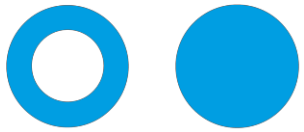

Hochschule
Bonn-Rhein-Sieg
University of Applied Sciences

Course: MSc. In Autonomous Systems Home Work No:Assignment 01

Contributing Team Members: Ahsan Kabir Nuhel and Linta Mariya Joy

Professor Name: Dr. Teena Hassan

Flashcard 1: Geoffrey Hinton

Task 1: Identify 3 key historical figures (e.g. Alan Turing) in the field of AI. Create 3 flashcards, one for each figure. One flashcard could be one slide with the following information.

Answer:

Figure 1. Geoffrey Hinton [1] Source: Deep learning pioneer Geoffrey Hinton quits Google | MIT Technology Review

Active Period in AI:

Geoffrey Hinton has been active in AI research since the 1970s and continues to influence the field till now [2].

Institutions:

Hinton has held positions at several prestigious institutions. He worked at Carnegie Mellon University during the 1980s before moving to the University of Toronto in 1987, where he remains active. In 2013, he joined Google to continue his groundbreaking work in AI [2].

Major Contributions to AI:

Hinton is best known for his work in deep learning and neural networks. He developed the backpropagation algorithm, a critical advancement that allowed neural networks to learn and evolve more efficiently. Additionally, he co-invented the Boltzmann Machine, a key early stochastic neural network. His work on deep belief networks in 2006 further revolutionized the field, making deep learning a viable technique for various AI applications. Hinton's more recent research on capsule networks aims to overcome limitations in convolutional neural networks (CNNs). His contributions have had far-reaching implications in fields such as image recognition, speech processing, and generative models [3].

Flashcard 2: Yann LeCun

Figure 2. Yann LeCun [4] Source: Yann LeCun | NYU Tandon School of Engineering

Active Period in AI: Yann LeCun has been contributing to AI since the 1980s and is active to this day [4].

Institutions:

LeCun worked at the University of Paris (1980s), Bell Labs (1988–1996), and has been a professor at New York University (since 2003) and a lead scientist at Facebook AI Research (since 2013) [5-6].

Major Contributions:

LeCun developed convolutional neural networks (CNNs), which are essential in modern AI, especially in computer vision tasks. He created the MNIST dataset, which has become a standard for benchmarking machine learning models. His work has impacted fields such as healthcare, autonomous driving, and robotics [5-6].

Flashcard 3: Zaheed Sabur

Figure 3. Zaheed Sabur [7] Source: https://en.banglatribune.com/tech-and- gadget/news/89607/Zaheed-Sabur-becomes-Google-s-first-Bangladeshi-director

Active Period in AI and Technology: 2007–Present [7]. Institutions:

•Zaheed graduated from American International University-Bangladesh (AIUB) in pursuit of becoming an engineer. He has completed his graduation from the university with a CGPA 4, making a record in the university's history. Zaheed started his career as a software engineer at Google's backend system development project in 2007 at India's Bangalore office, and six months later in the California office.

•Later in 2019, he was promoted to principal engineer and director at Google's Zurich office [7-8].

Major Contributions to AI and Technology:

• Zaheed is the engineering lead of Google's recently launched Gemini app [7-8].

•Zaheed Sabur began his career at Google in 2007, where he contributed to backend system development. Within a short time, he transferred to Google's office in California and later became a Principal Engineer and Director in Zurich.

•He played a significant role in the development of the Google Assistant Smart Displays, which received multiple awards, including over 20 CES awards.

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6 LeCun, Y. (1989). "Backpropagation Applied to Handwritten Zip Code Recognition."

7R. Haider, "Zaheed, first Bangladeshi to be Google director," Bangla Tribune, May 4, 2019. [Online]. Available: https://en.banglatribune.com/tech-and-gadget/news/89607/Zaheed-Sabur- becomes-Google-s-first-Bangladeshi-director. [Accessed: Oct. 04, 2024].

8"Zaheed Sabur: First Bangladeshi Director at Google," Dhaka Tribune, Feb. 22, 2021. [Online]. Available: https://www.dhakatribune.com/tech/2021/02/22/zaheed-sabur-first- bangladeshi-director-at-google. [Accessed: Oct. 04, 2024].

AI systems and Agents

Tesla Autopilot (Self-driving car system)

sense-plan-act paradigm

- **Sense**: A forward-facing radar, cameras ,ultrasonic sensors.[1]
- **Plan**: Finds efficient path by guiding the vehicle from on-ramp to off-ramp, including suggesting and making lane changes, navigating highway interchanges, and taking exits.[2]
- **Act**: Controls the car's steering, braking, and acceleration using actuators.

AI tasks and AI methods

- **Tasks**: Object detection, path planning, decision making, sensor fusion.
- **Methods**: Deep learning (for vision), reinforcement learning (for planning and decision making), convolutional neural networks (for visual data processing), Kalman filters (for sensor fusion).

Figure 1: Tesla Self driving car
source: https://www.gettyimages.de/detail/foto/automatic-driving-car-on-highway-lizenzfreies-bild/1415090444?utm_medium=organic&utm_source=google&utm_campaign=iptcurl

Boston Dynamics' Spot (Quadruped Robot)

sense-plan-act paradigm

- **Sense**: cameras, LiDAR and gas sensors[3]
- **Plan**: It plans walking patterns and body adjustments in real-time to maintain balance and avoid obstacles.
- **Act**: Executes movements via motorized legs to walk, climb stairs, and avoid obstacles.

• AI tasks and AI methods

- **Tasks**: Object recognition, terrain analysis, pathfinding, motion control.
- **Methods**: Reinforcement learning (for locomotion), SLAM (Simultaneous Localization and Mapping), deep learning (for object detection), kinematic modeling.

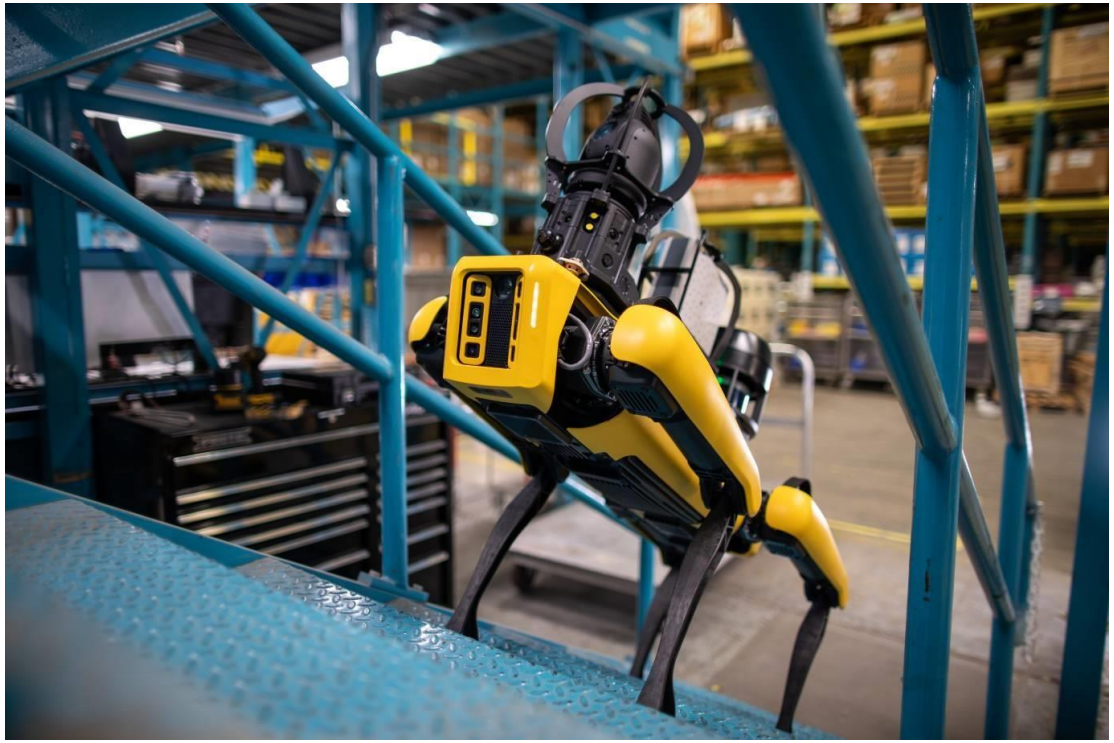

Figure 2: Boston Dynamics' Spot
source: https://bostondynamics.com/wp-content/uploads/2023/06/spot-climbs-stairs-min.jpg

AlphaFold (Protein Structure Prediction)

sense-plan-act paradigm

- **Sense**: Gathers biological sequence data from protein sequences.
- **Plan**: Predicts the 3D structure of proteins by analyzing interactions between amino acids and simulating folding patterns.
- **Act**: utilises Adaptive Computation Time (ACT) to extend the depth of the network for hard-to-predict proteins.

AI tasks and AI methods

- **Tasks**: : Structure prediction, sequence analysis, pattern recognition.
- **Methods**: : deep learning algorithm.[6]

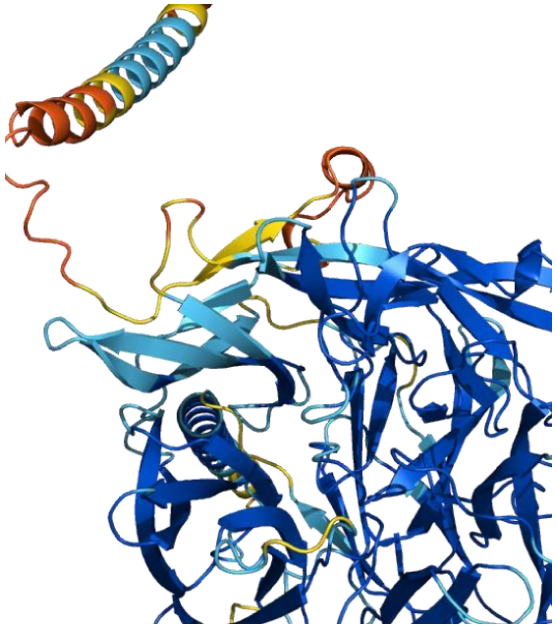

Figure 3: May protect the malaria parasite against attack by the immune system.
source: https://alphafold.ebi.ac.uk/assets/img/Q8I3H7_1.png

Sophia the Robot

sense-plan-act paradigm

- **Sense**: Captures speech and visual input through microphones and cameras.
- **Plan**: Interprets human emotions and social cues using emotion recognition and NLP algorithms.
- **Act**: Responds with speech and facial expressions to simulate human interaction.

AI tasks and AI methods

- **Tasks**: Human-robot interaction, emotion recognition, conversation.
- **Methods**: Machine learning, deep learning, natural language processing.

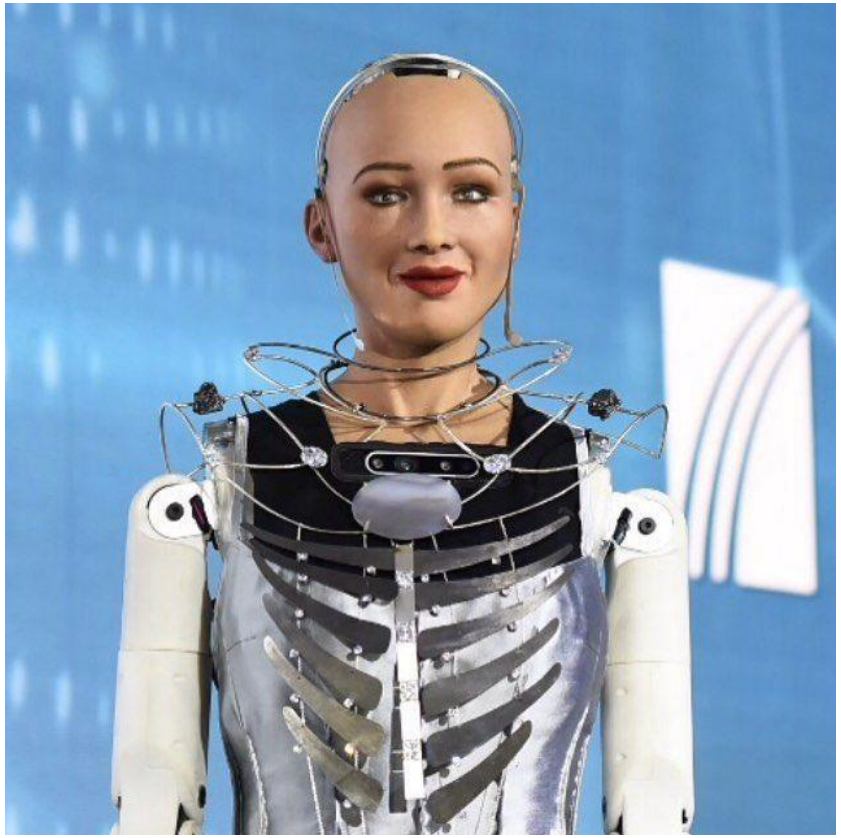

Figure 4: Sophia the Robot
source: https://www.beyond-expo.gr/wp-content/uploads/2024/04/Sophia-the-Robot.jpg

OpenAI’s DALL·E

sense-plan-act paradigm

- **Sense**: Processes input text (e.g., “A photorealistic image of an astronaut riding a horse”) to understand the intended image generation.
- **Plan**: Uses a transformer model to create a high-level representation of the image based on text.
- **Act**: DALL-E 2 is an AI system that can create realistic images and art from a description in natural language.[7]

AI tasks and AI methods

- **Tasks**: Image generation, creativity, text-to-image transformation.
- **Methods**: Contrastive Language-Image Pre-training[8]

Figure 5: A photorealistic image of an astronaut riding a horse source:https://images.ctfassets.net/kftzwdyauwt9/5GOIjwbUjLZHoGhX6q5oQg/d2984681d2a9466b71b7ca7632a8481c/Anastronautridingahorseinaphotorealisticstyle0.jpg?w=640&q=90&fm=webp

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8 https://openai.com/index/dall-e/

9 https://www.assemblyai.com/blog/how-dall-e-2-actually-works/

10 https://chatgpt.com/