

How AI Learns and Why That Matters to You

David Hart and Nic Herndon
Department of Computer Science
East Carolina University

November 6, 2024

• What is Machine Learning?

Machine learning is picking up on patterns present in large amounts of data.

- Pavlov's dogs
- Identifying potential risks for a medical patient
- Forecasting weather 10-days ahead



Source:

<https://www.akc.org/expert-advice/training/how-to-become-a-dog-trainer/>

- Neural networks

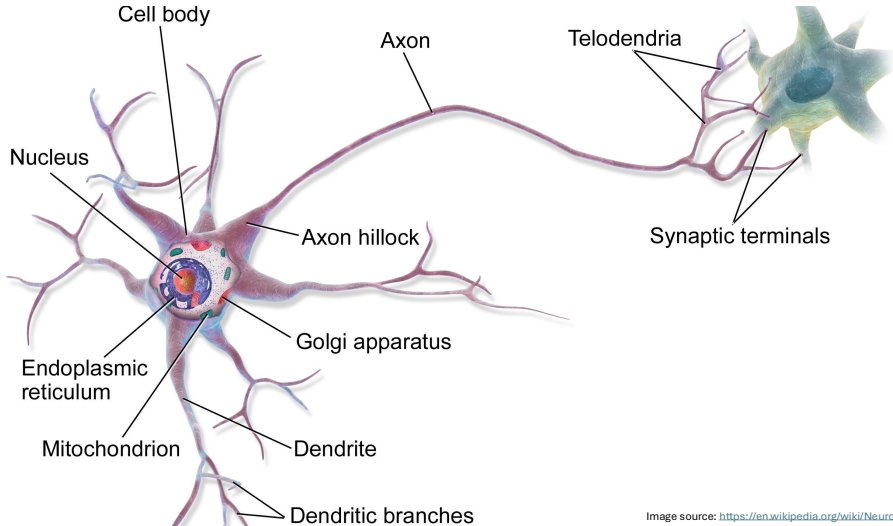
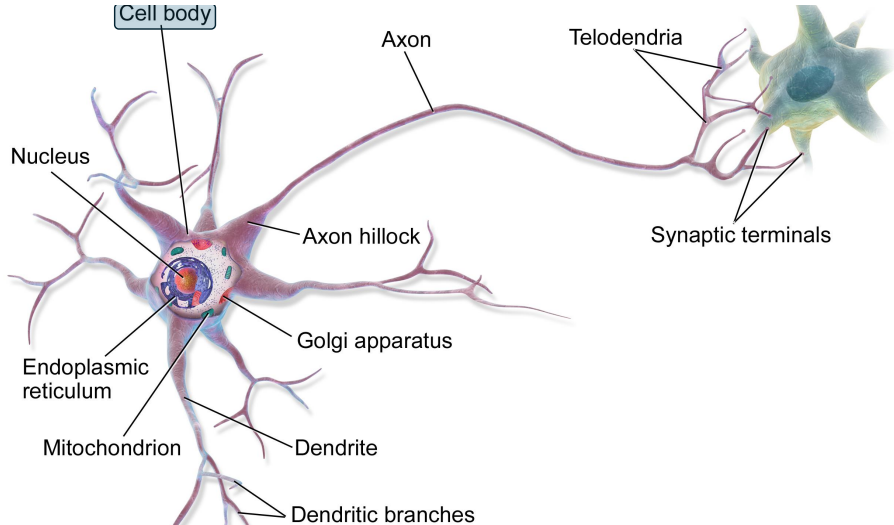
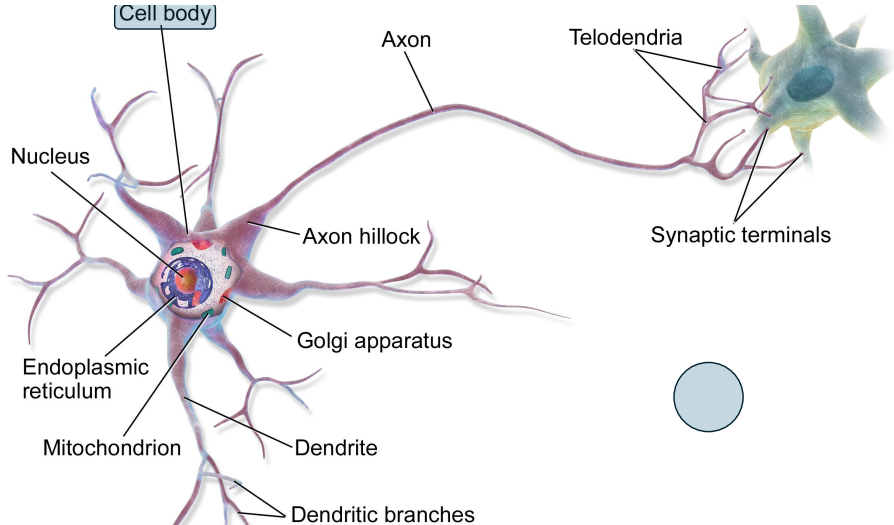


Image source: <https://en.wikipedia.org/wiki/Neuron>

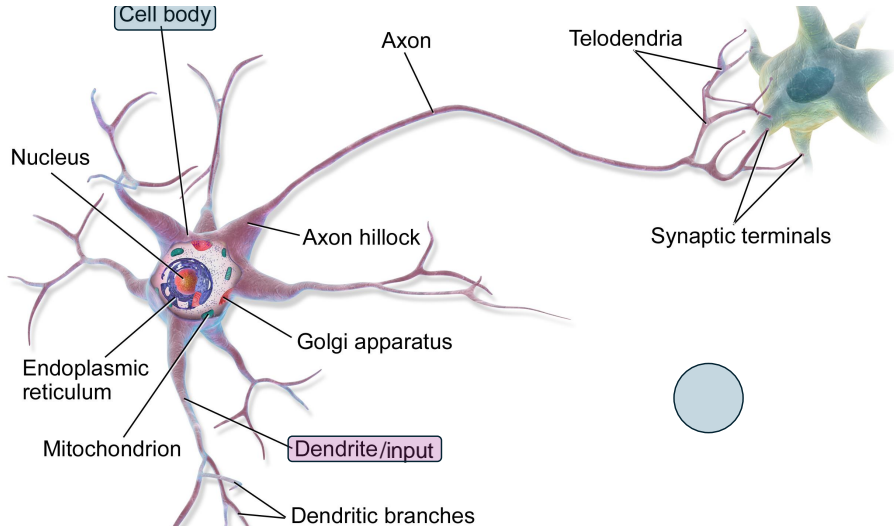
- Neural networks



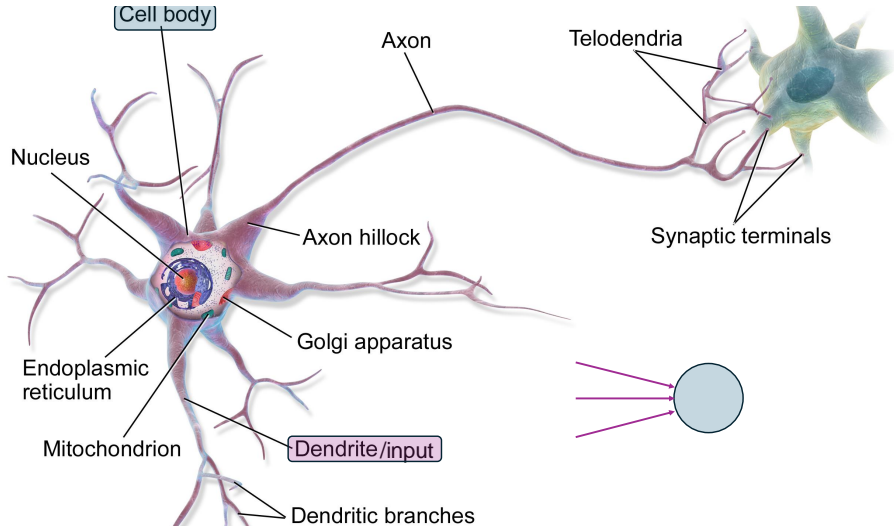
- Neural networks



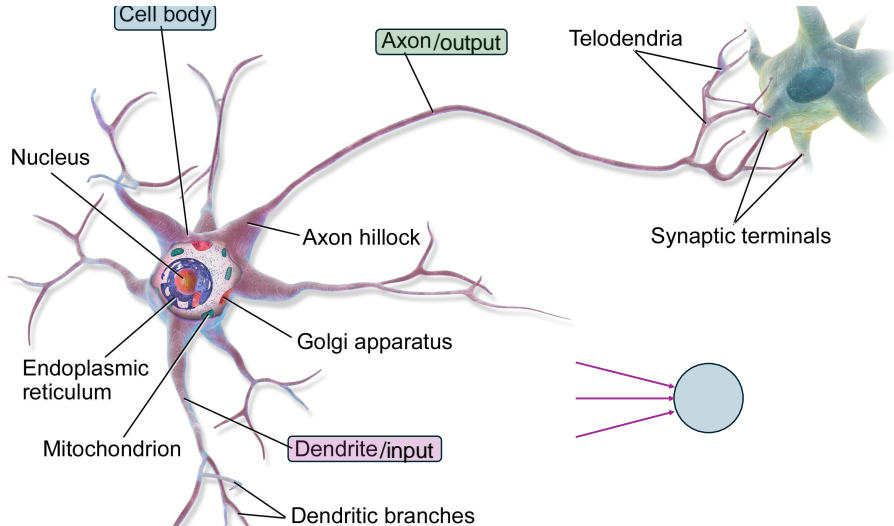
• Neural networks



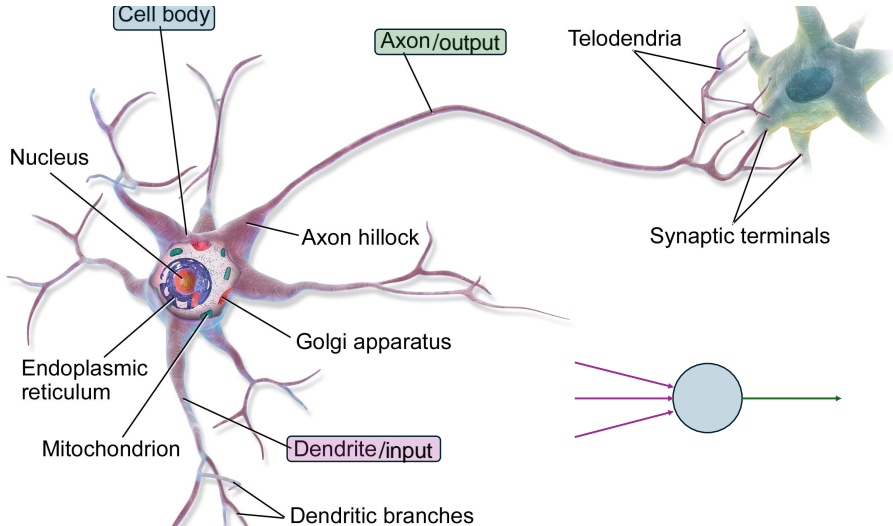
- Neural networks



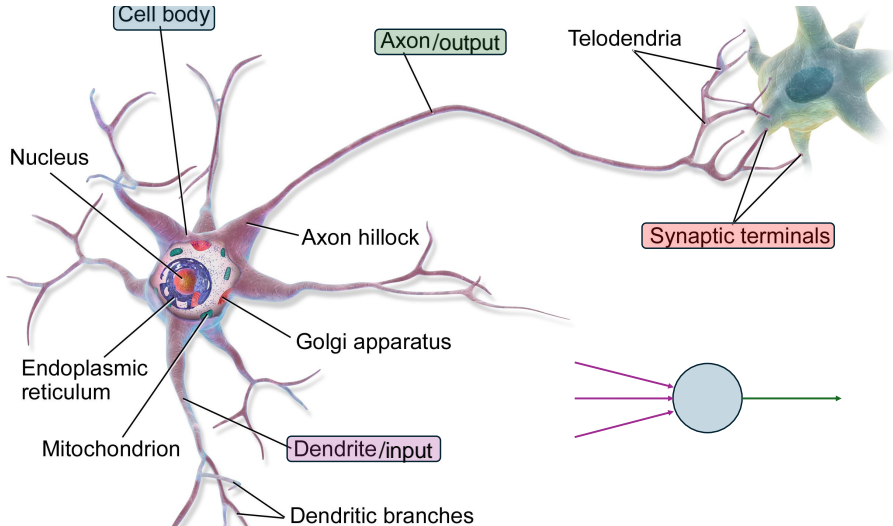
• Neural networks



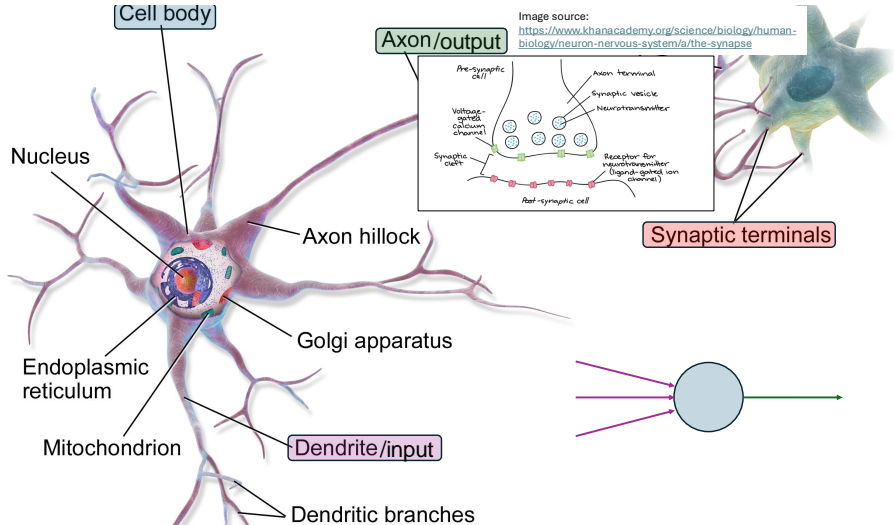
- Neural networks



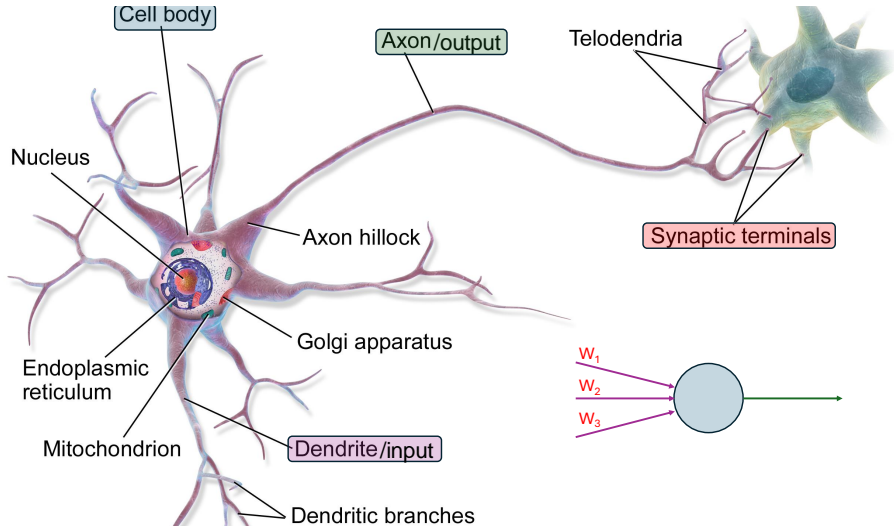
• Neural networks



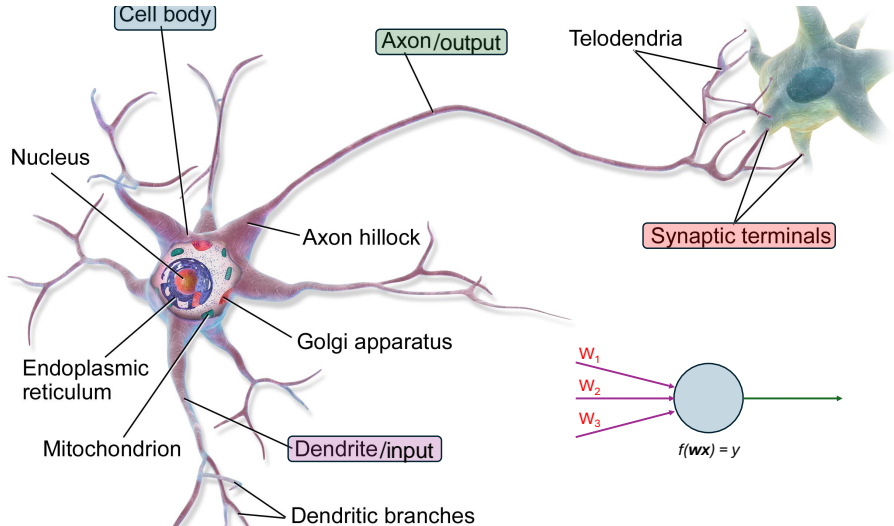
• Neural networks



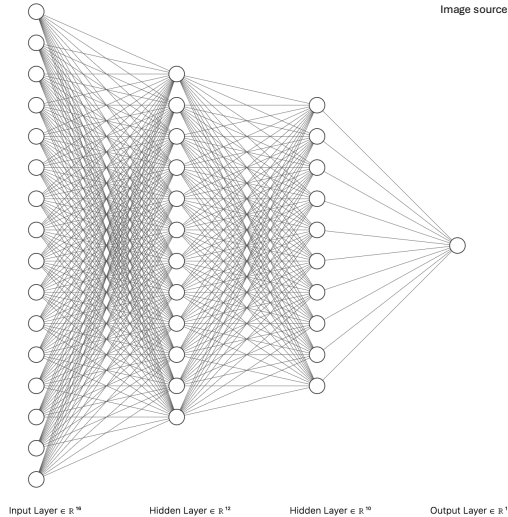
- Neural networks



- Neural networks



• Neural networks



• What is Artificial Intelligence?

Artificial Intelligence is a computer imitating something that a human can do.

- Playing chess
- Identifying objects in an image
- Answering questions in a chat
- Driving a car down the road
- Translating a sentence from English into Spanish

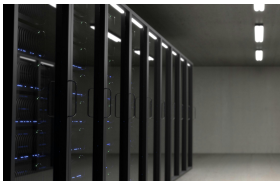


Source: <https://spectrum.ieee.org/how-ibms-deep-blue-beat-world-champion-chess-player-garry-kasparov>

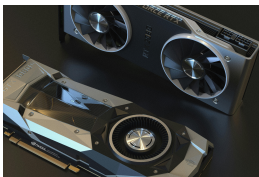
● When Machine Learning and Artificial Intelligence combined

- From around 1970 to 2010, Machine Learning and Artificial Intelligence were thought of as two different fields.
- Then three things began to converge...

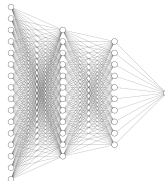
Big Data



Powerful GPUs



Neural Networks

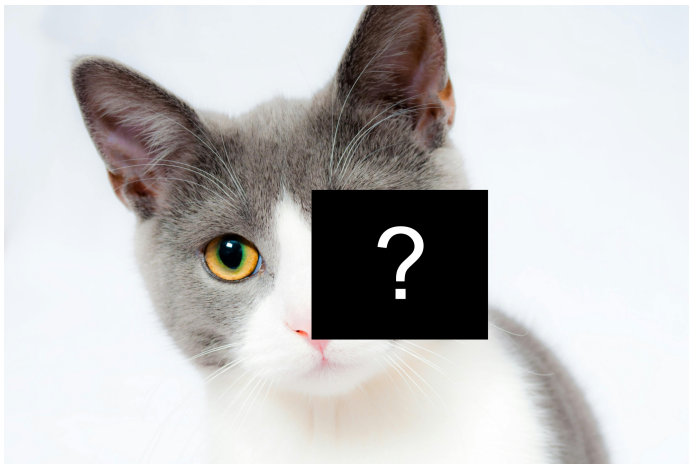


- With these three things present for the past 10 years, machine learning and artificial intelligence have combined into the powerful algorithms that we see today.
- Let's take a look at how you might train an AI model today...

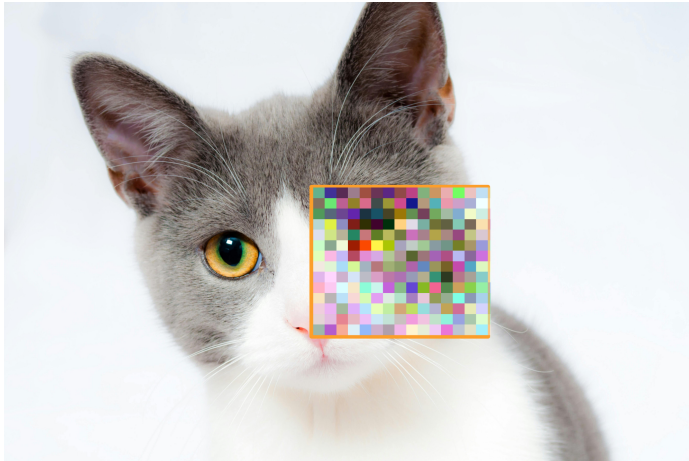
● How AI Learns - Example 1

- Predict the missing word:
 - Peanut butter and _____
 - Peanut butter and fish
 - Peanut butter and jelly
- Predict the missing word:
 - I'm singing in the _____
 - I'm singing in the car
 - I'm singing in the rain
- Predict the missing word:
 - Somewhere over the _____
 - Somewhere over the clouds
 - Somewhere over the rainbow

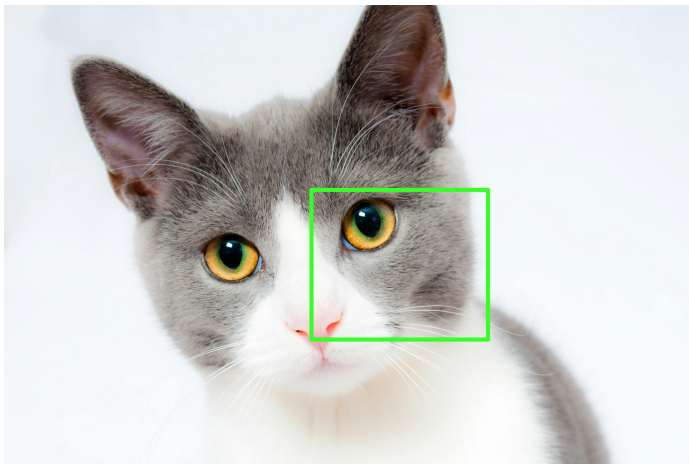
- How AI Learns - Example 2



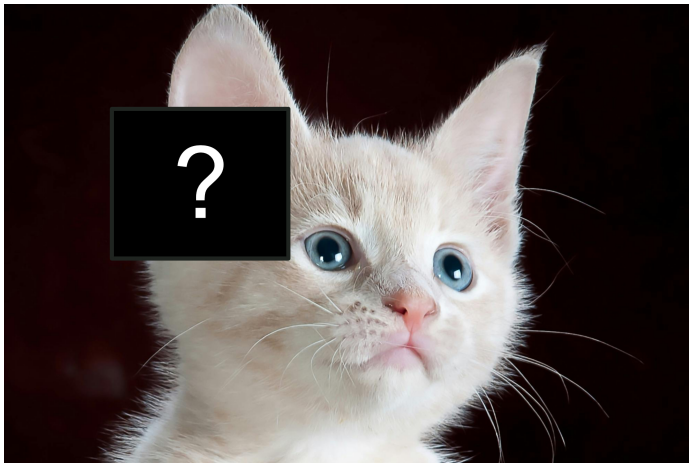
- How AI Learns - Example 2



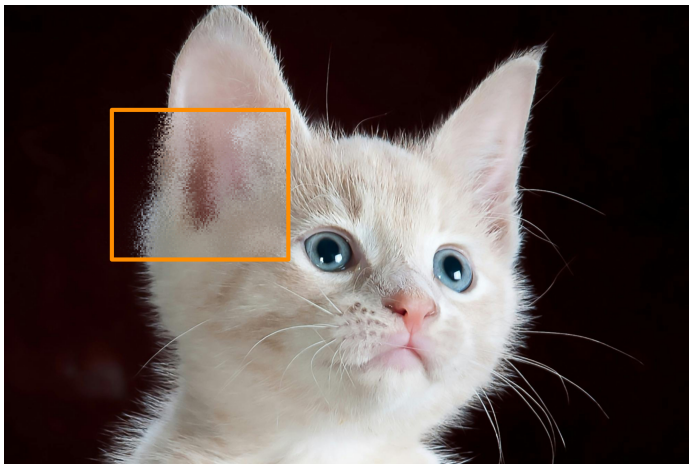
- How AI Learns - Example 2



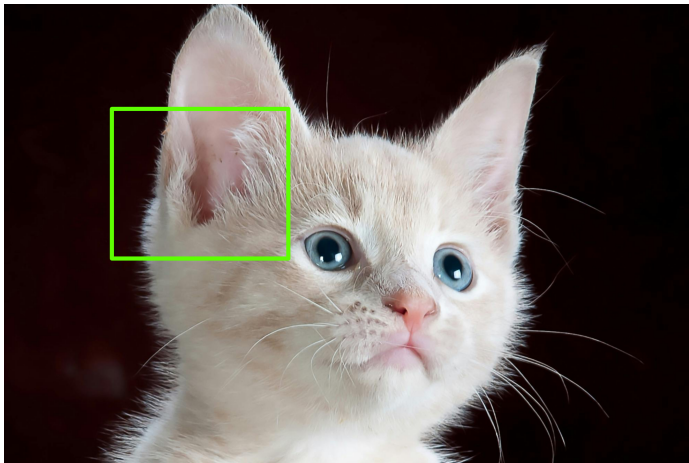
- How AI Learns - Example 2



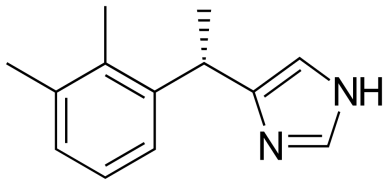
- How AI Learns - Example 2



- How AI Learns - Example 2



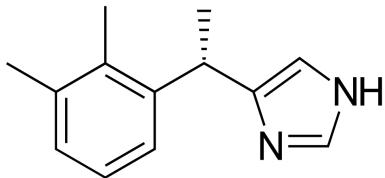
• How AI Learns - Example 3



- Melting Point = ?
- Density = ?
- pH (1% solvent) = ?

Figure: Diagram of the organic molecule
Dexmedetomidine

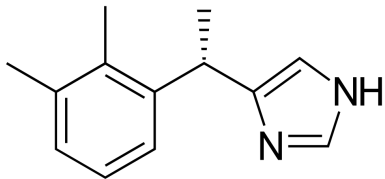
• How AI Learns - Example 3



- Melting Point = 27°C ?
- Density = $13.97\text{g}/\text{cm}^3$?
- pH (1% solvent) = 9.2 ?

Figure: Diagram of the organic molecule
Dexmedetomidine

• How AI Learns - Example 3



- Melting Point = 157°C
- Density = $1.17\text{g}/\text{cm}^3$
- pH (1% solvent) = 4.3

Figure: Diagram of the organic molecule
Dexmedetomidine

● How AI Learns - What is needed

- To train an AI, all you need is
 - A prediction task
 - Lots of data
 - A neural network that can save learned information
 - A way to tell the AI how far off it was when it is wrong
- In short, AI's are capable and complex pattern matchers.
- By learning those patterns, AI's can even create their own content.

● AI Content Generation

Create a photo of DARTH Vader riding a motorcycle through the woods in the rain...

● AI Content Generation

Create a photo of Darth Vader riding a motorcycle through the woods in the rain...



● Why It Matters To You

- As AI becomes more and more common in our world, it is important to understand what it is capable of.
- AI can
 - create incredibly realistic text, audio, images, and video.
 - mimic human behavior without copying data it has seen.
- AI cannot
 - easily be distinguished from human counterparts.
 - always guarantee its accuracy.

● AI in Academia

- AI will fundamentally change teaching, research, and other tasks in academia.
- Just like with the internet, smart phones, and other disruptive technologies, AI will require us to adapt.
- There are many legitimate fears for misuse of AI:
 - Increased student cheating
 - Overreliance on AI leading to decreased reasoning skills
 - Challenges in fairly assessing students
- But there is also amazing potential:
 - Enhanced productivity through automation of mundane tasks
 - Personalized virtual tutoring
 - Improved accessibility for diverse learners
 - New types of assignments and projects previously considered impossible

- Is AI friend or foe?



Source: <https://www.wsj.com/articles/tesla-blames-driver-in-fatal-car-crash-1523487100>

The automated car lacked "the capability to classify an object as a pedestrian unless that object was near a crosswalk," an NTSB report said.



Source: <https://www.nbcnews.com/tech/tech-news/self-driving-uber-car-hit-killed-woman-did-not-recognize-n1079281>

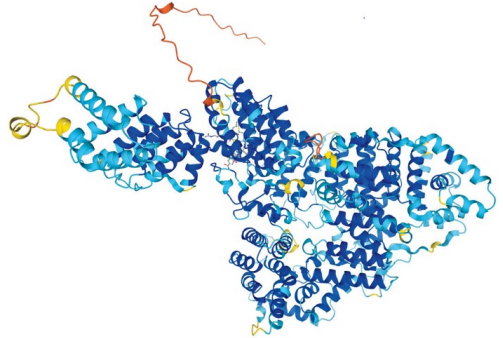
- Is AI friend or foe?

AI implant helps paralyzed man walk again



Source: <https://www.cnn.com/2023/09/27/health/digital-bridge-implants-paralysis/index.html>

AI revolutionizes drug development



Source: <https://cen.acs.org/analytical-chemistry/structural-biology/AlphaFold-pushes-science-forwardreleasing-structures/99/i28>

- Thank you

Department of Computer Science at ECU

- Nic Herndon – herndonn19@ecu.edu
- David Hart – hartda23@ecu.edu