Fundamentals of AI/ML

Session-1

TODAY

WHAT IS AI

ANI, AGI, ASI

1

BRANCHES OF AI

ML, Neural networks, DL, NLP, Robotics

2

Types of Algorithms

Supervised, Unsupervised ..

3

Generative AI

An application of ML

4

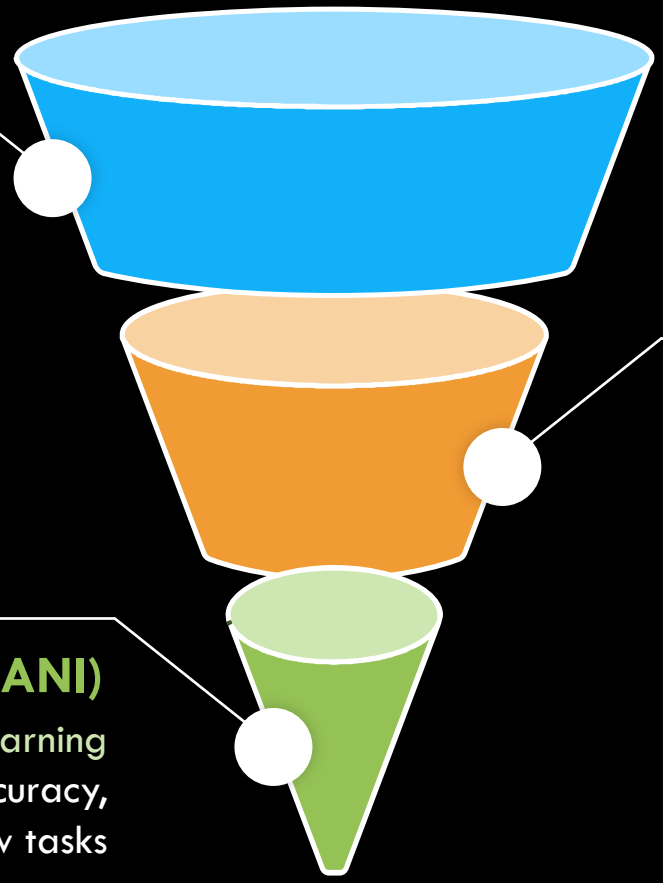
Applications

Brief case studies of studio use cases

5

What is Artificial Intelligence

Development of systems that can perform tasks requiring human-like intelligence



Artificial Super Intelligence (ASI)

Machine Consciousness

Better than humans in every task

Hypothetical future possibility

Artificial General Intelligence (AGI)

Machine Intelligence

Capable like humans in every task

- A goal for the future

Artificial Narrow Intelligence (ANI)

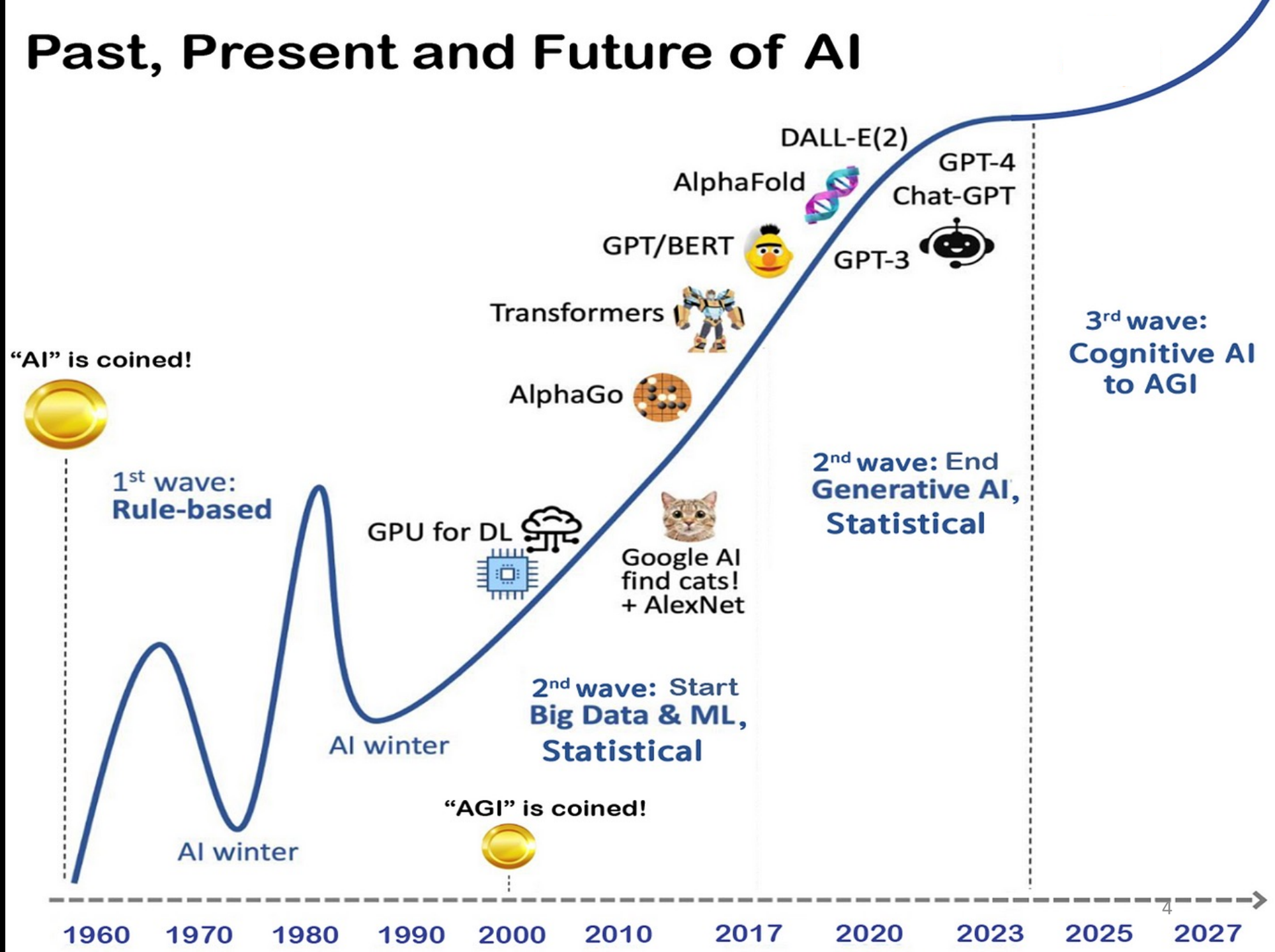
Machine Learning

performs specific tasks with high accuracy,

but unable to adapt to new tasks

- Exists now

Towards AGI



Source: https://medium.com/@petervoss/why-we-dont-have-agi-yet-and-how-to-change-that-33cc93cd0974

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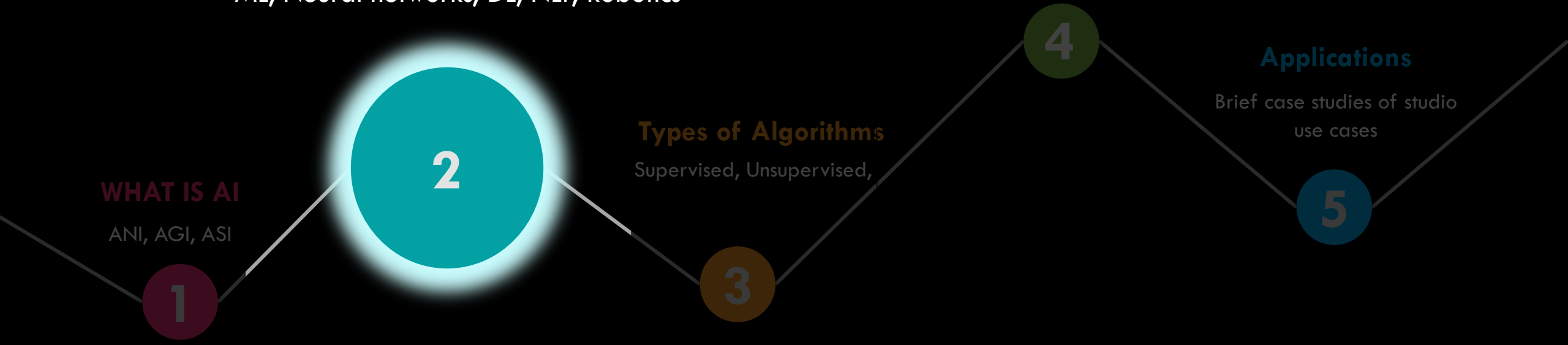
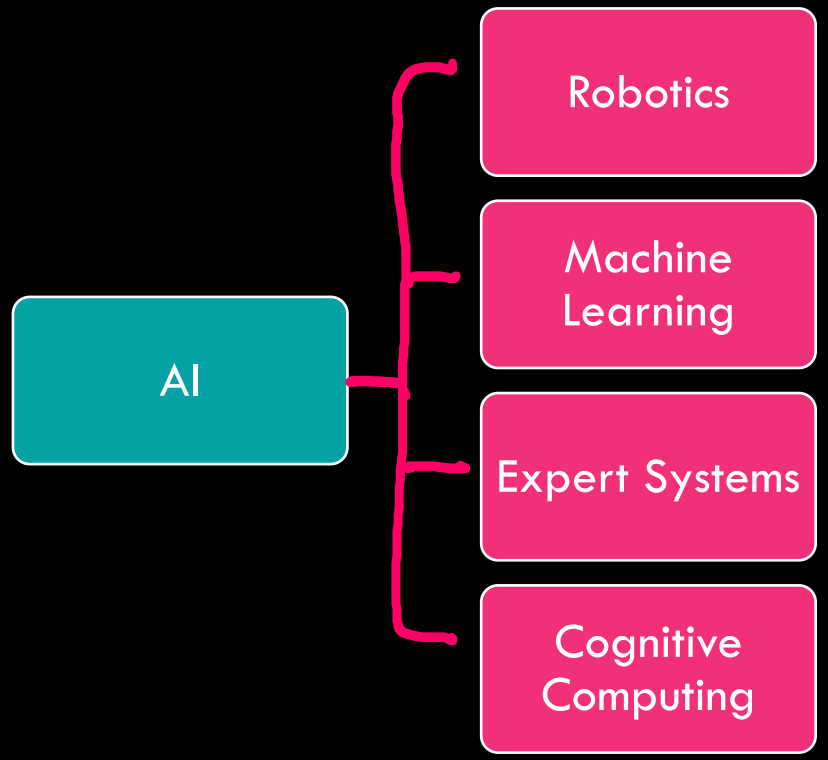
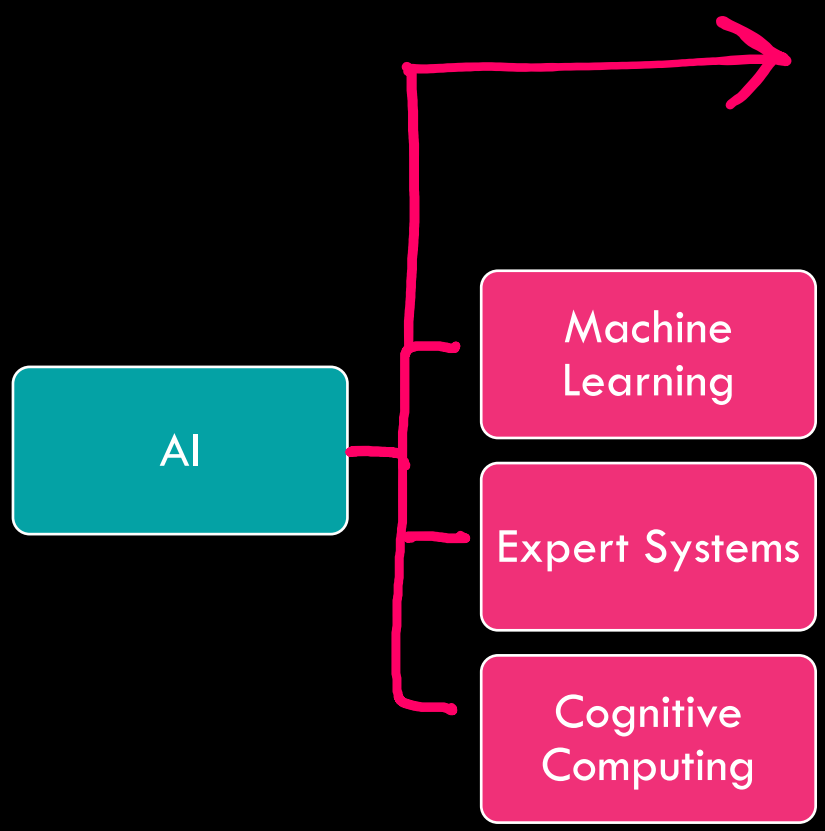


Branches of AI

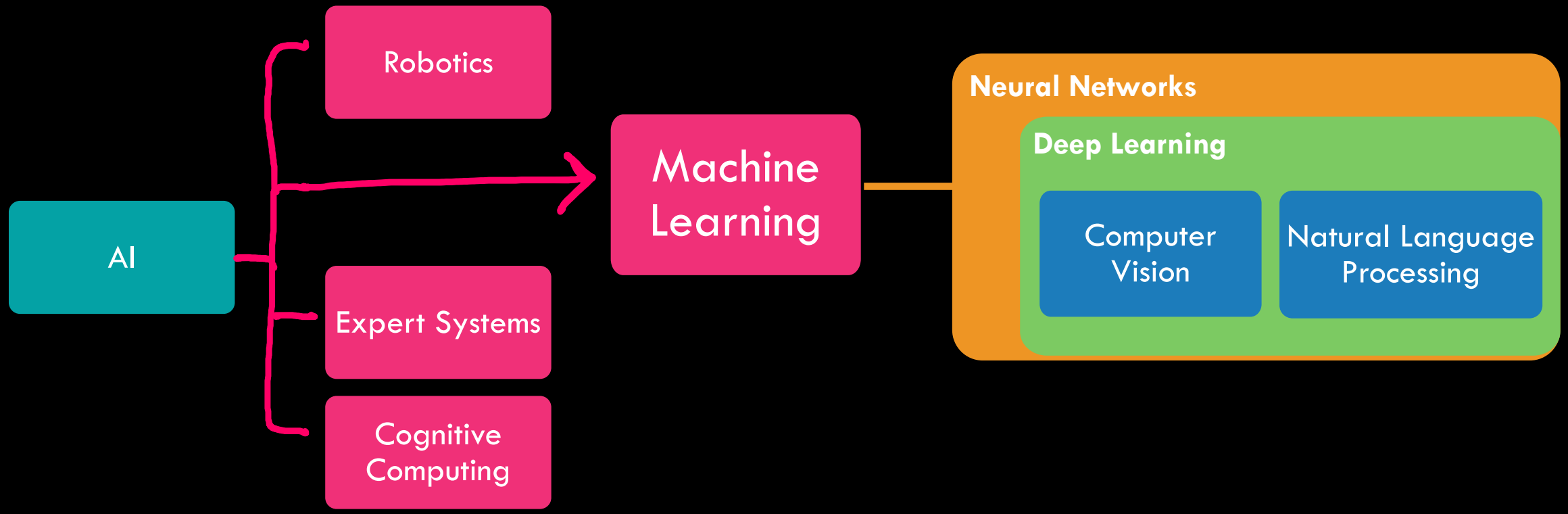


Branches of AI - Robotics



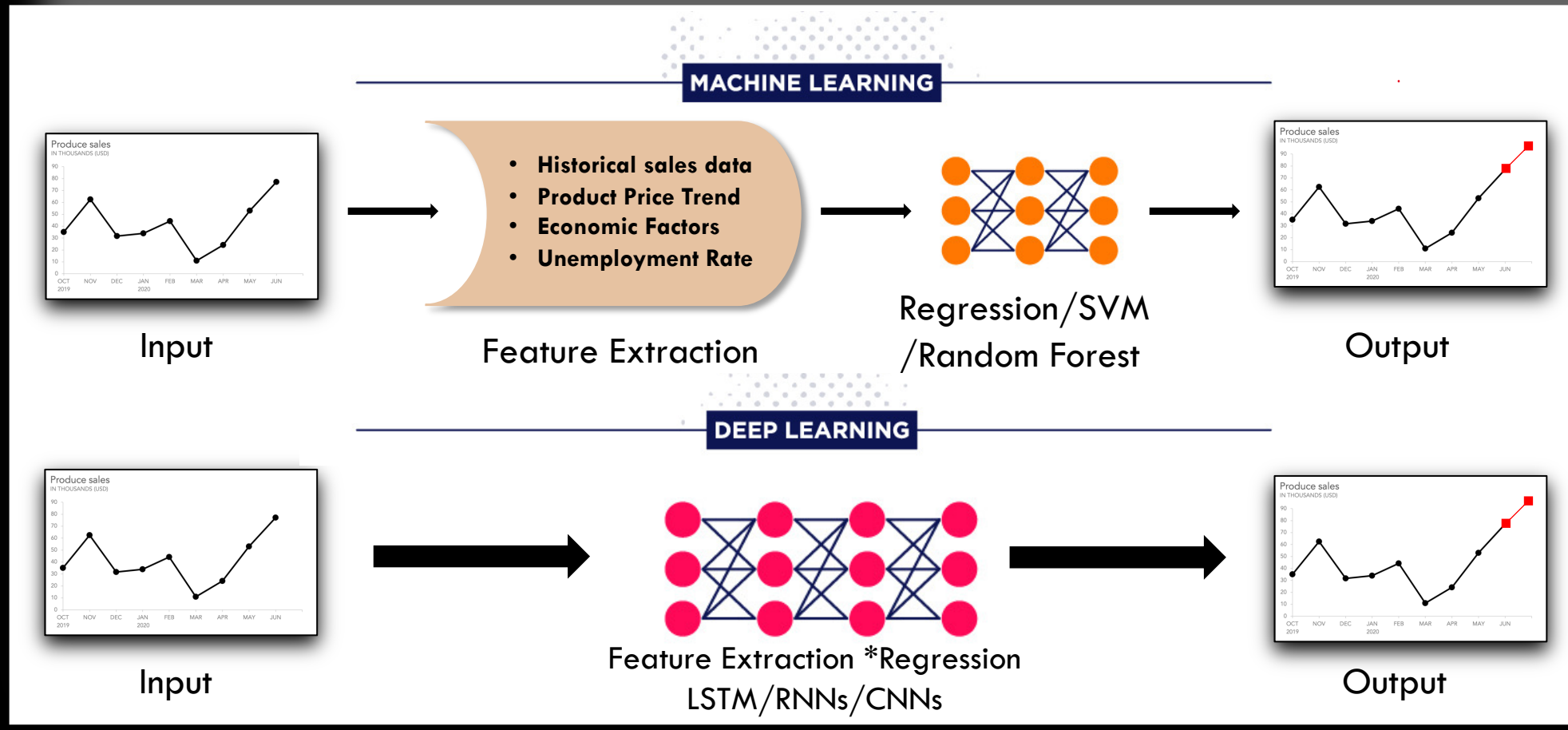
Dynamics' robots, like Spot, employ AI to navigate various terrains and perform tasks.

Branches of AI - ML

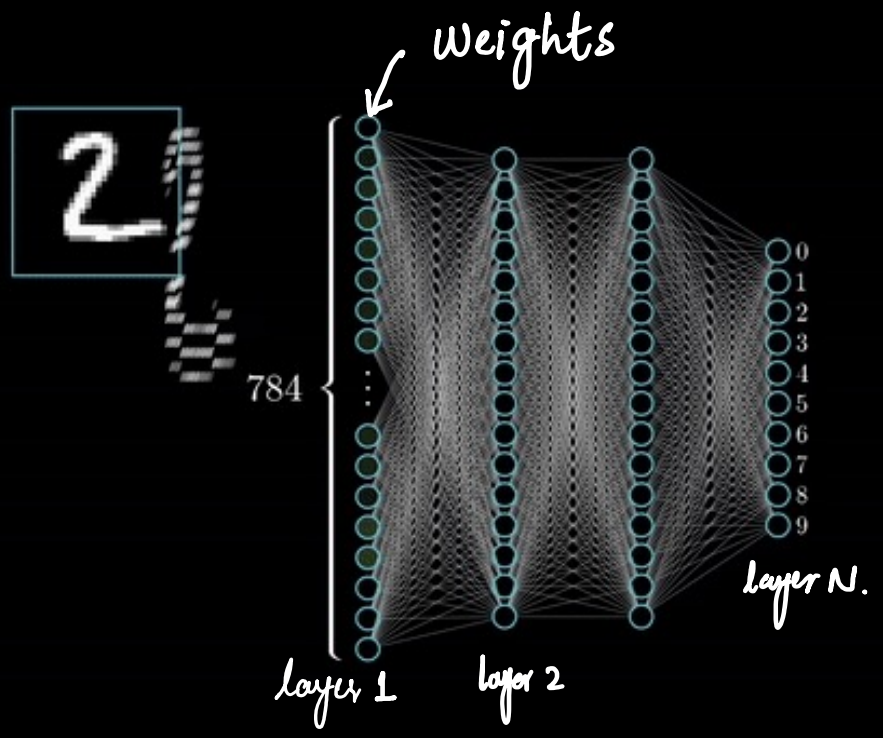


ML vs DL

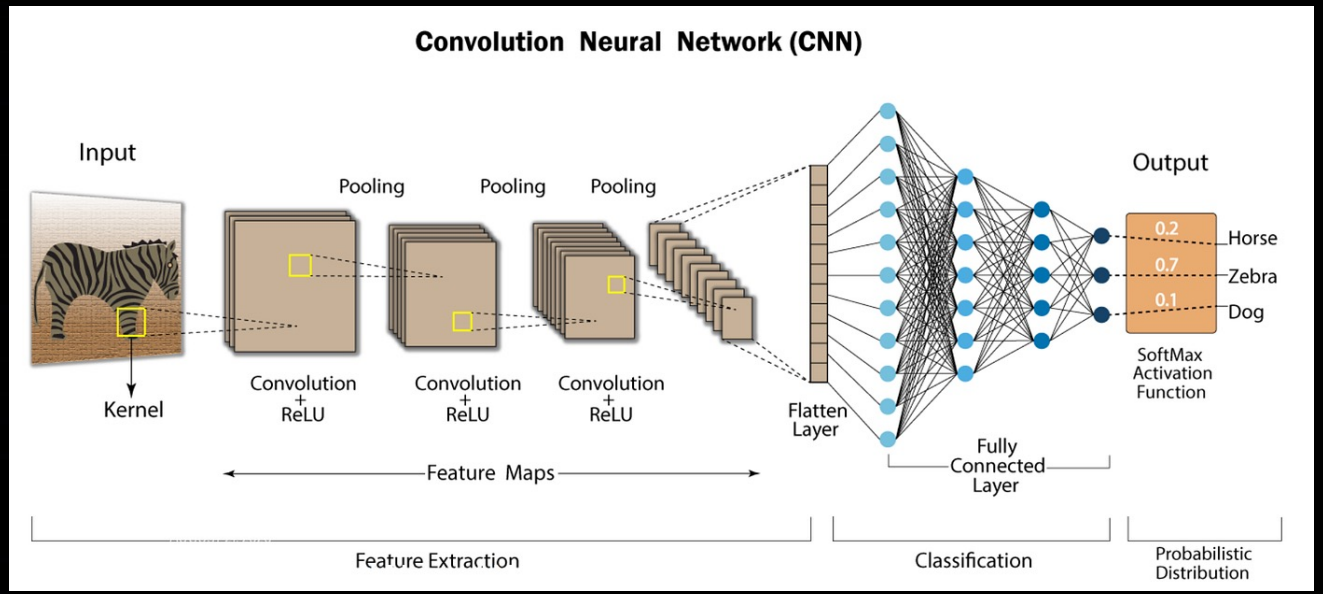
Use Case : Predict/forecast next month's sales.



DNN VS Convolutional Neural Networks (CNN)

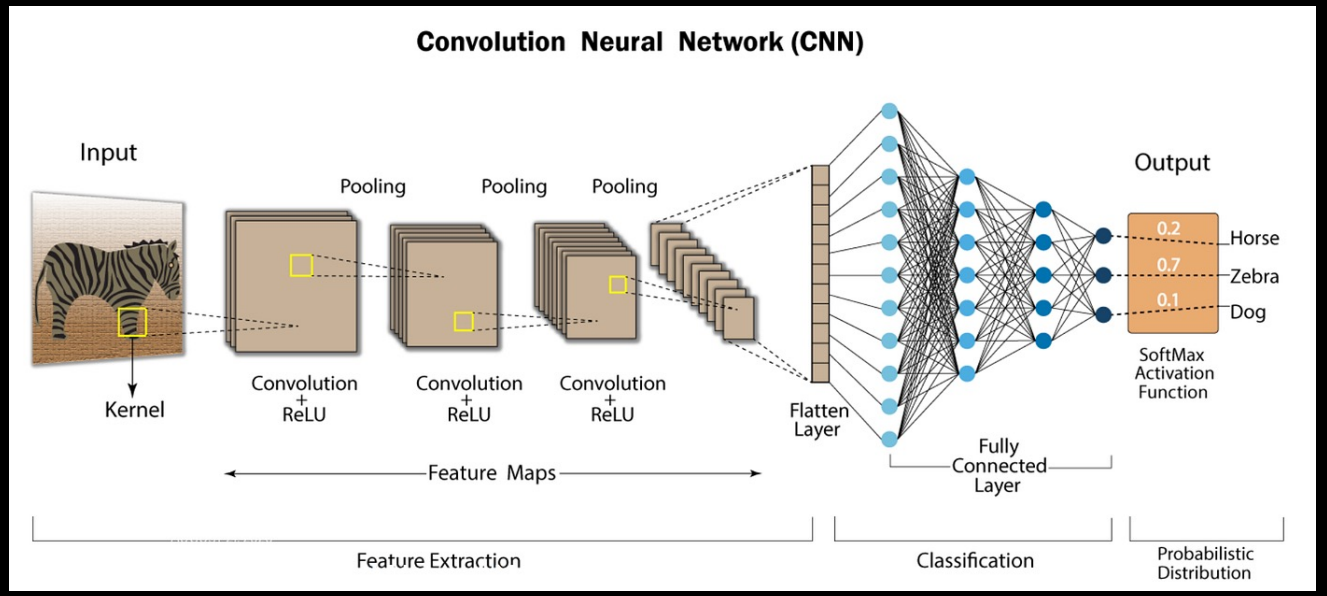


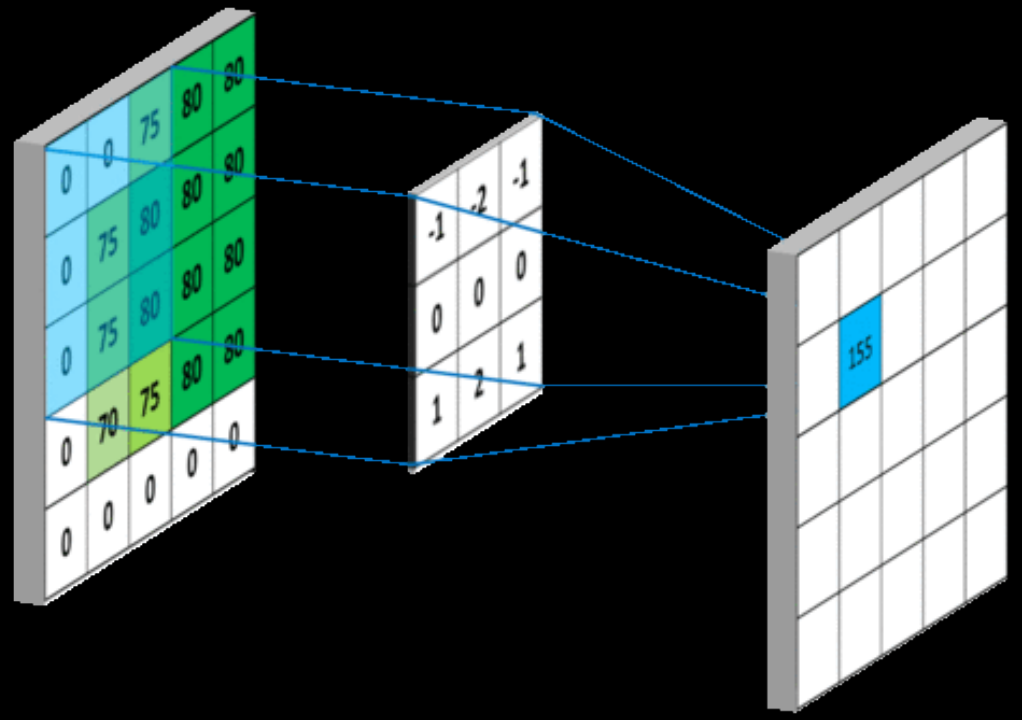
Deep Nueral Network



Convolutional Nueral Network

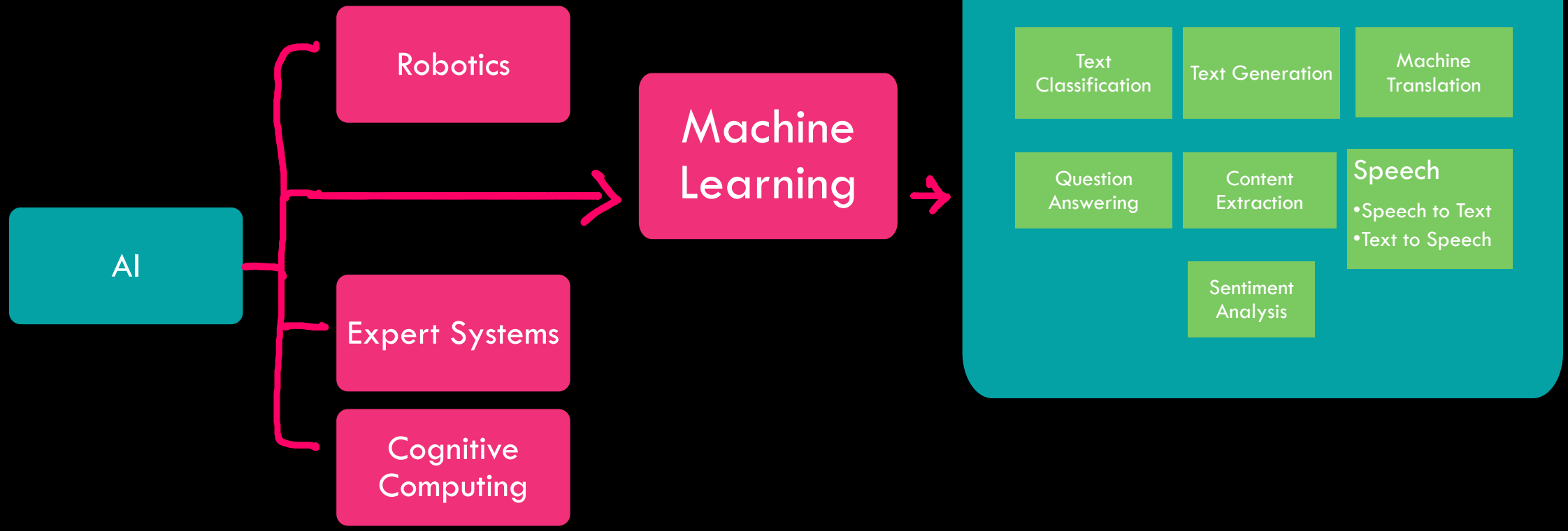
Convolutional Neural Networks (CNN)



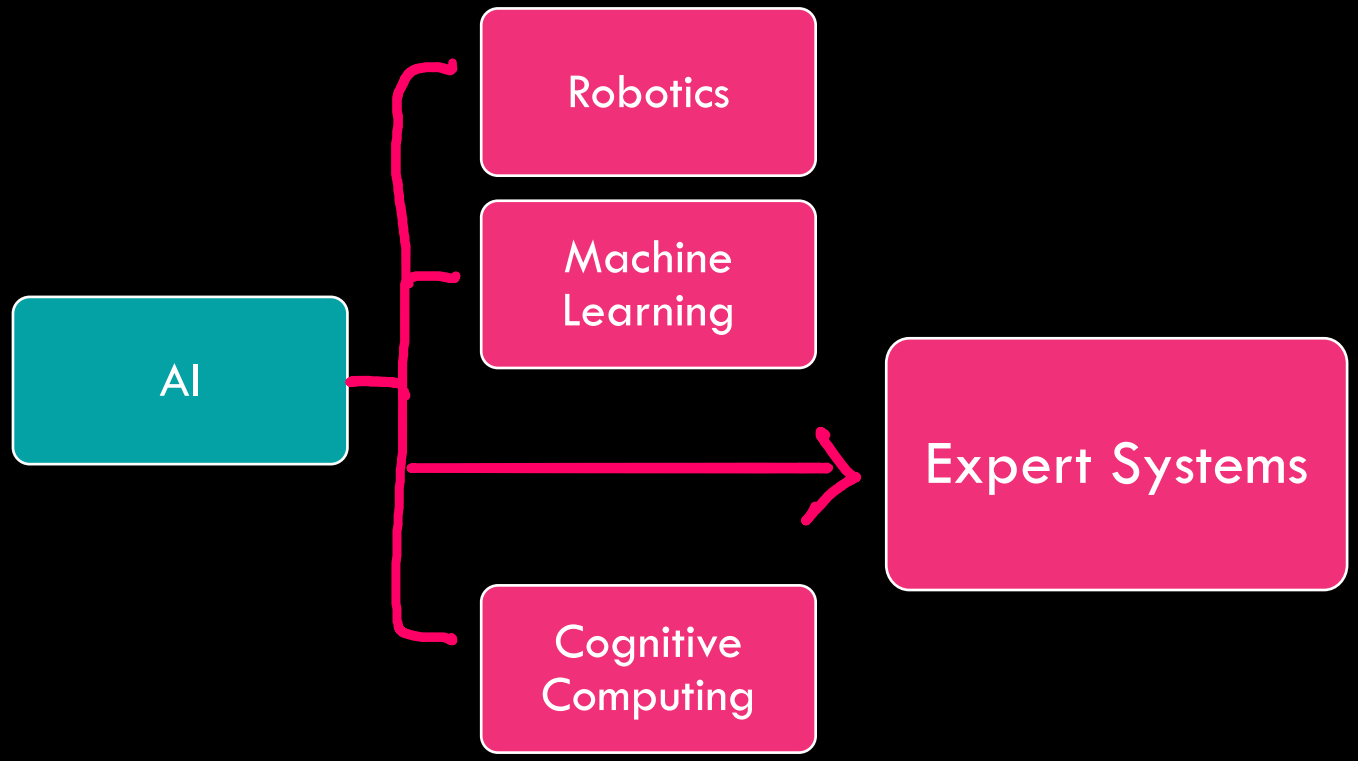


Process of convolution.

ML - NLP

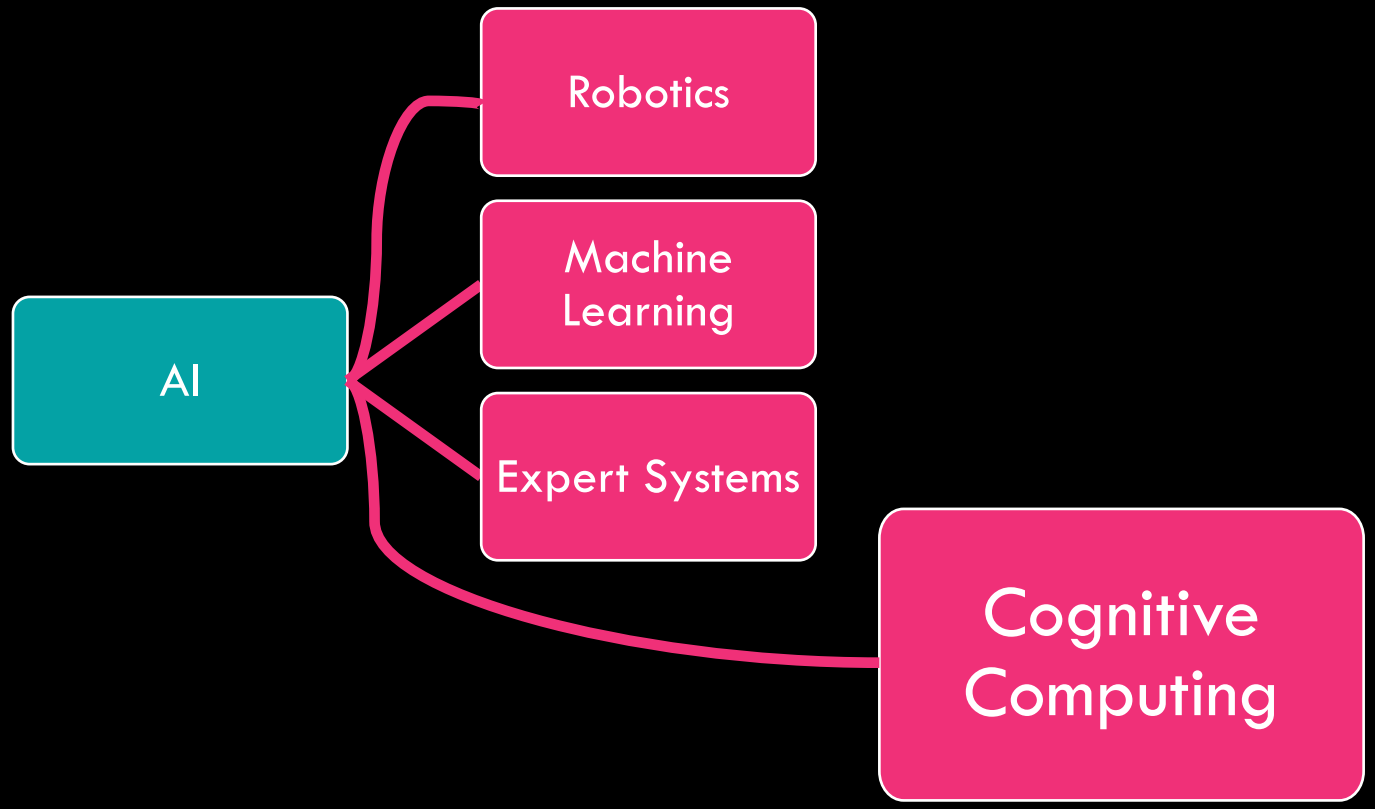

AI
Robotics
Expert Systems
Cognitive Computing
Machine Learning
Natural Language Processing (NLP)
Text Classification
Text Generation
Machine Translation
Question Answering
Content Extraction
Speech
•Speech to Text
•Text to Speech
Sentiment Analysis

Branches of AI – Expert Systems



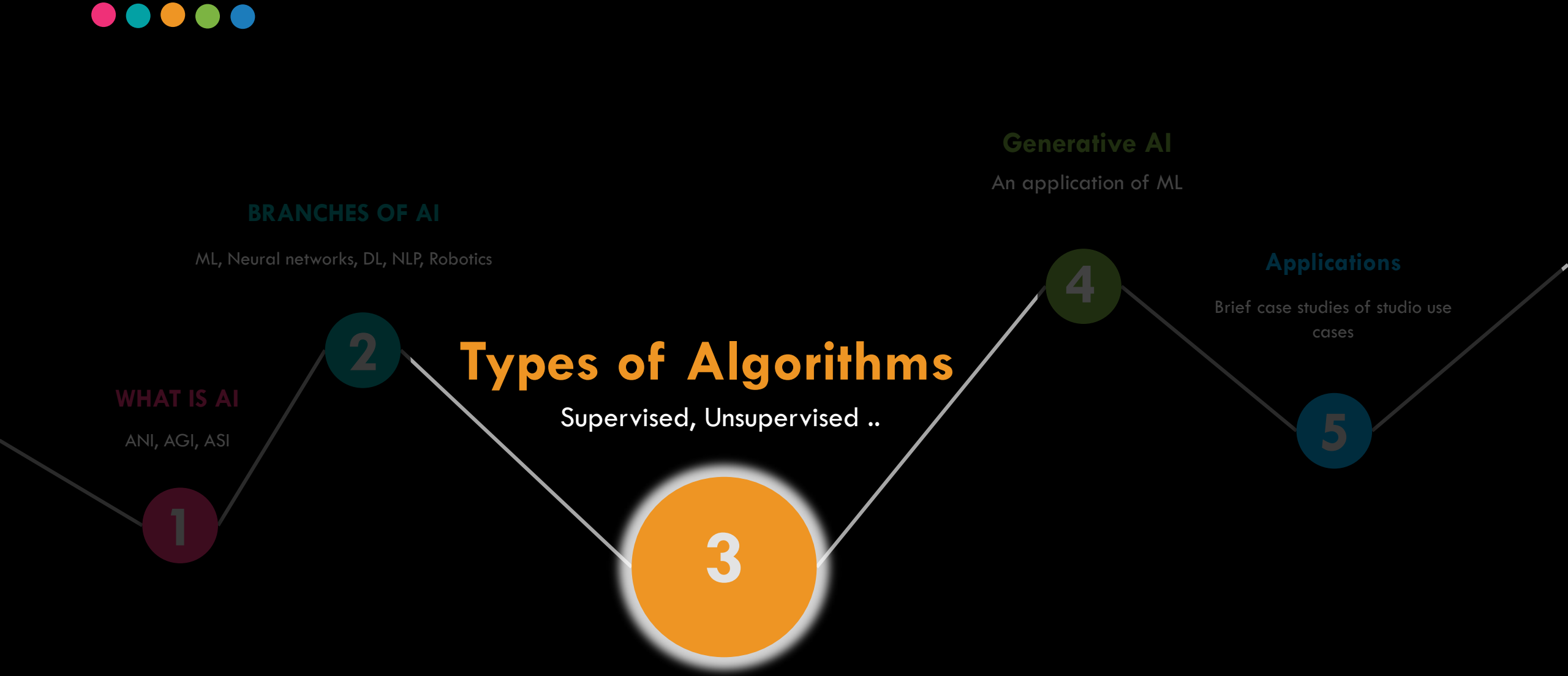
IBM's Watson can analyse large volumes of data and provide expert recommendations in fields like healthcare.

Branches of AI – Cognitive Computing



Google's DeepMind has developed AlphaFold, which predicts protein folding and assists in biological research.

TODAY



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Applications

Brief case studies of studio use cases

Machine Learning

A subset of AI focused on the idea that systems can learn from data, identify patterns, and make decisions.

Supervised Learning

models are trained on **labelled** data.

Reinforcement Learning

an agent learns to make **decisions** by taking **actions** in an **environment** to achieve a goal.

Unsupervised Learning

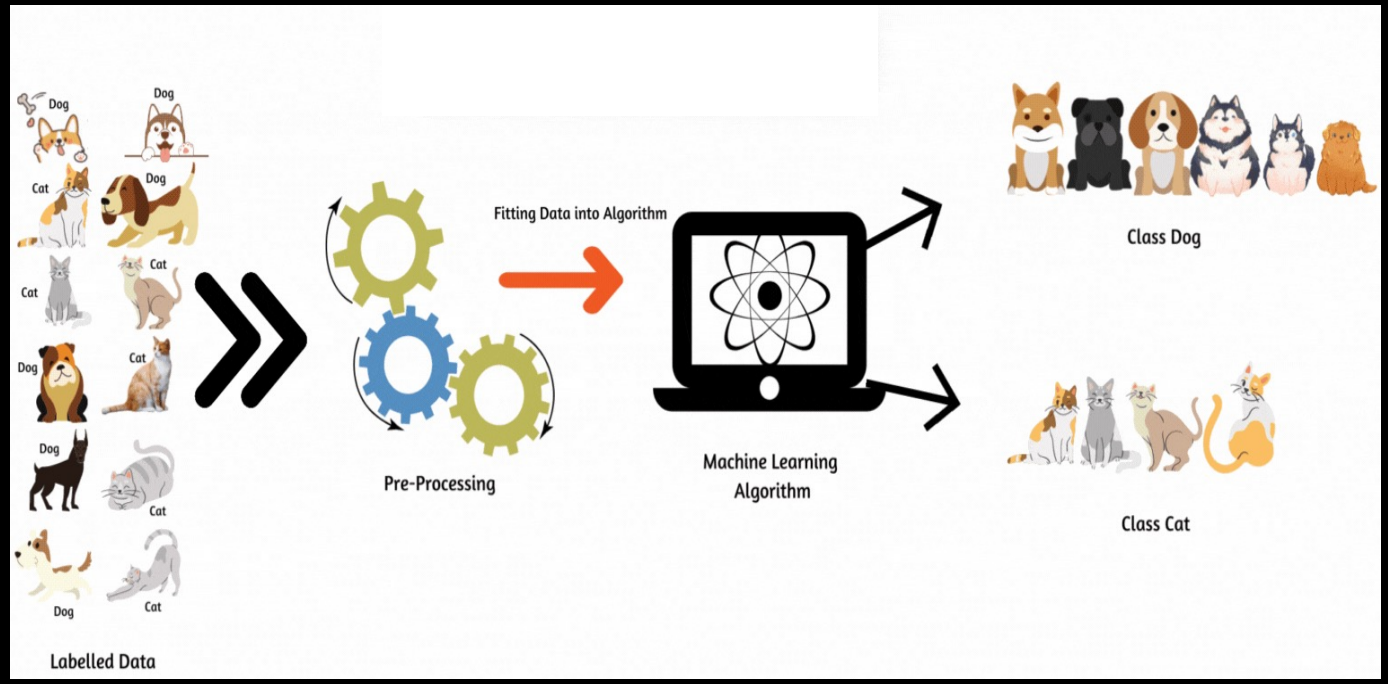
models learn **patterns** from **untagged** data.

Self/Semi Supervised Learning

Bridges the gap between supervised and unsupervised learning

Supervised Learning

LEARNING WITH A TEACHER, WHERE THE MODEL LEARNS FROM LABELLED DATA.



- **Classification**
- **Regression**

Examples

- Image recognition (labelling images with categories).
- Spam detection (identifying emails as spam or not spam).
- Face detection using Yolov8

Challenges

- Requires a large dataset of examples with known outcomes.
- The quality and quantity of the training data significantly affect the model's performance.

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Unsupervised Learning

Learning without a teacher, discovering hidden patterns in data

Clustering
(Divide by similarity)

Customer segmentation

grouping customers with similar behaviours

Social network Analysis

Cluster individuals in social networks according to their interest, interactions

Association
(Identify Sequences)

Market Basket Analysis

Cluster products bought together

- *Used for product placement, retail recommendation systems.*

Product Development

Identify associations between product features and customer satisfaction

Dimensionality Reduction

Visualization

Visualize big data with dimensionality reduction on 2D/3D

- *PCA, tSNE*

Algorithms

Classical ML

K-Means Clustering, DBSCAN, Principal Component Analysis (PCA), t-Distributed Stochastic Neighbor Embedding (t-SNE)

Deep Learning

Autoencoders

Generative Adversarial Networks (GANs)

Word Embeddings:

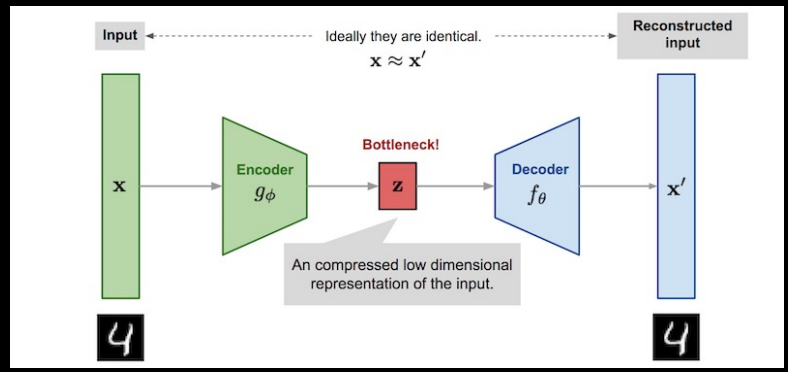
Unsupervised DL Algorithms

Autoencoders

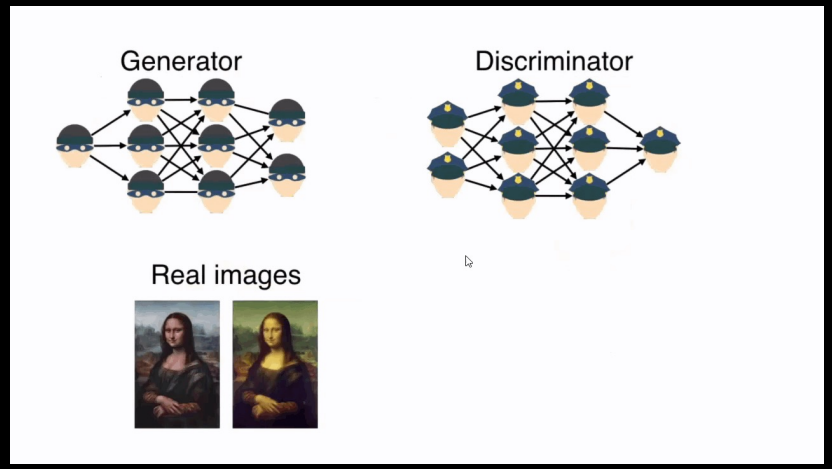
encoder: input → vector (image → [0.1, 0.3, .. 0.9])

decoder: vector → output (vector [0.1, 0.3 .. 0.9] → image)

NN architecture used for dimensionality reduction, data compression



Generative Adversarial Networks (GANs)



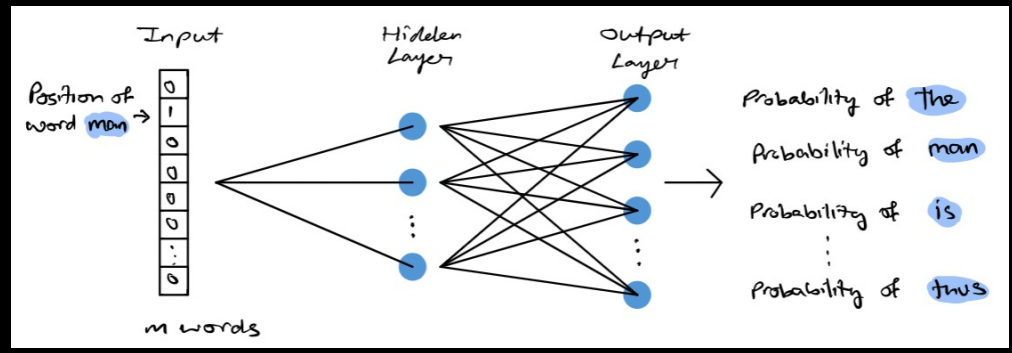
Word Embeddings

Dense vector representation of Words, uncovering semantic meaning, fundamental to NLP

Word2Vec by Google

GloVe by Stanford

FastText by meta



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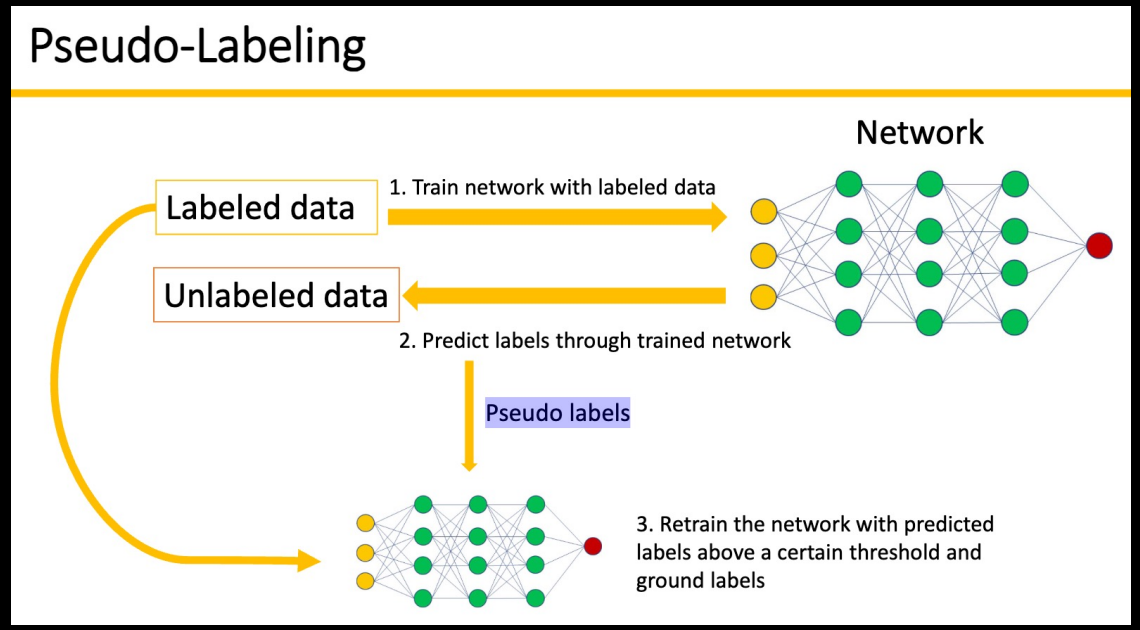
Bridges the gap between supervised and unsupervised learning

Semi-Supervised Learning

Learn a better prediction rule together from labelled and unlabeled data

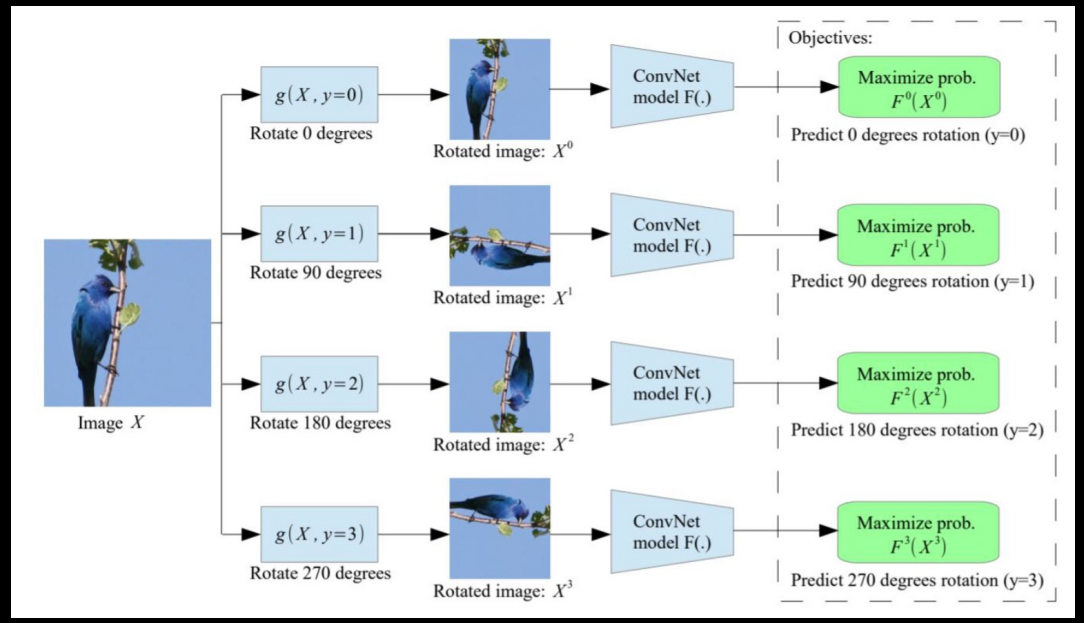


Use Cases

- Utilized in foundational Models like SAM
- Automatic Speech Recognition (ASR) by Meta – pseudo labelling on multilingual unlabeled data

Self-Supervised Learning

Multi-class classification problem with pretext tasks to learn new representations



Use Cases

- Language models predicting missing words in sentences.

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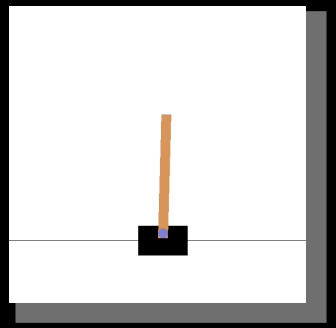
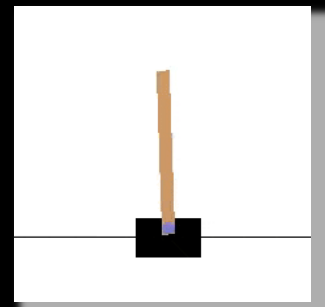
Untrained agent



Reinforcement Learning

Trained agent



How it works: The agent receives rewards or penalties for the actions it takes, guiding it toward the best strategy.

Problem

Robot must find optimized path to destination

Goal

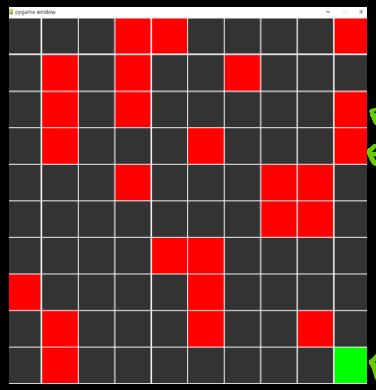
Maximize the reward

Actions

Move up, down, left, right

Reward Function

100 points for goal state
-100 points for obstacles
0 points for other states



Obstacles

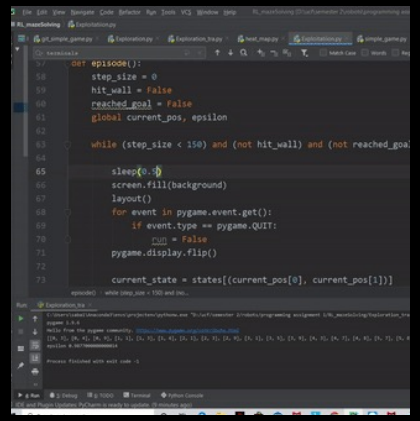
Goal state

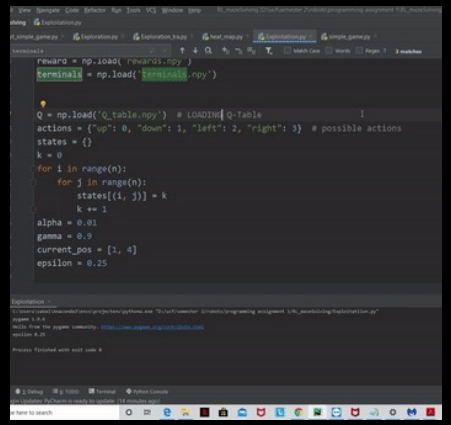
Environment

10x10 maze

Robot explores the maze through a series of episodes, and eventually learns to reach destination by taking minimum number of steps.

- Initially agent takes random action -> results in new state



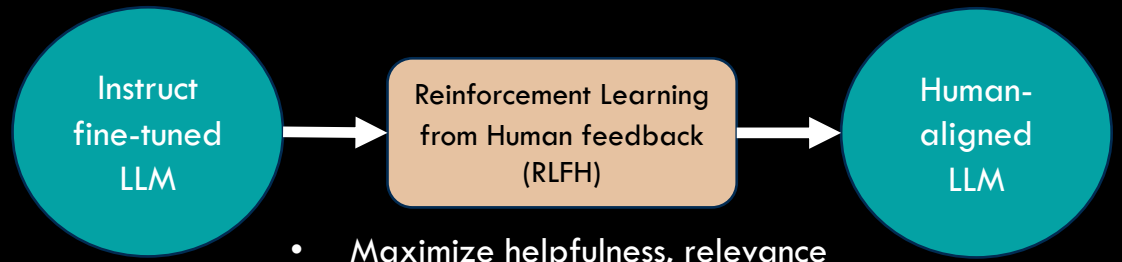


Trained agent

Reinforcement Learning and Language Models

Aligning Models with Human Values

- Large models trained on vast amount data from internet -> provide dangerous information



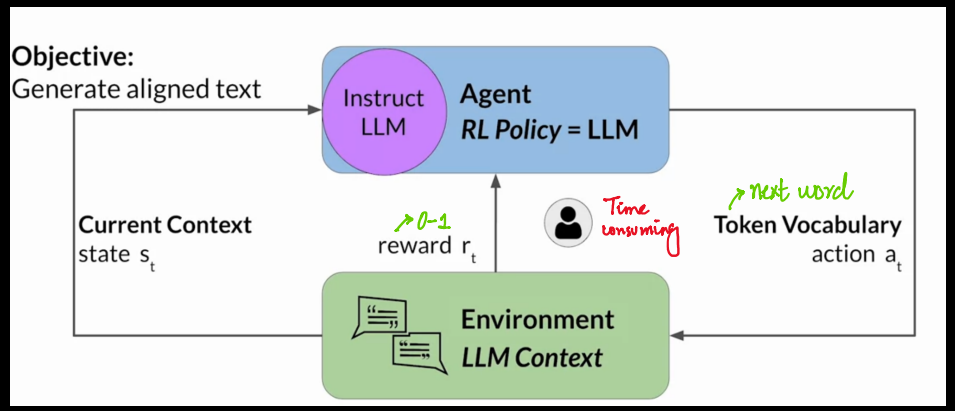
- Maximize helpfulness, relevance
- Minimize harm
- Avoid dangerous topic

future applications

Personalization of LLM

↓

Individualized learning



Reward

Human acts as reward evaluator,

e.g. toxic output is rated as 0

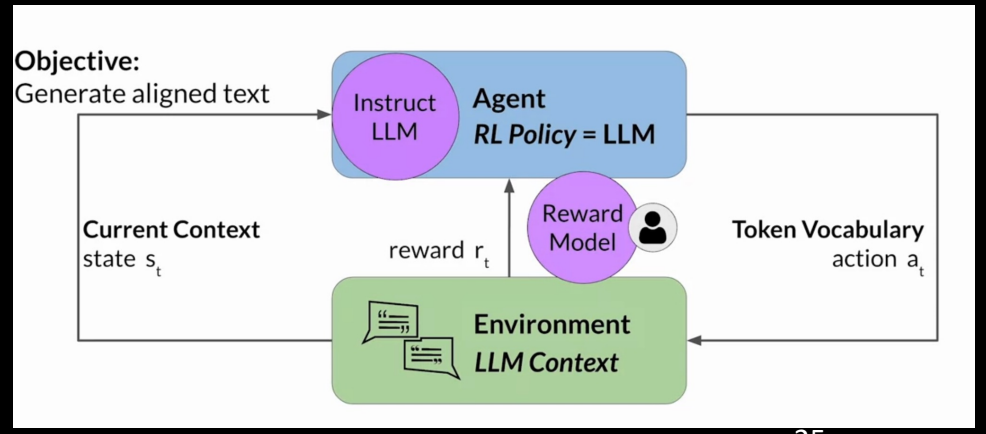
Non-toxic output is rated as 1

↳ LLM weights are updated to maximize Reward

Human evaluation-time consuming.

Train a secondary model for evaluation.

Reward Model : A supervised classification model



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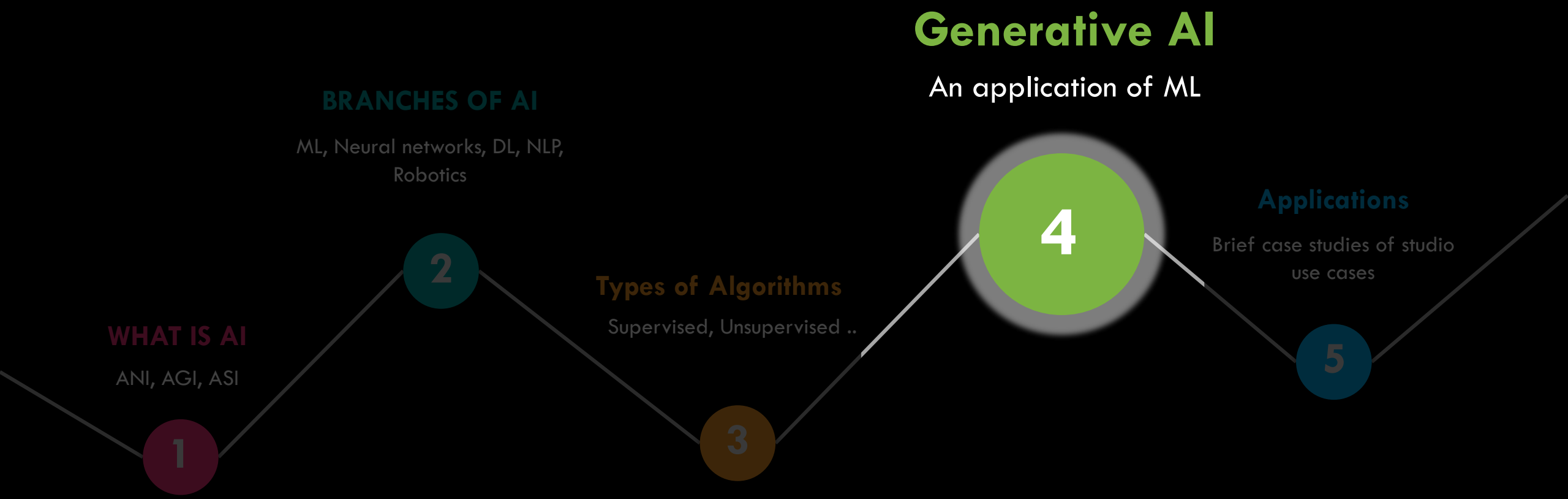

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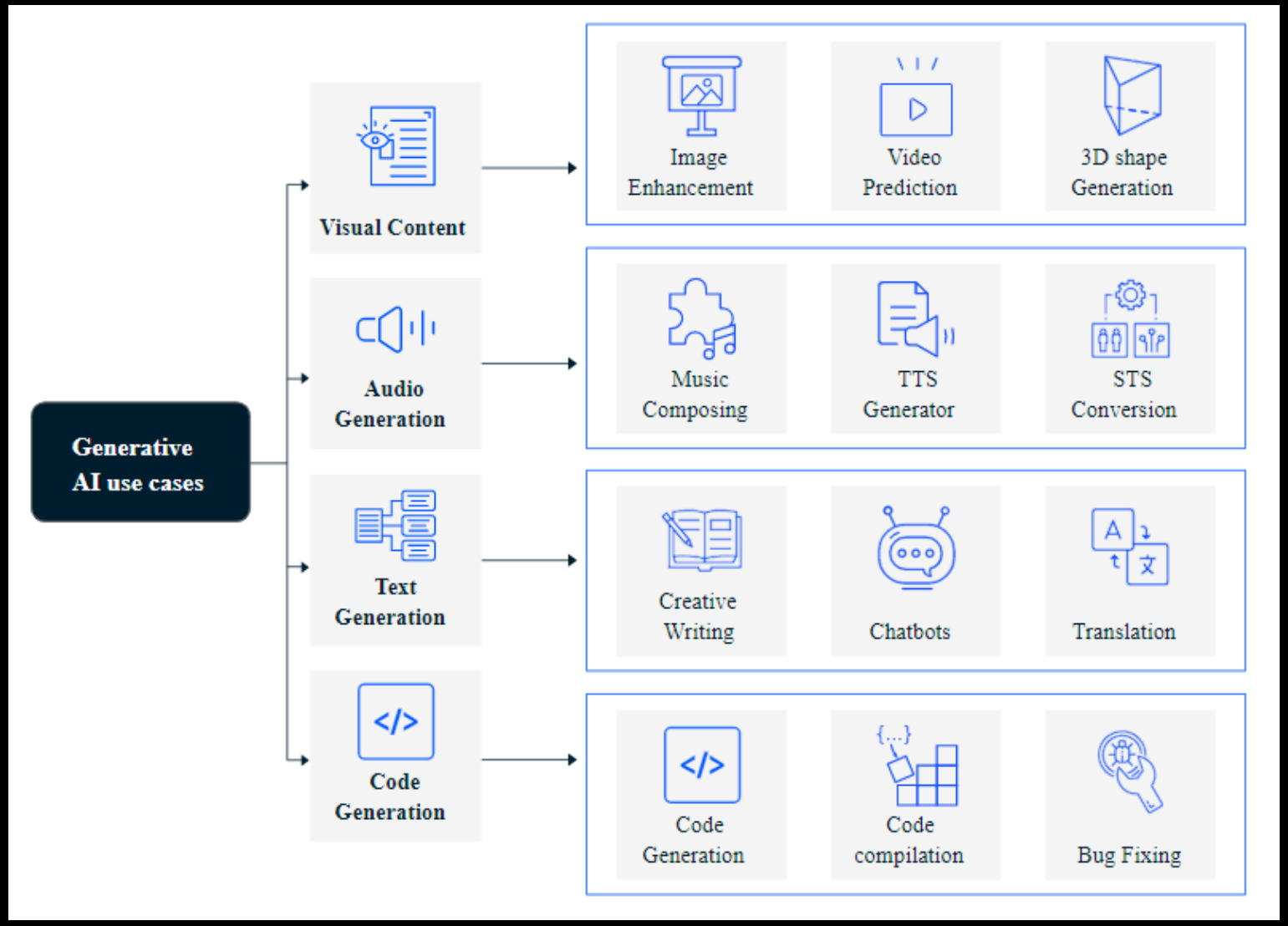


Generative AI

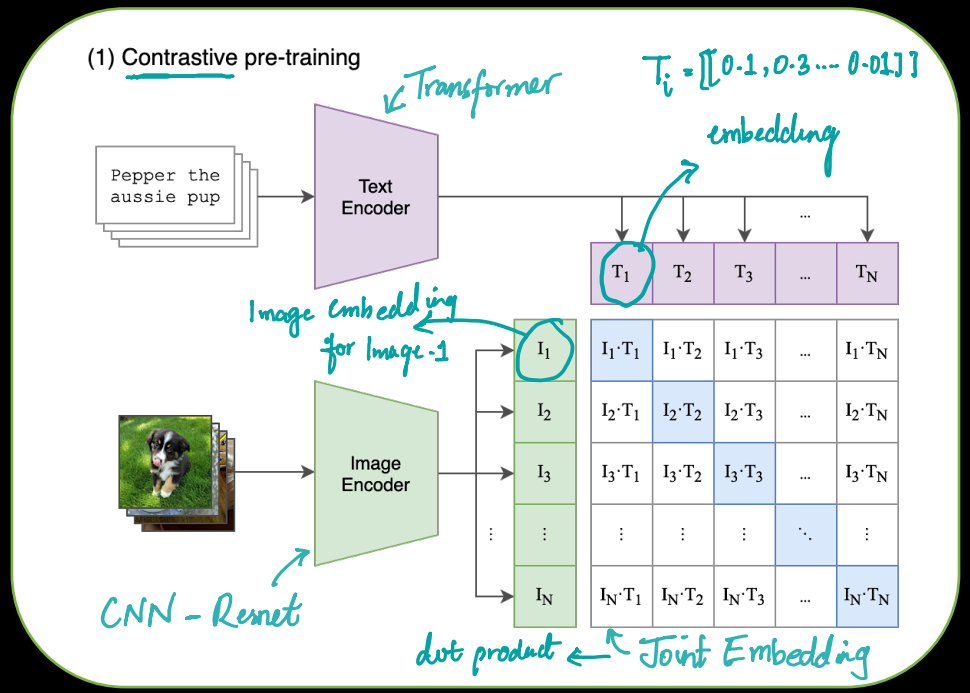
An application of AI that produces new content/data resembling the training data.

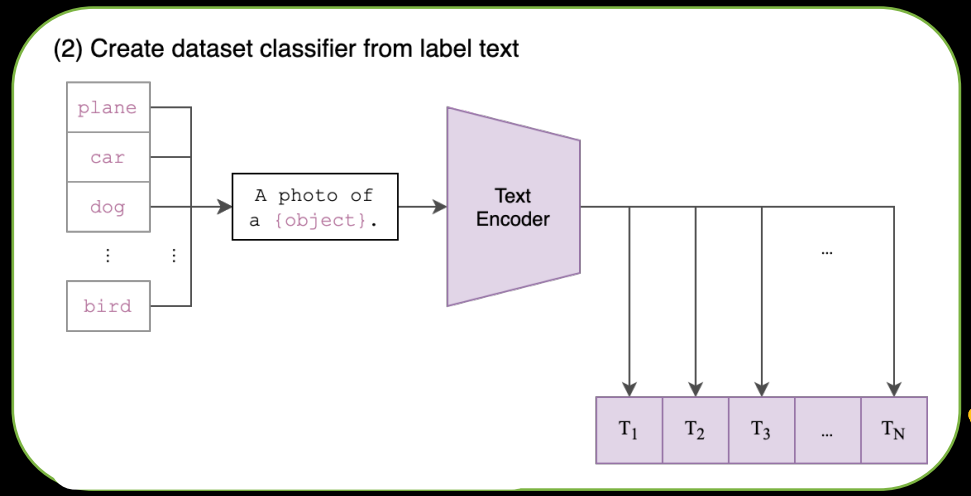
Building Blocks of GenAI

Attention is all you Need: **Transformers** architecture proposed - replacing LSTM, RNN for NLP tasks - *2017*

Contrastive Langugae Image Pretraining: **CLIP by OpenAI** unveiling multi-model learning – Unifying Vision and Language - *2021*

Bring Similar things together.





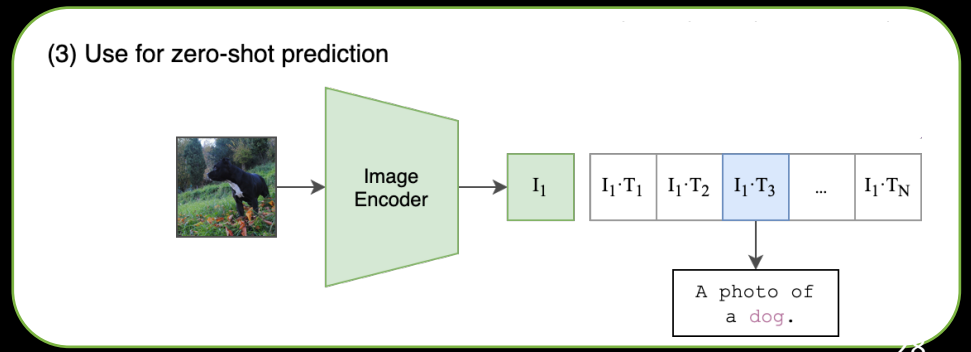
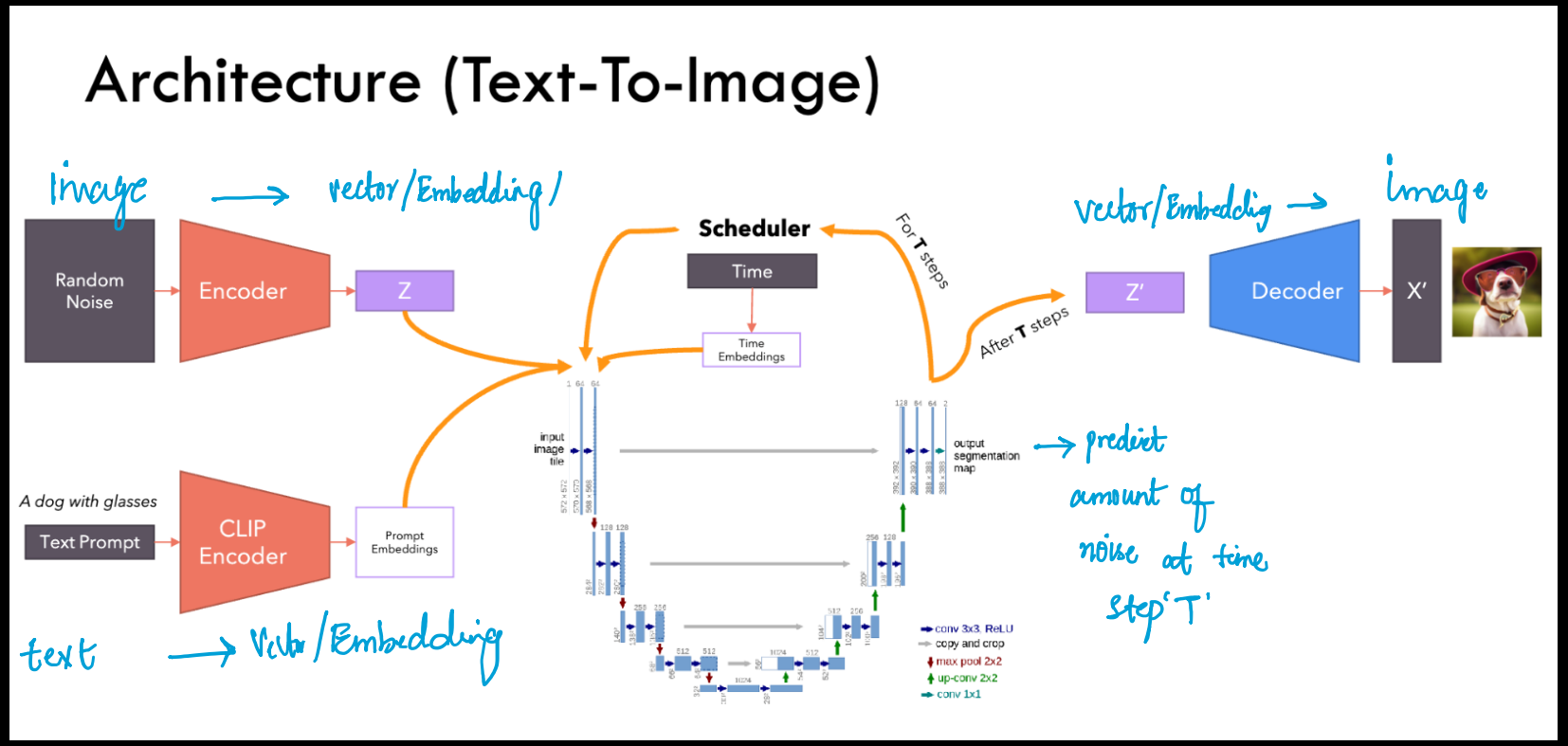


Image Generation in GenAI

Latent Diffusion Model



Upcoming – Introduction to Deep Learning