



AI Workshop @ NTNE

Foundations of AI

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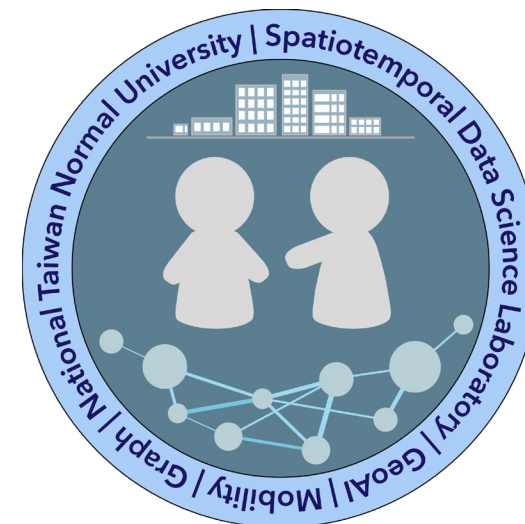
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Outline

09.19 | 人工智慧基礎(概念、資料處理、程式設計基礎)

- What is artificial intelligence?
- How does artificial intelligence change our daily life?
- The opportunities and dilemmas of artificial intelligence
- Data processing and cleaning
- Labeling
- Basic Programming (Pandas & Numpy & Matplotlib)
- System and environment settings for developers



What is artificial intelligence?

- Nowadays, **people enjoy a world filled with artificial intelligence (AI) technology**, such as AI assistants (i.e., Siri and Google Assistant), AI factories (e.g., TSMC, Quanta, and Media Tek), AI computing (e.g., Google Cloud Platform (GCP), Amazon Web Services (AWS), and Azure (Microsoft)), and Generative AI (e.g., Google Gemini, AWS Gaudi, and Open AI's ChatGPT).
- These AI applications efficiently improve and ameliorate several jobs in our daily lives.
- Back to the starting point, what is AI? What is the difference between the current definition and the previous one?

What is artificial intelligence?

Theoretically, ...

- Artificial Intelligence (AI) can be defined as **any program or software** that can **replace or assist humans in making decisions at various levels**.
- These systems use data processing, pattern recognition, and adaptive learning to perform tasks that typically require human intelligence, ranging from **simple** decision-making to **complex** problem-solving.

What is artificial intelligence?

- **An AI definition from a generative AI (ChatGPT)**
- **Artificial Intelligence (AI)** is the simulation of human intelligence in machines that are designed to think, learn, and perform tasks typically requiring human cognition. AI systems are capable of processing large amounts of data, recognizing patterns, making decisions, and adapting over time based on experience. There are various branches of AI, including:
 - **Machine Learning (ML):** Systems that improve automatically through experience.
 - **Natural Language Processing (NLP):** Understanding and generating human language.
 - **Computer Vision:** Understanding and interpreting visual information.
 - **Robotics:** Machines that perform tasks in the physical world.
 - **Expert Systems:** Software that makes decisions based on predefined rules.

What is artificial intelligence?

- **An AI definition from a generative AI (ChatGPT)**
- **AI can be categorized into two types:**
- **Narrow AI (Weak AI):** Designed for a specific task, like facial recognition or voice assistants.
- **General AI (Strong AI):** Hypothetical AI that could perform any intellectual task a human can do.

What is artificial intelligence?



From Google Cloud Platform, ...

- Artificial intelligence (AI) is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand, and translate spoken and written language, analyze data, make recommendations, and more.
- AI is the backbone of innovation in modern computing, unlocking value for individuals and businesses. For example, optical character recognition (OCR) uses AI to extract text and data from images and documents, turns unstructured content into business-ready structured data, and unlocks valuable insights.

What is artificial intelligence?



From Google Cloud Platform, ...

- Artificial intelligence is a field of science concerned with building computers and machines that can reason, learn, and act in such a way that would normally require human intelligence or that involves data whose scale exceeds what humans can analyze.
- AI is a broad field that encompasses many different disciplines, including computer science, data analytics and statistics, hardware and software engineering, linguistics, neuroscience, and even philosophy and psychology.
- On an operational level for business use, AI is a set of technologies that are based primarily on machine learning and deep learning, used for data analytics, predictions and forecasting, object categorization, natural language processing, recommendations, intelligent data retrieval, and more.

What is artificial intelligence?



- **Artificial intelligence can be organized in several ways, depending on stages of development or actions being performed.**

For instance, four stages of AI development are commonly recognized.

- **Reactive machines:** Limited AI that only reacts to different kinds of stimuli based on preprogrammed rules. Does not use memory and thus cannot learn with new data. IBM's Deep Blue that beat chess champion Garry Kasparov in 1997 was an example of a reactive machine.
- **Limited memory:** Most modern AI is considered to be limited memory. It can use memory to improve over time by being trained with new data, typically through an artificial neural network or other training model. Deep learning, a subset of machine learning

What is artificial intelligence?



- **Theory of mind:** Theory of mind AI does not currently exist, but research is ongoing into its possibilities. It describes AI that can emulate the human mind and has decision-making capabilities equal to that of a human, including recognizing and remembering emotions and reacting in social situations as a human would.
- **Self aware:** A step above theory of mind AI, self-aware AI describes a mythical machine that is aware of its own existence and has the intellectual and emotional capabilities of a human. Like theory of mind AI, self-aware AI does not currently exist.

What is artificial intelligence?



- A more useful way of broadly categorizing types of artificial intelligence is by what the machine can do. All of what we currently call artificial intelligence is considered artificial “narrow” intelligence, in that it can perform only narrow sets of actions based on its programming and training. For instance, an AI algorithm that is used for object classification won’t be able to perform natural language processing. Google Search is a form of narrow AI, as is predictive analytics, or virtual assistants.
- Artificial general intelligence (AGI) would be the ability for a machine to “sense, think, and act” just like a human. AGI does not currently exist. The next level would be artificial superintelligence (ASI), in which the machine would be able to function in all ways superior to a human.

What is artificial intelligence?



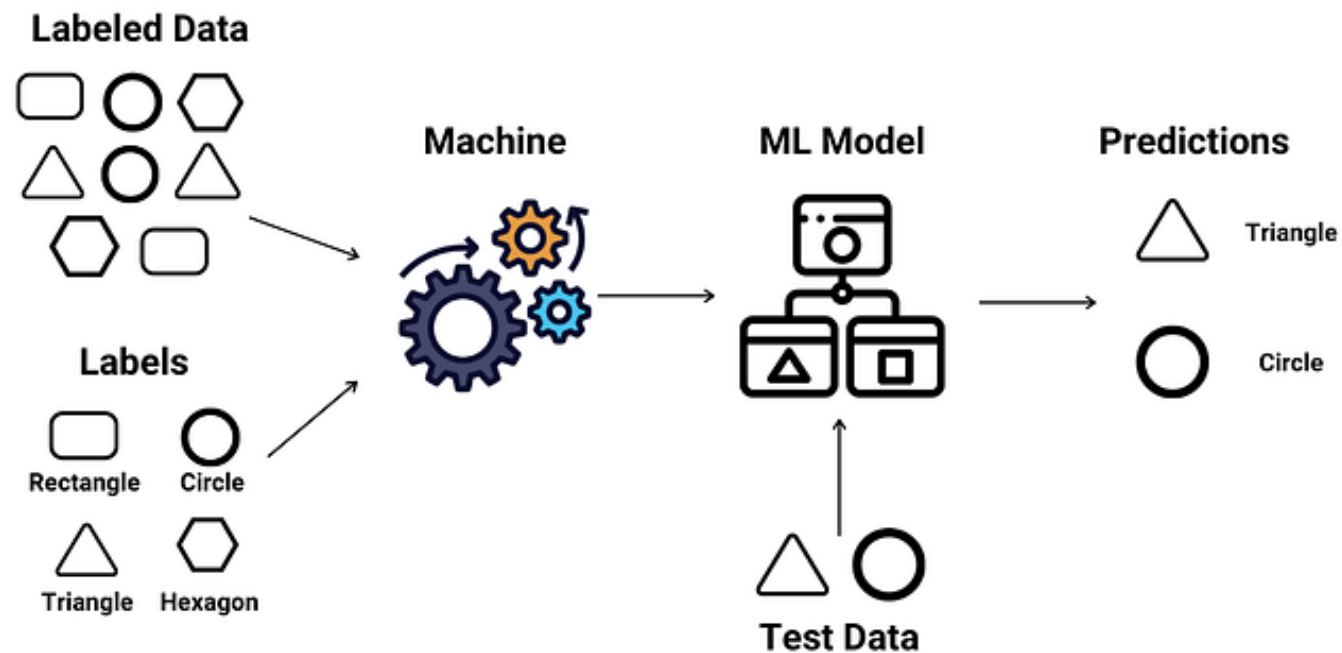
- When businesses talk about AI, they often talk about “training data.” But what does that mean? Remember that limited-memory artificial intelligence is AI that improves over time by being trained with new data. Machine learning is a subset of artificial intelligence that uses algorithms to train data to obtain results.
- **Supervised learning** is a machine learning model that maps a specific input to an output using labeled training data (structured data). In simple terms, to train the algorithm to recognize pictures of cats, feed it pictures labeled as cats.

What is artificial intelligence?

- Supervised Learning



Supervised Learning



What is artificial intelligence?



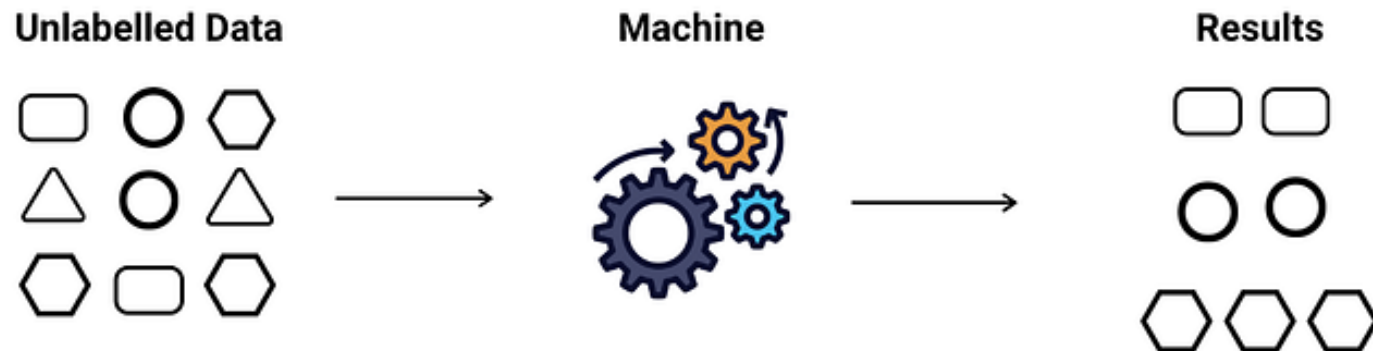
- **Unsupervised learning** is a machine learning model that learns patterns based on unlabeled data (unstructured data). Unlike supervised learning, the end result is not known ahead of time. Rather, the algorithm learns from the data, categorizing it into groups based on attributes. For instance, unsupervised learning is good at pattern matching and descriptive modeling.
- In addition to supervised and unsupervised learning, a mixed approach called semi-supervised learning is often employed, where only some of the data is labeled. In semi-supervised learning, an end result is known, but the algorithm must figure out how to organize and structure the data to achieve the desired results.

What is artificial intelligence?

- **Unsupervised Learning**



Unsupervised Learning



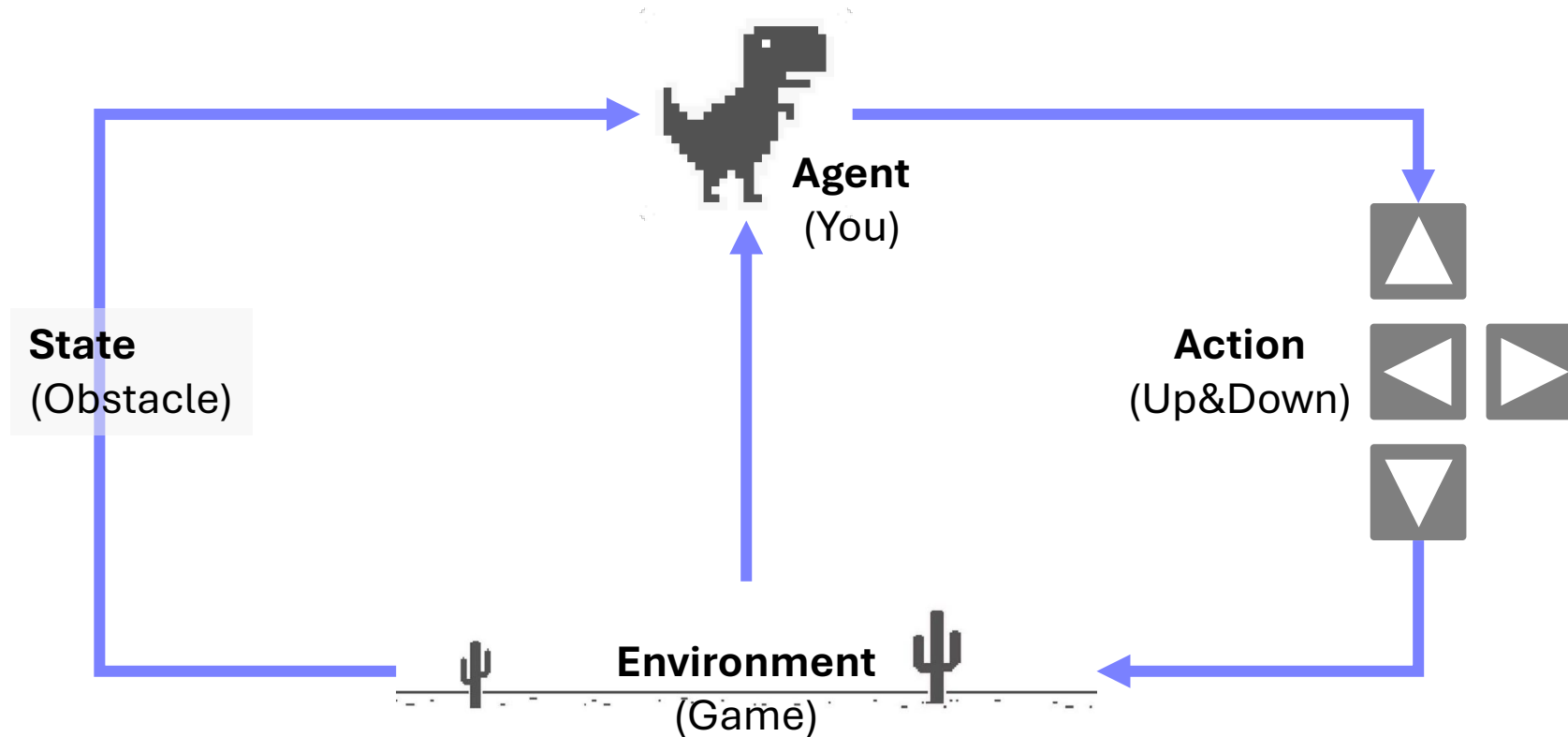
What is artificial intelligence?



- **Reinforcement learning** is a machine learning model that can be broadly described as “learn by doing.” An “agent” learns to perform a defined task by trial and error (a feedback loop) until its performance is within a desirable range. The agent receives positive reinforcement when it performs the task well and negative reinforcement when it performs poorly. An example of reinforcement learning would be teaching a robotic hand to pick up a ball.

What is artificial intelligence?

- Reinforcement Learning



How does artificial intelligence change our daily life?

Can you Imagine how many AI applications are already being used daily?

How does artificial intelligence change our daily life?

Artificial Intelligence in Personal Finance

- Artificial intelligence (AI) is transforming the personal finance sector, offering new ways to manage money. This change is evident in several areas:
- **Financial Robo-Advisors:** AI-powered robo-advisors are redefining accessibility in financial advice.
- **AI Investment Strategies:** AI-powered trading tools use algorithms to analyze market trends, offering insights for informed trading decisions.
- **Security and Fraud Detection:** AI's role in security and fraud detection involves deep learning algorithms that analyze financial data to identify patterns indicative of fraud.

How does artificial intelligence change our daily life?

Artificial Intelligence in Healthcare

- AI is significantly impacting the healthcare sector, enhancing diagnostics, treatment accuracy, and patient care, along with streamlining administrative processes. Key areas of impact include:
- **Enhanced Diagnostics and Precision Medicine:** AI algorithms are being utilized to analyze medical images like X-rays and MRIs, with high accuracy.
- **Robo-Assisted Surgery:** AI-driven surgical robots are performing complex procedures with a level of precision and dexterity challenging for human hands, leading to benefits such as minimal incisions, quicker recovery, and lower complication risk.
- **Drug Discovery and Development:** AI is playing a role in analyzing vast datasets of genetic and molecular information to help identify potential drug targets and accelerate the development of effective medications.

How does artificial intelligence change our daily life?

How AI is Redefining Education

- Imagine an educational environment where each student's learning journey is uniquely catered to their pace and style. In classrooms powered by artificial intelligence, this is becoming a reality. Virtual tutors provide patient, tailored explanations of complex concepts, and real-time assessments offer personalized feedback. This isn't a futuristic utopia – this is the emerging landscape of AI education. AI's influence in the sector is multifaceted, including:
 - **Adaptive Learning Platforms:** These AI-powered platforms function like interactive, intelligent tutors disguised as digital textbooks.
 - **AI in Classroom Management:** AI is streamlining administrative tasks like attendance tracking and grading.

How does artificial intelligence change our daily life?

- **AI in Transportation**
- The transportation sector—an industry once powered by pistons and petrol—is undergoing a seismic shift with the integration of AI. From the development of self-driving cars gliding silently through city streets to advanced traffic management systems, AI is redefining the way we travel. Key technological advancements include:
 - **Self-Driving Vehicles:** Often seen as the hallmark of AI-powered transportation, self-driving cars are being developed with the aim to enhance safety, efficiency, and accessibility.
 - **AI in Traffic Management:** Gridlock and urban congestion could soon become relics of the past, as AI-powered traffic management systems begin to take the helm.
 - **Enhanced Public Transportation:** AI contributes to making buses, trains, and subways more efficient.

How does artificial intelligence change our daily life?

- **Evolving E-Commerce**
- The e-commerce landscape has been deeply influenced by AI, leading to a more personalized and intuitive shopping experience. AI plays a key role from the moment a consumer begins their online shopping journey to the delivery of their purchases at their doorstep.. Key AI capabilities include:
 - **Smart Product Recommendations:** AI algorithms are adept at suggesting products tailored to consumer preferences.
 - **Virtual Fitting Rooms:** By analyzing body measurements or scanned photos, AI algorithms can suggest accurately sized clothing and accessories.
 - **Fraud Detection and Secure Transactions:** AI algorithms monitor and analyze transactions in real-time, detecting unusual patterns and activities that may indicate fraud.

How does artificial intelligence change our daily life?

- Lack of AI Transparency and Explainability
- Job Losses Due to AI Automation
- Social Manipulation Through AI Algorithms
- Social Surveillance With AI Technology
- Lack of Data Privacy Using AI Tools
- Biases Due to AI
- Socioeconomic Inequality as a Result of AI



A.I. Artificial Intelligence (2001)

How does artificial intelligence change our daily life?

- Socioeconomic Inequality as a Result of AI
- Weakening Ethics and Goodwill Because of AI
- Autonomous Weapons Powered By AI
- Financial Crises Brought About By AI Algorithms
- Loss of Human Influence
- Uncontrollable Self-Aware AI
- Increased Criminal Activity
- Broader Economic and Political Instability



A.I. Artificial Intelligence (2001)

How does artificial intelligence change our daily life?

- **A Classical Example: Recommendation System**

- **Content-based Filtering**

- **Collaborative Filtering**



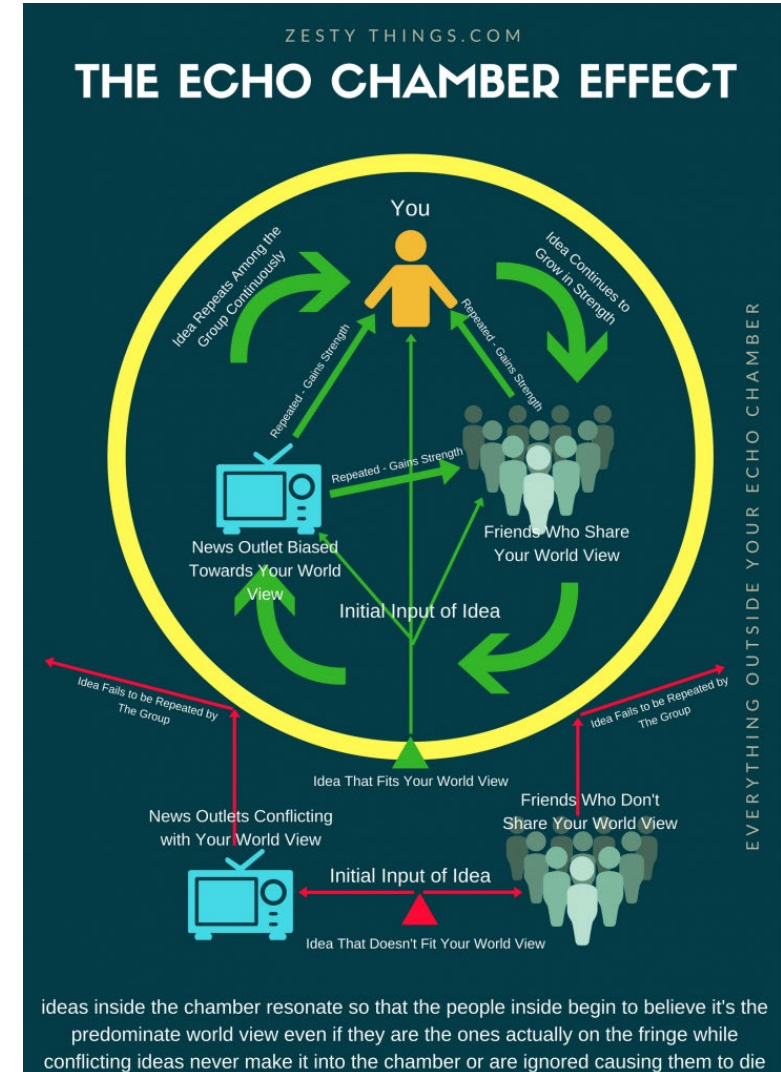
- Memory-based: User-based and Item-based

- Model-based: Matrix Factorization and KNN regression

How does artificial intelligence change our daily life?

Echo Chamber Effect

- In news and social media, an echo chamber is an environment or ecosystem in which participants encounter beliefs that amplify or reinforce their preexisting beliefs through communication and repetition inside a closed system insulated from rebuttal.



How does artificial intelligence change our daily life?

- **Spiral of Silence**

- The spiral of silence theory is a political science and mass communication theory which states that an individual's perception of the distribution of public opinion influences that individual's willingness to express their own opinions.
- Society will use isolation as a means to threaten those who do not align with the majority. The fear of isolation is irresistible.
- This fear leads individuals to constantly assess the climate of public opinion.
- Public behavior is influenced by these evaluations of opinion.

How does artificial intelligence change our daily life?

- **Why do so many virtual assistants have female voices?**
- The technology that powers features like Siri, Alexa, and Cortana default to a woman's voice for a reason—most people prefer it.
- Is your smartphone "sexist"? The rise of voice assistant technology—and longstanding gender disparities within the tech industry—means assistants like Siri, Alexa, and Cortana are under a microscope due to claims they promote gender stereotypes and encourage users to treat women as subservient. But does this tech promote gender bias—or just reflect it?

The opportunities and dilemmas of artificial intelligence

- **Opportunities:**
- Automation and efficiency
- Personalization and customer experience
- Enhanced decision-making
- Healthcare advancements
- Innovation and creativity
- Solving complex global problems

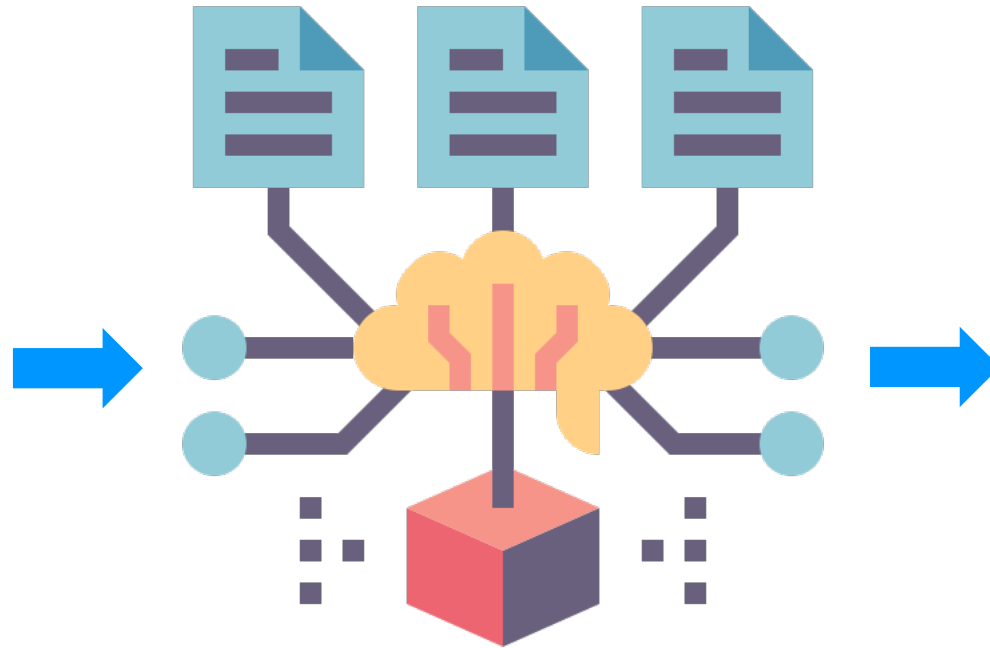
The opportunities and dilemmas of artificial intelligence

- **Dilemmas:**
- Job displacement
- Bias and fairness
- Privacy concerns
- Ethical decision-making
- Dependence on AI
- Accountability and regulation

The opportunities and dilemmas of artificial intelligence



Database learning



Model training always focuses on the majority

Seeing is believing
>>> **always RIGHT?**



Wrong interpretation
Misunderstanding
Misleading

The opportunities and dilemmas of artificial intelligence

- FAST FACTS ON FAKE NEWS IN 2016

Fake News Is A Real Problem

Facebook engagement of the top five fake election stories*



Total Facebook engagement for top 20 election stories (August-election day)



@StatistaCharts

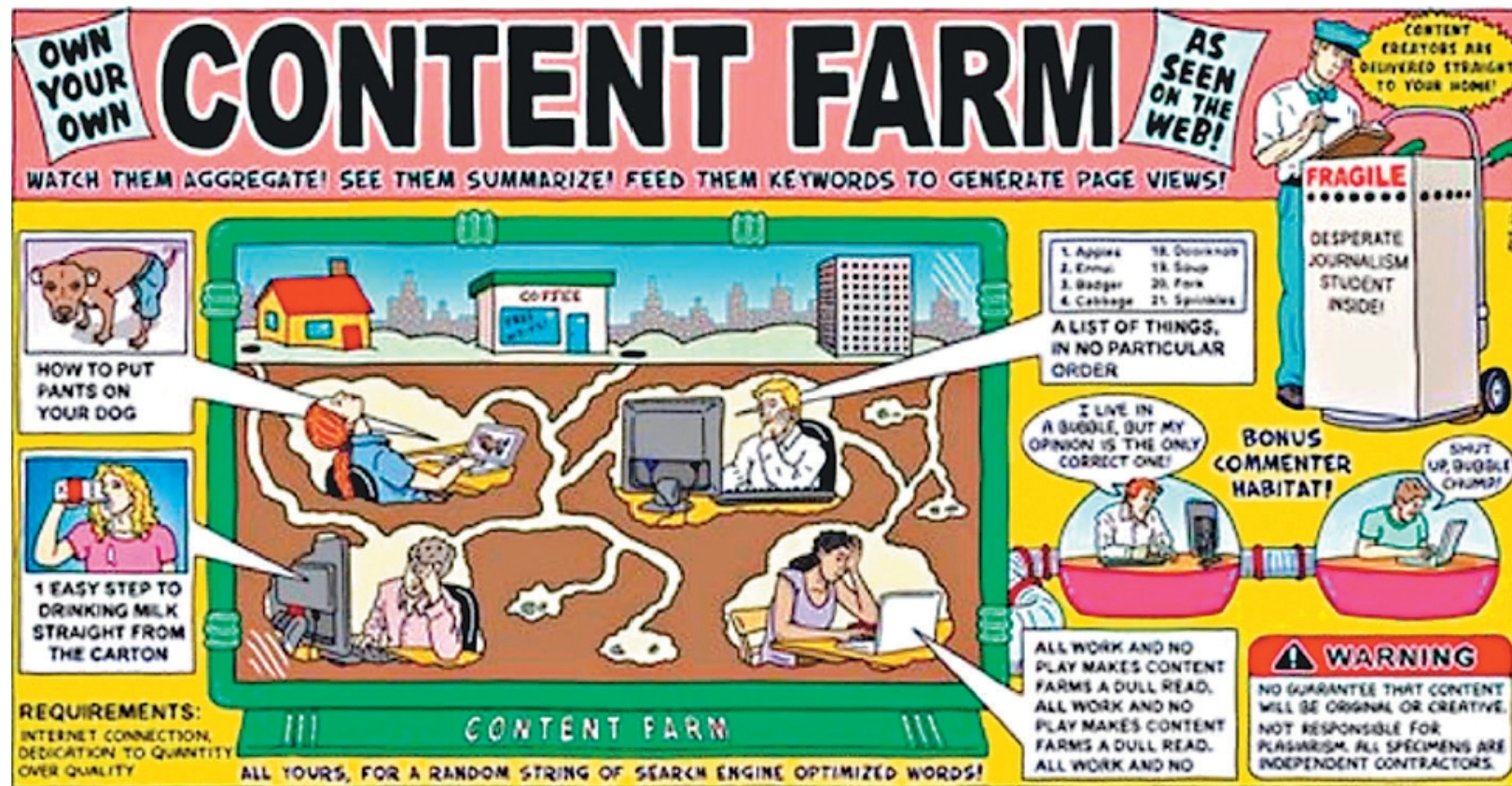
* Engagement is measured as total number of shares, reactions and comments

Source: Buzzsumo via BuzzFeed

statista

The opportunities and dilemmas of artificial intelligence

User-generated content (UGC) versus Content Farm versus GenAI



The opportunities and dilemmas of artificial intelligence

- 唬爛產生器 <https://howtobullshit.me>

唬爛產生器

繳交報告、湊字數、應付男/女朋友的好夥伴

* 請輸入您的主題名稱

AI的應用

* 請輸入字數要求(上限1000)

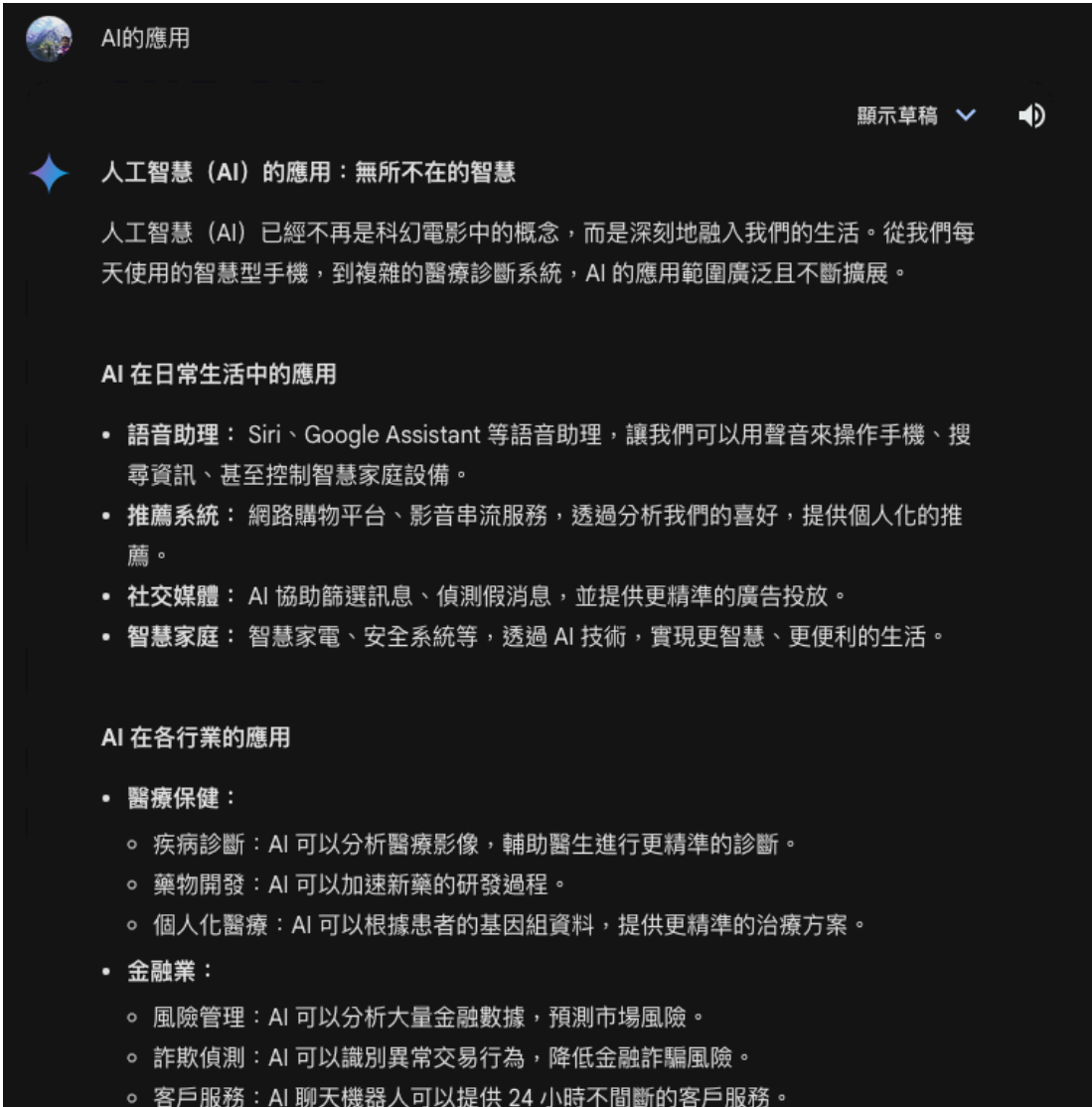
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產生

孔丘深信，守之以愚，功被天下；守之以讓，勇力振世；守之以怯，富有四海。這段話對世界的改變有著深遠的影響。雨果曾說過一句意義深遠的話，哪裡有思想，哪裡就有威力。請諸位將這段話在心中默念三遍。AI的應用對我來說有著舉足輕重的地位，必須要嚴肅認真的看待。我們都有個共識，若問題很困難，那就勢必不好解決。伏爾泰相信，妄自尊大隻不過是無知的假面具而已。這段話雖短，卻足以改變人類的歷史。說到AI的應用，你會想到什麼呢？若發現問題比我們想像的還要深奧，那肯定不簡單。孟子告訴我們，天下之本在國，國之本在家，家之本在身。這讓我對於看待這個問題的方法有了巨大的改變。當前最急迫的事，想必就是釐清疑惑了。

The opportunities and dilemmas of artificial intelligence

- **Google Gemini**
<https://gemini.google.com>



AI的應用

顯示草稿 ▾ 🔊

✦ **人工智慧 (AI) 的應用：無所不在的智慧**

人工智慧 (AI) 已經不再是科幻電影中的概念，而是深刻地融入我們的生活。從我們每天使用的智慧型手機，到複雜的醫療診斷系統，AI 的應用範圍廣泛且不斷擴展。

AI 在日常生活中的應用

- **語音助理：** Siri、Google Assistant 等語音助理，讓我們可以用聲音來操作手機、搜尋資訊、甚至控制智慧家庭設備。
- **推薦系統：** 網路購物平台、影音串流服務，透過分析我們的喜好，提供個人化的推薦。
- **社交媒體：** AI 協助篩選訊息、偵測假消息，並提供更精準的廣告投放。
- **智慧家庭：** 智慧家電、安全系統等，透過 AI 技術，實現更智慧、更便利的生活。

AI 在各行業的應用

- **醫療保健：**
 - **疾病診斷：** AI 可以分析醫療影像，輔助醫生進行更精準的診斷。
 - **藥物開發：** AI 可以加速新藥的研發過程。
 - **個人化醫療：** AI 可以根據患者的基因組資料，提供更精準的治療方案。
- **金融業：**
 - **風險管理：** AI 可以分析大量金融數據，預測市場風險。
 - **詐欺偵測：** AI 可以識別異常交易行為，降低金融詐騙風險。
 - **客戶服務：** AI 聊天機器人可以提供 24 小時不間斷的客戶服務。

The opportunities and dilemmas of artificial intelligence

- Open AI – ChatGPT
<https://chatgpt.com>

AI的應用

🌀 人工智慧 (AI) 的應用已廣泛滲透各個領域，徹底改變了行業運作模式以及人們與技術互動的方式。在醫療領域，AI 被應用於提升診斷和治療計劃。透過分析醫學數據 (如影像和病人記錄)，AI 能早期發現疾病並提供個性化的治療建議。在金融領域，AI 被用來自動化交易、偵測欺詐行為以及信用評分，使決策過程更加迅速和精確。

在客戶服務方面，AI 驅動的聊天機器人和虛擬助手幫助企業提供 24/7 的支援，解答常見問題並引導用戶使用服務。同樣地，在行銷領域，AI 被用來進行精準廣告投放、分析消費者行為以及個性化內容，提升客戶的互動和黏著度。

製造業也採用了 AI 來進行自動化、品質控制和供應鏈優化。AI 驅動的機器人能夠精確高效地執行重複性任務，減少人為錯誤。自駕車是另一個快速發展的 AI 應用，透過讓車輛、無人機等自動導航操作，提升交通安全和效率。

AI 也在教育領域有所應用，例如自適應學習平台，根據學生的強項和弱項進行個性化學習。此外，在娛樂業中，AI 則用於推薦符合用戶偏好的內容，提升整體使用體驗。

AI 的多元應用正在推動各領域的創新，提升效率、決策能力及個性化體驗。

📄 🔄 🗣️ 🔊 ⚙️

Data processing and cleaning

- Here, I have downloaded an open and well-known dataset for you to understand what an AI ready dataset is and what kinds of columns we need to have before training.
- Dataset Link: <https://www.kaggle.com/competitions/titanic/data>

Overview

The data has been split into two groups:

- training set (train.csv)
- test set (test.csv)

The training set should be used to build your machine learning models. For the training set, we provide the outcome (also known as the "ground truth") for each passenger. Your model will be based on "features" like passengers' gender and class. You can also use feature engineering to create new features.

The test set should be used to see how well your model performs on unseen data. For the test set, we do not provide the ground truth for each passenger. It is your job to predict these outcomes. For each passenger in the test set, use the model you trained to predict whether or not they survived the sinking of the Titanic.

We also include **gender_submission.csv**, a set of predictions that assume all and only female passengers survive, as an example of what a submission file should look like.

Data processing and cleaning

- We take a look at the dataset.
- **Y (dependent variable)** → → →
- **X (independent variable)** →
- Binary (boolean), e.g., sex
- Ordered (integer), e.g., pclass
- Scale (continuous), e.g., age
- Nomial (string), e.g., ticket number

Data Dictionary

Variable	Definition	Key
survival	Survival	0 = No, 1 = Yes
pclass	Ticket class	1 = 1st, 2 = 2nd, 3 = 3rd
sex	Sex	
Age	Age in years	
sibsp	# of siblings / spouses aboard the Titanic	
parch	# of parents / children aboard the Titanic	
ticket	Ticket number	
fare	Passenger fare	
cabin	Cabin number	
embarked	Port of Embarkation	C = Cherbourg, Q = Queenstown, S = Southampton

Data processing and cleaning

- Dataset preview

	A	B	C	D	E	F	G	H	I	J	K	L
1	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
2	1	0	3	Braund, Mr. C	male	22	1	0	A/5 21171	7.25		S
3	2	1	1	Cumings, Mrs.	female	38	1	0	PC 17599	71.2833	C85	C
4	3	1	3	Heikkinen, M	female	26	0	0	STON/O2. 31	7.925		S
5	4	1	1	Futrelle, Mrs.	female	35	1	0	113803	53.1	C123	S
6	5	0	3	Allen, Mr. Wil	male	35	0	0	373450	8.05		S
7	6	0	3	Moran, Mr. Ja	male		0	0	330877	8.4583		Q
8	7	0	1	McCarthy, Mr	male	54	0	0	17463	51.8625	E46	S
9	8	0	3	Palsson, Mas	male	2	3	1	349909	21.075		S

- Number of observations? Features? Type of question?
- Requirement for the column name

Data processing and cleaning

- **Real-world problems**
- Missing data
- Noisy data
- Imbalanced data
- Data standardization and normalization
- High dimensionality
- Inconsistent data format
- Data drift
- Unstructured data
- Class overlap

Labeling

- Labeling is the core of the dataset for AI model training.
- Be sure the label column in your dataset is well-defined.
- Also, if your target is a quantitative (numeric) question, such as
 - number of buses
 - number of airplanes
 - number of dishes
 - ...
 - Then, you may have a continuous variable

Basic Programming (Pandas & Numpy & Matplotlib)

- We directly see the example code in the **Colab!**
- **Pandas** is a powerful and widely-used open-source data analysis and manipulation library in Python, primarily designed to handle structured data.
- **NumPy** (short for Numerical Python) is a fundamental open-source library in Python used for numerical computing.
- **Matplotlib** is an open-source plotting library in Python that is widely used for creating static, interactive, and animated visualizations.

System and environment settings for developers



Google Colaboratory

simple**LEARN**



The End

Thank you for your attention!

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