fuzzy Logic Systems

Examples – Consumer electronics, automobiles, etc.



The Applications of AI – Smart city



The Applications of AI – Smart Healthcare

Drug discovery: assist the rapid development of customized medicine.

Health management: related to nutrition physical and psychological wellbeing customized medicine.

Hospital management: focusing on the structural management of medical records.

Assisting medical research: focusing on the structural management of medical records.

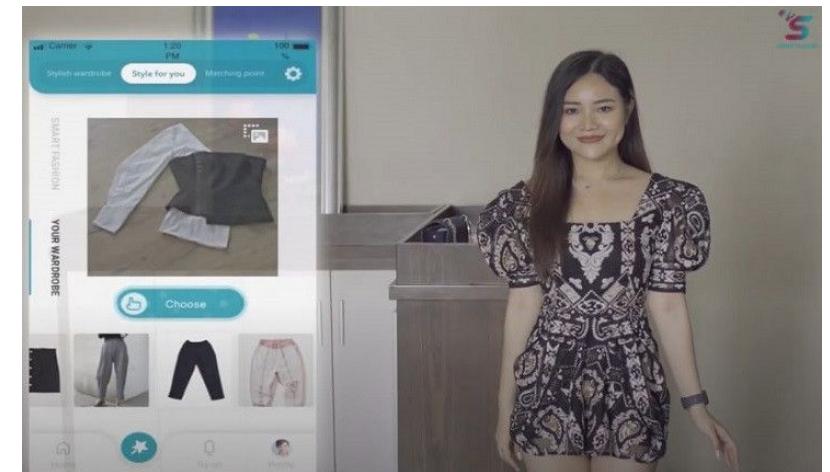
Virtual assistant: voice digital medical records, intelligent triage and consultation, and recommendation of medications.

Medical imaging: assist the medical image recognition, labeling and 3D reconstruction.

Assist diagnosis: consultation robot.

Disease risk prediction: identifying the disease risk through genome sequencing.

The Applications of AI – Smart Retail



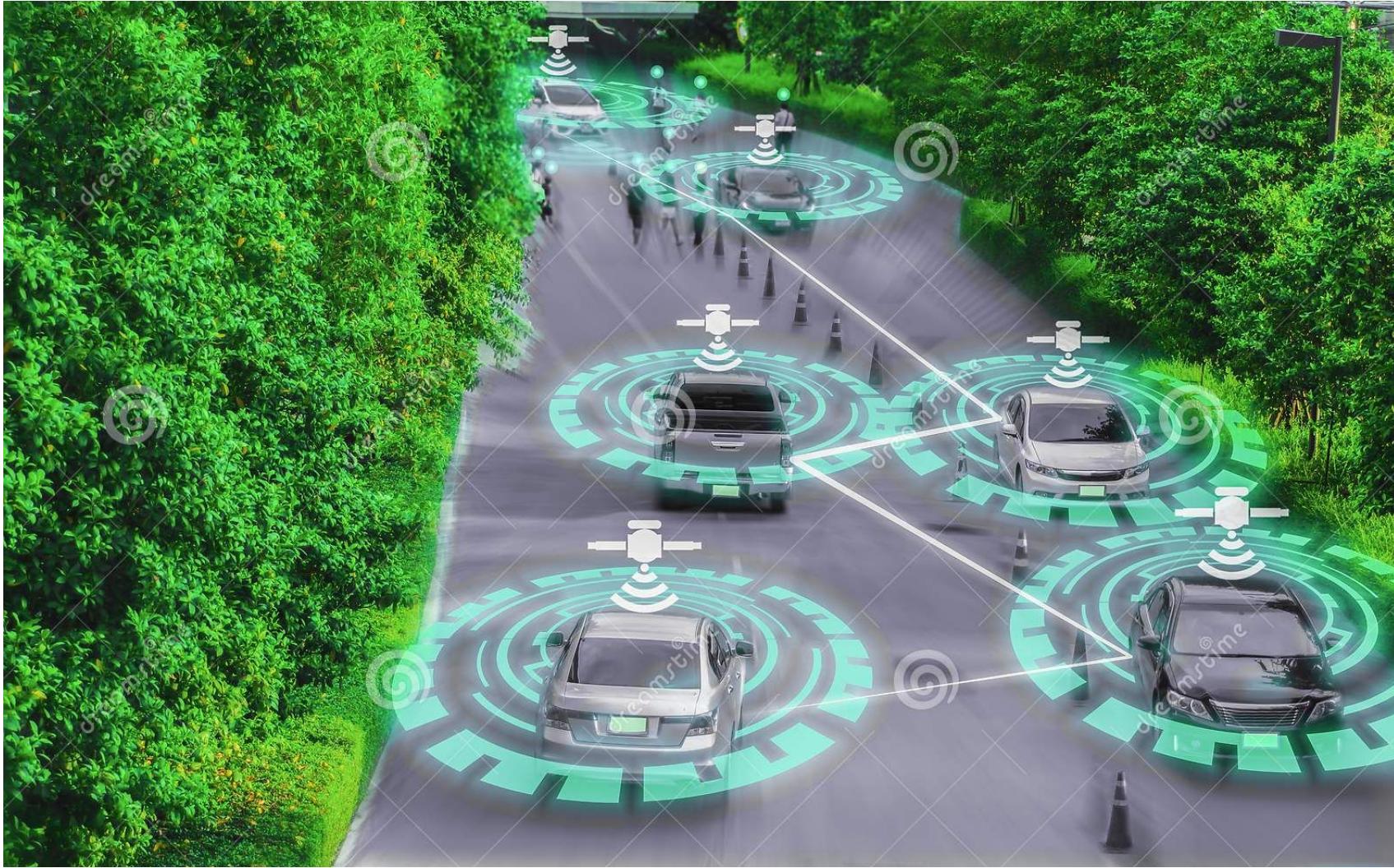
The Applications of AI – Smart Security



The Applications of AI – Smart Home



The Applications of AI – Smart Driving



Current Status of AI

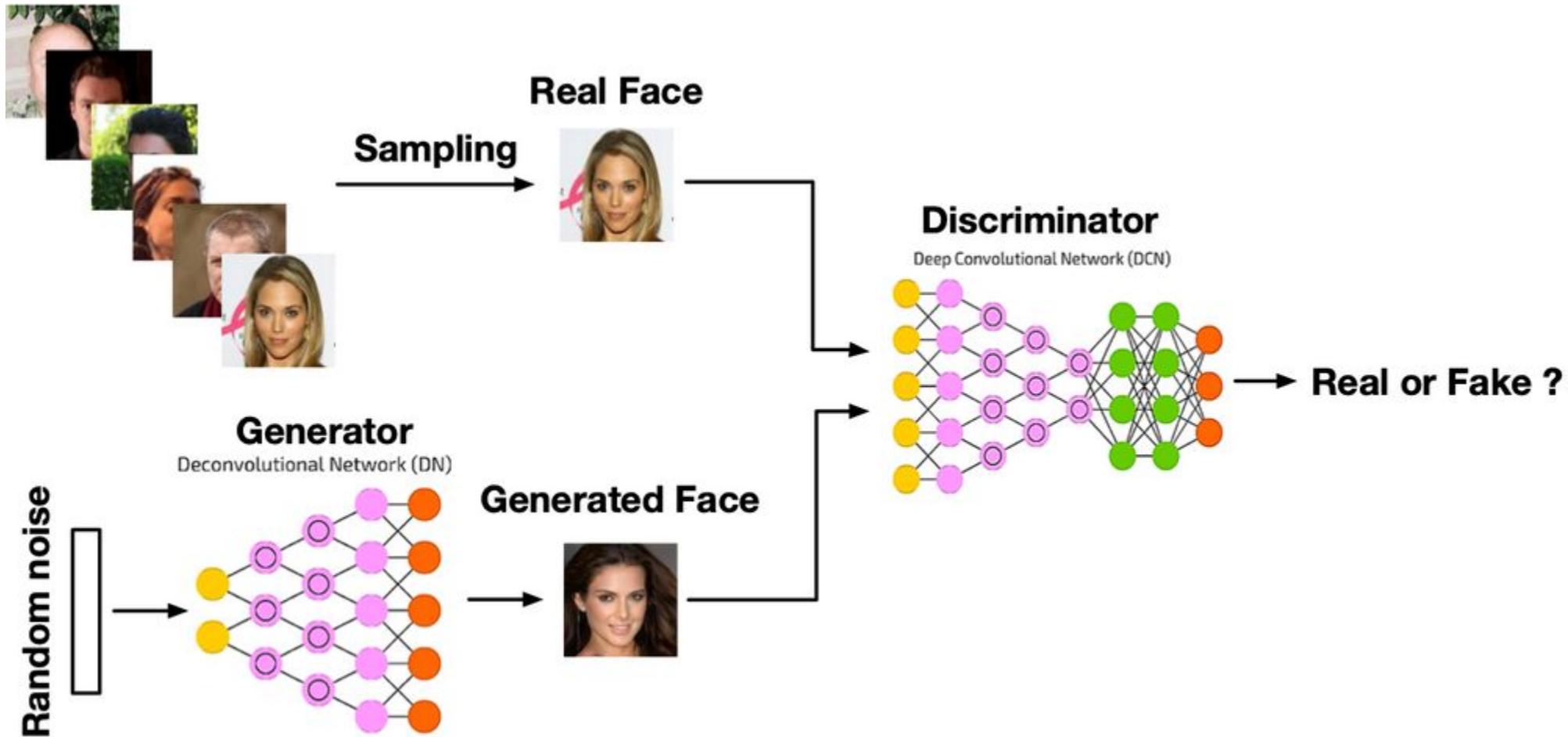
Performance	Examples	Values
Store and compute: the machines started to compute and deliver information	Examples: distributed computing, neural network	Values: helping people to store and process data rapidly, and being the foundation of perception and recognition
Listen and read: the machines started to read and listen, make judgement and take simple actions	Examples: cameras that can recognize human faces and the speakers can understand human language	Values: helping people “read” and “listen” to accomplish the relevant tasks
Understand and think: the machines started to understand, think and make decisions like humans	Examples: unmanned vehicles capable of totally independent driving, robots moving automatically	Values: being able to fully assist or replace human to do certain tasks

Three stages of artificial intelligence

The diagram illustrates the three stages of artificial intelligence as follows:

- Computing intelligence:** Represented by a light gray shield containing a white alarm clock and gear icon. Description: Store and compute; the machines started to compute and deliver information. Examples: distributed computing, neural network. Values: helping people to store and process data rapidly, and being the foundation of perception and recognition.
- Perception intelligence:** Represented by a dark gray shield containing a white alarm clock and gear icon. Description: Listen and read; the machines started to read and listen, make judgement and take simple actions. Examples: cameras that can recognize human faces and the speakers can understand human language. Values: helping people “read” and “listen” to accomplish the relevant tasks.
- Recognition intelligence:** Represented by a dark gray shield containing a white alarm clock and gear icon. Description: Understand and think; the machines started to understand, think and make decisions like humans. Examples: unmanned vehicles capable of totally independent driving, robots moving automatically. Values: being able to fully assist or replace human to do certain tasks.

The Contradiction Between Technology and Ethics



Exercises

1. There are different interpretations of artificial intelligence in different contexts. Please elaborate on the artificial intelligence in your eyes.
2. Artificial intelligence, machine learning and deep learning are three concepts often mentioned together. What is the relationship between them? What are the similarities and differences between the three terms?
3. After reading the artificial intelligence application scenarios in this chapter, please describe in detail a field of AI application and its scenarios in real life based on your own life experience.
4. Which chip is for deep neural networks and Ascend AI processors. Please brief these four major modules.
5. Based on your current knowledge and understanding, please elaborate on the development trends of artificial intelligence in the future in your view.