ISOM5240
Deep Learning Business Applications with Python

Prof. James Kwok

Associate Professor of Business Education

Certified Information Systems Auditor (CISA)

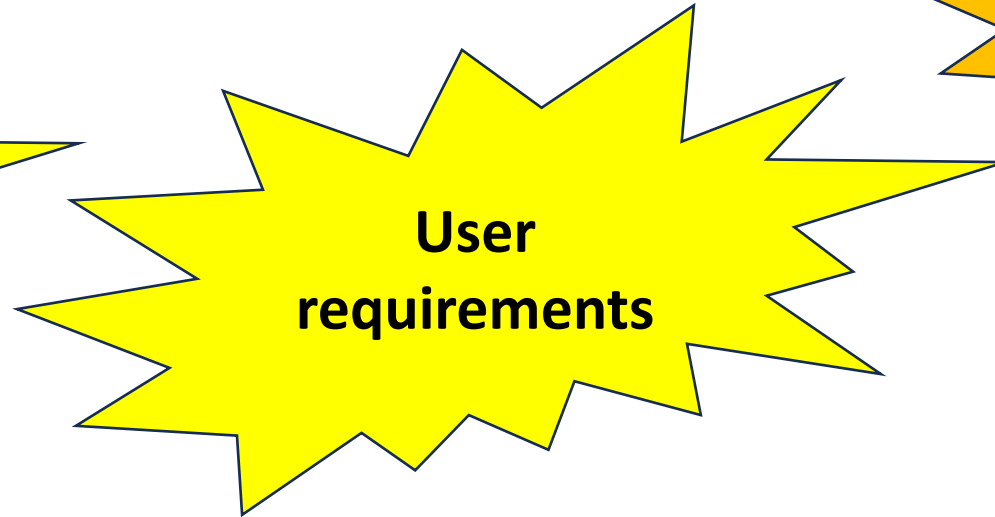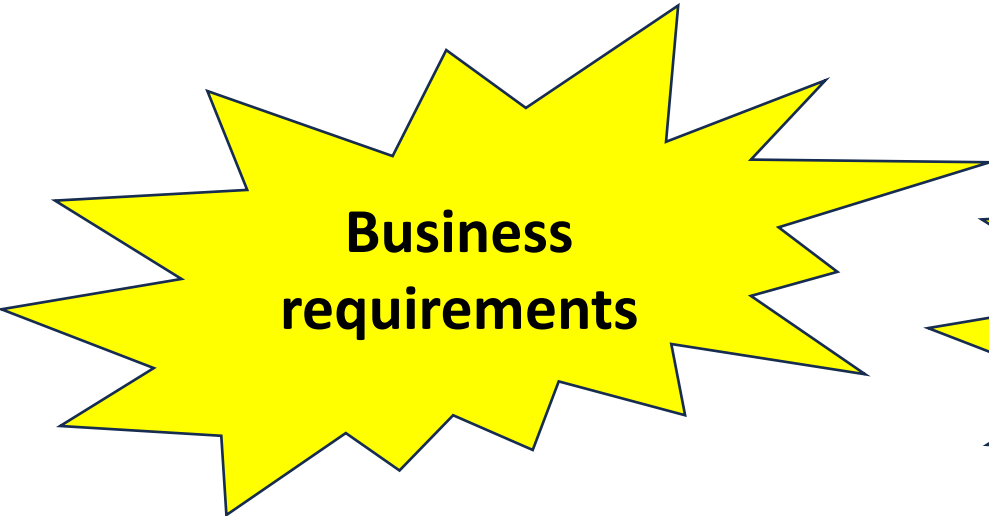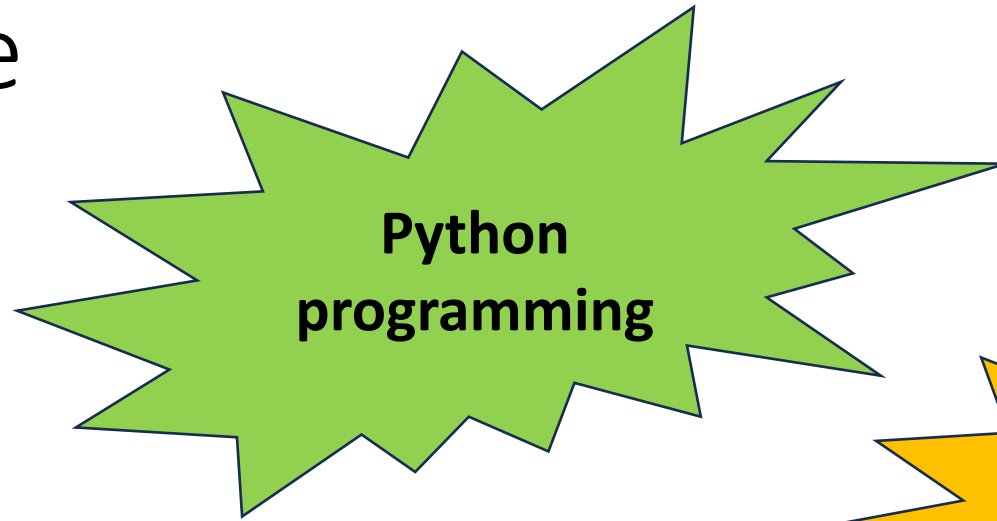**Email: jkwok@ust.hk**

Attendance Requirement

- Attendance at classes is **mandatory** for all courses.
- Students must notify the professor of the course and the HKUST MSBA Program Office **in advance** if they are unable to attend classes.
- Absent with any reason (e.g. sick leave with valid medical proof) will be treated as below:

Absent for	2-credit course (total 8 sessions)
1st time	Allowed (Program Office will issue warning email to students)
2nd time	Allowed (One-third grade reduction will be given)
3rd time	"W" (representing withdrawal from class) will be shown on transcript

- Professors have the discretion to execute a stricter attendance policy at course level.
- Classes will **start on time.**
- Full-time student who are **more than 15 mins late** will be considered **Absent from Class.** Part-time students will be given **30 mins** for the buffer time.
- Students who leave the class early without informing the course instructor and the MSBA Program Office will be considered **absent**.

HKUST BUSINESS SCHOOL 香港科大商學院 WORLD CLASS IN ASIA | MSc in Business Analytics

About this course

- Python
- Business Applications

Python programming

ChatGPT

Business requirements

User requirements

What this course is about

- Deep learning business applications
  - NLP
- Transfer Learning – Pre-trained models
  - Fine-tuned Models
- Python programming
  - Why Python for deep learning
    - Readability
    - Less complexity
    - Easy to understand the code
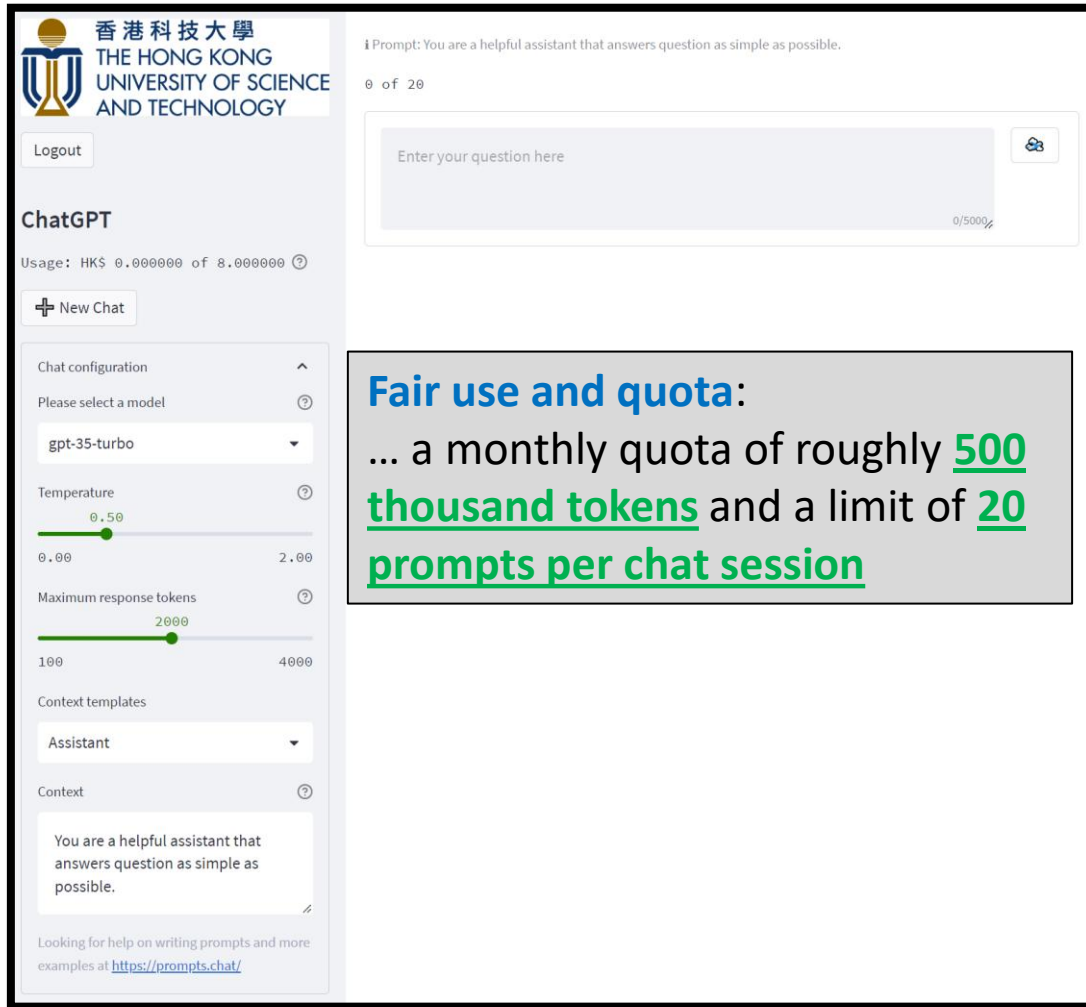
Who can benefit from the course?

- Those who want to develop deep learning business applications & models that can be used by other users who need not be familiar with the model

- Those who want to apply transfer leaning in business application development

- Those who want to develop deep learning business applications which make tasks easier for themselves

- Those who want to be aware of the power of Python programming

Important prerequisites for success

Get ready to get your hands dirty

- Learn by doing
  - One **CANNOT** benefit from the course by just **reading lecture materials**

- Learn by yourself (because you are programmer and developer)
  - Use google and other resources to learn from others

- Perseverance
  - **Time**
  - **Patience**

- Not scared of programming
  - New to programming: can work with a **partner**, and ask our **TA**

ChatGPT

香港科技大學
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

Logout

ChatGPT

Usage: HK$ 0.000000 of 8.000000 ⓘ

➕ New Chat

Chat configuration ⌃
Please select a model ⓘ
gpt-35-turbo ▾

Temperature ⓘ
0.50
0.00   2.00

Maximum response tokens ⓘ
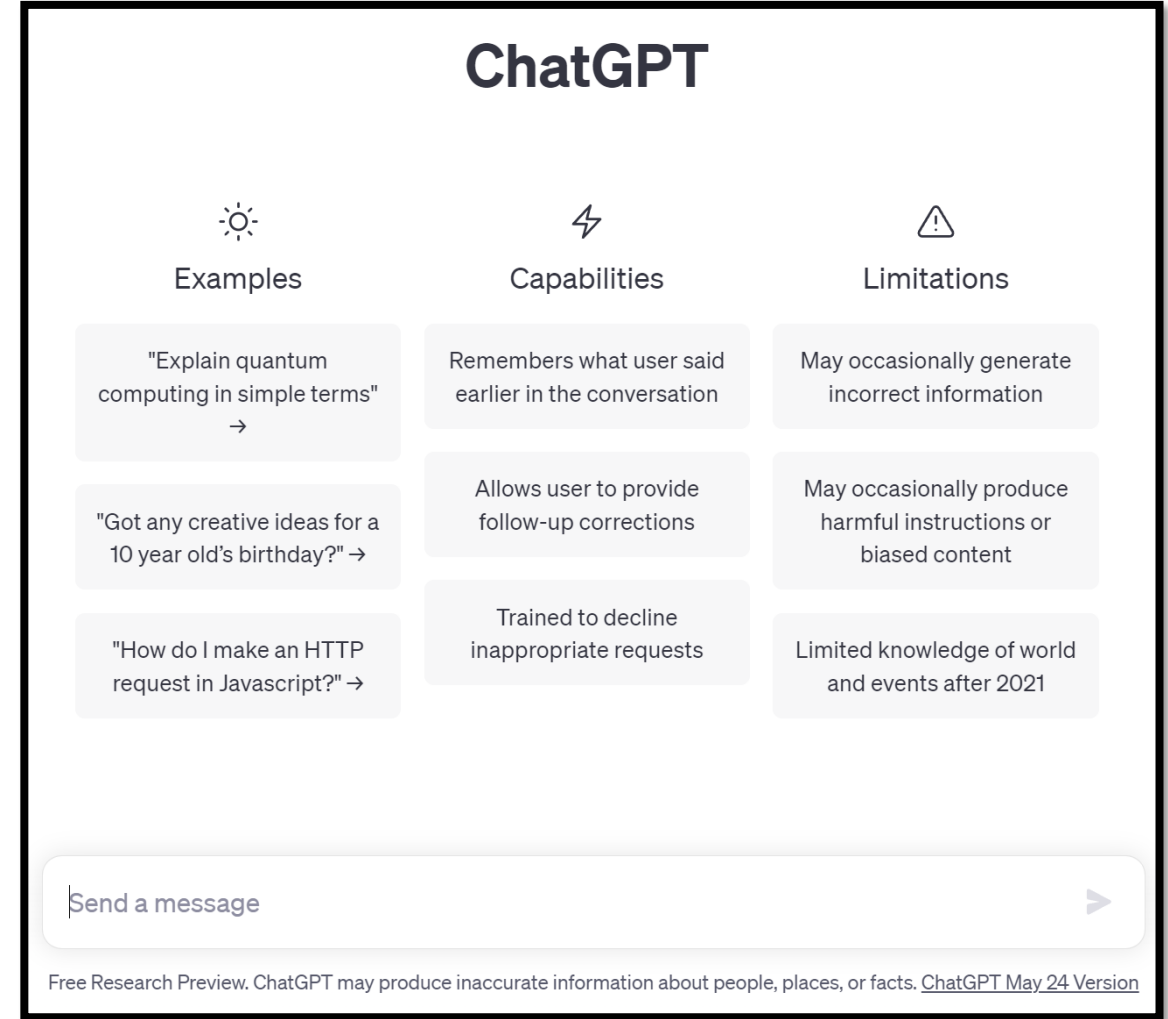2000
100   4000

Context templates
Assistant ▾

Context ⓘ
You are a helpful assistant that answers question as simple as possible.

Looking for help on writing prompts and more examples at https://prompts.chat/

ⓘ Prompt: You are a helpful assistant that answers question as simple as possible.

0 of 20

Enter your question here

0/5000

Fair use and quota:
… a monthly quota of roughly **500 thousand tokens** and a limit of **20 prompts per chat session**
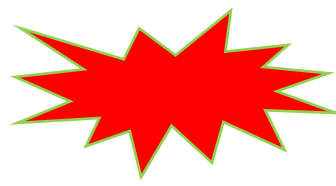
ChatGPT

☼
Examples

⚡
Capabilities

⚠
Limitations

"Explain quantum computing in simple terms" →

Remembers what user said earlier in the conversation

May occasionally generate incorrect information

"Got any creative ideas for a 10 year old's birthday?" →

Allows user to provide follow-up corrections

May occasionally produce harmful instructions or biased content

"How do I make an HTTP request in Javascript?" →

Trained to decline inappropriate requests

Limited knowledge of world and events after 2021
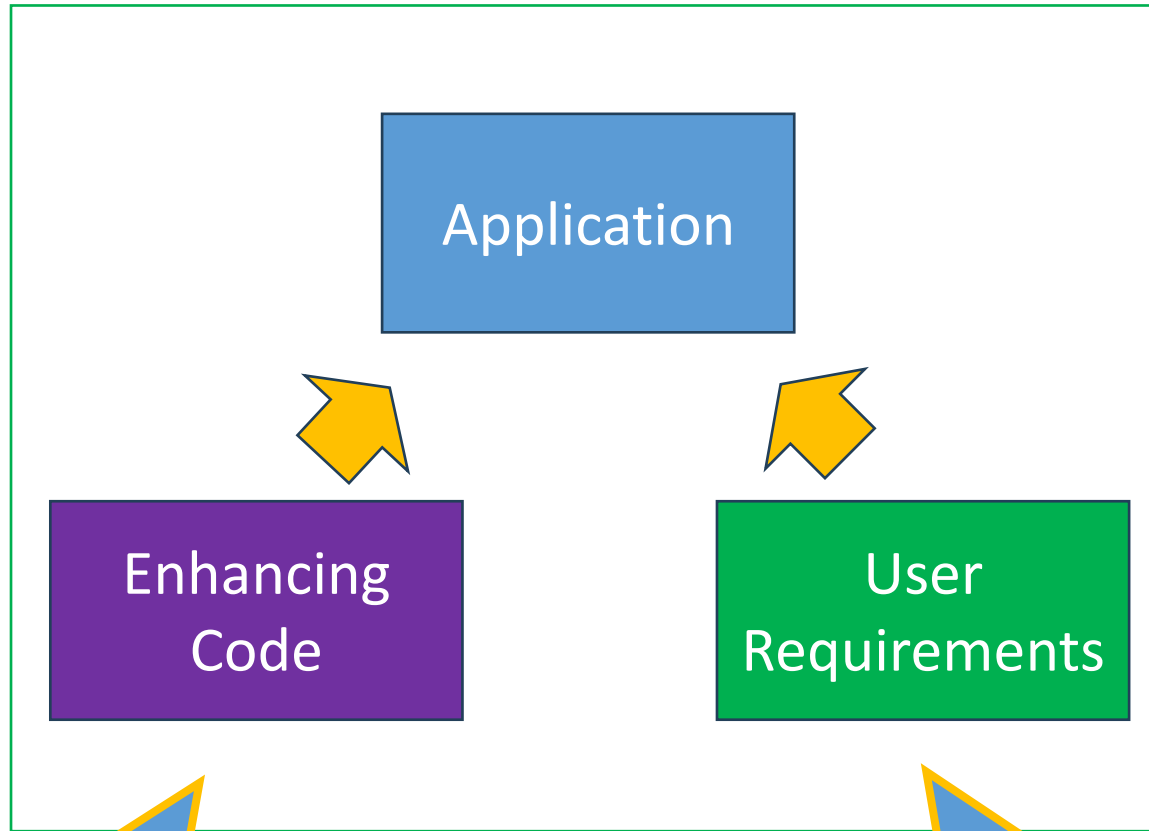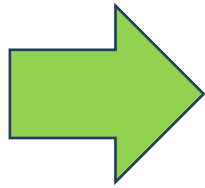
Send a message

Free Research Preview. ChatGPT may produce inaccurate information about people, places, or facts. ChatGPT May 24 Version

https://chatgpt.ust.hk/

https://chat.openai.com/

https://itsc.hkust.edu.hk/services/general-it-services/generative-ai-tools/help

Application Development in Python

"Skilled Developers No Need to Worry About ChatGPT"

"ChatGPT is Additional Asset to Developers; Not a Replacement"

"ChatGPT Can't Handle Complex Tasks"
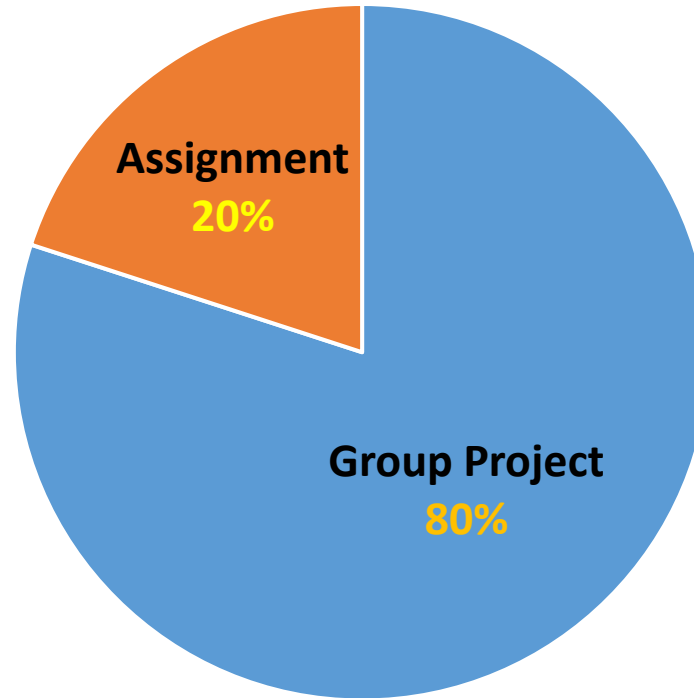
"Developers Still Needed for Quality Checking"

"No Tech is Proven to Replace Creativity"

"AI Won't Steal Your Job; Person Using AI Will"

Grading

- You may work alone or in a group of two students for project.
- The submission deadline of lab assignment will be announced during class.
- The topic of project should be discussed with the instructor beforehand.

Course Plan – 7 parts in total

Python

Part 2

Objects, Data types, Operators, Lists, Tuples, Dictionaries, if-then-else, for-loop, functions, Packages etc.

Deep Learning

Part 1

DeepSeek

Parts 3-6

Transformers

Project

Part 7

Project Presentation
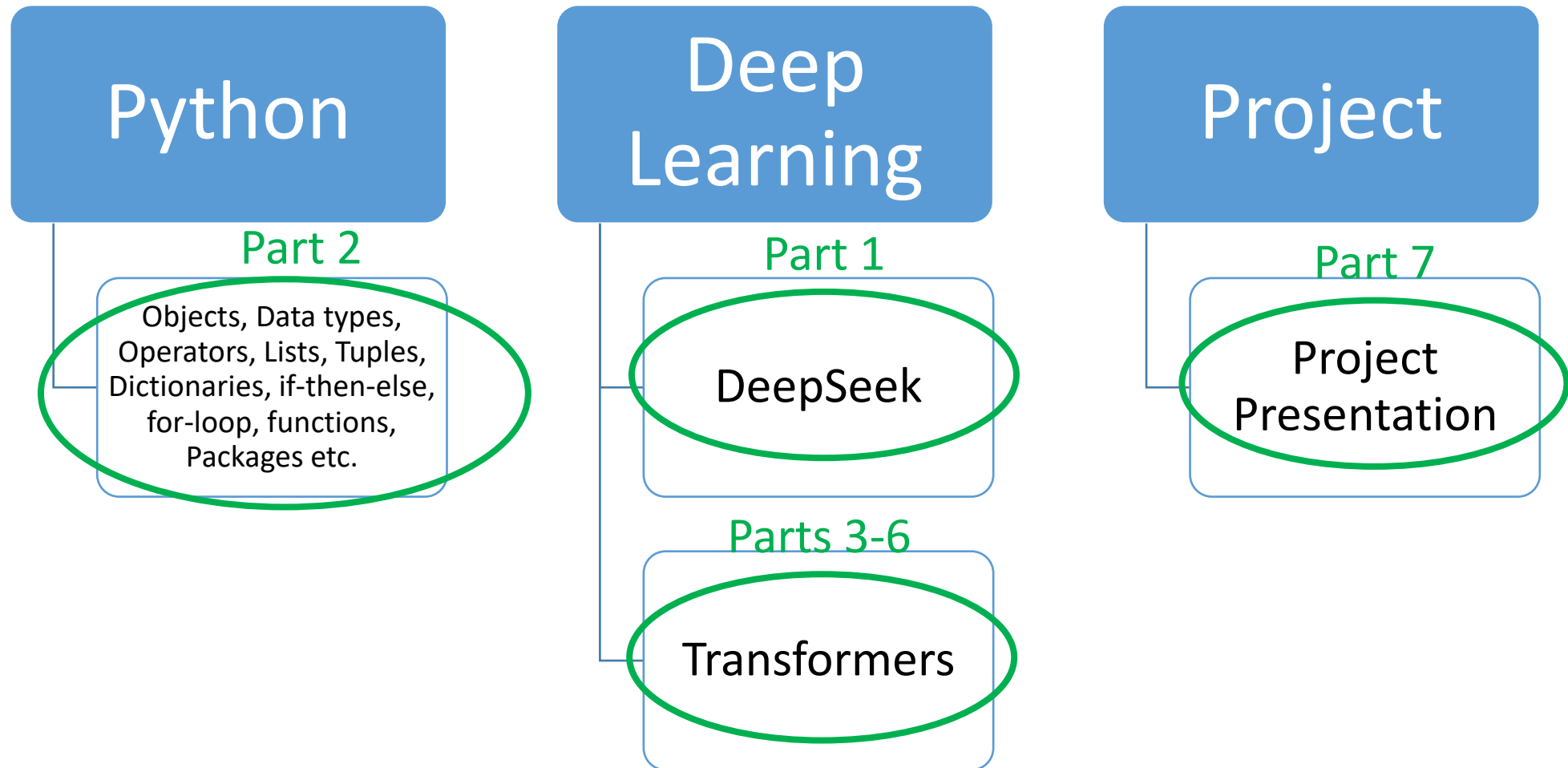
End

ISOM5240
Deep Learning Business Applications with Python

Introduction to Deep Learning Models

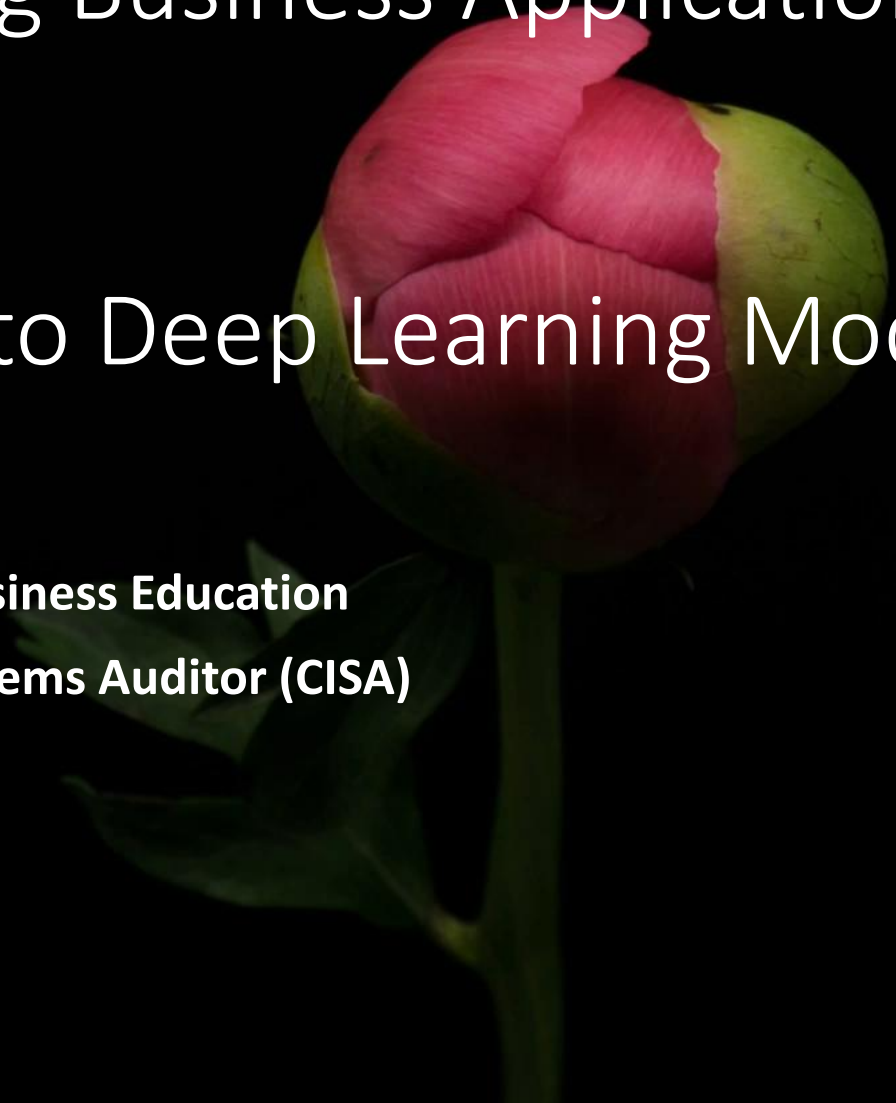**Prof. James Kwok**

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Course Plan – 7 parts in total

Python

Objects, Data types, Operators, Lists, Tuples, Dictionaries, if-then-else, for-loop, functions, Packages etc.

Deep Learning

DeepSeek

Transformers

Project

Project Presentation
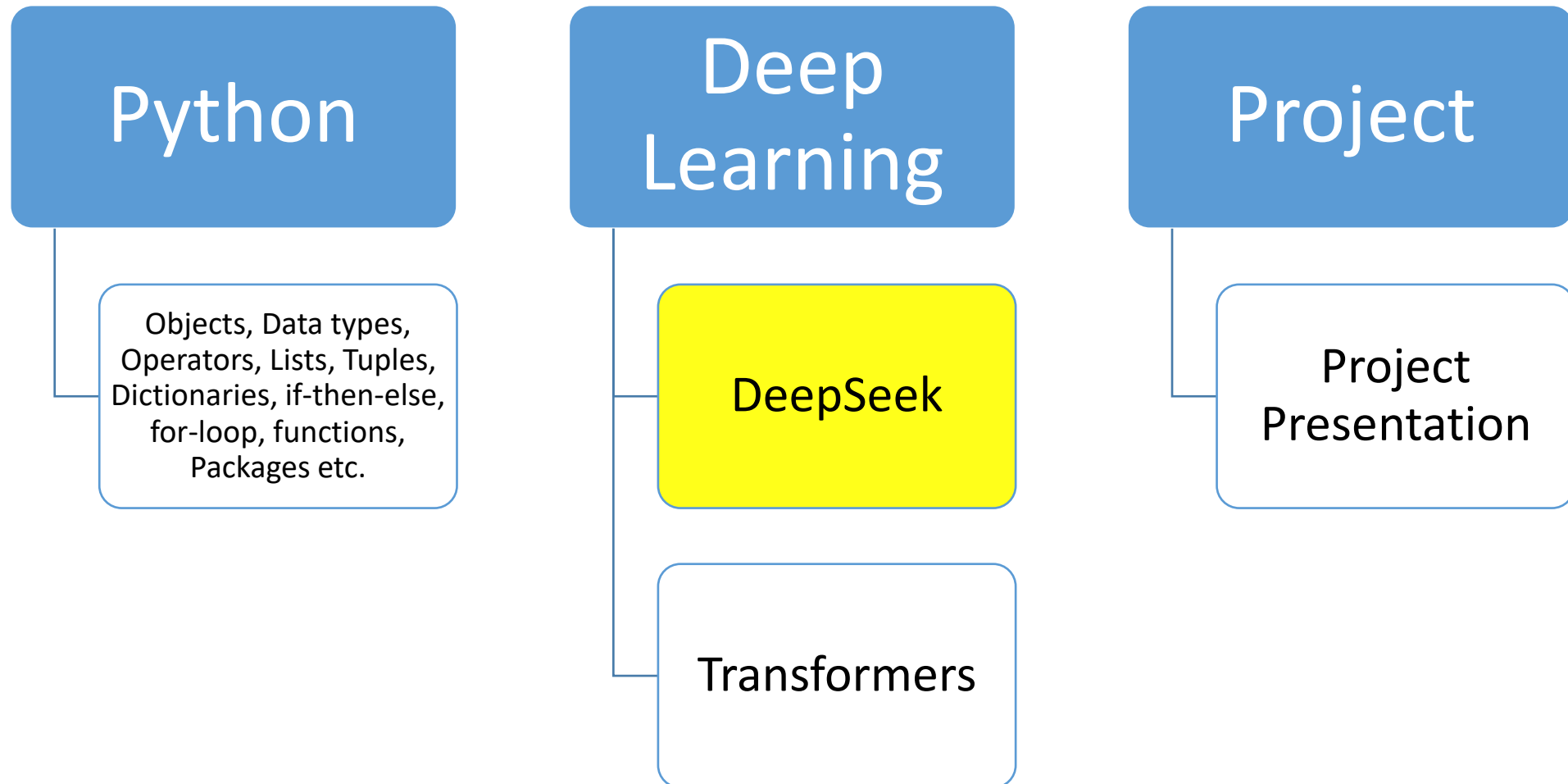
Outline

1. Artificial Intelligence (AI), Machine Learning, and Deep Learning

2. Human Brain Vs Deep Learning

3. Different Deep Neural Networks

4. Implementing Deep Learning in Business

5. <<Your First Deep Learning Business Application>>

6. Final Remarks

1. Artificial Intelligence (AI),
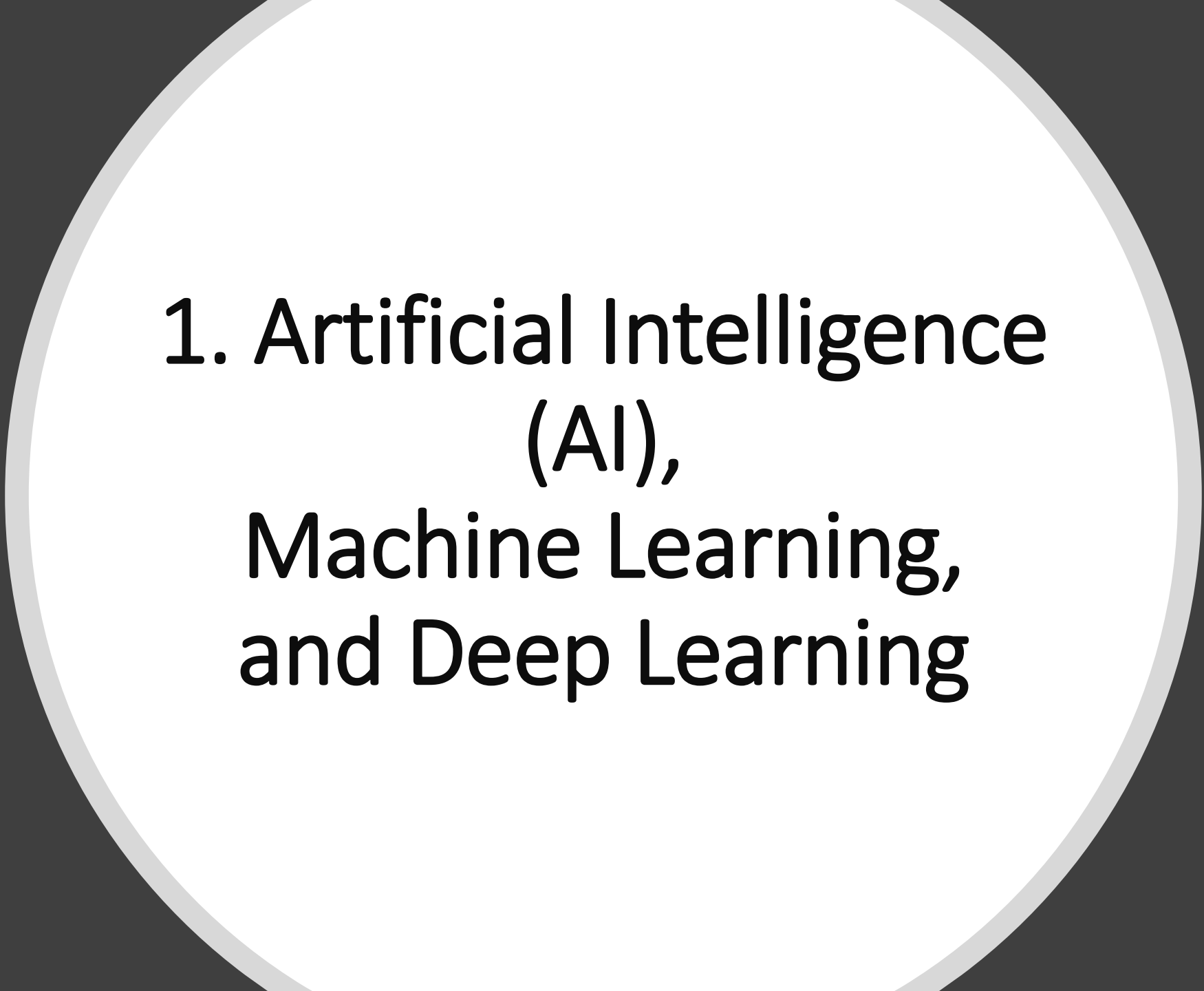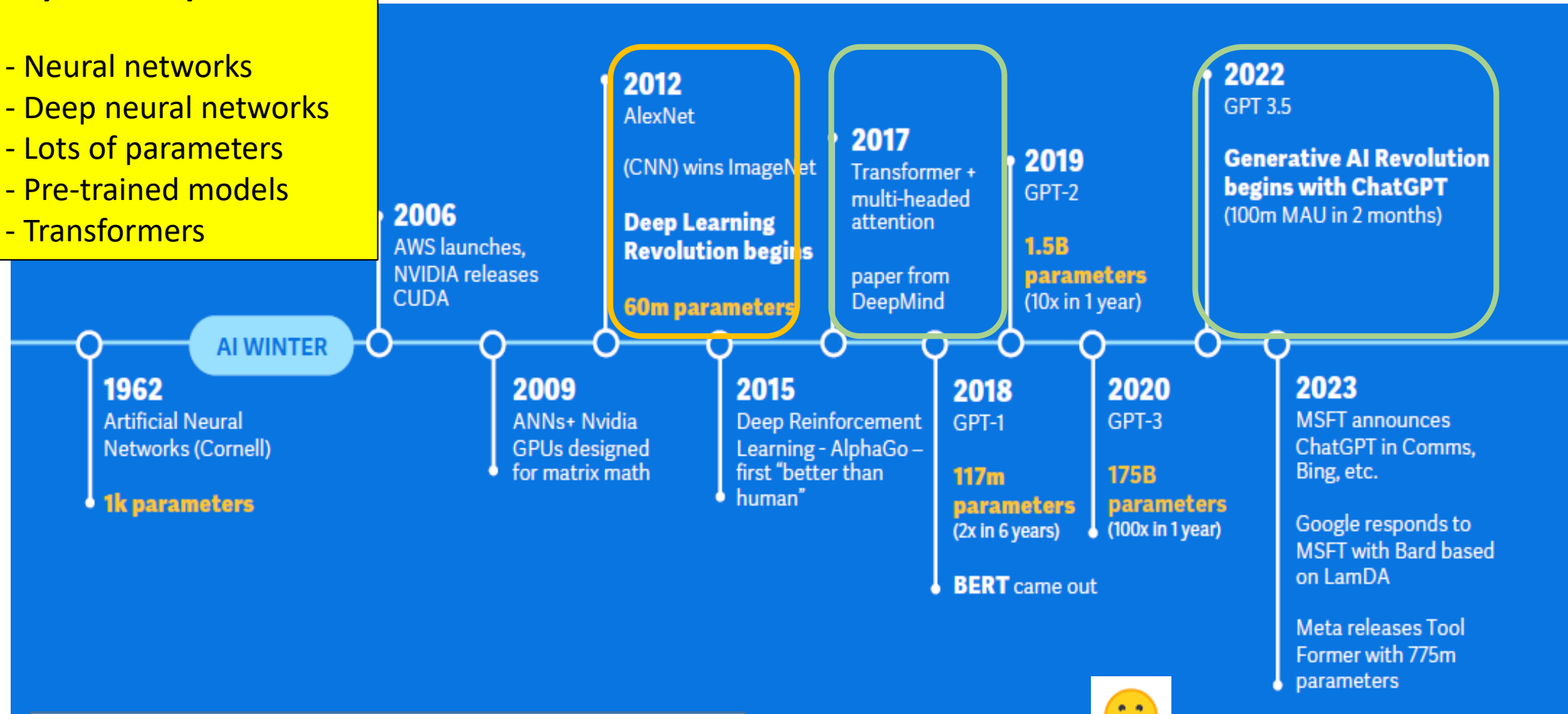# Machine Learning,
and Deep Learning

Key takeaways:

- Neural networks
- Deep neural networks
- Lots of parameters
- Pre-trained models
- Transformers

2006
AWS launches, NVIDIA releases CUDA

2012
AlexNet
(CNN) wins ImageNet
Deep Learning Revolution begins
60m parameters

2017
Transformer + multi-headed attention
paper from DeepMind

2019
GPT-2
1.5B parameters
(10x in 1 year)

2022
GPT 3.5
Generative AI Revolution begins with ChatGPT
(100m MAU in 2 months)

AI WINTER

1962
Artificial Neural Networks (Cornell)
1k parameters

2009
ANNs+ Nvidia GPUs designed for matrix math

2015
Deep Reinforcement Learning - AlphaGo – first "better than human"

2018
GPT-1
117m parameters
(2x in 6 years)
BERT came out

2020
GPT-3
175B parameters
(100x in 1 year)

2023
MSFT announces ChatGPT in Comms, Bing, etc.

Google responds to MSFT with Bard based on LamDA

Meta releases Tool Former with 775m parameters

1000 classes, 60 millions parameters and 650,000 neurons, 5 CNN layers
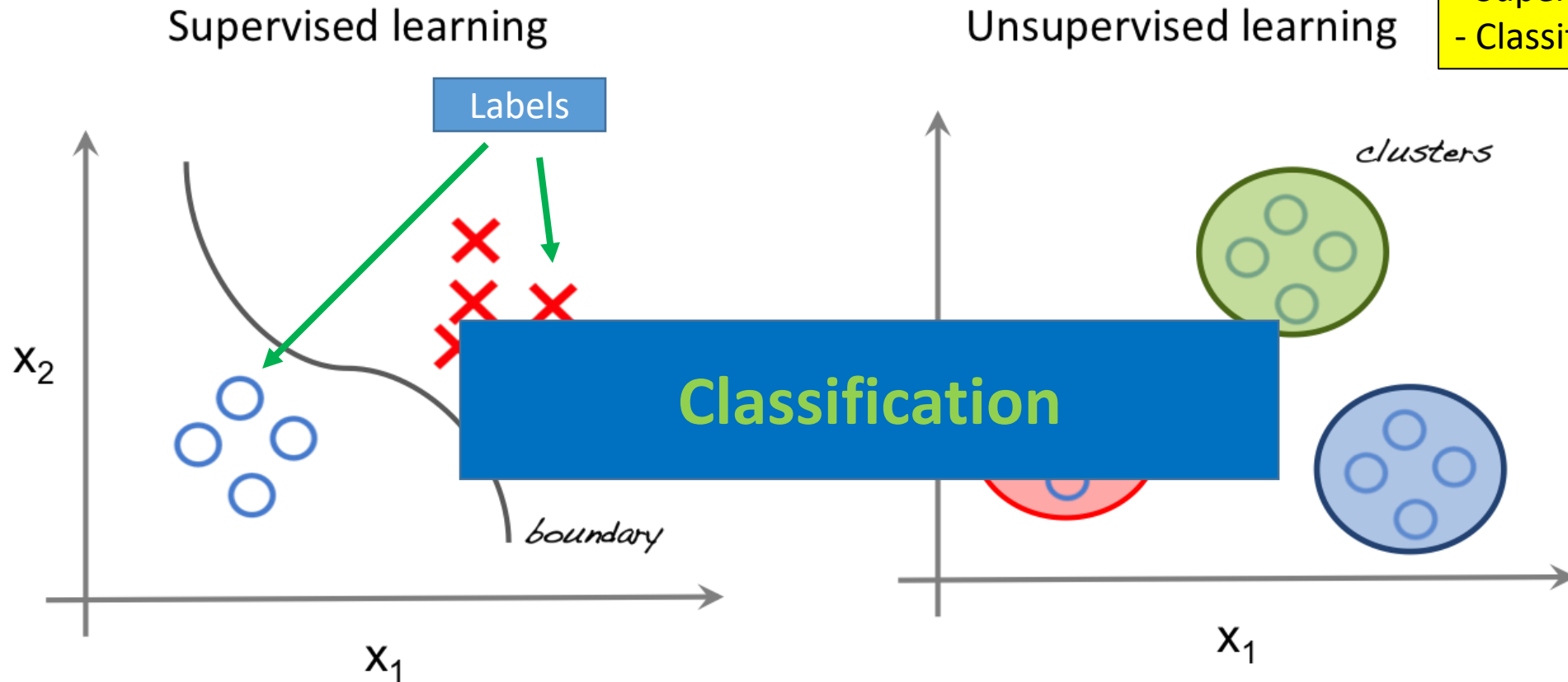**Supervised Learning**

Transformer

Hugging Face Transformers

ChatGPT

DeepSeek

Supervised Learning Vs Unsupervised Learning

ChatGPT uses supervised learning

Key takeaways:

- Supervised learning
- Classification

Supervised learning

Unsupervised learning

Labels

Classification

x_2

boundary

x_1

clusters

x_1

Artificial Intelligence

Machine Learning

Deep Learning

DL is a specialized form of ML that involves neural networks with multiple layers. These deep neural networks aim to simulate the way the human brain works, allowing for more complex tasks.

ML is a type of AI that enables computers to **learn from data** without being explicitly programmed. It focuses on algorithms that improve their performance over time.
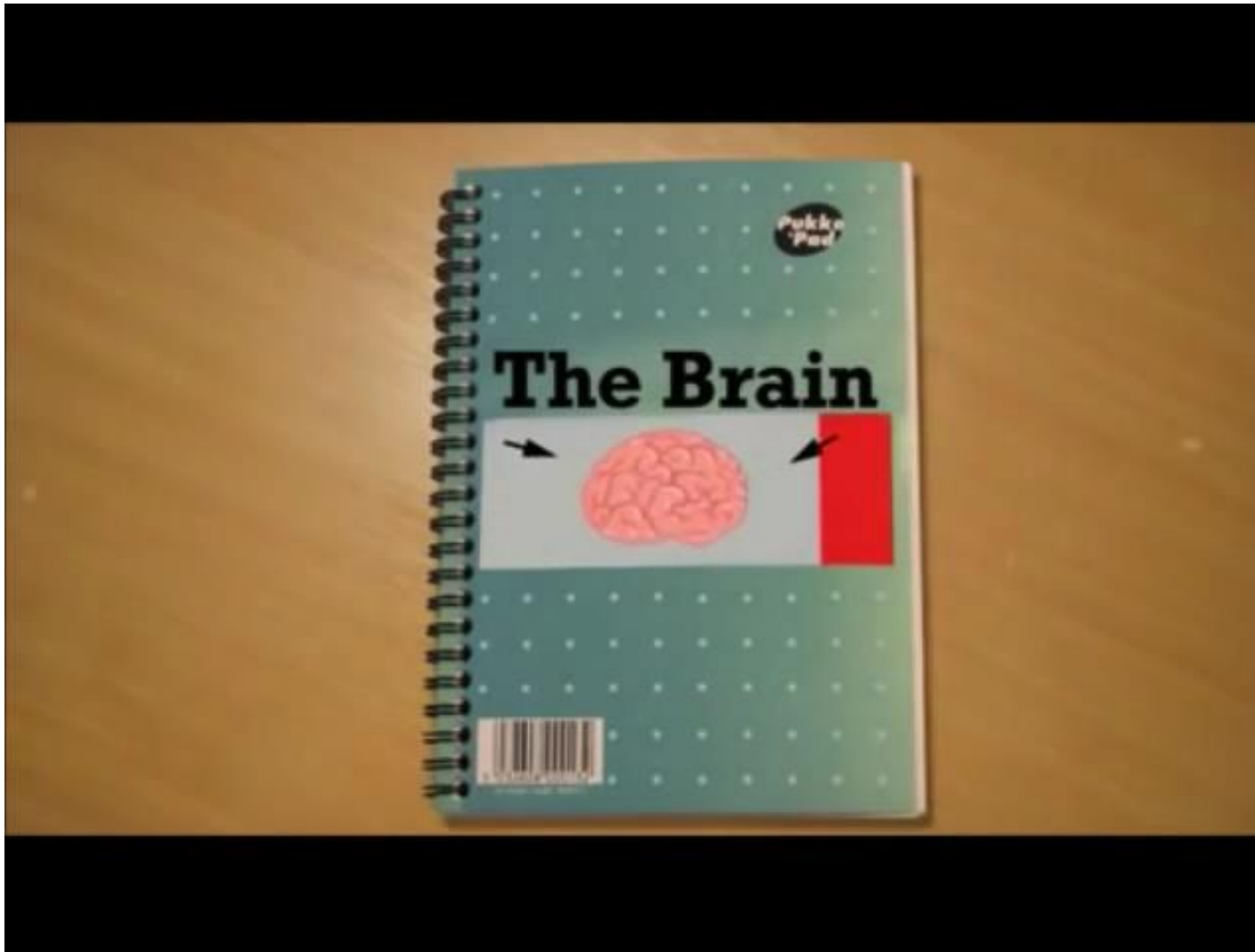
AI refers to machines or computer systems that can perform tasks that typically require human intelligence.

Key takeaways:

- Lots of data

2. Human Brain vs. Deep Learning

Deep Learning

Overall:
Boss – e.g., Learning
Learning: thinking, remembering, and feeling
Weight: 3 pounds
Power: 25 watts
Structure: cerebrum (2 halves)
Control: Solve problems, speaking, drawing, imagination
Memory: Short-term and Long-term

Neurons:
- over 100 billion
- Messages flow backwards and forwards

Learning:
- Messages travel from one neuron to another
- Brain starts to create connections or **pathways** between neurons
- Trial and error
- Creating pathways is how we learn and remember things

Source: https://www.youtube.com/watch?v=cgLYkV689s4

Human Brain:

Boss – e.g., Learning

Learning: thinking, remembering, and feeling

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Deep Learning:

Boss – e.g., Learning

Learning: thinking, remembering, and feeling

Weight: _____

Power: _____

Structure: _____

Control: Solve problems, speaking, drawing, imagination

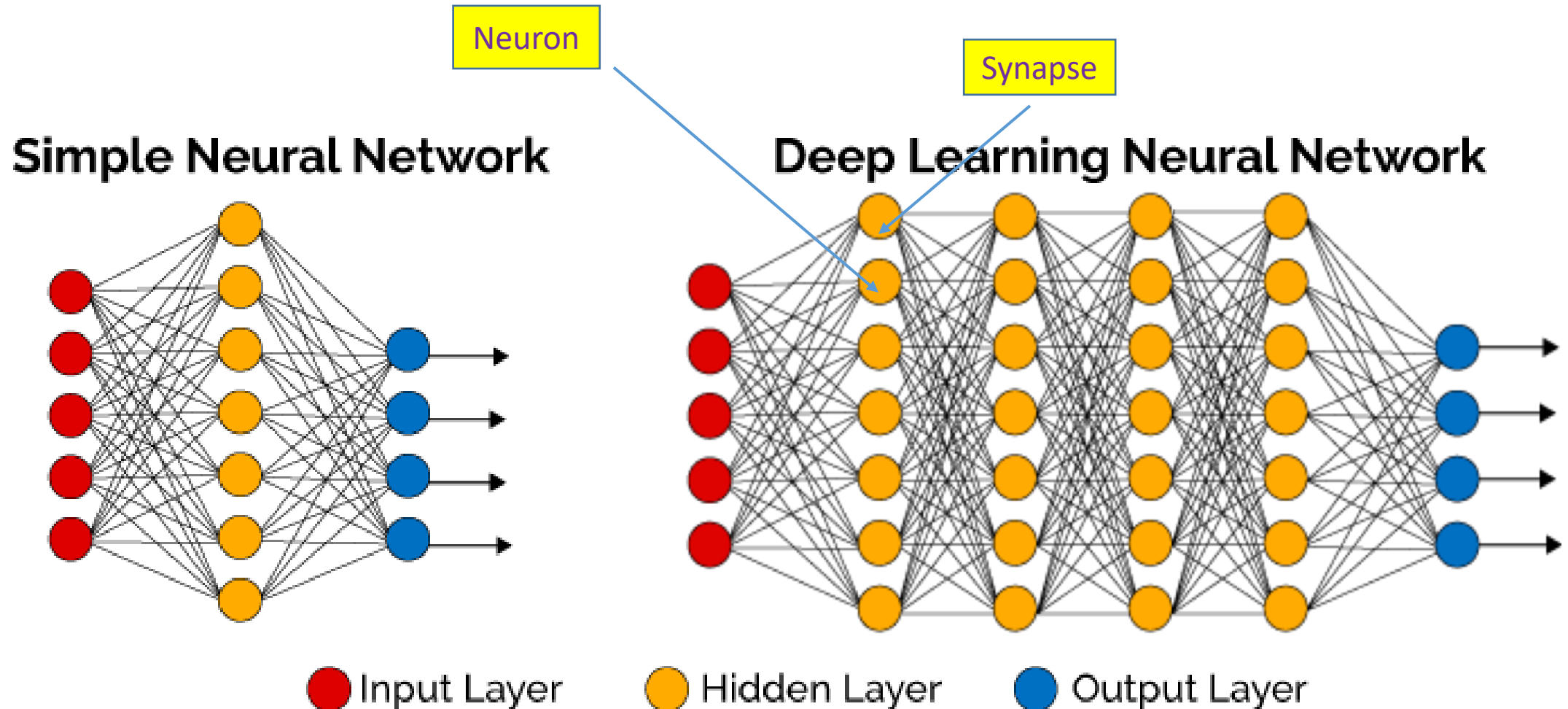**Memory**: Short-term and Long-term

Neurons:
- over 100 billion
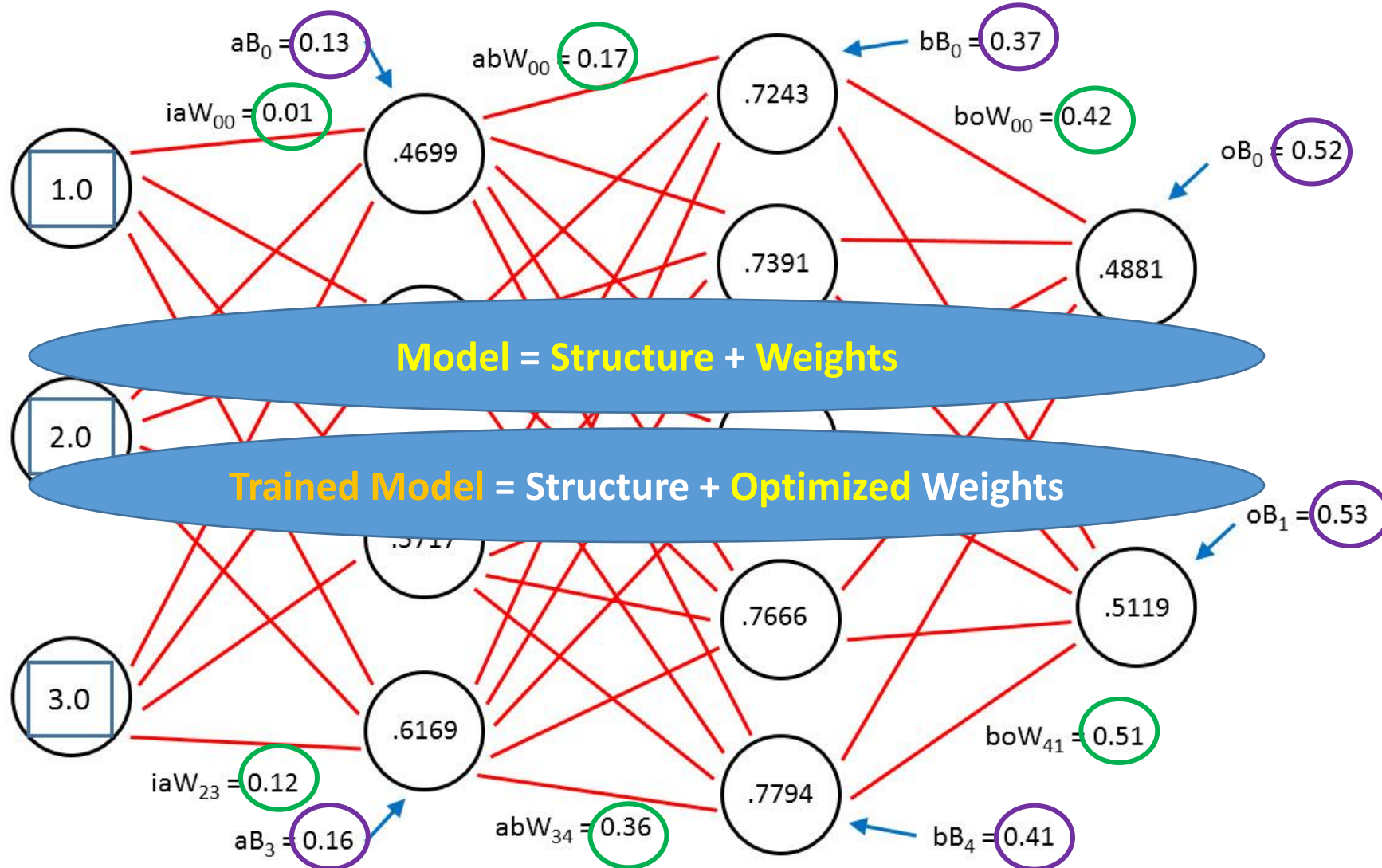- Messages flow backwards and forwards

Learning:
- Messages travel from one neuron to another
- Brain starts to create connections or **pathways** between neurons
- Trial and error
- Creating pathways is how we learn and remember things

Deep Learning Neural Network Model

Deep Learning Neural Network Model
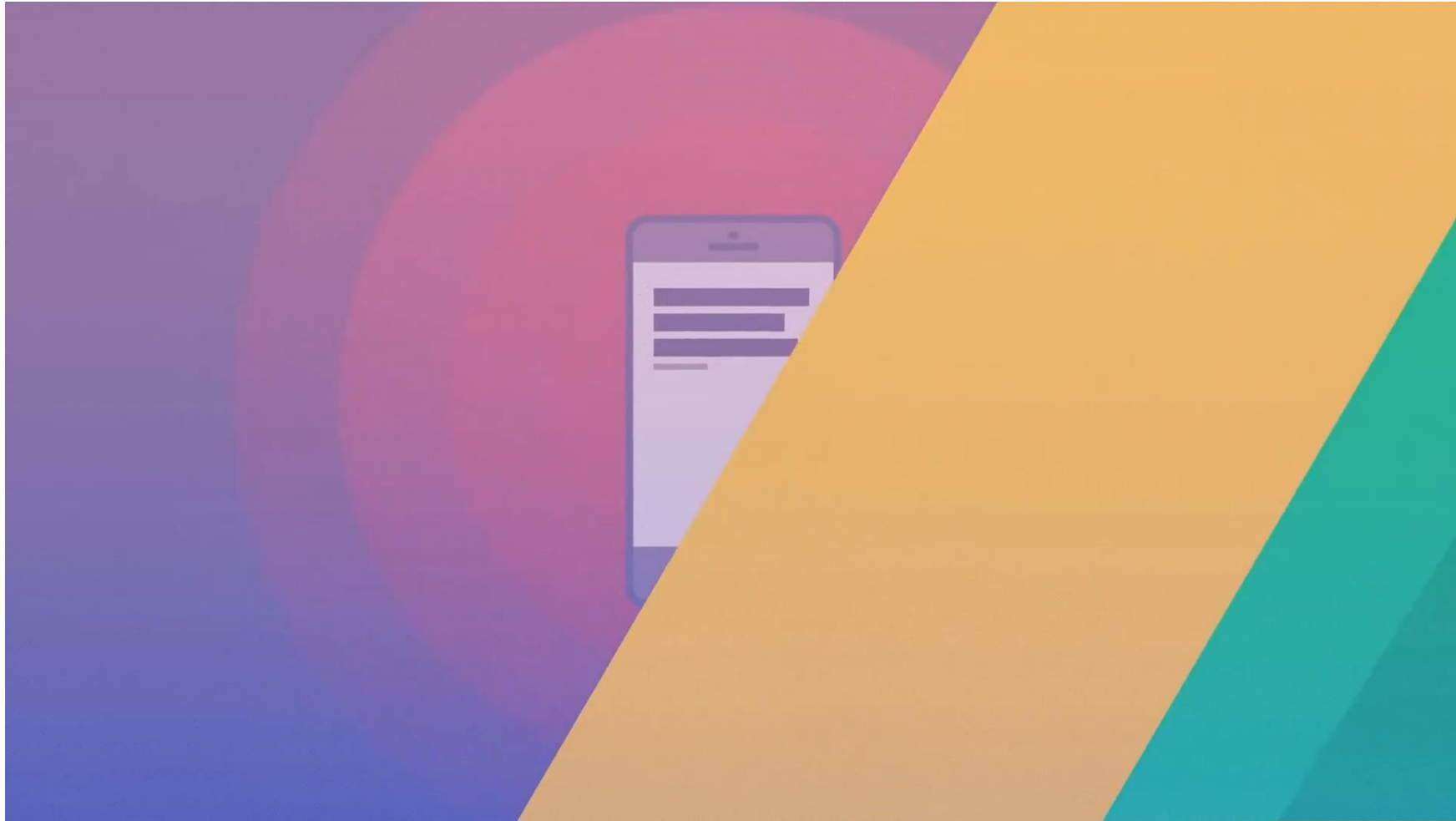
An Example of Deep Learning Neural Network

Programming Approach

Deep Learning (or ML) Approach

Try to do: Identify it as a **Cat**

Program vs. Deep Learning

An Example of Deep Learning

Programming Approach

Try to do: Identify it as a **Cat**

Deep Learning Approach

Programming Logic:
At Pixel level
- (body) Lots of black white colors mixed together
- (eye) black colors surrounded by yellow color (two if them)

Model

Learning: **Thousands** of **DIFFERENT** cat pictures

Prediction: **Evaluate the performance**

Problem: Different **Cats**
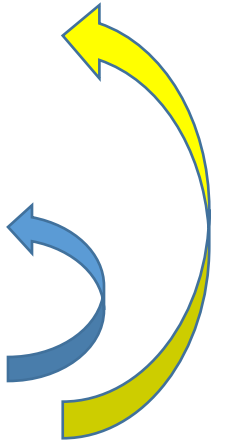
Problem: Wrong model, data etc.

An Example of Deep Learning

Programming Approach

Try to do: Identify it as a **Cat**

Deep Learning Approach

Programming Logic:
At Pixel level
- (body) Lots of black white colors mixed together
- (eye) black colors surrounded by yellow color (two if them)

Trained Model

Problem: Different **Cats**

Problem: Wrong model, data etc.

Summary
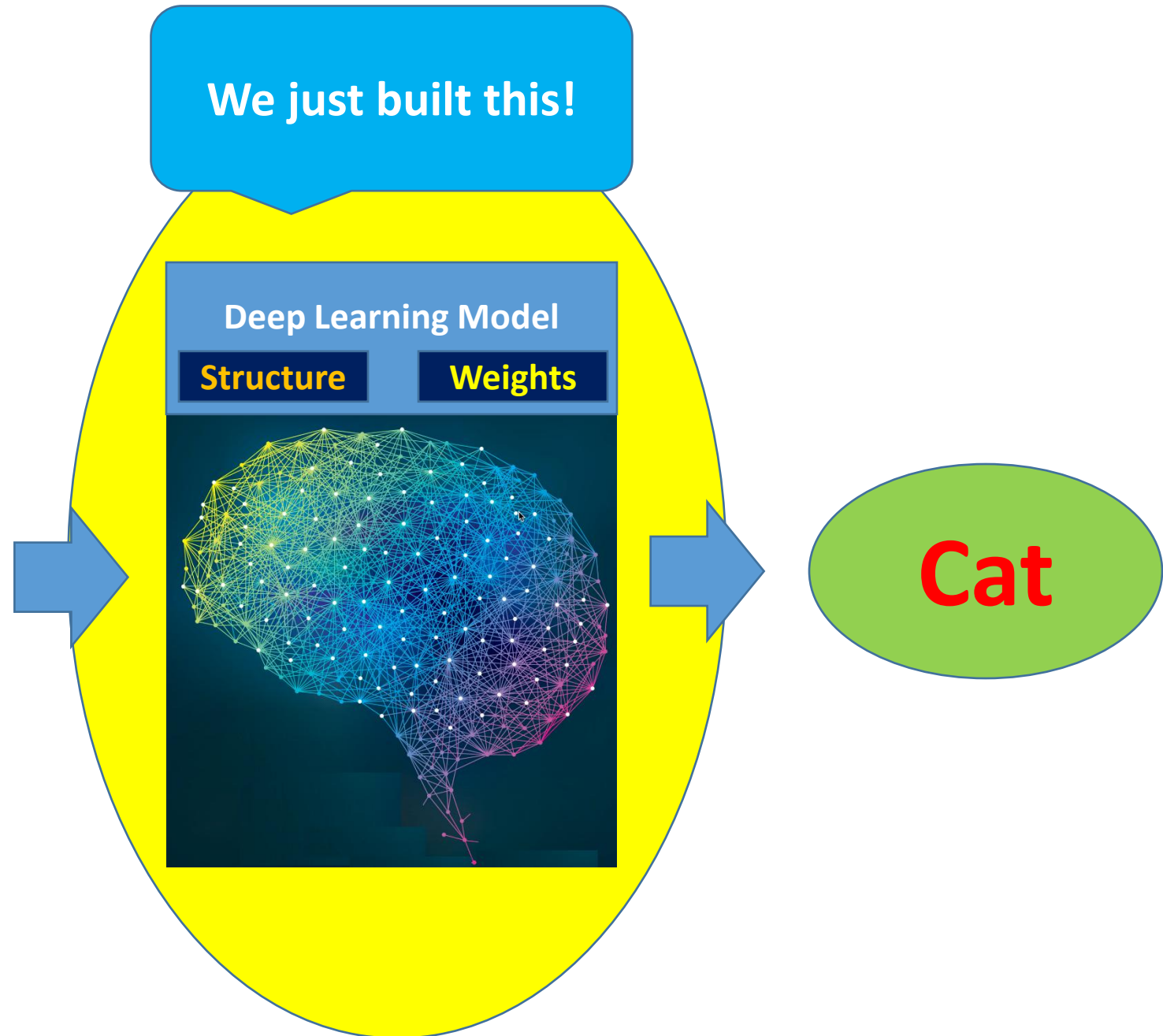
3. Different Deep Neural Networks

Different Deep Neural Networks
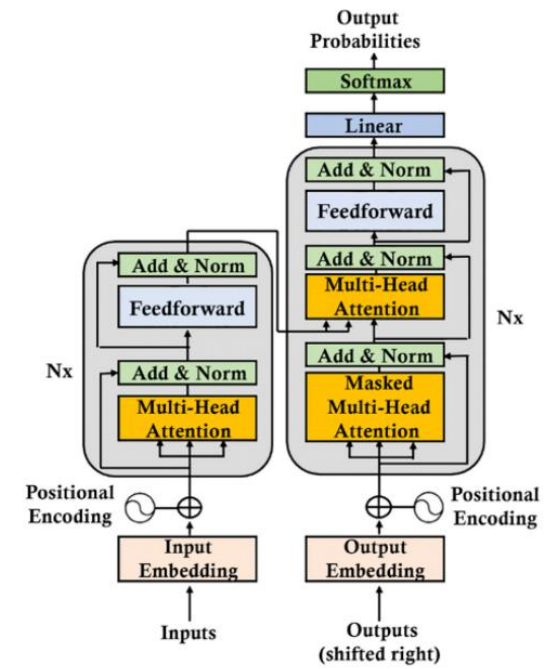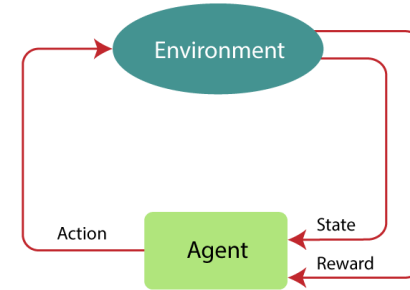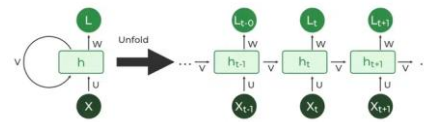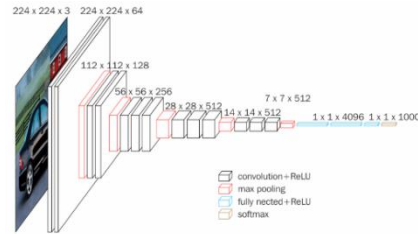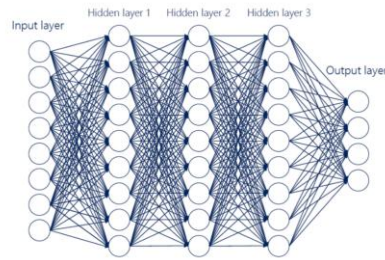
Source: https://www.youtube.com/watch?v=nOdz80J4_Rc

Source: https://www.youtube.com/watch?v=V1eYniJ0Rnk

4. Implementing Deep Learning in Business

Implementing Deep Learning in Business

Deep Learning Business Application

Business Objective(s) → Trained Model → Business Application

BYOM: Dataset → Model Training → Trained Model

TM: Trained Model (or Pre-trained Model)

FPM: Dataset → Finetuning Pretrained Model → Trained Model

Training data

Testing data
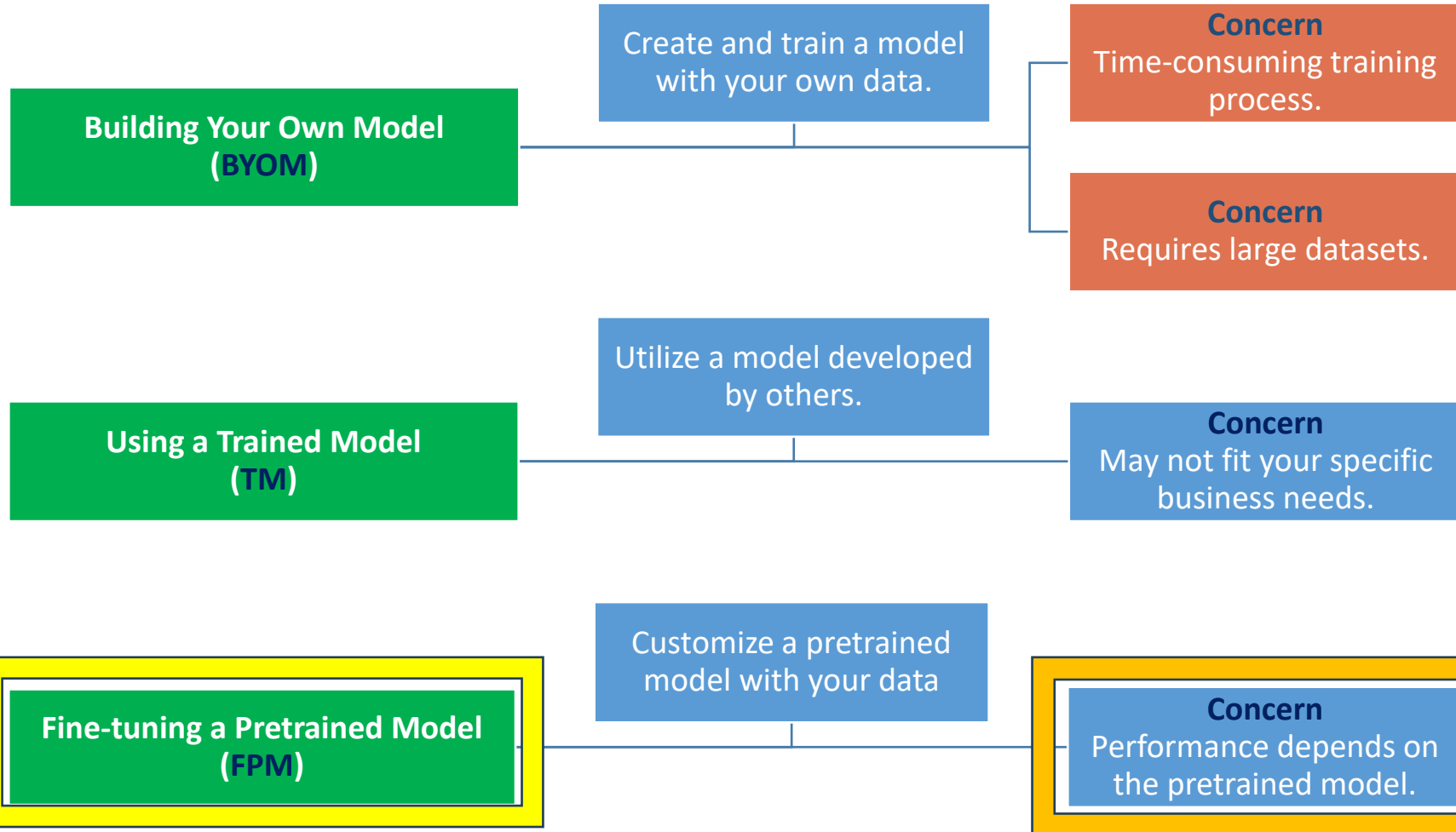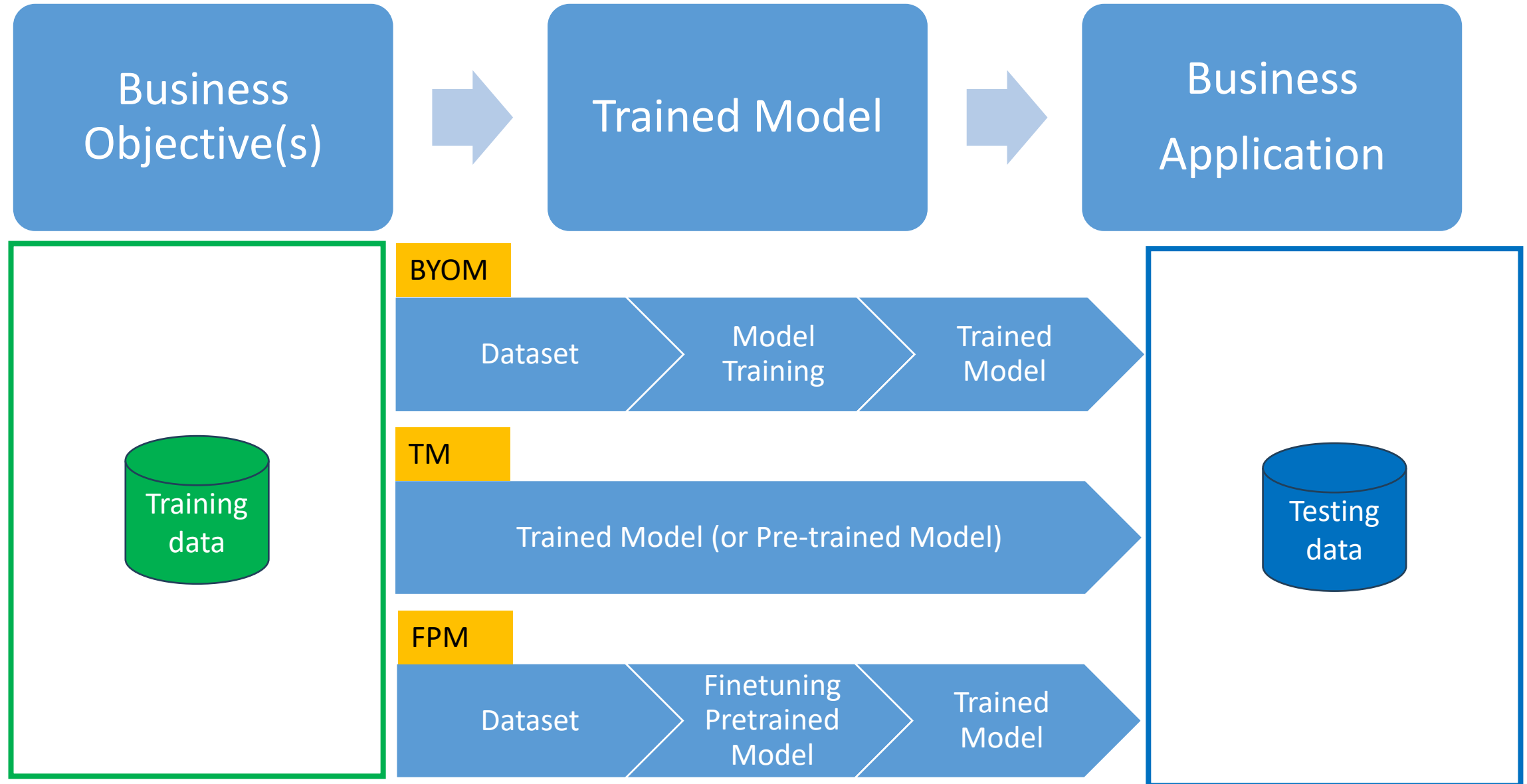
Deep Learning Business Application: Example

Business Objective(s) → **Trained Model** → **Business Application**

Objective: Assist medical professionals in predicting whether **a patient in your hospital** has **cancer or not**.

Dataset: Utilize chest X-ray images of the **patients in your hospital**.

Training data

BYOM

Dataset → Model Training → Trained Model

TM

Trained Model (or Pre-trained Model)

FPM

🤗 **Hugging Face**
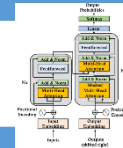
Dataset → Finetuning Pretrained Model → Trained Model

Testing data

Testing dataset: Capture a chest X-ray image from a **new patient**, apply the trained model to the new image, and examine the model's output – **cancer or not**.

5. Your First Deep Learning Business Application

In-class Activity

6. Final Remarks

Final Remarks

- Deep learning is the future

Would AI replace Human?
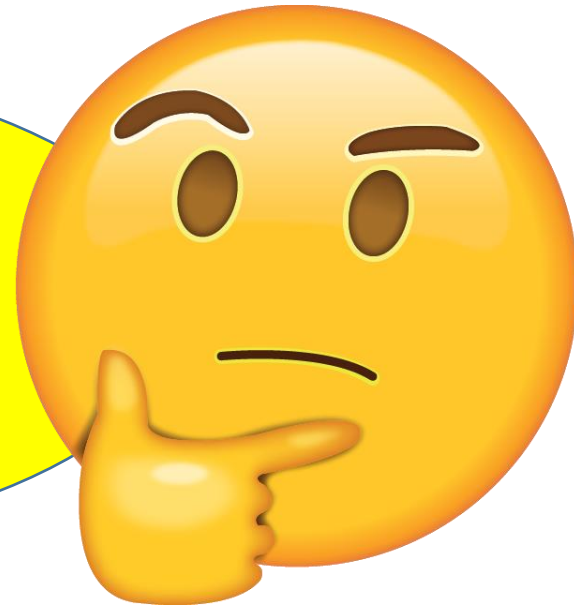
No evidence of jobs being entirely automated by AI, analysis shows

Anthropic's assessment of over 4 million user-submitted AI prompts found that most workers used the technology to augment their work, not replace it.

Published Feb. 11, 2025

The Anthropic Economic Index

Feb 10, 2025 • 9 min read

</> Computer & Mathematical	37.2%
Top Titles	
Computer Programmers	6.1%
Software Developers, Systems Software	5.3%
Software Developers, Applications	3.4%
Top Tasks	
Develop and maintain software applications and websites	16.8%
Program and debug computer systems and machinery	6.9%
Design & maintain database systems for data management and analysis	2.3%

✏ Arts & Media	10.3%
Top Titles	
Technical Writers	1.8%
Copy Writers	1.6%
Editors	1.3%
Top Tasks	
Produce and perform in film, TV, theater, and music	1.8%
Manage organizational public relations & strategic comms	1.3%
Develop & execute multi-industry marketing & promotional strategies	1.2%

| 📚 Education & Library	9.3%
Top Titles	
Tutors	1.6%
Archivists	1.5%
Instructional Designers	0.8%
Top Tasks	
Design and develop comprehensive educational curricula and materials	1.9%
Teach and instruct diverse subjects across educational settings	1.7%
Manage book and document publishing processes	1.4%

🏛 Office & Administrative	7.9%
Top Titles	
Bioinformatics Technicians	2.9%
Statistical Assistants	0.4%
Word Processors	0.4%
Top Tasks	
Perform routine IT system administration and maintenance	1.8%
Provide comprehensive customer service and support	0.7%
Record, analyze, and report operational and research data	0.6%

⚗ Life, Physical & Social Science	6.4%
Top Titles	
Clinical Psychologists	0.5%
Historians	0.4%
Anthropologists	0.4%
Top Tasks	
Conduct academic research and disseminate findings	1.2%
Record, analyze, and report operational and research data	0.5%
Conduct chemical analyses and experiments on various substances	0.3%

📋 Business & Financial	5.9%
Top Titles	
Security Management Specialists	0.5%
Credit Counselors	0.4%
Financial Analysts	0.4%
Top Tasks	
Analyze financial data & develop investment & budgeting strategies	0.8%
Provide personal financial advice and education	0.8%
Record, analyze, and report operational and research data	0.4%

End