



NANYANG  
TECHNOLOGICAL  
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SINGAPORE

CC0007 Science and Technology for Humanity

# Artificial Intelligence II (Business Aspect)

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# AI Applications

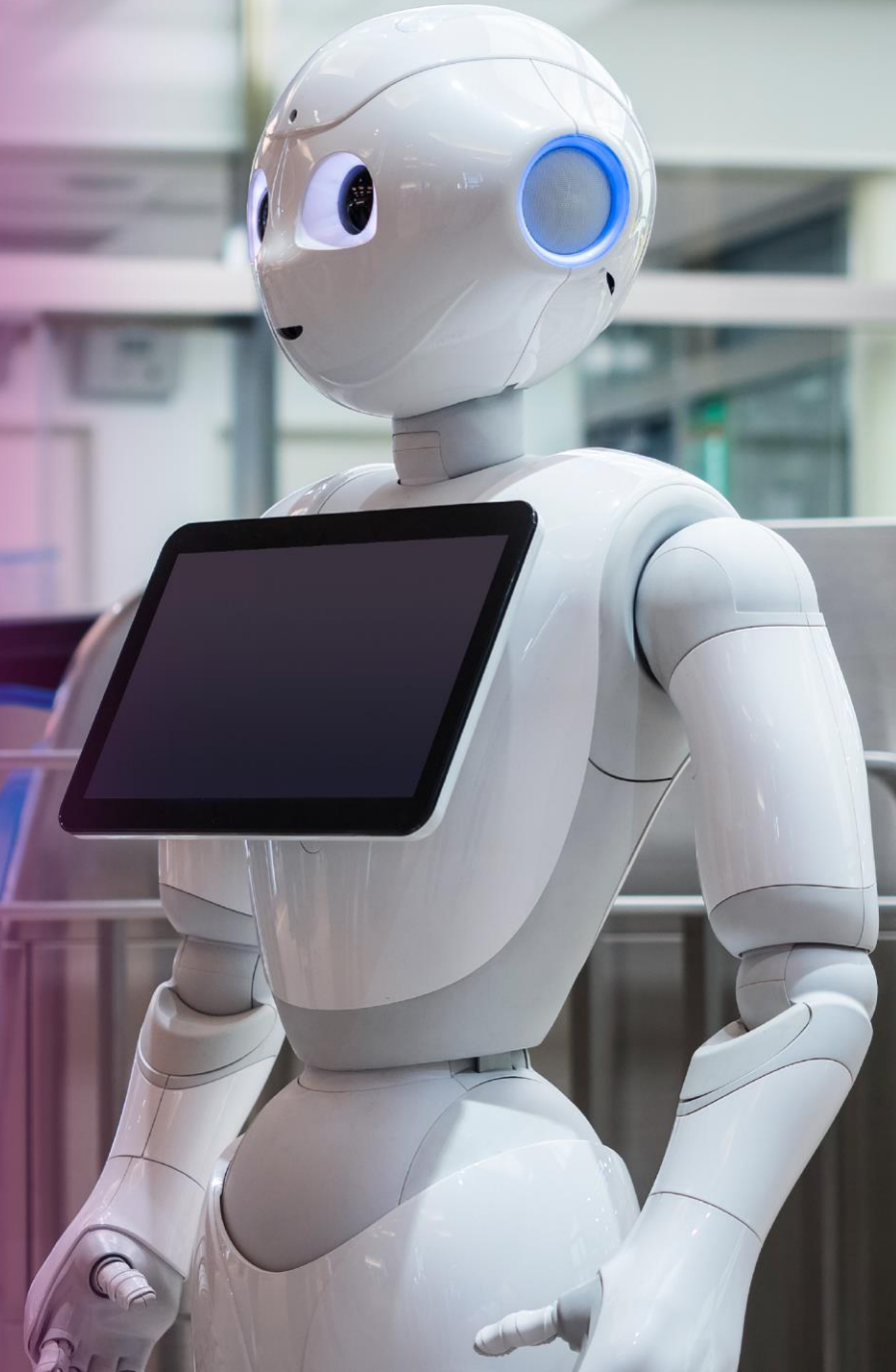
- Image recognition
- Deep fakes
- AI in healthcare
- Robotics





# Robots

..... IoT (Internet of Things) devices comprising sensors connected to a cloud or edge computing for data analysis.



# Robots in Retail

- Robots can be deployed as *data collectors*.
- Example: Auchan Retail Portugal (European grocery retailer) has autonomous shelf-monitoring technology with robots in supermarkets and hypermarkets.
- As robots navigate within the stores, they capture photos of various aisles and shelves. This information is digitised, converted into data, to generate insights into pricing and out-of-stock merchandise.
- Robots can observe and detect rates of consumer purchases by observing dwindling items on store shelves and make automated supplies order.

Forgan, B. (2020, October 1). *What robots can do for retail*. Harvard Business Review. Retrieved September 8, 2022 from <https://hbr.org/2020/10/what-robots-can-do-for-retail>





# Automotive Industry – Advanced Robotic Motion

- In the past, robots are used for **basic assembly and welding** of metal parts in a car factory.
- However, more fluid and dexterous motions still require human workers.
- An innovation in “teaching robots how to move by **demonstration**” sparked advances in intelligent robotic motion.
- A major development would be to create robots with *seven axes*, **fully mimicking human-arm motion**, and teaching them how to move.



# Robots in Hotels



- Robot concierge is becoming prevalent in hotels.
- Example: IBM developed *Connie*, a robot and is used at the Hilton McLean.
- *Connie can assist hotel guests on directions, dining options, and places of interest.*
- A key goal of hotel industry is to *alleviate customer pain points*, specifically, having to queue and wait to speak to a hotel employee for questions and help.
- Robots also act as an *attraction for guests*, with its ability to interact and express emotions.



# Autonomous Robotic Cleaners are Rolled Out Into Commercial Spaces, Office Buildings, Airports



- *Neo* (picture) is a 4-feet tall, 1000-pound robot floor scrubber. It requires no human supervision on its tasks to clean large commercial spaces.
- Prior to the pandemic, cleaning was outsourced to cleaning companies.
- During COVID-19, the demand for Neo shot up 100% in March 2020.
- Robots are *compliant, tireless* and advanced models can *collect data on places with higher cleaning effort required*.
- In Cincinnati/Northern Kentucky Airport, Neo is deployed 3 to 4 times a day for cleaning 10,000 sqft of tiled floors. **This relieves human cleaners to carry out heavier floor maintenance.**

# Robots (IoT) Solutions for Other Industries

- The use of robots to observe and analyse inventory levels are applicable to **predictive maintenance**.
- In the aircraft industry, unexpected airplane maintenance leads to flight delays, especially if repairs are needed and exacerbated further by the lack of necessary spare parts.
- Hence, IoT has been implemented to manage the inventory of parts and supplies, as well as better diagnosing when aircrafts should be sent for servicing.





# AI Applications

- Image recognition
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- Drones



# Drones: Flying Internet of Things

These devices are capable of autonomous navigation in the air, and do not really require a human pilot. Instead, a single human pushes buttons to merely control a group of many drones.





# Reality Capture From the Skies

- Topographically mapping out surfaces of the earth, especially in 3-D, is of vital importance for various industries and applications.
- In the past, this task relied on pilots taking aircrafts to record such images, or via satellite imaging.
- These had their drawbacks.
- Human pilots are sometimes restricted in terms of maneuverability in tight spaces, especially in urban settings.
- Satellite imaging faces obstacles including cloud cover.





# Drones are Taking Over...

- Drones are relatively lightweight and agile, in comparison to pilots.
- Their cameras can capture high-resolution imagery and send to cloud computing for analysis. They can remain in operation for long periods of time.
- Accuracy of drone imagery is comparable to laser scanning.
- A fleet of drones can do the work of many pilots more efficiently and faster.
- *Today, drones are so cheap, one can purchase it from a retail store and use it for serious enterprise work.*





# Construction Industry

- The construction industry is worth an estimated \$8 trillion annually, the second highest after agriculture.
- However, many construction projects end up an average of 20 months behind schedule and 80% over budget.
- Drones can alleviate this because they can provide real-time inspection of construction sites, such as the soil condition and 3D imagery.
- For example, a full construction site can be mapped using drones at a cost of only \$25 per day!



# Applications of Drones

- Agriculture, scanning of crops, land, topography
- Infrastructure inspection
- Energy generation monitoring (wind and solar)
- Oil and gas exploration
- Border control, public safety

*Industries can only manage what is measurable, hence drones are crucial to providing sought after data.*





# Some Developments

- Autonomous drones: Relatively few drone pilots are required to manage huge fleets.
- However, drone traffic controllers and software engineers are expected to grow in demand exponentially!



# AI Applications

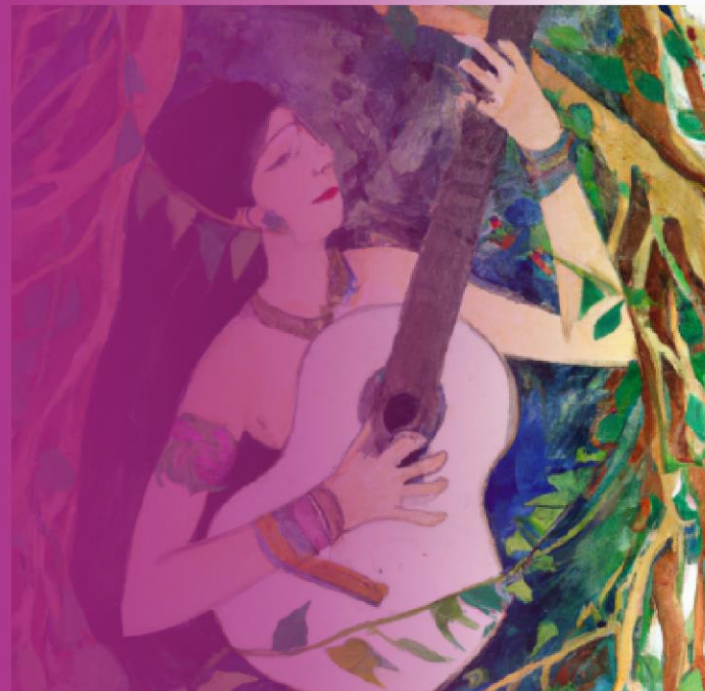
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- Other noteworthy applications
  - Text-to-image generation



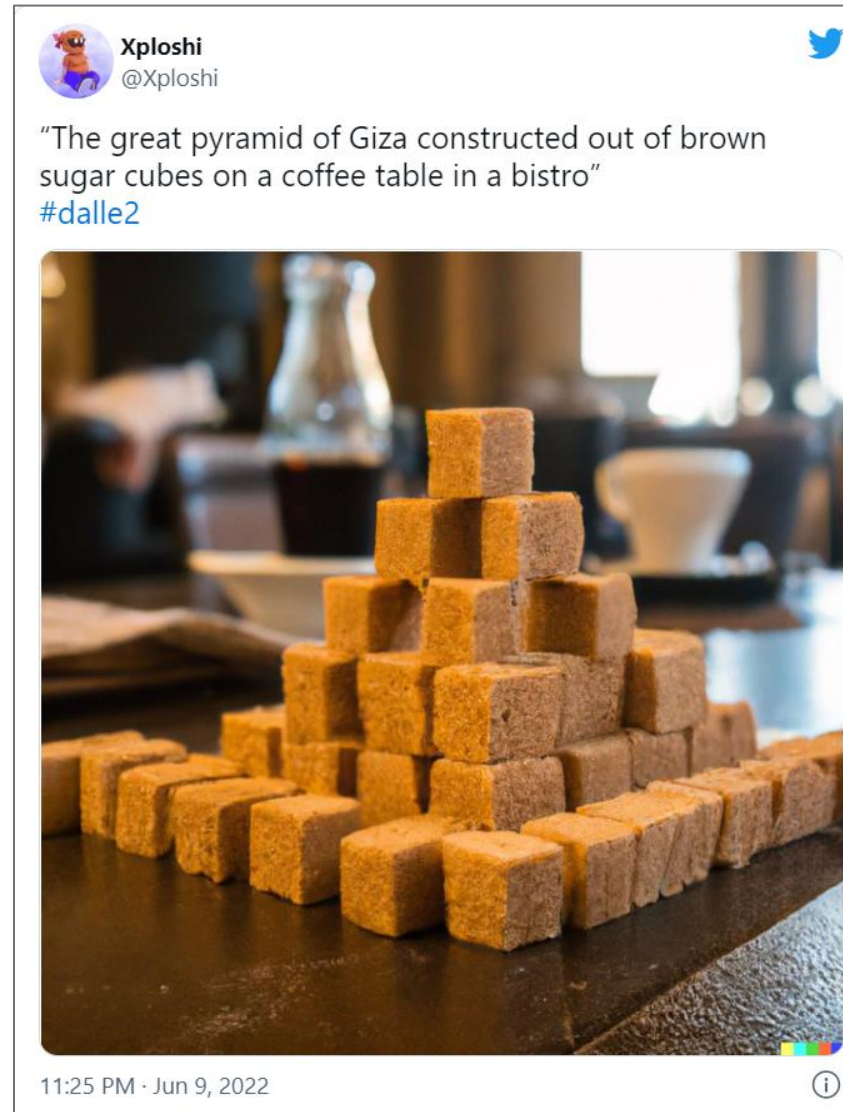


# Text-to-Image Generation

- A new breakthrough has allowed for the generation of images based on text input!
- Opens the doorway to countless imaginative innovations and applications!



# Text-to-Image Generation





# Text-to-Image Generation





## The creation of the algorithm that made the first black hole image possible was led by MIT grad student Katie Bouman

Catherine Shu @catherineshu / 11:40 AM GMT+8 • April 11, 2019

 Comment

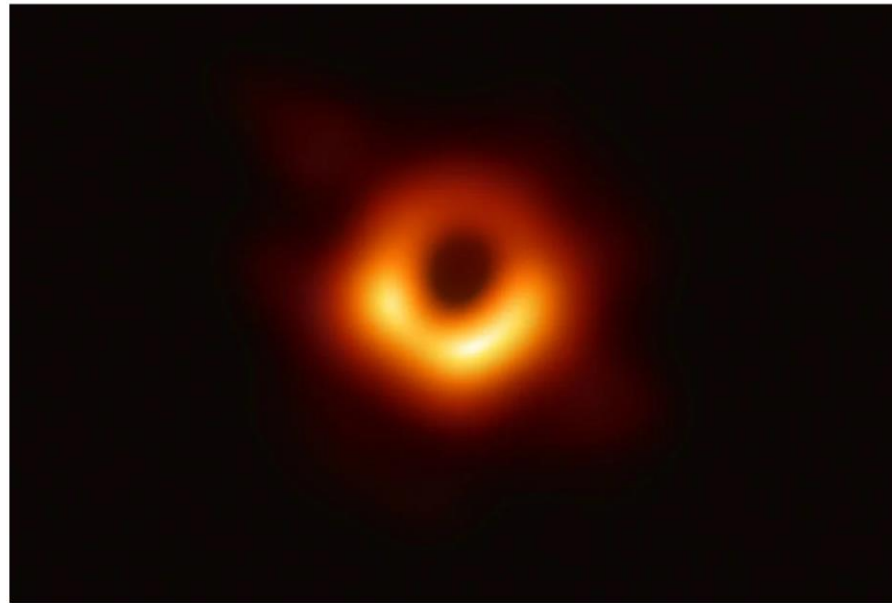


 Image Credits: MIT



# AI Applications

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- Other noteworthy applications
  - Text-to-image generation
  - Social and non-profit



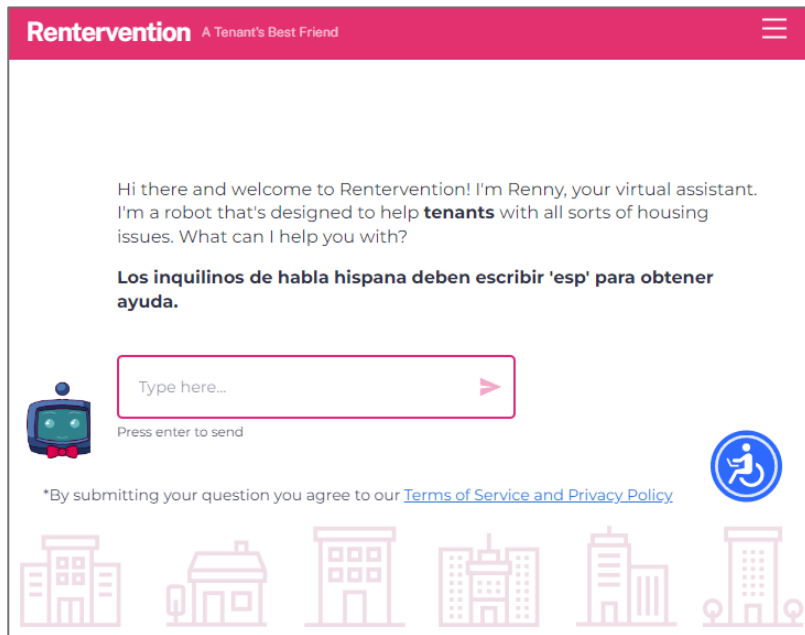
# Social Services Make Use of Robots to Distribute Food Packs



- The COVID-19 pandemic was a catalyst for implementing AI for *non-profit social services*.
- For example, nearly 4000 students in Penn Hills, Pittsburgh usually relied on schools for their breakfasts and lunches.
- When schools were closed during the pandemic, Carnegie Mellon University researchers used **machine learning to create new bus routes to deliver meals to children, in an efficient manner**. **Existing bus routes** to transport students to schools were ***not ideal for meal distributions***.
- This community programme delivered approximately 6000 monthly meals, comprising students as well as senior citizens.



# Homeless Services Agencies Use Chatbots to Provide Mental Health and Legal Advice



- *Rentervention* is a chatbot developed by non-profit legal aids in Illinois to assist tenants facing evictions during tough times.
- Many tenants did not know that city and state ordinances already protected them to some extent.
- The chatbot is capable of addressing basic issues faced by renters, like: “Lack of heat, water, power”, or “Locked out by landlord.”
- For more complicated cases, a team of over 80 volunteer attorneys would directly assist the renters.
- Over 20,000 users were served in March 2020 by the latest chatbot version.

# Telemedicine

- Another use of chatbots is for telemedicine, where patients can get diagnosis for common questions about the COVID-19 pandemic.
- This frees up doctors and staff for other medical needs.
- A prime and global scale example: An international humanitarian group *Doctors Without Borders (MSF or Médecins San Frontières)*, since 2010.
- Impact is particularly high for crisis response in resource poor nations or remote areas, where there is a lack of medical workers and facilities.
- Over the years since, thousands of cases have been managed via MSF's telemedicine services, without which they would not have received critical clinical diagnoses which are probably considered routine in developed nations with high standards of healthcare.





# The Promises and Wonders of AI



# Steady Progress of AI

*“Artificial intelligence would be the ultimate version of Google. The ultimate search engine that would understand everything on the web. It would understand exactly what you wanted, and it would give you the right thing.*

*We’re nowhere near doing that now.*

*However, we can get incrementally closer to that, and that is basically what we work on.”*

— Larry Page



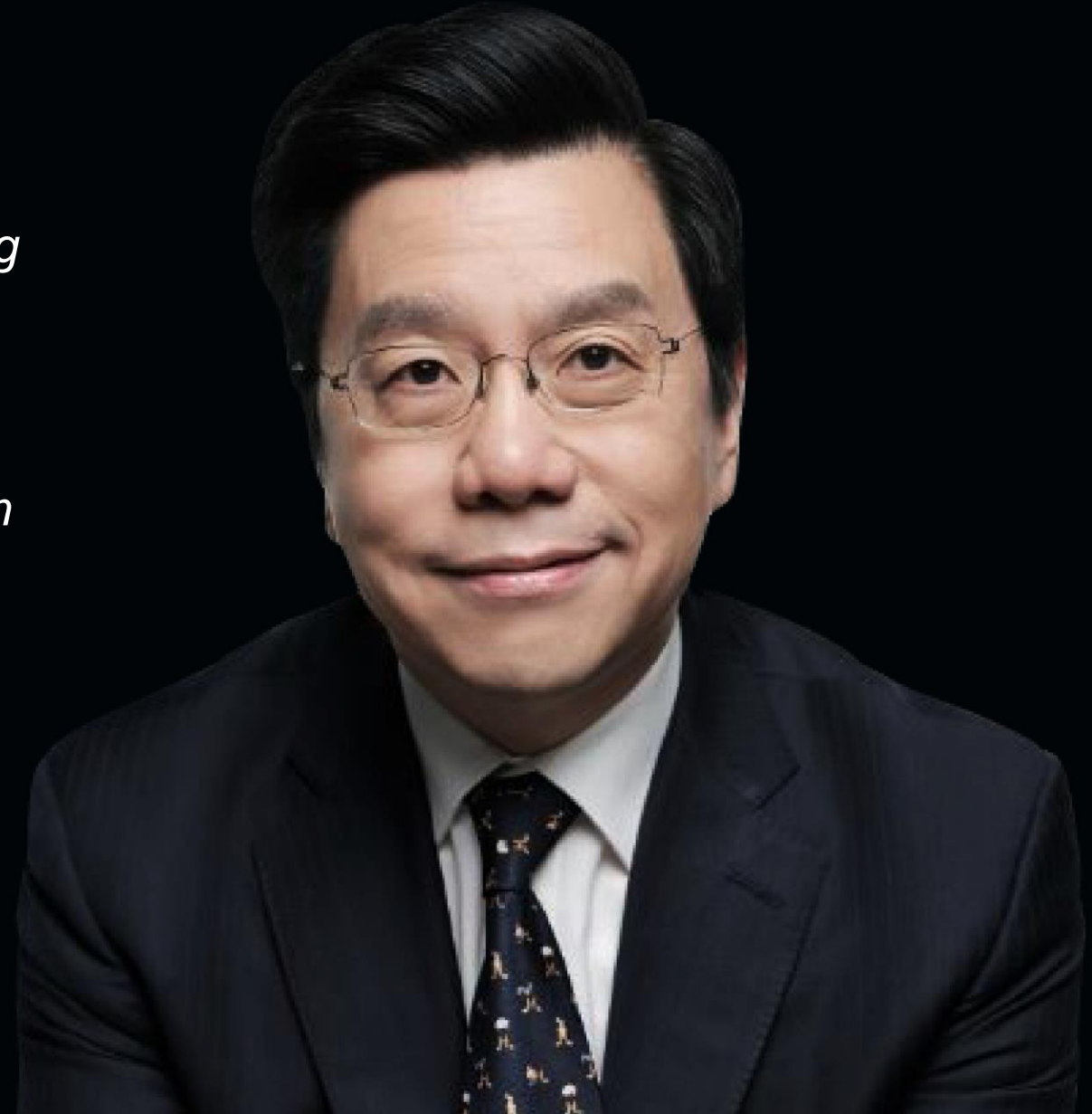


# AI Proliferating into Various Industries

*“The gradual platformisation of AI is very interesting to me. The efforts by Google, Amazon, Salesforce — they’re bringing AI down to a level of not needing to be an expert to use it.*

*I think the day that any good software engineer can program AI will be the day it really proliferates.”*

— Kai-Fu Lee,  
former President of Google China,  
Taiwanese Computer Scientist,  
Businessman, Writer



# Challenges and Warnings

*“I’m increasingly inclined to think that there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don’t do something very foolish.*

*I mean with artificial intelligence we’re summoning the demon.*

*...the pace of (AI) progress is faster than people realise. It would be fairly obvious if you saw a robot walking around talking and behaving like a person, you’d be like ‘Whoa... that’s like... what’s that?’*

*...that would be really obvious. What’s not obvious is a huge server bank in a dark vault somewhere with an intelligence that’s potentially vastly greater than what a human mind can do. Its eyes and ears would be everywhere, every camera, every microphone, and device that’s network accessible.*

— Elon Musk **warned** about AI





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