CSX 4201 & ITX4201 Artificial Intelligence Concepts

Introduction to AI and Programming Environment

Lecturer: Matee Vadrukchid

About Me

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I'M LECTURER OF CSX 4201 & ITX4201 ARTIFICIAL INTELLIGENCE CONCEPTS.

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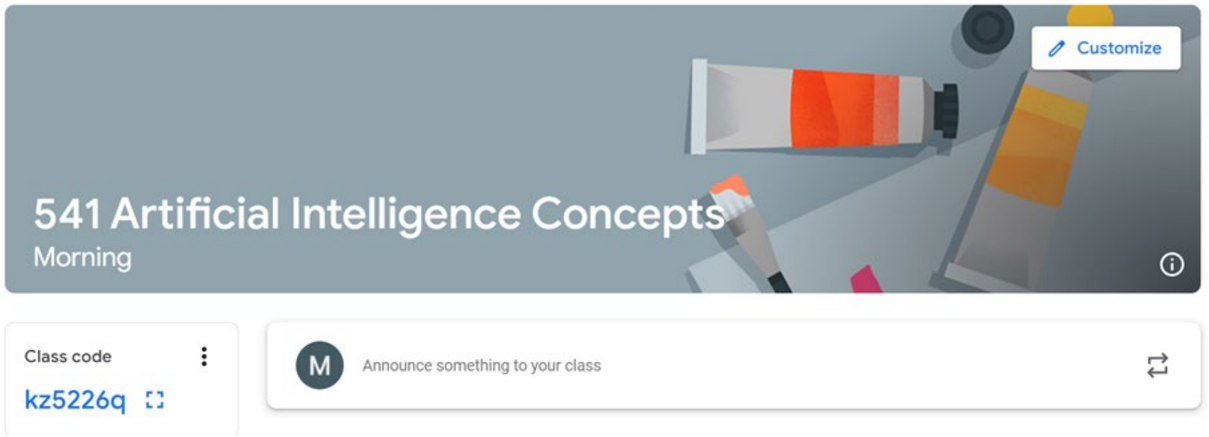


GOOGLE CLASSROOM, MICROSOFT TEAMS, AND EMAIL

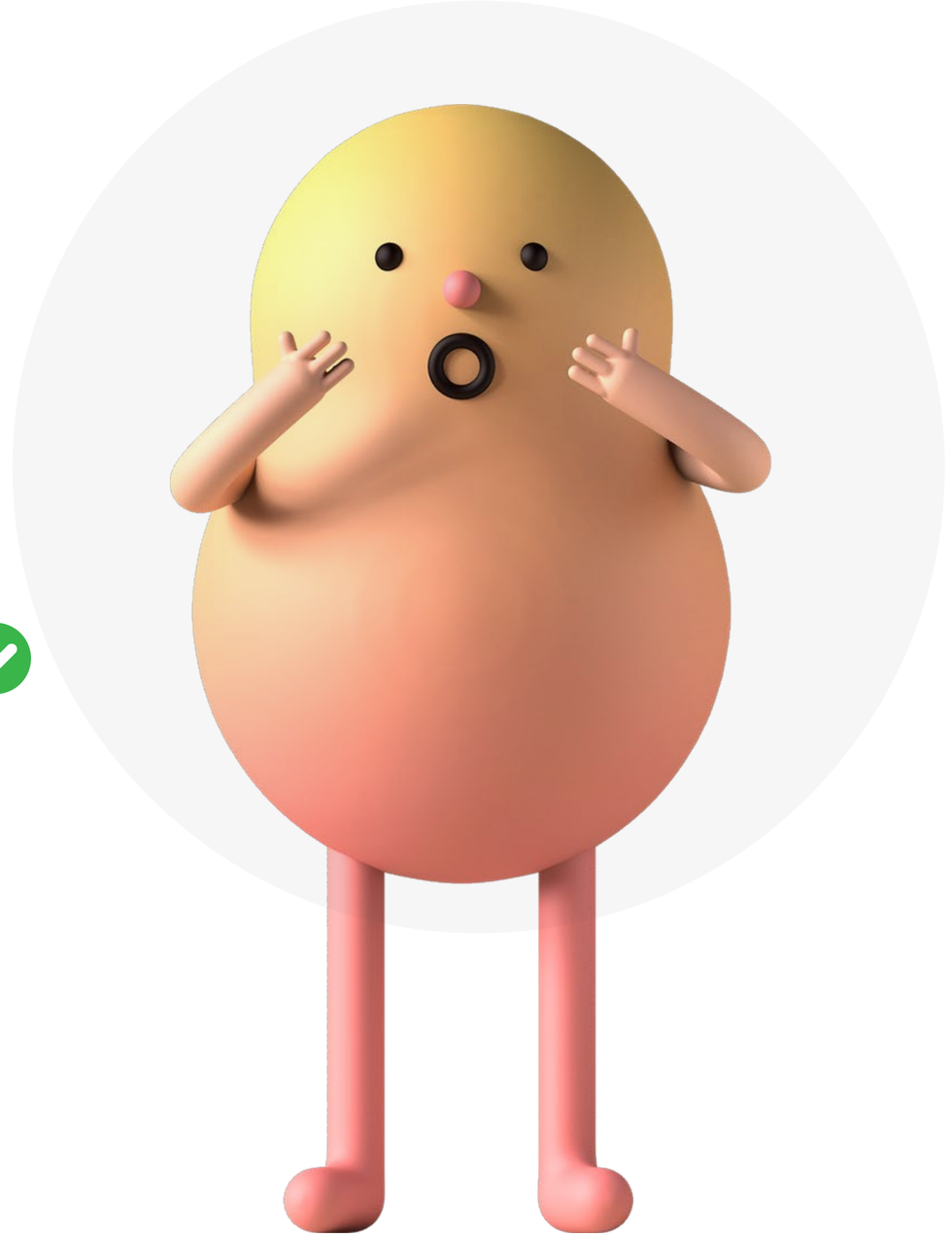
About Course

CSX 4201 & ITX4201 Artificial Intelligence Concepts.

EVALUATION

- Attendance and Participation: 10%
- Assignments: 30%
- Final Project Presentation and Report: 20%
- Midterm Exam 20%
- Final Exam 20%

Practice : 60% OF SCORE



Course goals

CSX 4201 & ITX4201 Artificial Intelligence **Concepts**

Be familiar with all major ML methods

- **Regression (linear, logistic): MLE, MPE**
- **Clustering Algorithms: K-Means, DBSCAN**
- **Neural Networks** ✅
- **Deep Learning** ✅

✅ Applying AI to Real -World Technical Problems

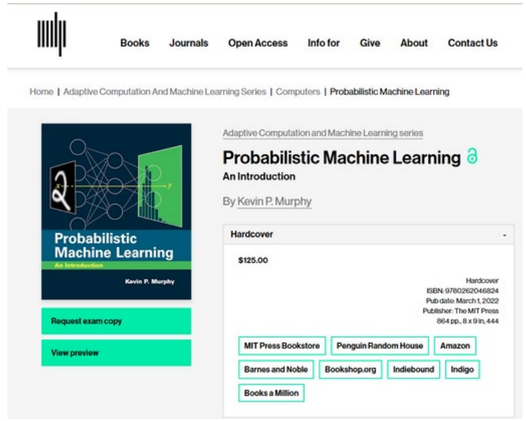
- **Assignments**
- **Project**

Textbooks

CSX 4201 & ITX4201 Artificial Intelligence Concepts.

Mathematics for Machine Learning, Cambridge University Press; 1st edition (2020)

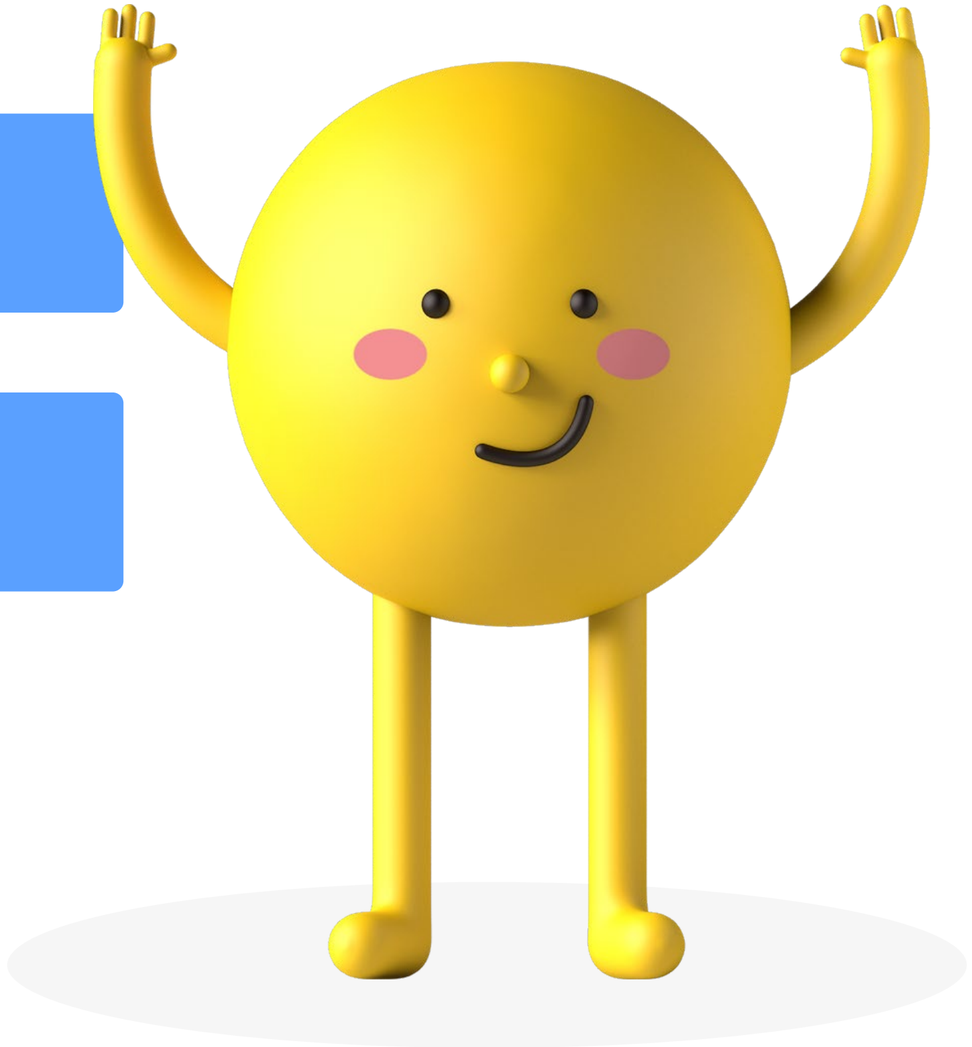
Marc Peter Deisenroth & Probabilistic Machine Learning, The MIT Press (2022), Kevin P. Murphy



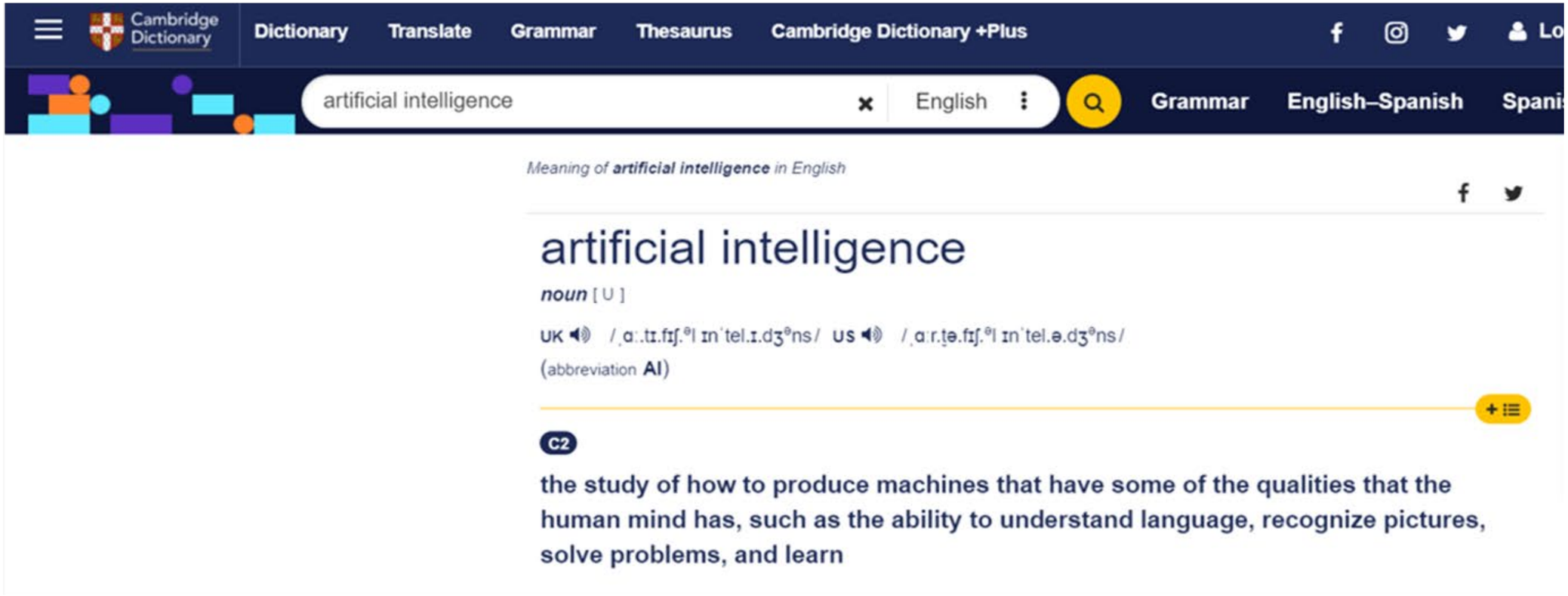
Kahoot Time !!!

kahoot.it

PIN :

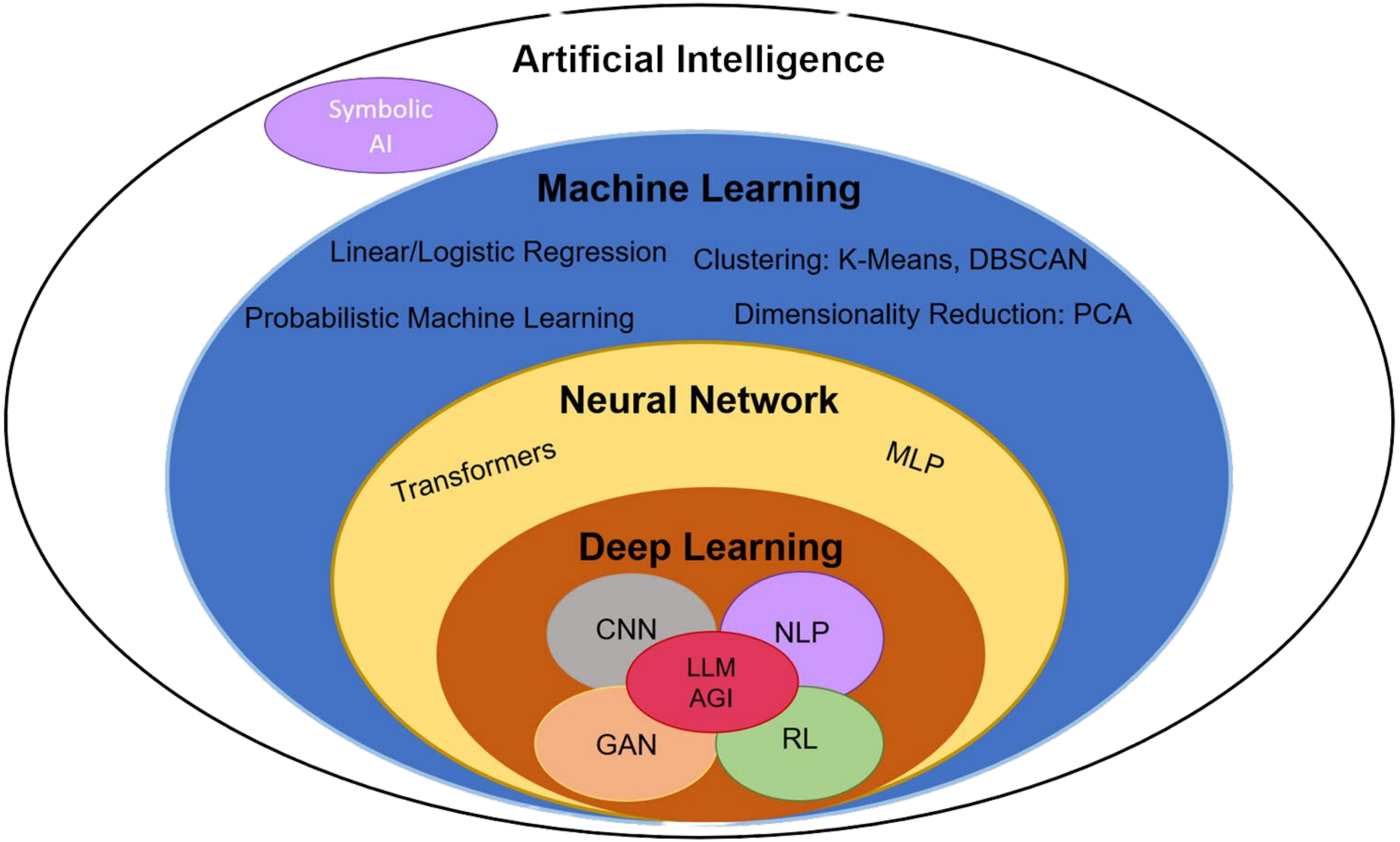


CAMBRIDGE DICTIONARY



THE STUDY OF HOW TO PRODUCE COMPUTERS THAT HAVE SOME OF THE QUALITIES OF THE HUMAN MIND , SUCH AS THE ABILITY TO UNDERSTAND LANGUAGE, RECOGNIZE PICTURES, SOLVE PROBLEMS, AND LEARN

Artificial Intelligence (AI)



Where is Machine Learning used?

Types of Learning

01. Supervised (X , Y)

- Given an observation x, what is the best label y?

02. Unsupervised X

- Given a set of x's, cluster or summarize them

03. Reinforcement

- Given a sequence of states x and possible actions a, learn which actions maximize reward.

Types of Learning as Probabilities

01. Supervised (X , Y)

- p(y|x) - conditional probability estimation
- min || ŷ(x) – y || - optimization

02. Unsupervised X

- p(x) - “generative” model

Types of models

01. Generative

- p(x)

02. Discriminative

- p(y|x)

X: features, predictors, design matrix, input
y: response, label, output

Types of models

01. Parametric

- $\hat{y} = w.\ x$
- $\hat{y} = f(x; \theta)$
- w and θ are parameters

02. Non-parametric

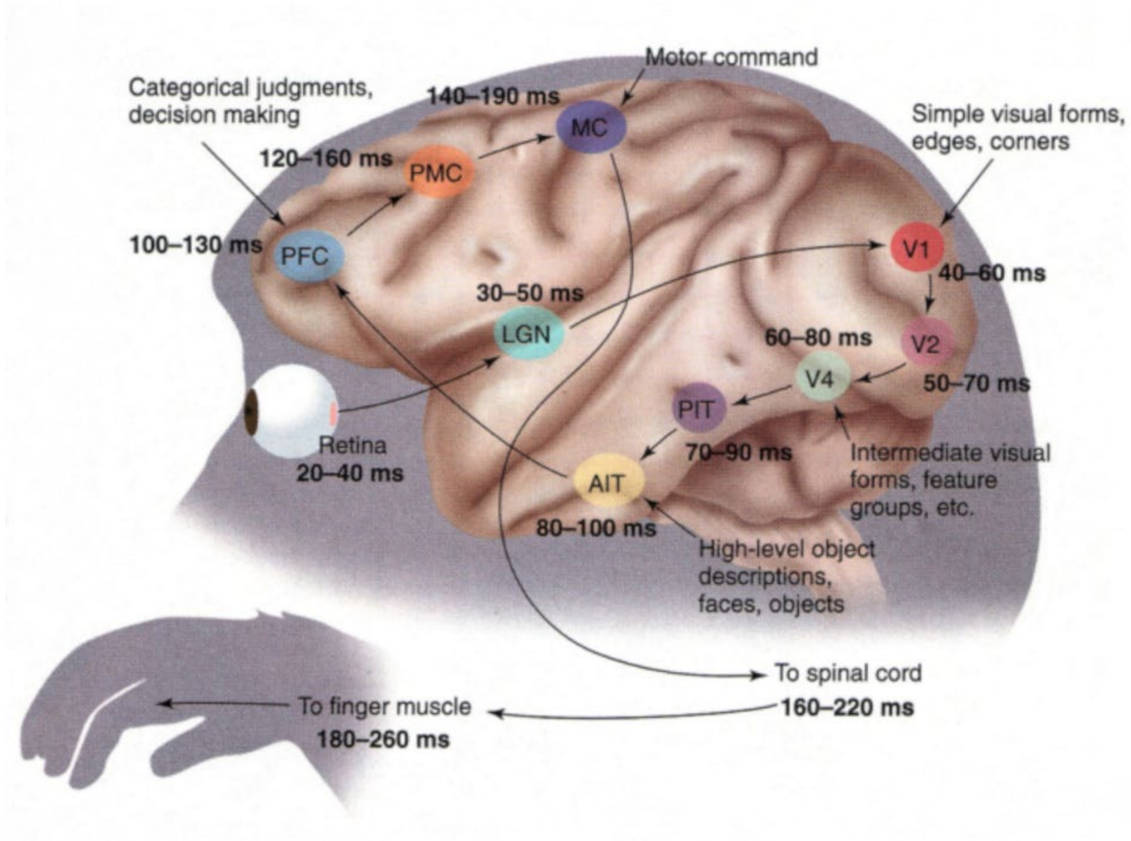
- k-mean, DBSCAN

03. Semi-parametric

- Deep learning

Neural Network

Deep Learning

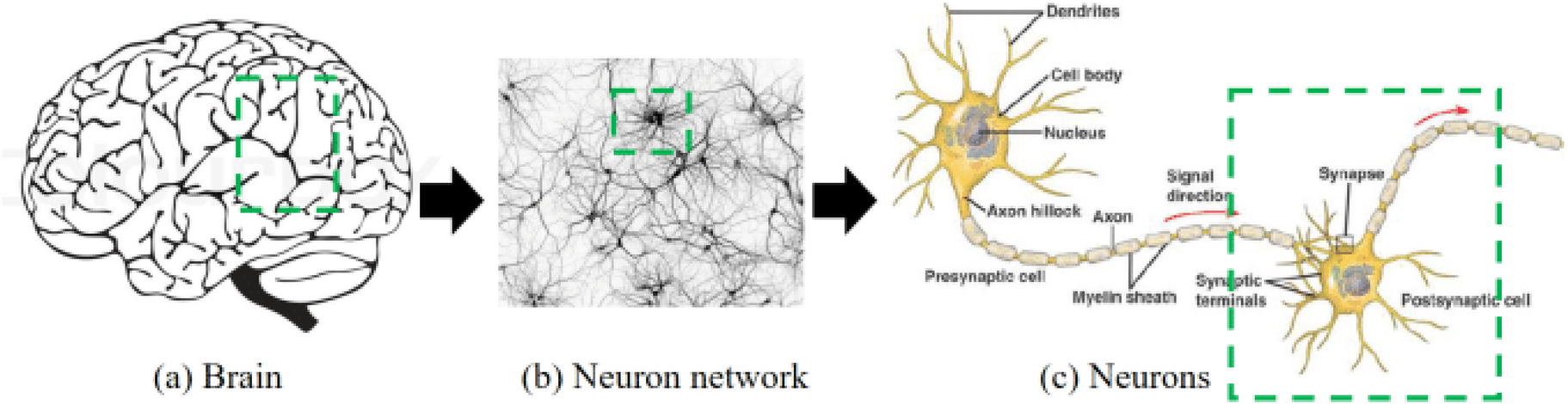


The first **hierarchy of neurons** that receives information in the **visual** cortex are sensitive to specific edges while brain regions further down the visual pipeline are sensitive to more complex structures such as faces.

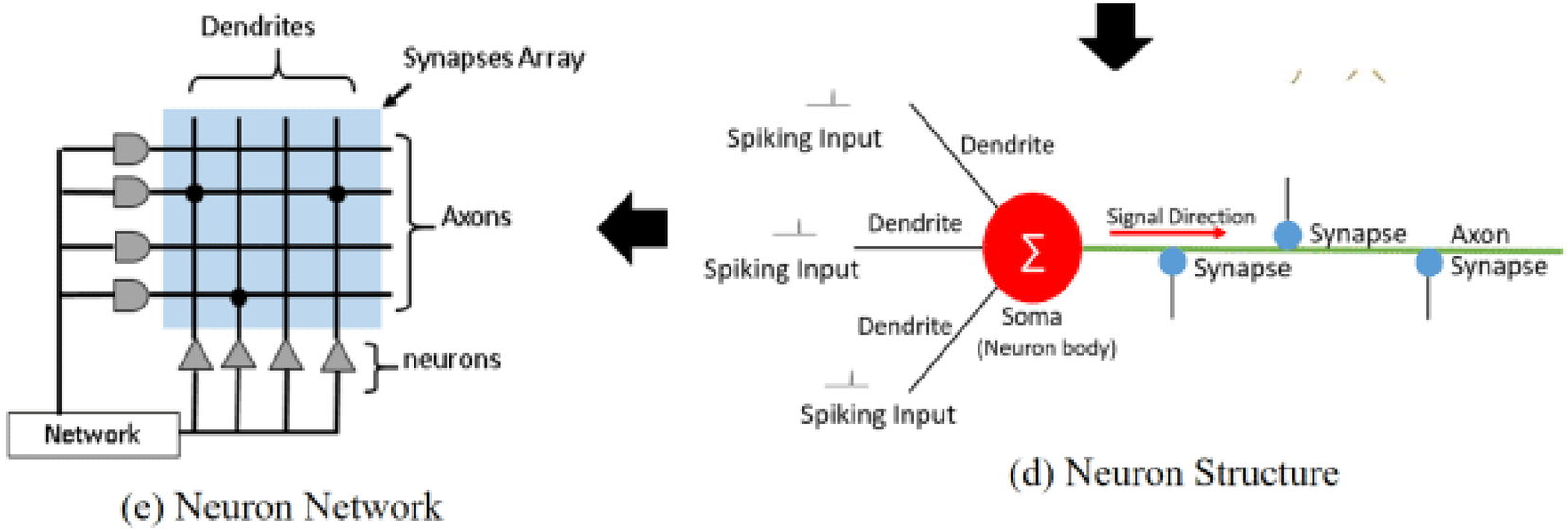
Our brain has lots of neurons connected together and the **strength of the connections** between neurons represents long term knowledge.

Ref Link

Deep Learning



(a) Brain (b) Neuron network (c) Neurons



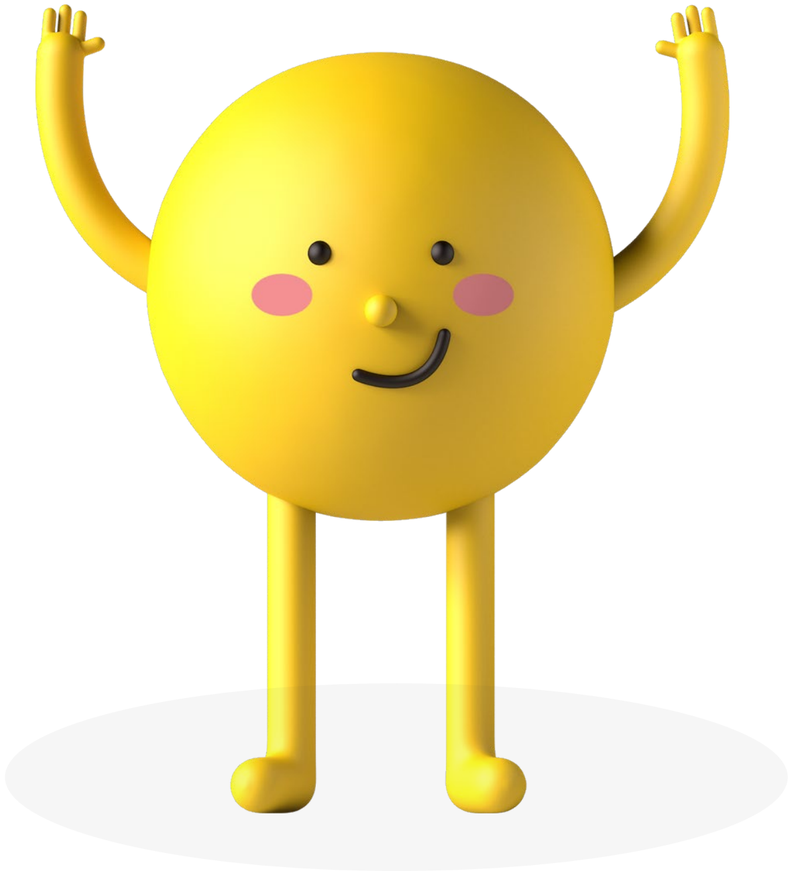
(e) Neuron Network (d) Neuron Structure

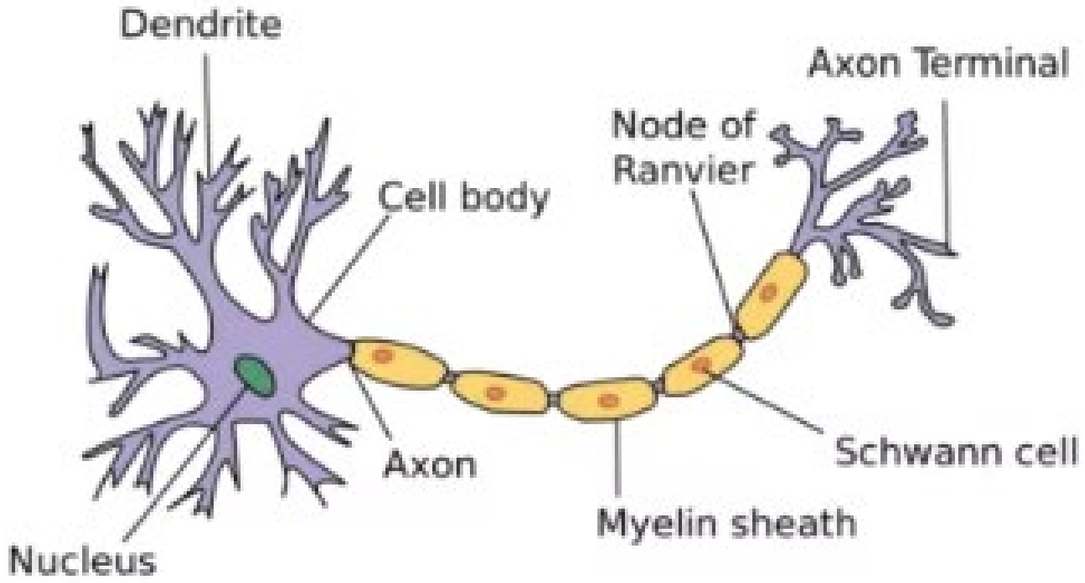
Understanding the Human Brain + Brilliant Scientists = Neural Networks

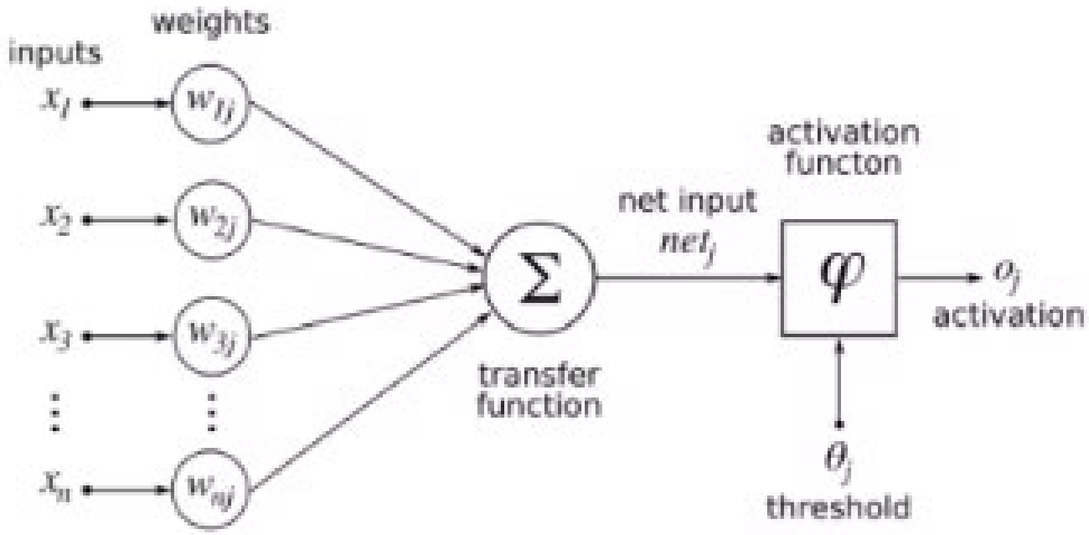
Ref Link

Deep Learning

Neuron Connecting Structure







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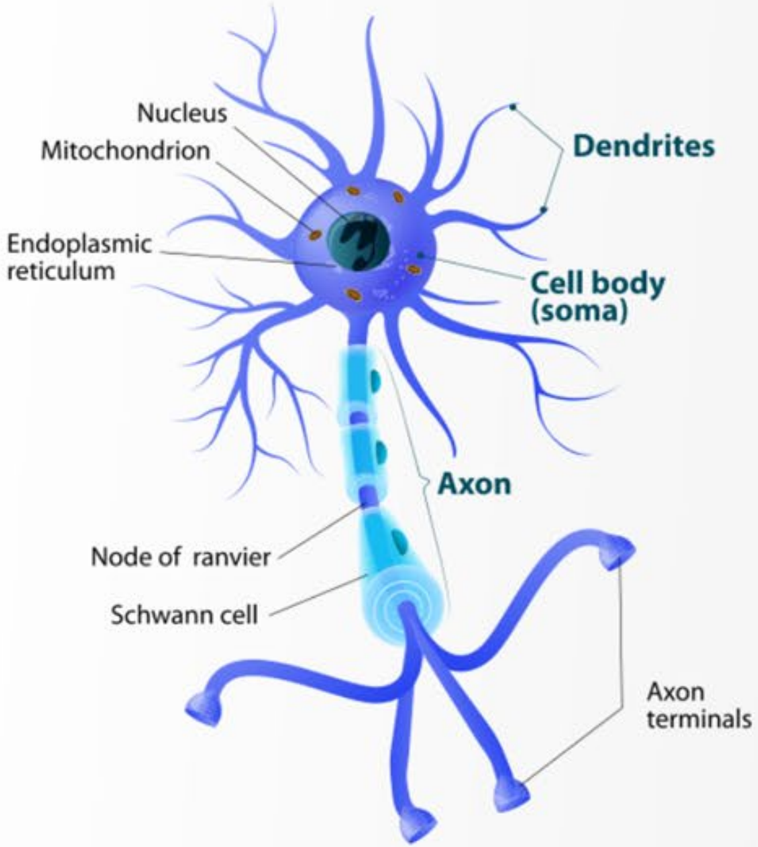
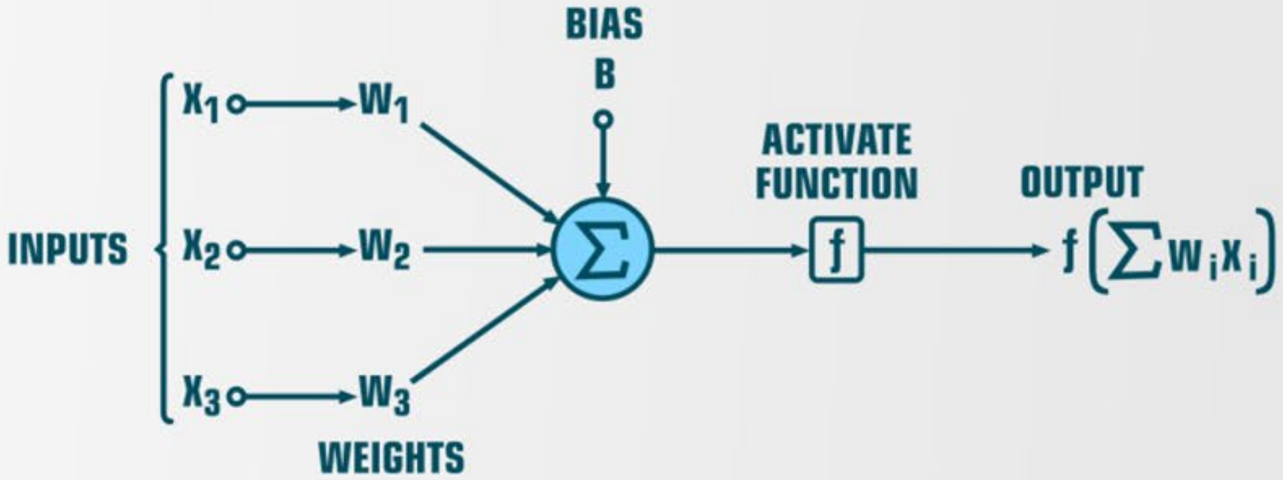
Deep Learning

Structure of Typical Neuron



Structure of Artificial Neuron



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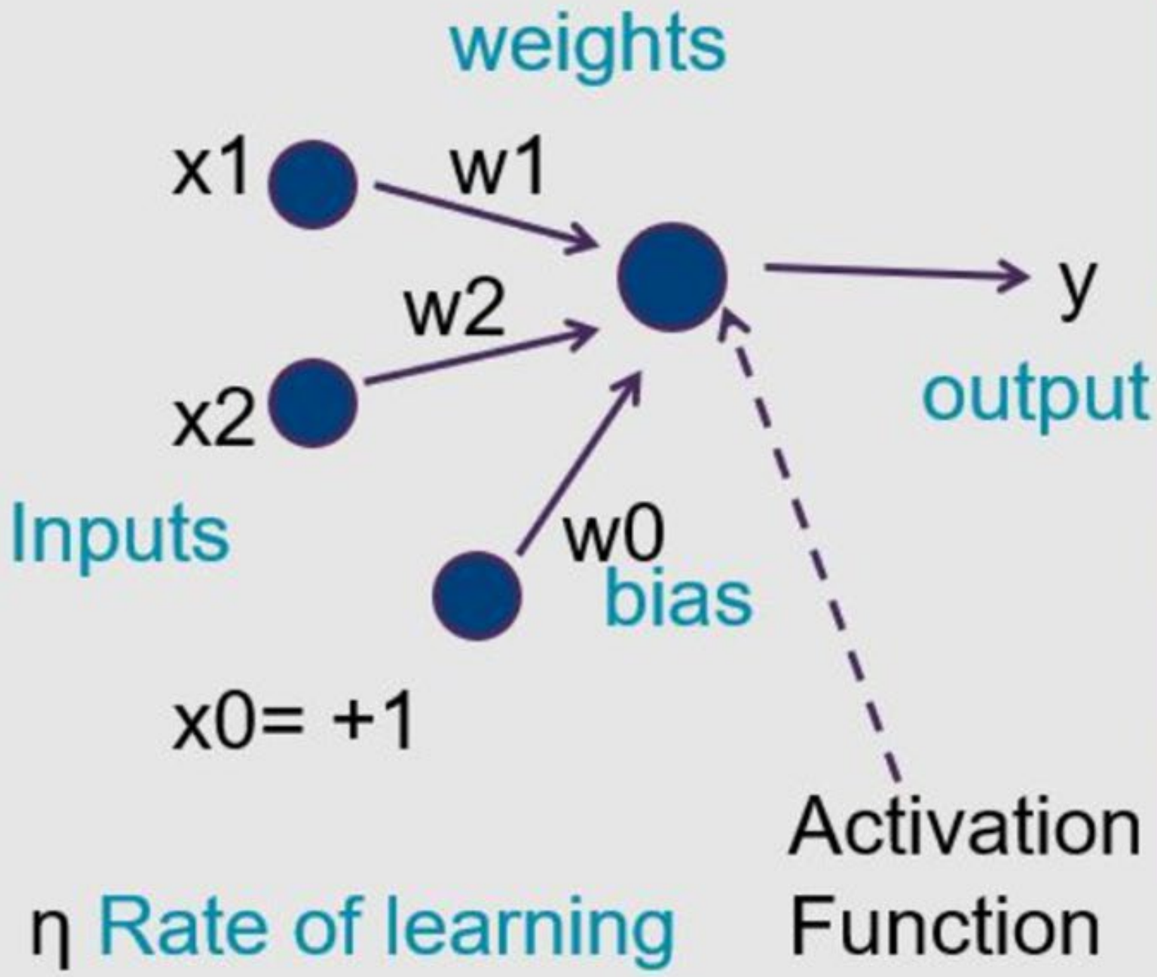
Neural Network



Inputs (x1, x2)	Hidden weights and bias	Output
0 , 0.5		Square (1)
2 , -2.0		Circle (-1)
-1 , -1.5		Circle (-1)
-2 , -1		Circle (-1)
-2 , 0.5		Square (1)
1.5 ,-0.5		Square (1)

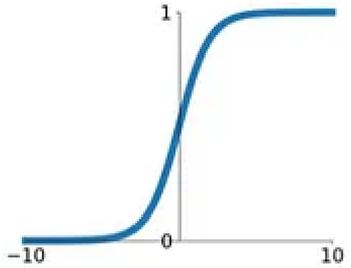
Ref Link

Neural Network

Activation Functions

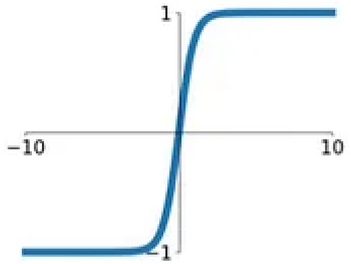
Sigmoid

$$\sigma(x) = \frac{1}{1+e^{-x}}$$



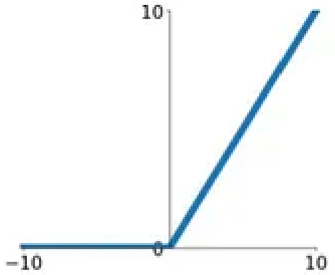
tanh

$$\tanh(x)$$



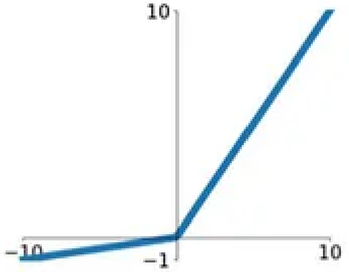
ReLU

$$\max(0, x)$$



Leaky ReLU

$$\max(0.1x, x)$$

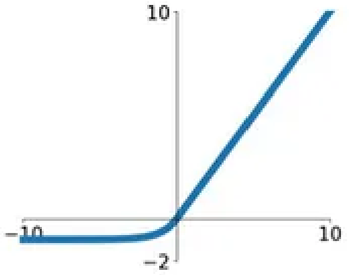


Maxout

$$\max(w_1^T x + b_1, w_2^T x + b_2)$$

ELU

$$\begin{cases} x & x \geq 0 \\ \alpha(e^x - 1) & x < 0 \end{cases}$$



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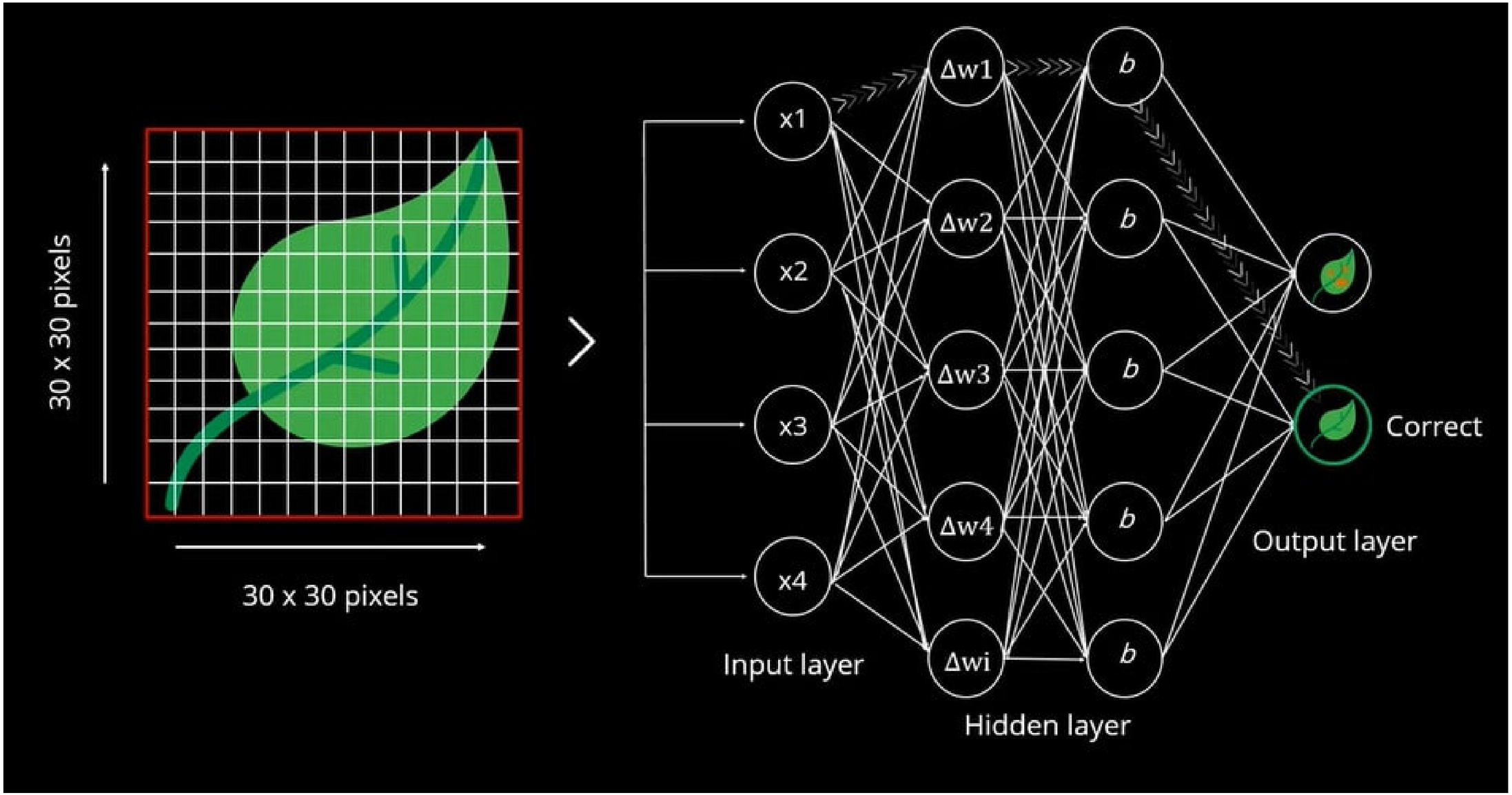
Neural Network



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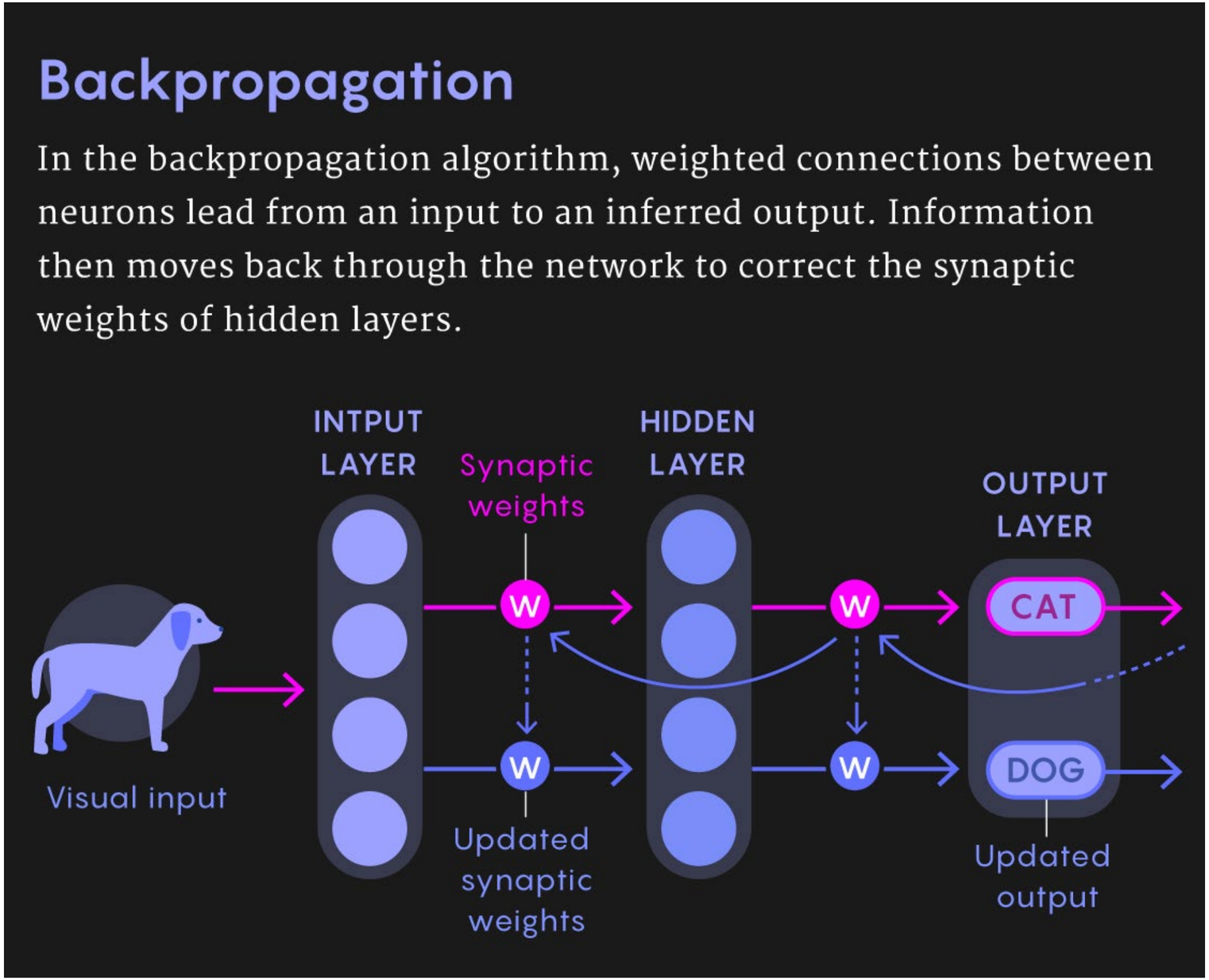

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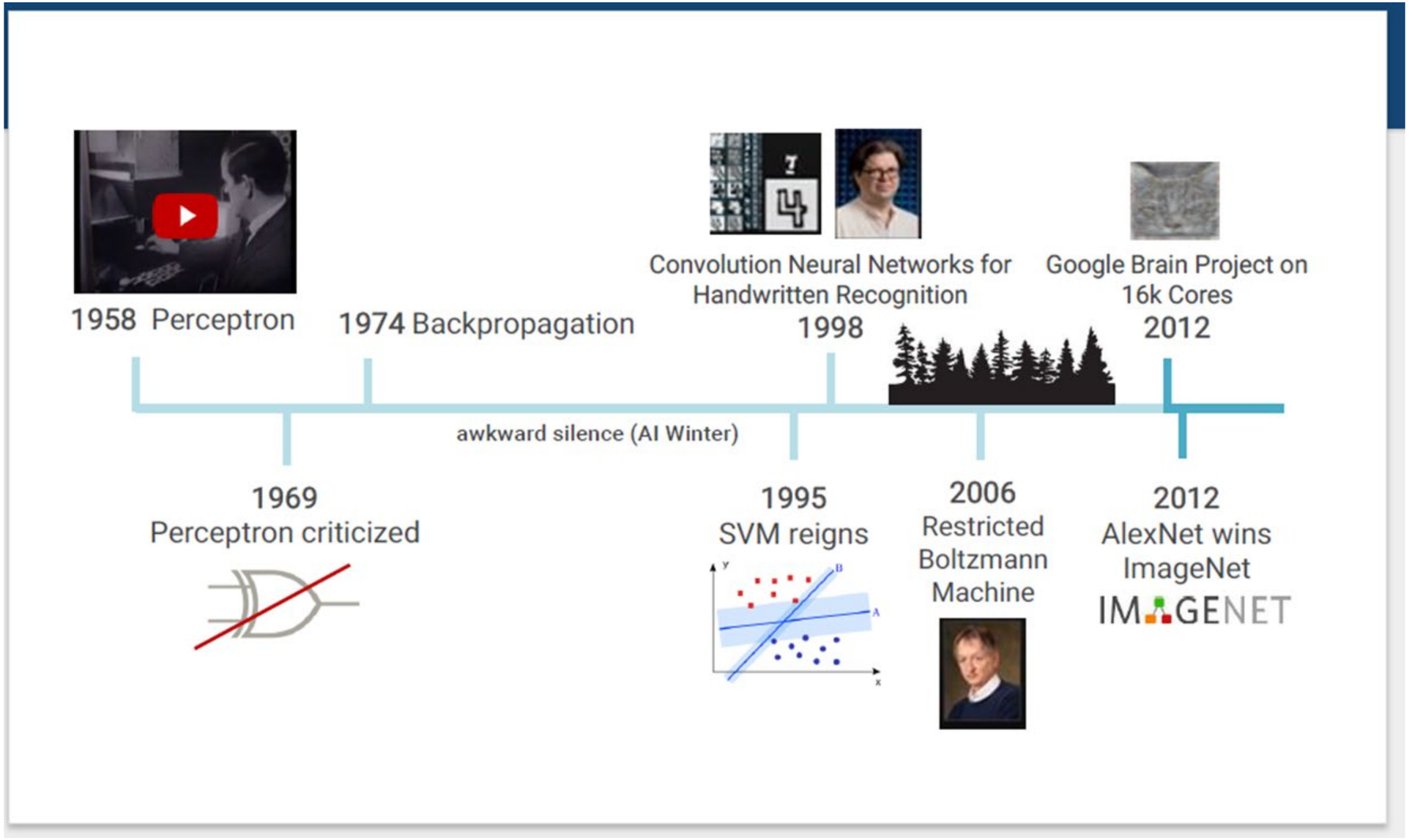
Neural Network



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Deep Learning

Application

01

CNN

Convolution Neural Networks

02

NLP

Neuron-Linguistic Programming

03

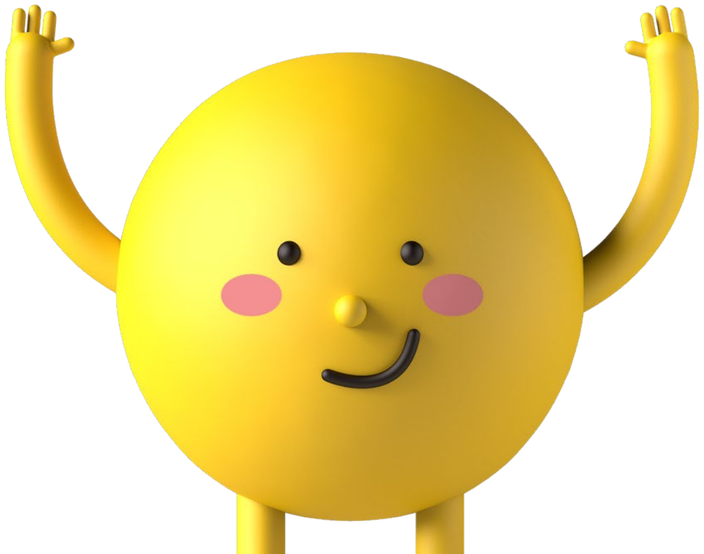
GAN

Generative adversarial network

04

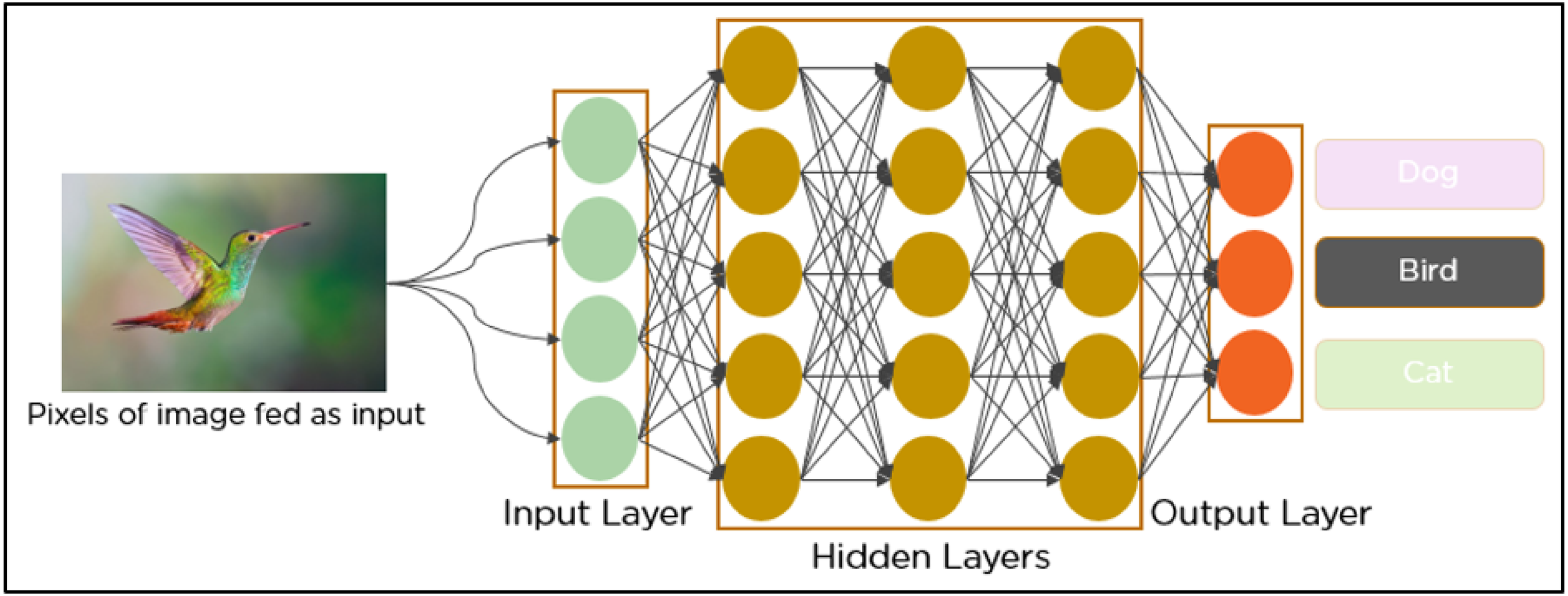
RL

Reinforcement Learning



Convolutional Neural Network

Convolutional Neural Network



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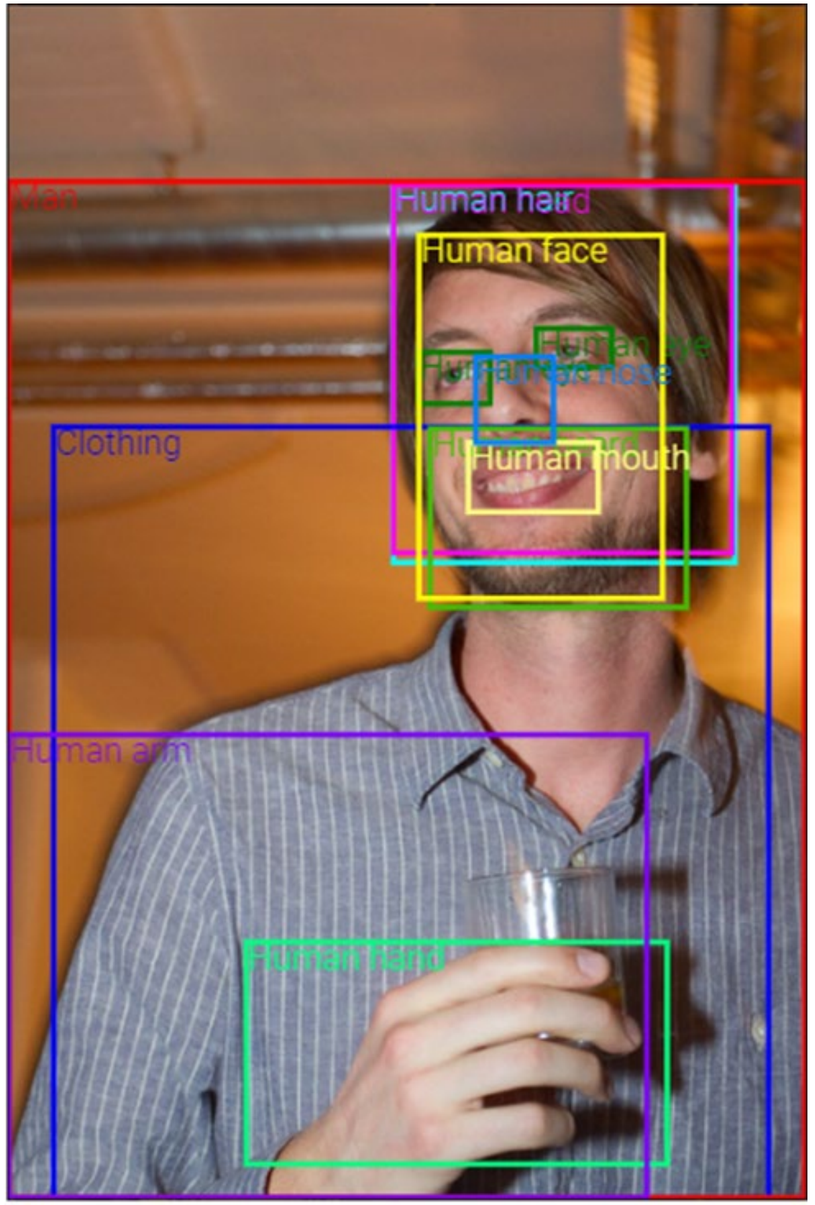
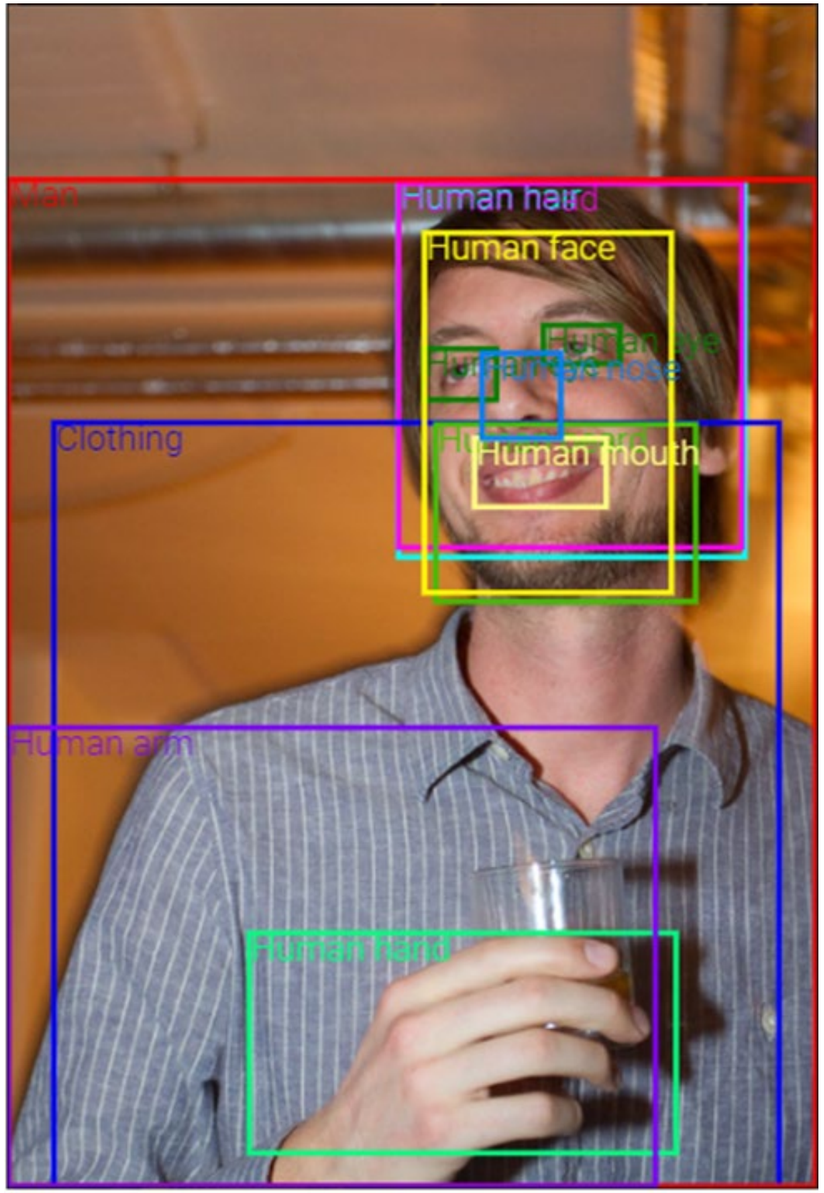
Dataset

Drawing by Hand



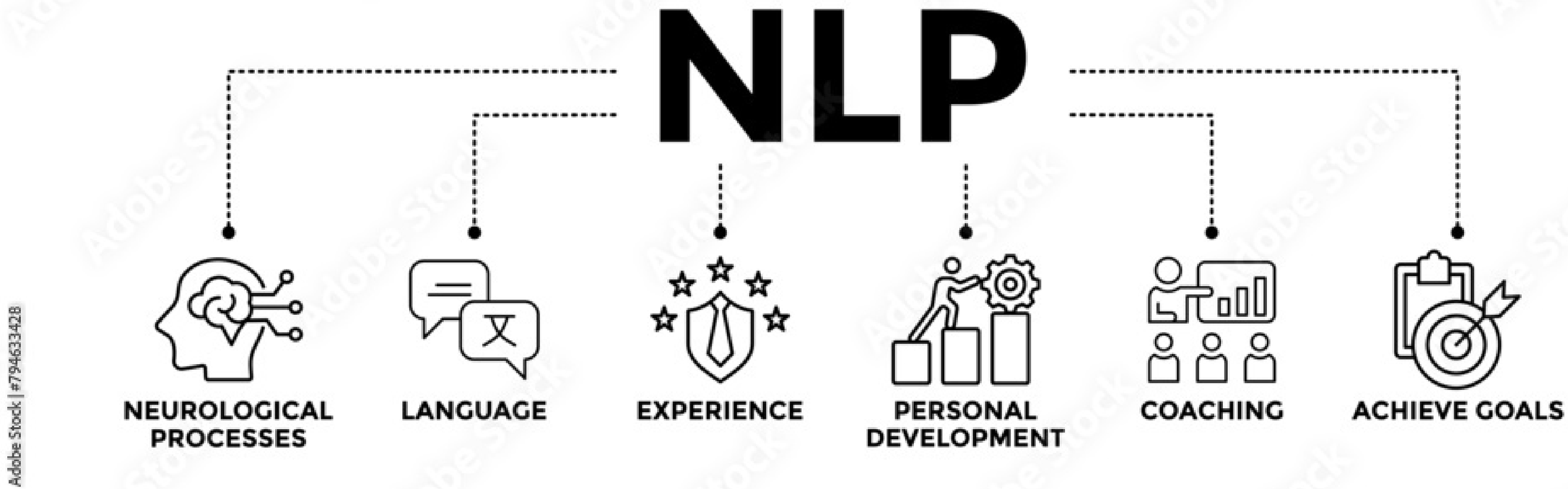
Detections



Segmentation

Neuron - Linguistic Programming

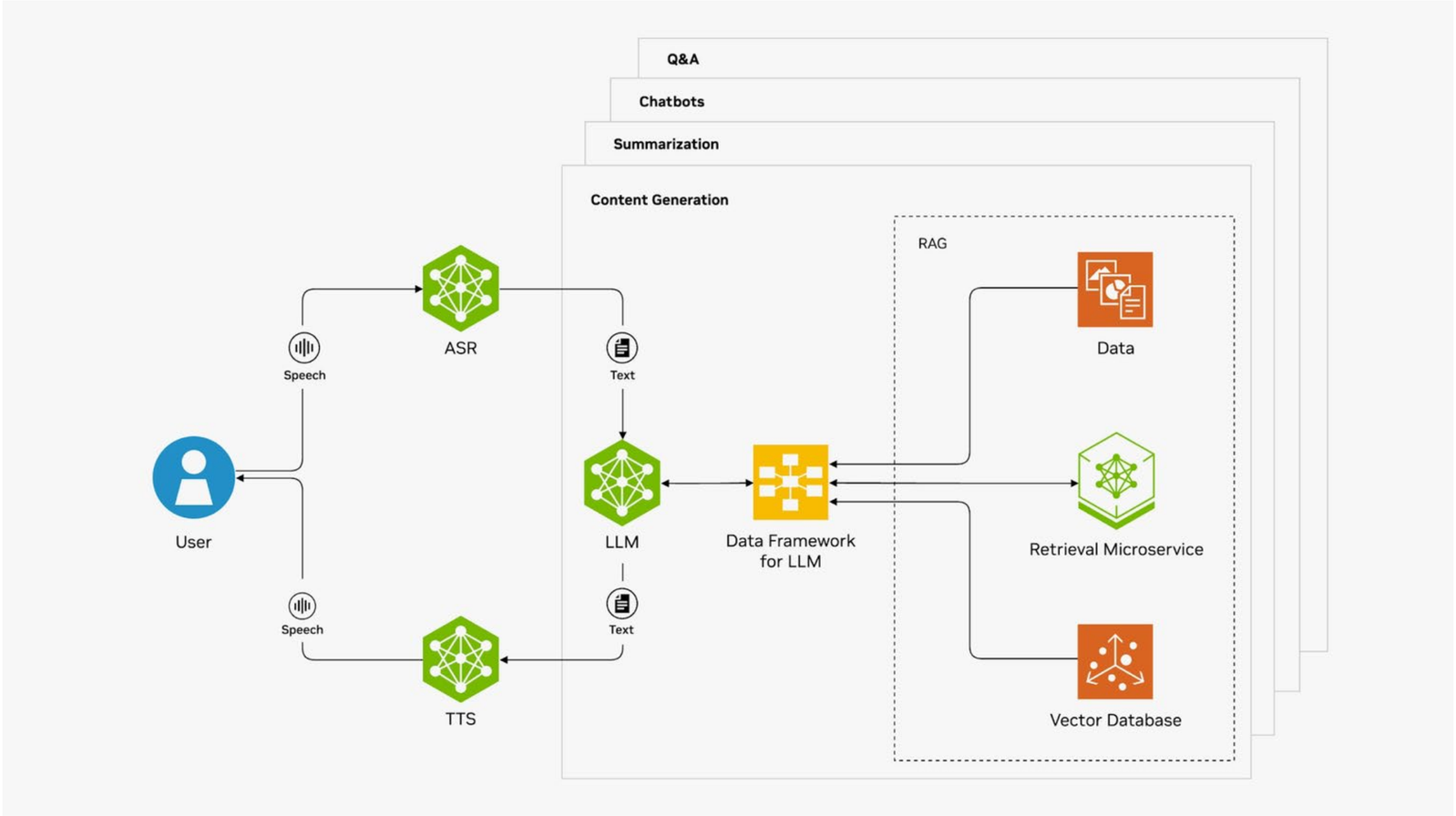
Neuron - Linguistic Programming



Language

Ref Link

Neuron - Linguistic Programming



Understand Language

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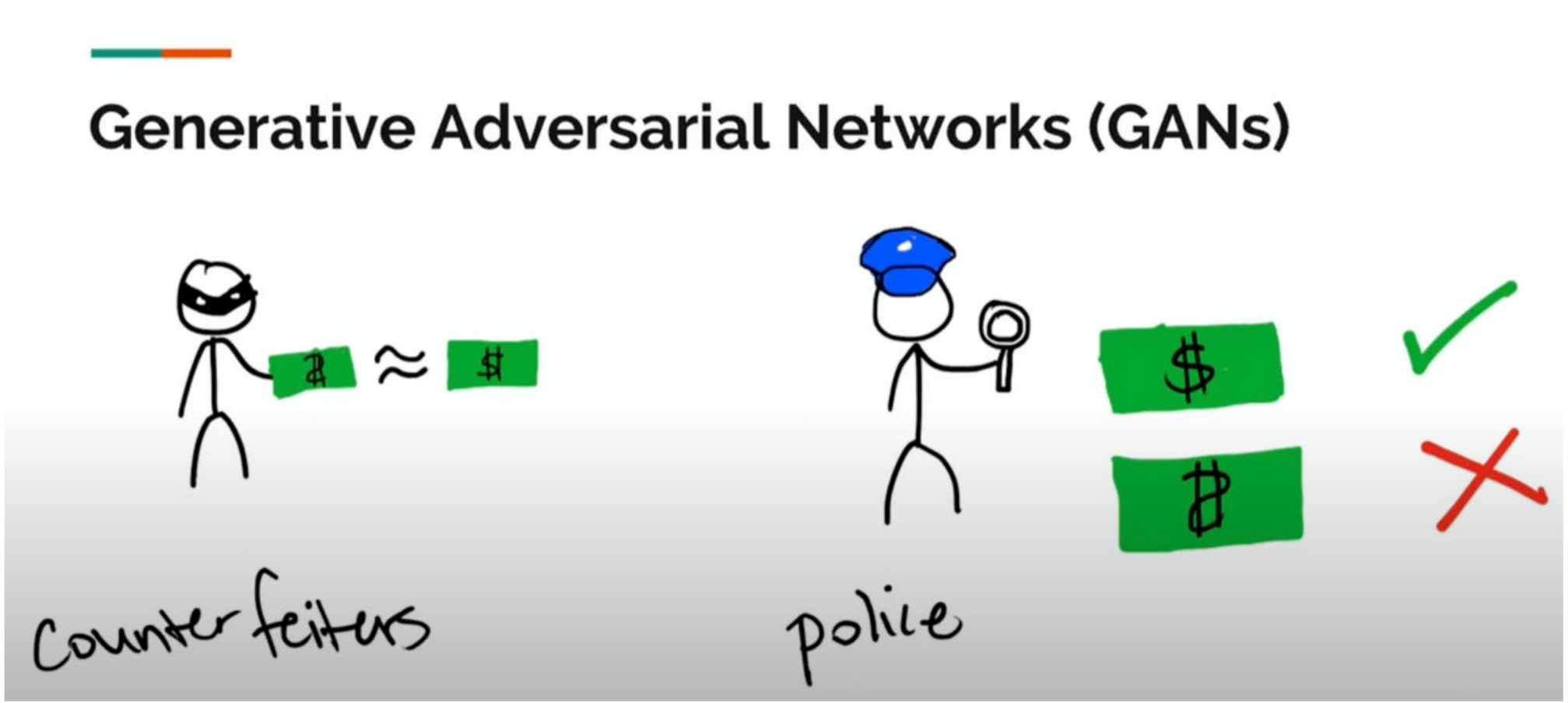
Generative Adversarial network

Generative adversarial network



Two Models

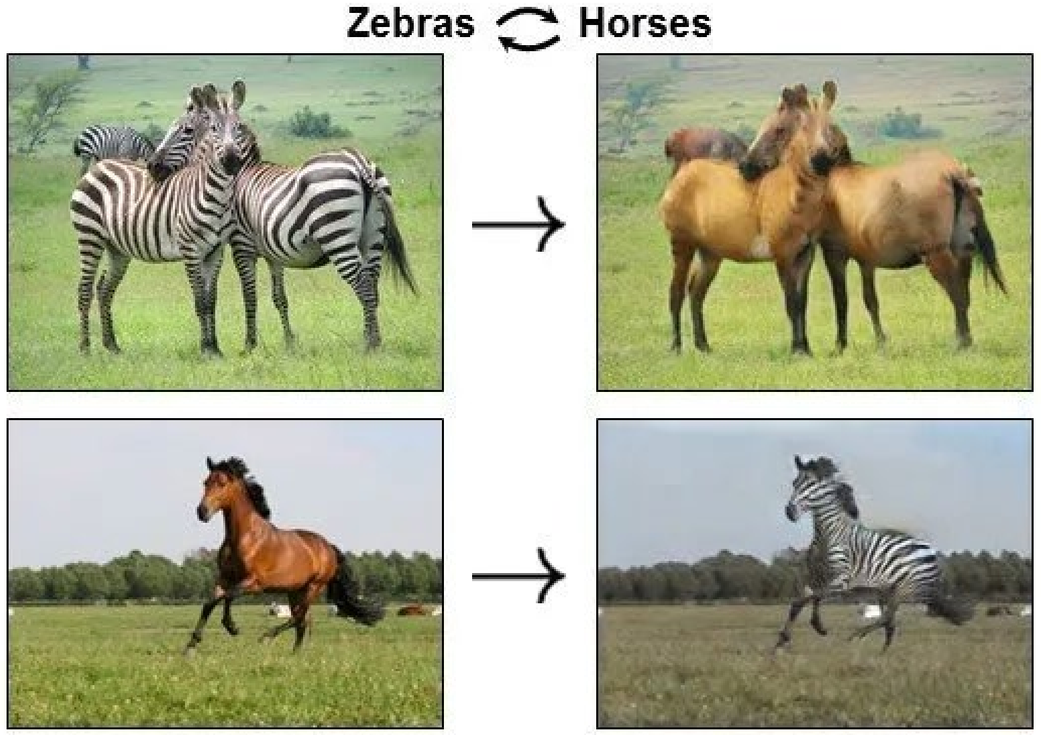
Ref Link

Generative adversarial network

Noise ~ N(0,1)

Generative Model

Ref Link



Ref Link

Real Image

Input.jpg

StyleGAN

Closest artificial face in the GAN's latent space

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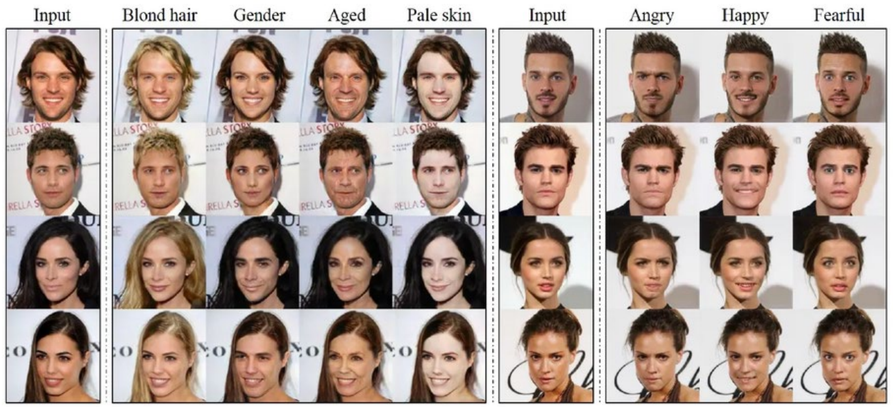

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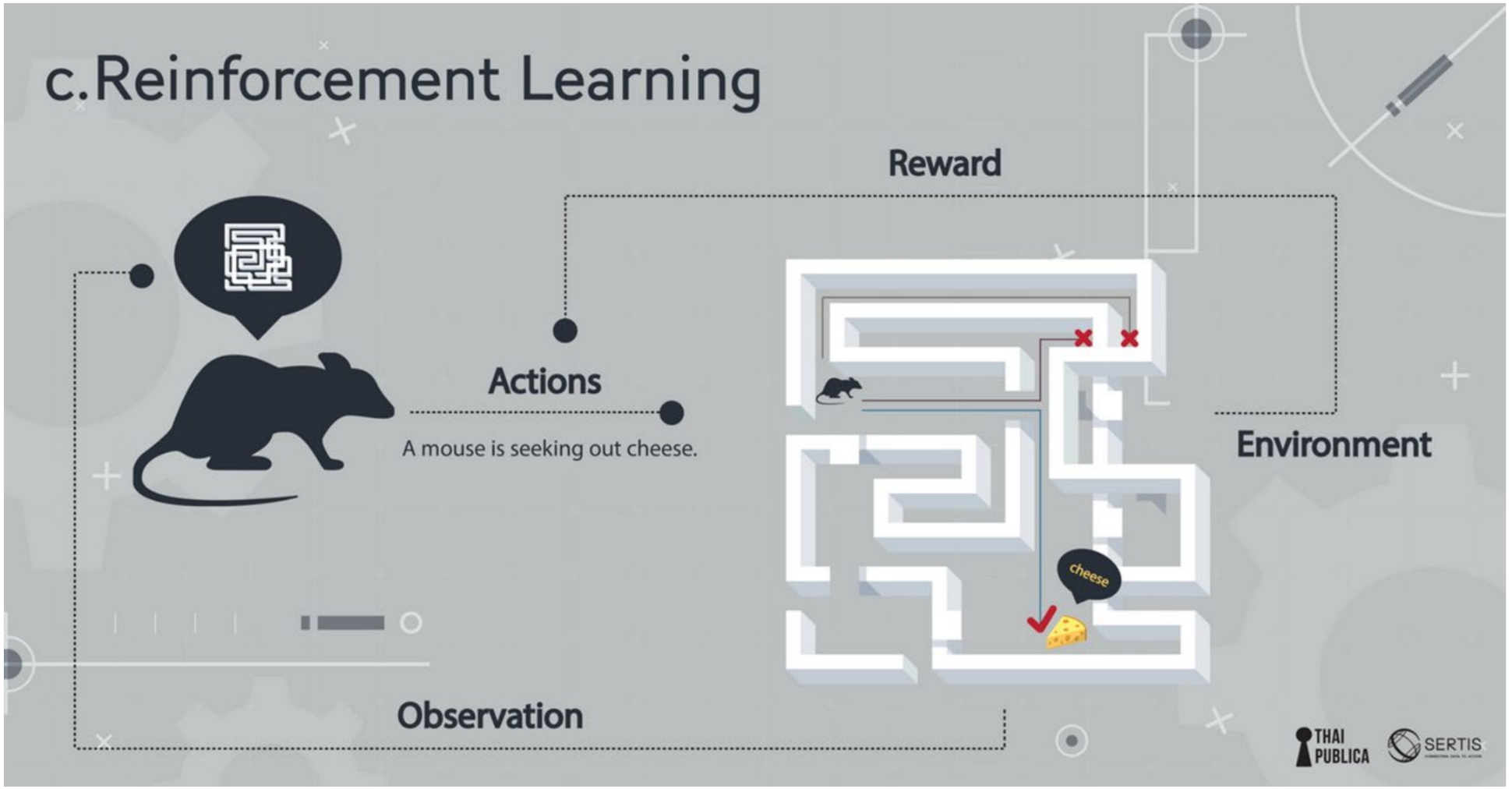
Reinforcement Learning

Reinforcement Learning



Trial and Error

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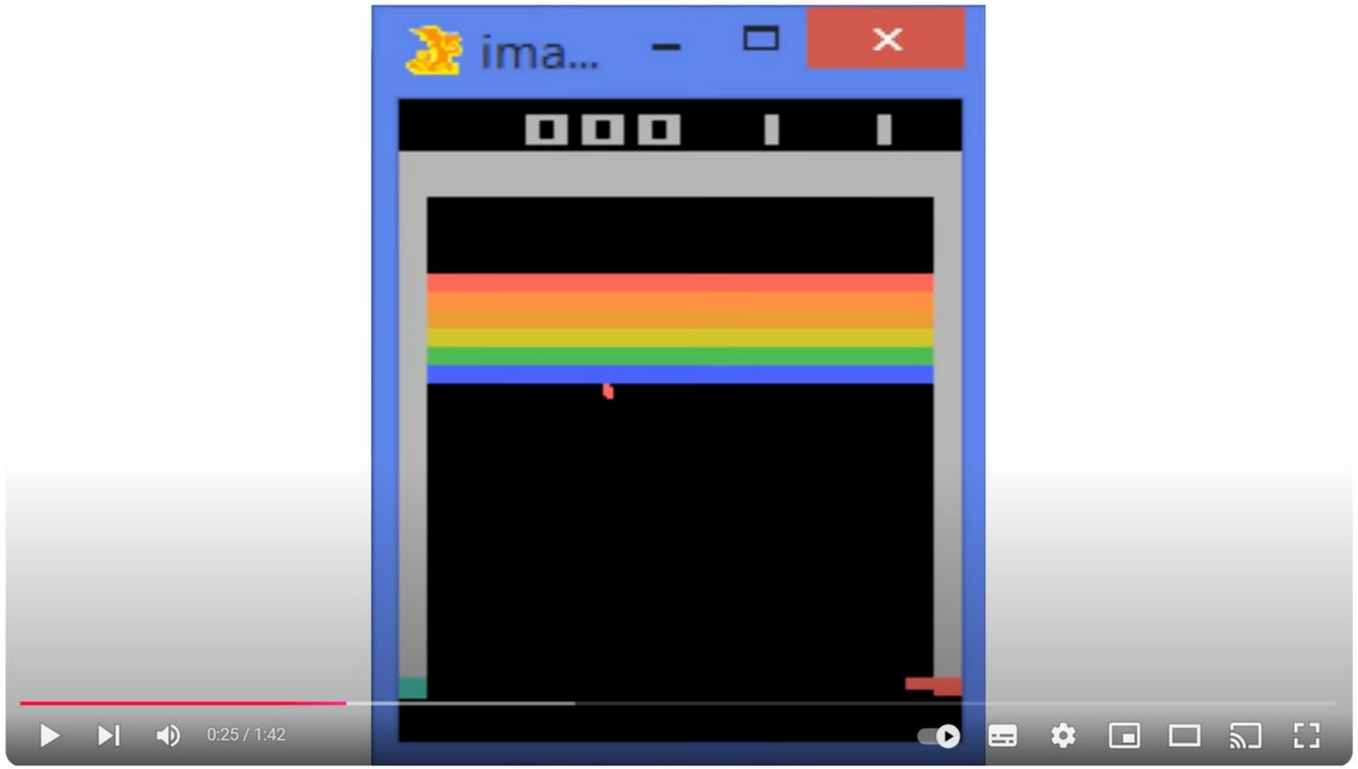
Reinforcement Learning



https://www.youtube.com/watch?v=V1eYniJ0Rnk&t=24s

Ref Link

Reinforcement Learning

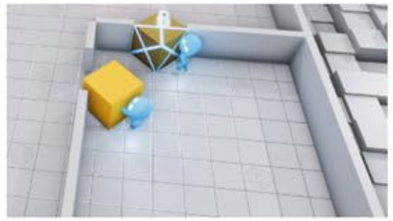
In our environment, agents play a team-based hide-and-seek game. Hiders (blue) are tasked with avoiding line-of-sight from the seekers (red), and seekers are tasked with keeping vision of the hiders. There are objects scattered throughout the environment that hiders and seekers can grab and lock in place, as well as randomly generated immovable rooms and walls that agents must learn to navigate. Before the game begins, hiders are given a preparation phase where seekers are immobilized to give hiders a chance to run away or change their environment.

The agents can **move** by setting a force on themselves in the x and y directions as well as rotate along the z-axis.

The agents can **see** objects in their line of sight and within a frontal cone.

The agents can **sense** distance to objects, walls, and other agents around them using a lidar-like sensor.

The agents can **grab and move** objects in front of them.



The agents can **lock** objects in place. Only the team that locked an object can unlock it.

DeepMind : https://www.youtube.com/watch?v=kopoLzvh5jY

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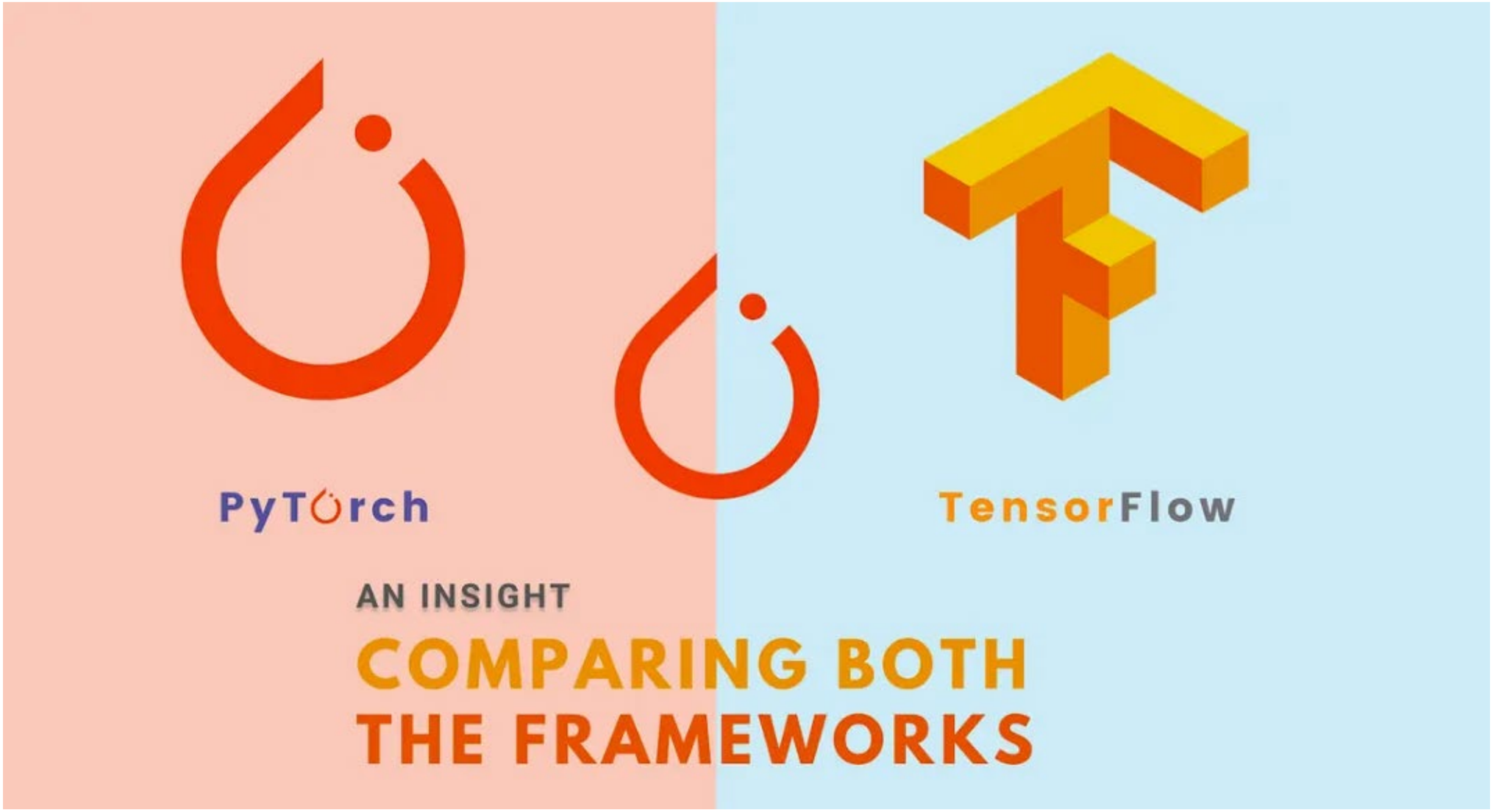
Framework AI



Ref Link

Python = script which fastest in term of develop

C++ = Machines code which slowest in term of develop

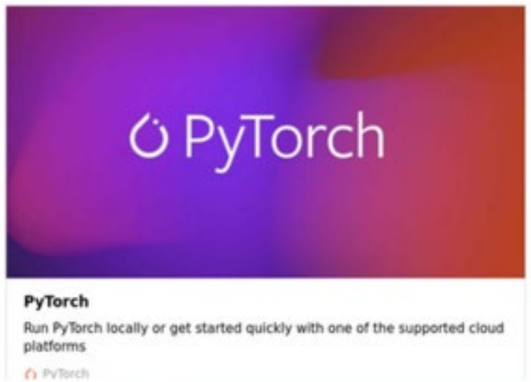
Ref Link

Install Environment

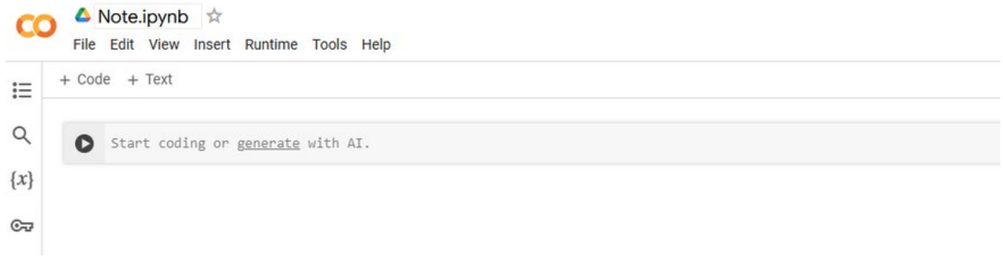
https://code.visualstudio.com

https://www.python.org/downloads/release/python-3912/

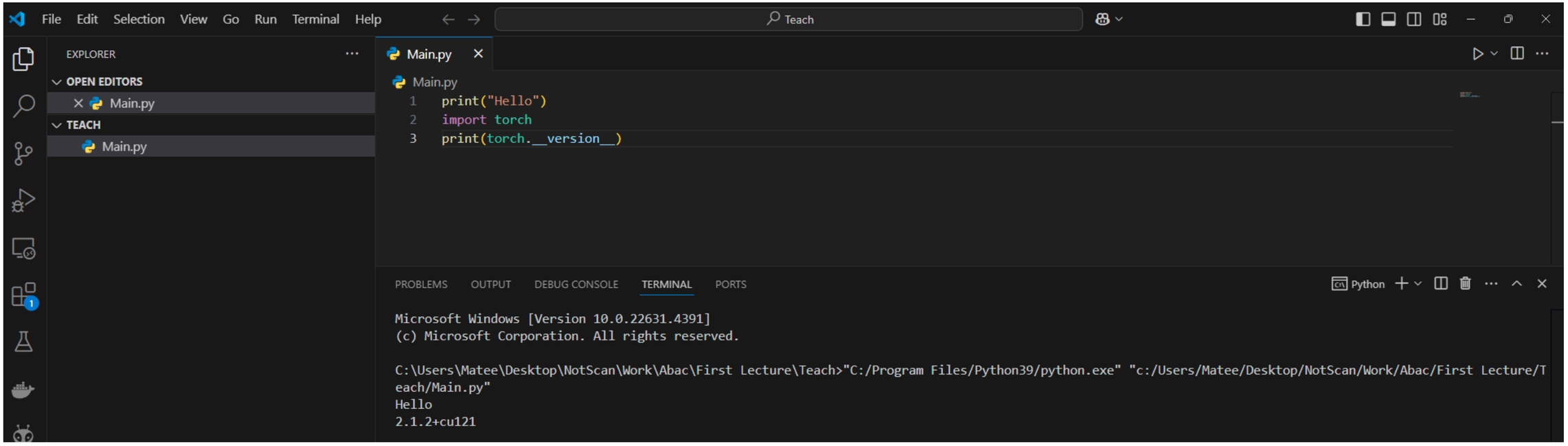
Pytorch: https://pytorch.org/get-started/locally/

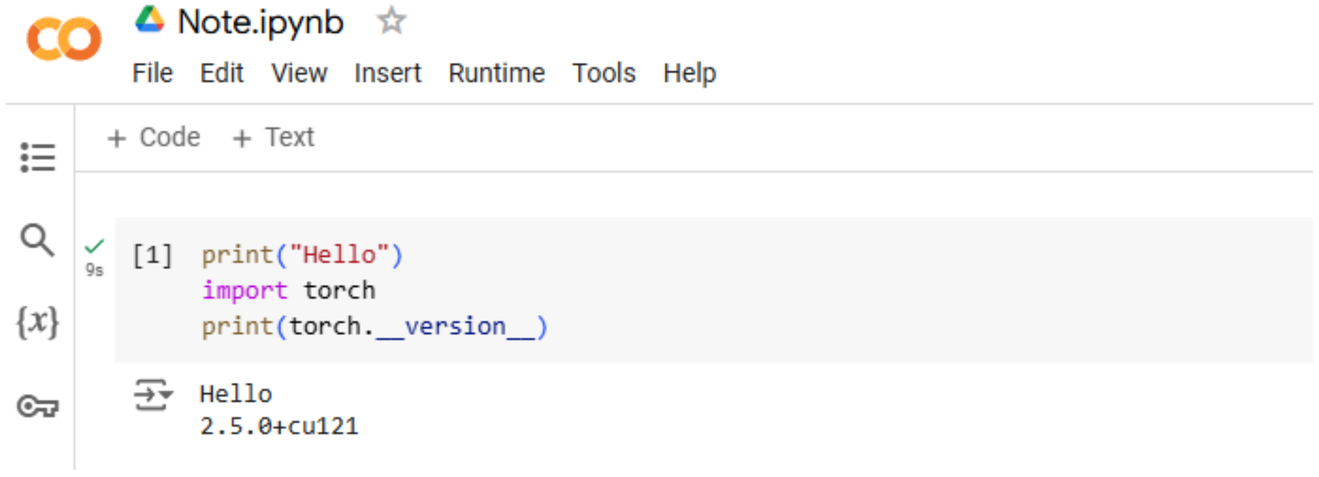


Google Colab: https://colab.google/



Homework Today



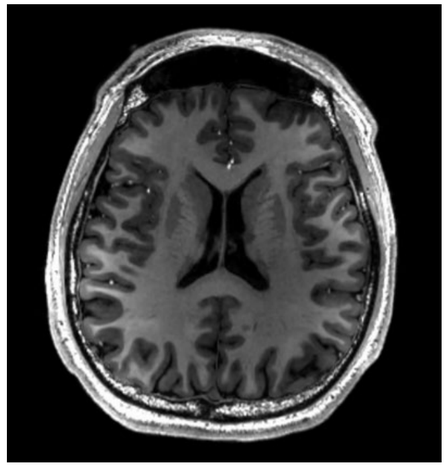


Challenging

- **Lack of Data**: Limited availability of sufficient data for training AI models, hindering their ability to generalize and perform accurately.
- **Computing** Power: High demand for powerful computing units needed to train complex AI models; limited access can slow down development.
- **Quality of Data**: Poor-quality data, such as noisy or biased datasets, can lead to unreliable and biased AI model outputs.
- **Variety of Data**: Insufficient data variety makes it difficult for models to generalize across different scenarios, affecting their robustness and performance.

Challenging

- Lack of Data



Where are these images available?

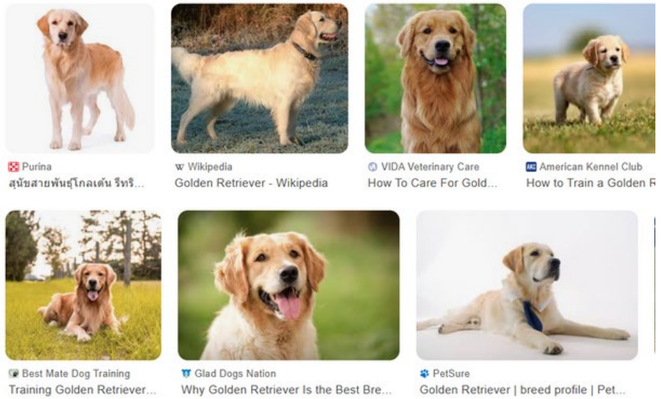
In my experience, 1,000 images are not effective enough for my work.

https://en.wikipedia.org/wiki/Magnetic_resonance_imaging_of_the_brain

Challenging

- Bias

Train Images



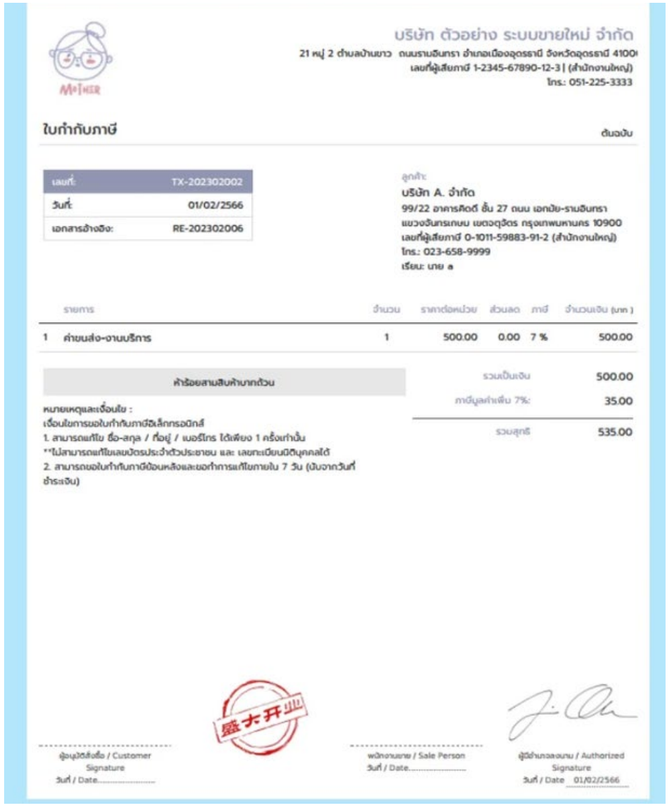
google search golden ritriever

Test Images

google search Albino Tanuki

Week	Topic	Contents
Week 1	Introduction to AI and Programming Environment	- Discuss the scope and impact of artificial intelligence. - Review the essential tools and environments for AI development.
Week 2	Basic Mathematics for Machine Learning	- Review basic mathematical concepts essential for AI. - Highlight the importance of statistics and probability in machine learning.
Week 3	Linear Regression: MLE and MAP	- Explore the concepts of estimation techniques in statistics. - Examine applications of these techniques in machine learning.
Week 4	Clustering Algorithms	- Understand different clustering methods and their uses, such as K-Means, DBSCAN, and Self-Organizing Map. - Discuss the applications of clustering in various AI scenarios.
Week 5	Online Search, Learning, Real-Time Search Techniques	-Explore strategies for heuristic-based optimization in pathfinding and real-time decision-making. -Discuss the application of informed search strategies to efficiently navigate through complex search spaces.
Week 6	Neural Networks: Mathematical Insights	- Introduce the mathematical underpinnings of neural networks. - Discuss the relevance of these concepts to learning processes.
Week 7	Neural Networks: Implementation	- Cover the implementation aspects of neural networks. - Explore tools and libraries commonly used in neural network implementation.
Week 8	Data Preparation for Machine Learning	- Discuss the steps involved in preparing data for analysis. - Emphasize the importance of data quality and preprocessing.
Week 9	Introduction to Convolutional Neural Networks (CNN)	- Explain the basic principles of CNNs. - Discuss their application in image.
Week 10	Introduction to Image Classification, Object Detection, and Image Segmentation	- Discuss the various approaches to image classification. - Explore techniques for object detection and segmentation.
Week 11	Transfer Learning	- Discuss the concept of leveraging pre-existing models for new problems. - Explore the benefits and challenges of transfer learning.
Week 12	Introduction to Generative Adversarial Networks (GAN)	- Introduce the concept and architecture of GANs. - Discuss various applications of GANs in creative and analytical contexts.
Week 13	Introduction to Natural Language Processing (NLP)	- Discuss the fundamental techniques used in NLP. - Explore the impact of NLP on understanding and generating human language.
Week 14	Introduction to Reinforcement Learning	- Introduce basic concepts and applications of reinforcement learning. - Discuss how these techniques are used in real-world AI systems.
Week 15	Project Presentation	- Project presentation - Report of their project

Assignment 1



บริษัท ตัวอย่าง ระบบขายใหม่ จำกัด
21 หมู่ 2 ตำบลป่าหมาว ถนนรามอินทรา อำเภอเมืองอุดรธานี จังหวัดอุดรธานี 4100
เลขที่ผู้เสียภาษี 1-2345-67890-12-3 | (สำนักงานใหญ่)
โทร.: 051-225-3333

ใบกำกับภาษี ต้นฉบับ

เลขที่:	TX-202302002
วันที่:	01/02/2566
เอกสารอ้างอิง:	RE-202302006

ลูกค้า:
บริษัท A. จำกัด
99/22 อาคารคิดดี ชั้น 27 ถนน เอกมัย-รามอินทรา
แขวงจันทรเกษม เขตจตุจักร กรุงเทพมหานคร 10900
เลขที่ผู้เสียภาษี 0-1011-59883-91-2 (สำนักงานใหญ่)
โทร.: 023-658-9999
เรียน: นาย a

	รายการ	จำนวน	ราคาต่อหน่วย	ส่วนลด	ภาษี	จำนวนเงิน (บาท)
1	ค่าขนส่ง-งานบริการ	1	500.00	0.00	7 %	500.00

ห้าร้อยสามสิบห้าบาทถ้วน

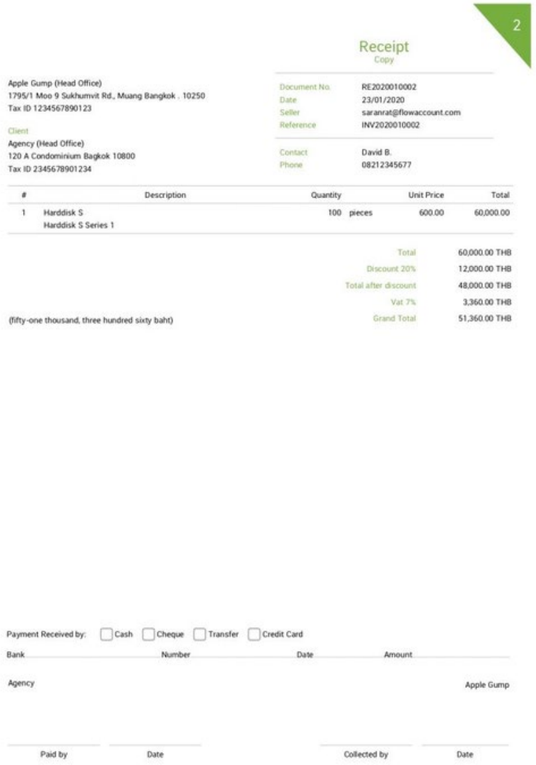
รวมเป็นเงิน	500.00
ภาษีมูลค่าเพิ่ม 7%:	35.00
รวมสุทธิ	535.00

หมายเหตุและเงื่อนไข :
เงื่อนไขการออบใบกำกับภาษีอิเล็กทรอนิกส์
1. สามารถแก้ไข ชื่อ-สกุล / ที่อยู่ / เบอร์โทร ได้เพียง 1 ครั้งเท่านั้น
**ไม่สามารถแก้ไขเลขบัตรประจำตัวประชาชน และ เลขทะเบียนนิติบุคคลได้
2. สามารถออบใบกำกับภาษีฉบับหลังและยกเลิกการแก้ไขภายใน 7 วัน (นับจากวันที่ชำระเงิน)

ผู้ซื้อ / Customer Signature
วันที่ / Date.....

พนักงานขาย / Sale Person
วันที่ / Date.....

ผู้มีอำนาจลงนาม / Authorized Signature
วันที่ / Date 01/02/2566



2

Receipt
Copy

Apple Gump (Head Office)
1795/1 Moo 9 Sukhumvit Rd., Muang Bangkok , 10250
Tax ID 1234567890123

Client
Agency (Head Office)
120 A Condominium Bagkok 10800
Tax ID 2345678901234

Document No. RE2020010002
Date 23/01/2020
Seller saranran@flowaccount.com
Reference INV2020010002

Contact David B.
Phone 08212345677

#	Description	Quantity	Unit Price	Total
1	Harddisk S Harddisk S Series 1	100 pieces	600.00	60,000.00

Total	60,000.00 THB
Discount 20%	12,000.00 THB
Total after discount	48,000.00 THB
Vat 7%	3,360.00 THB
Grand Total	51,360.00 THB

(fifty-one thousand, three hundred sixty baht)

Payment Received by: Cash Cheque Transfer Credit Card

Bank Number Date Amount

Agency

Apple Gump

Paid by Date

Collected by Date

CP ALL, 7-Eleven พ้อยขวาง 1(08076)
TAX#0107542000011(VAT Included)
Vat 06177 POS# :D9408C0000200202

ใบเสร็จรับเงิน/ใบกำกับภาษีอย่างย่อ

1	มาม่าคัพ ต้มยำกุ้ง		13.00
1	เป๊ปซี่ 1 ลิตร		24.00
1	เป๊ปซี่ 1 ลิตร		24.00
1	มาม่าคัพ รสหมูสับ		13.00
1	มะม่วงหิมพานต์ 7se		20.00
1	UHTโลว์ลิน่ชลดฯ		13.00
1	UHTโลว์ลิน่ชลดฯ		13.00
1	โลว์ลิน่นี่ส์ 12G		5.00
1	โลว์ลิน่นี่ส์ 12G		5.00
1	โลว์ลิน่นี่ส์ 12G		5.00
5	แสตมป์ 1 บาท	@0.00	0.00NP
3	แสตมป์ 3 บาท	@0.00	0.00NP
Total	(18)	135.00	
Purse		135.00	

TID #15021599 TRACE #016966
R#0001366800 P1:0797427 31/08/59 19:28
ศูนย์สมาชิกบัตร7-11 Value Card 0-2711-7777
------ ข้อมูลบัตร 4629510101659416 ------

	ครั้งนี้	คงเหลือ
Purse (บาท)	-135.00	181.50
Point (แต้ม)	+65	6250

- 200 Bills Without Buyer Details
- 100 Completed Bills

Deadline: 22 Nov 2024

Submit: Google Classroom

Questions?