SIC Batch 5

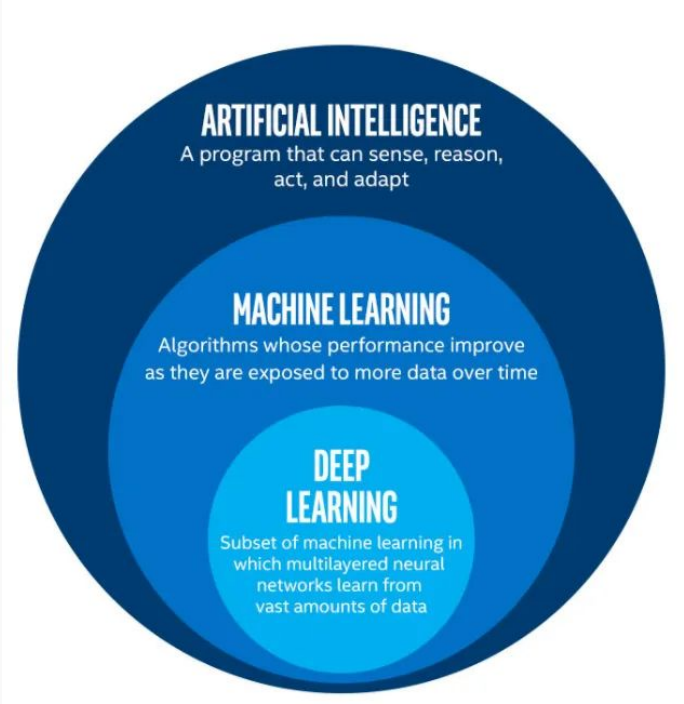
Week 1 - Introduction to AI

Artificial Intelligence (AI)

Is the simulation of human intelligences by machines

Machine Learning

“Machine learning is the science of getting computers to act without being explicitly programmed.” — Stanford University



Source: towardsdatascience.com

Why Now?

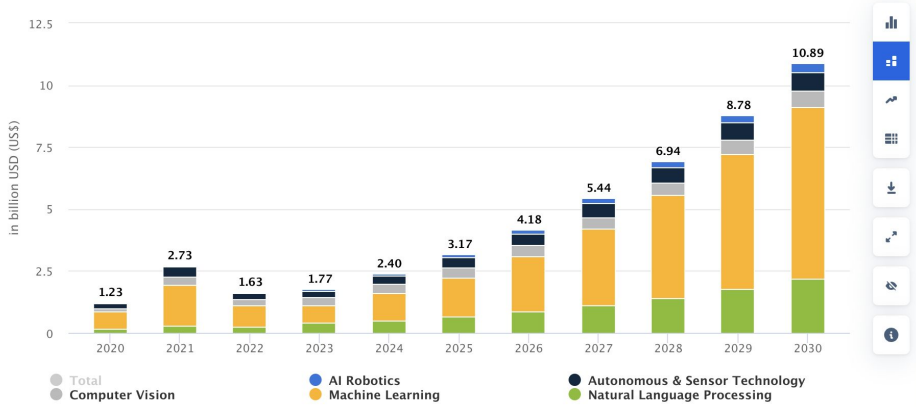
‘AI IS THE NEW ELECTRICITY’ “Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of and industry that I don’t think AI will transform in the next several years.”

Andrew Ng Founder and CEO og Landing AI, Founder of deeplearning.ai, Co-founder at Coursera

Why Now?

Market: Artificial Intelligence | Region: Indonesia | Region comparison: Compare to other regions +

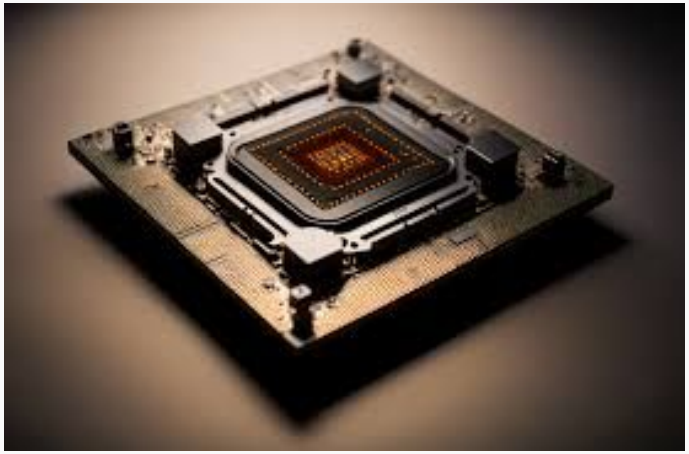
MARKET SIZE | MARKET SIZE CHANGE



Notes: Data shown is using current exchange rates and reflects market impacts of the Russia-Ukraine war.

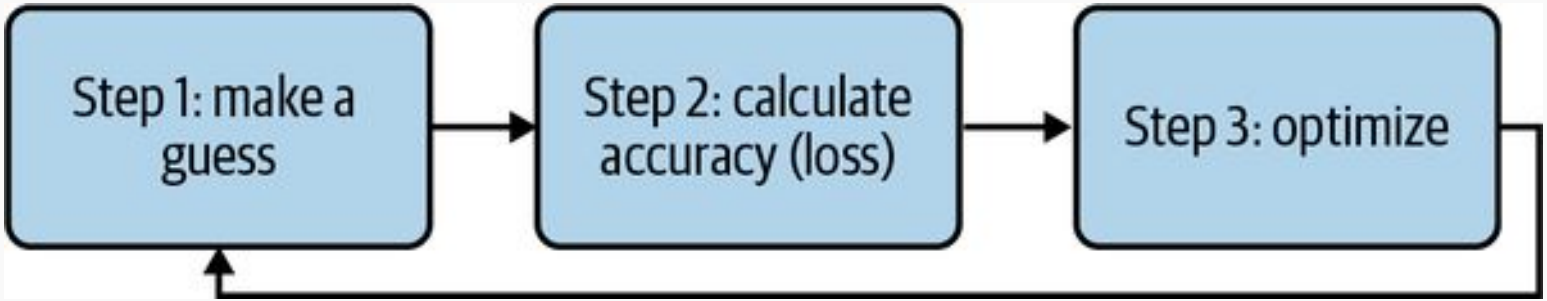
Most recent update: Mar 2024

Source: Statista Market Insights



Increased Processing Power: Modern CPUs and GPUs offer significantly more processing power compared to their predecessors. This allows AI algorithms to handle complex calculations faster, enabling the training of larger and more intricate models

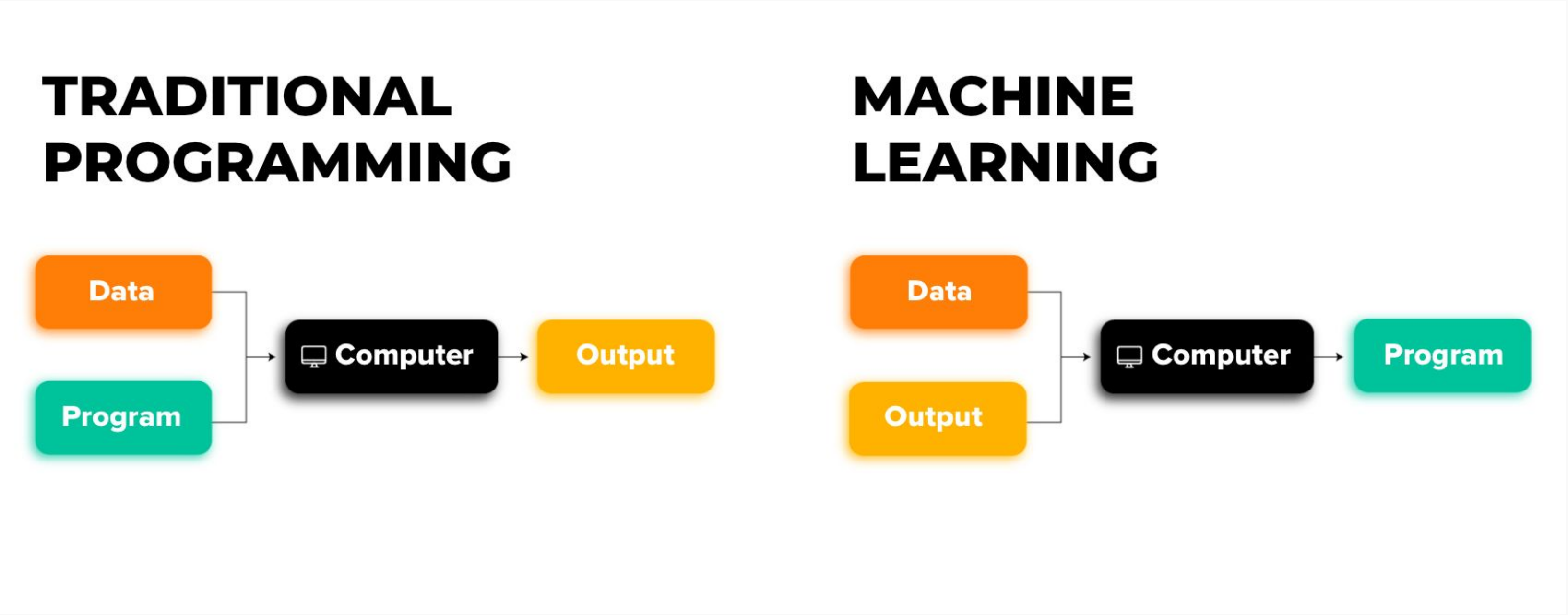
How A Machine Can Learn?



Source: oreily

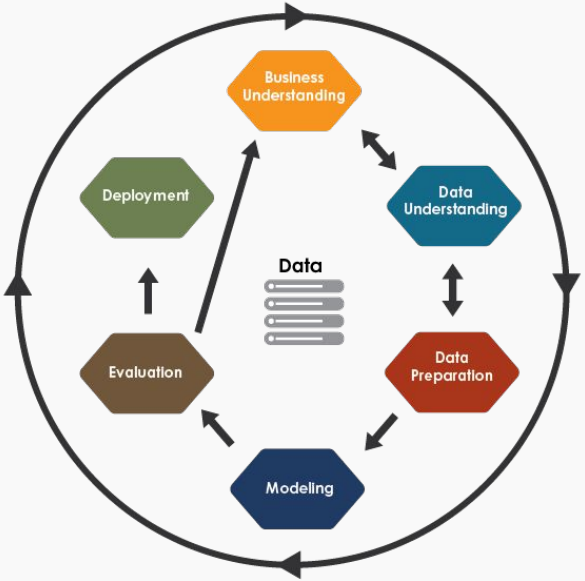
Over time, by making guesses, figuring out how good or how bad that guess might be, optimizing the next guess based on that intel, and then repeating it, the computer will “learn” the parameters for W and B (or indeed anything else), and from there, it will figure out the rules that make up our line

Machine Learning vs Traditional Programming



Source: avenga.com

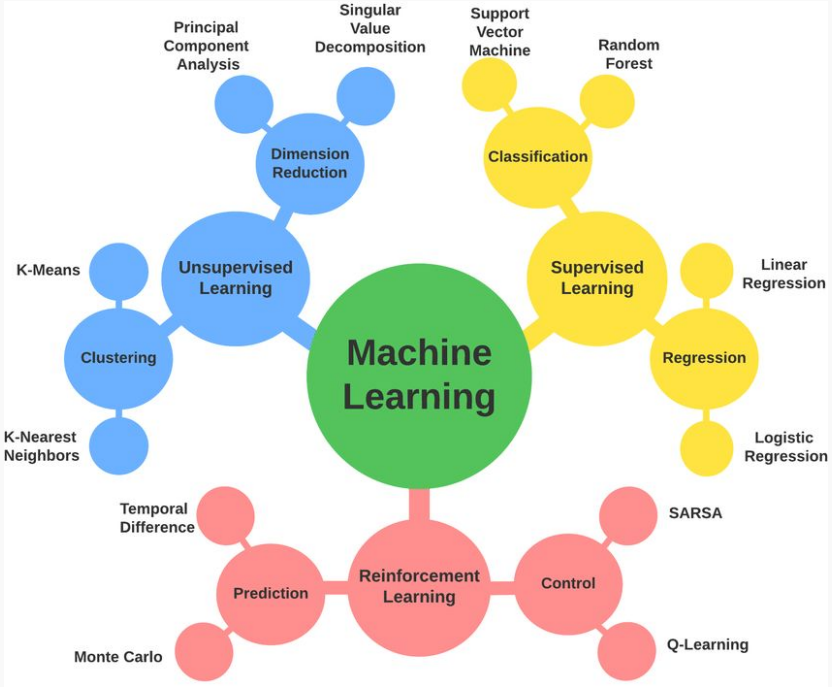
Machine Learning Cycle



Source: datascience-pm.com

Business understanding – What does the business need?
Data understanding – What data do we have / need? Is it clean?
Data preparation – How do we organize the data for modeling?
Modeling – What modeling techniques should we apply?
Evaluation – Which model best meets the business objectives?
Deployment – How do stakeholders access the results?

Machine Learning Techniques

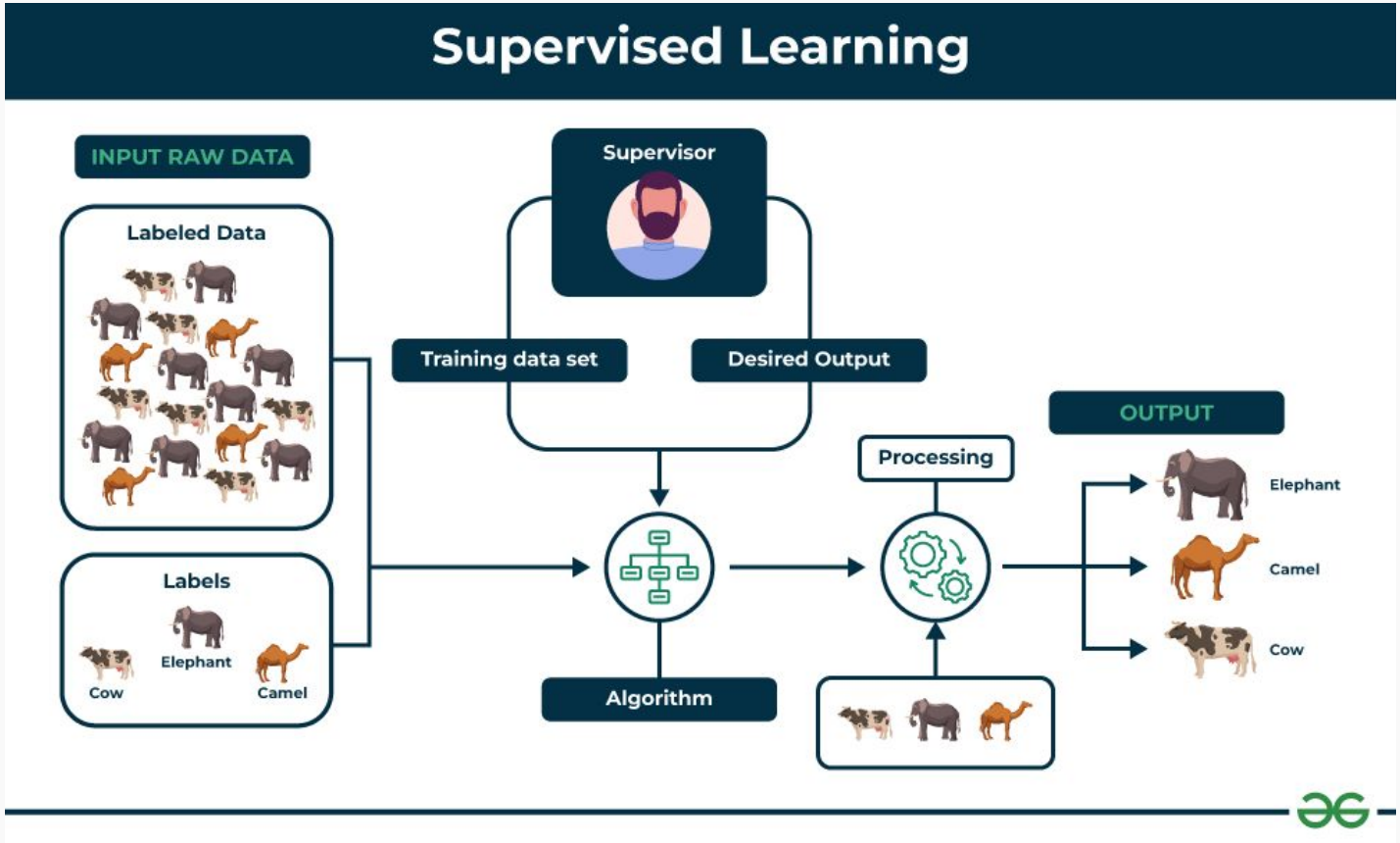


Source: researchgate.net

Supervised Machine Learning

- Supervised learning is a type of machine learning where the algorithm learns from labeled data.
- Labeled data consists of input features (X) and corresponding target values (y).
- The algorithm learns a mapping function from the input features to the target values.
- This mapping function can then be used to predict the target value for new, unseen data points.

Supervised Machine Learning



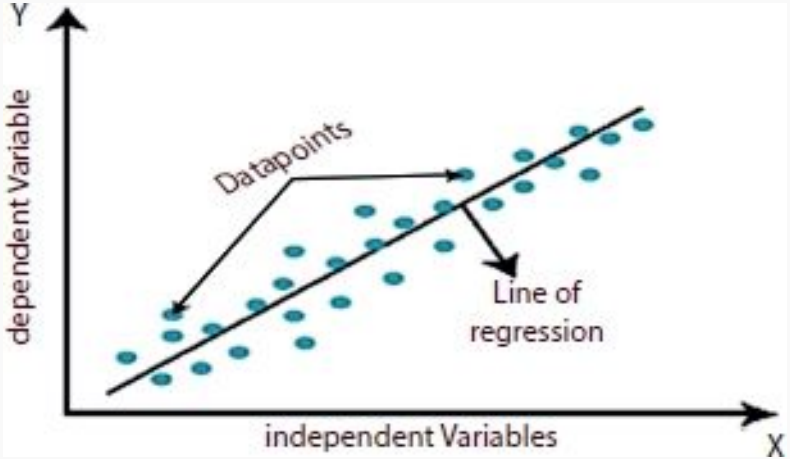
Source: geeksforgeeks.com

Supervised Machine Learning - Regression

- Regression analysis is a statistical method used to model the relationship between a dependent variable (y) and one or more independent variables (X).
- The goal of regression is to learn a function that maps the independent variables to the dependent variable.
- This function can then be used to predict the value of the dependent variable for new data points.
- Regression algorithms are typically used to predict continuous outcomes.

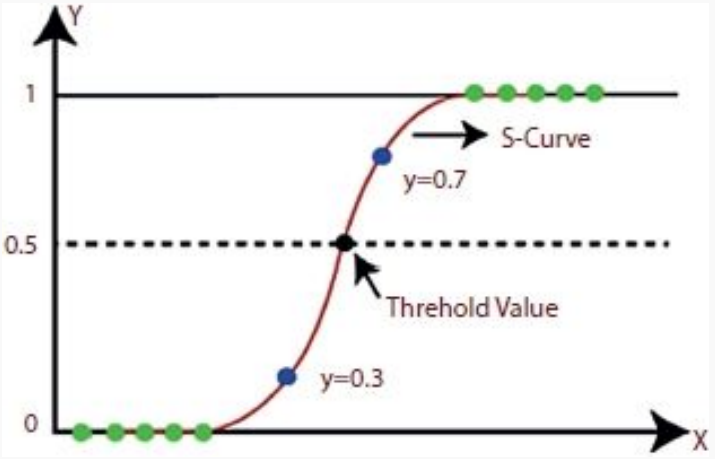
SML - Regression

Linear Regression



Source: oreily

Logistic Regression



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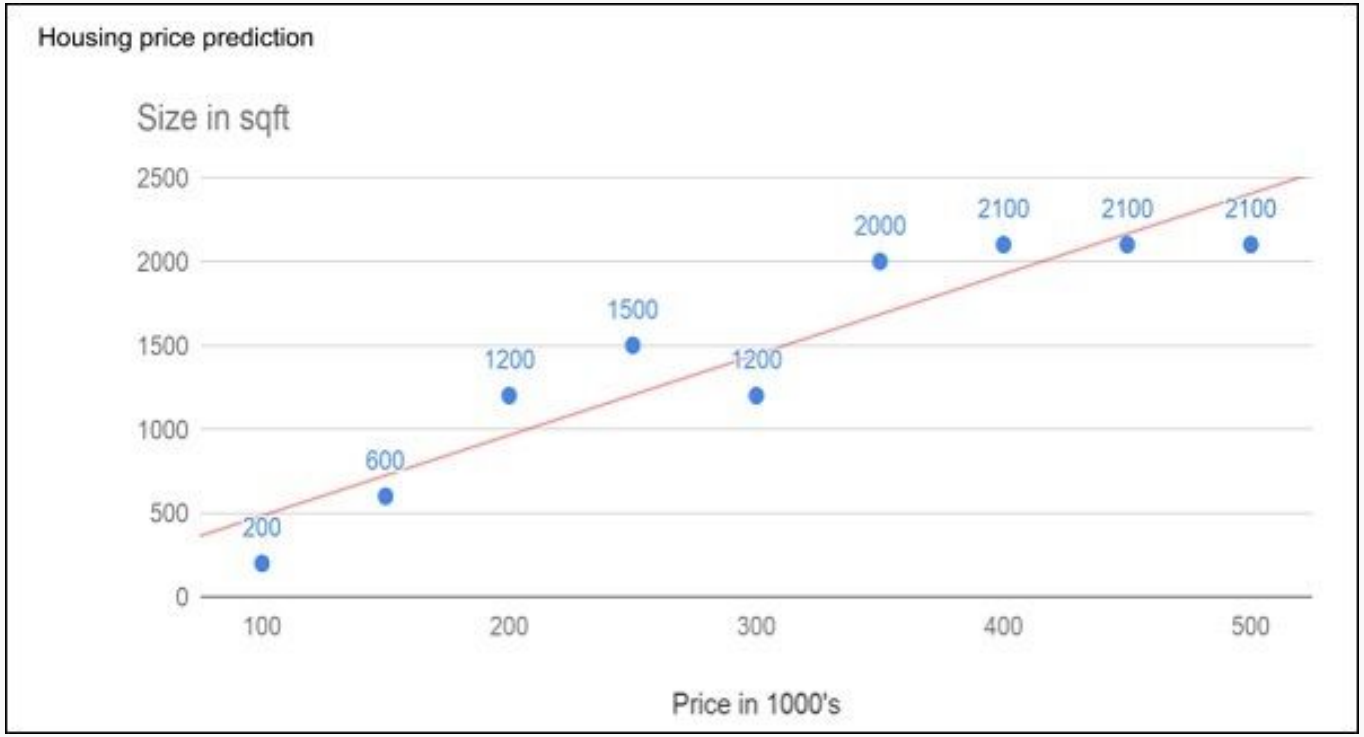
SML - Regression Use Case



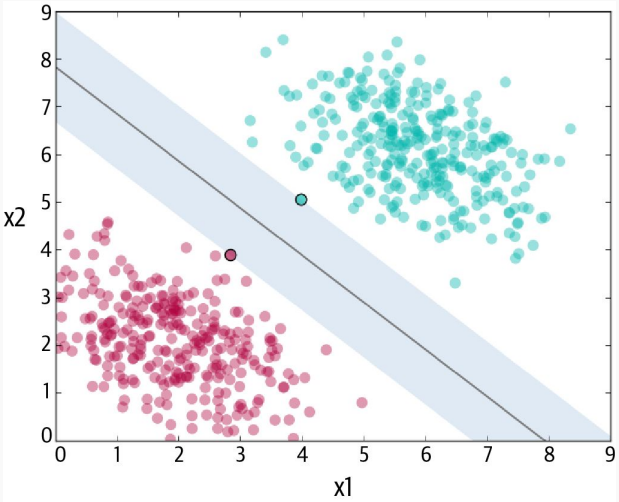
- House Price Prediction
- Energy consumption prediction
- Climate modeling
- Stock market analysis
- etc

Supervised Machine Learning - Classifications

- Classification is a supervised machine learning task that involves predicting the class label of a data point.
- The class label refers to the category to which the data point belongs.
- Classification algorithms learn from labeled data containing examples with known class labels.
- After training, the model can then classify new, unseen data points into the appropriate category

SML - Classification

Support Vector Machine

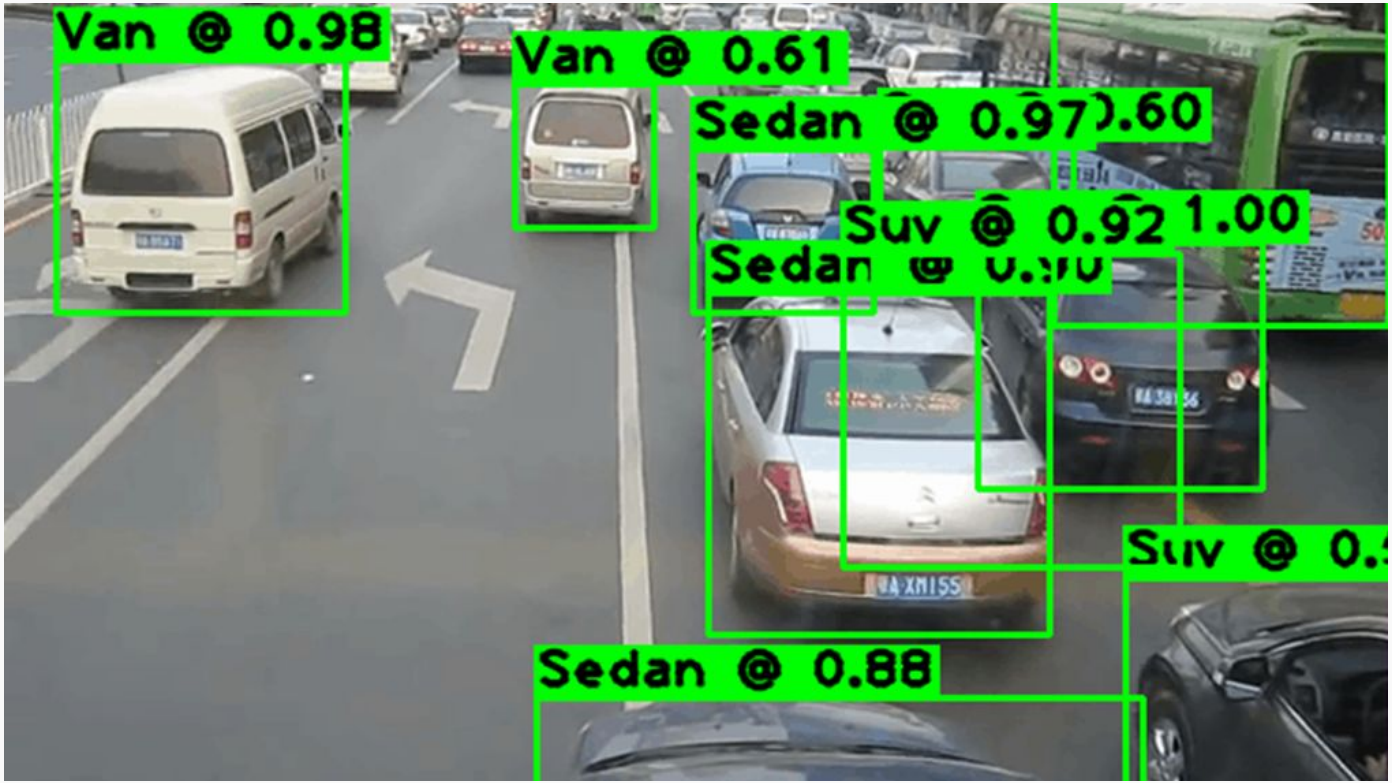


Source: oreily

KNN (K-Nearest Neighbours)

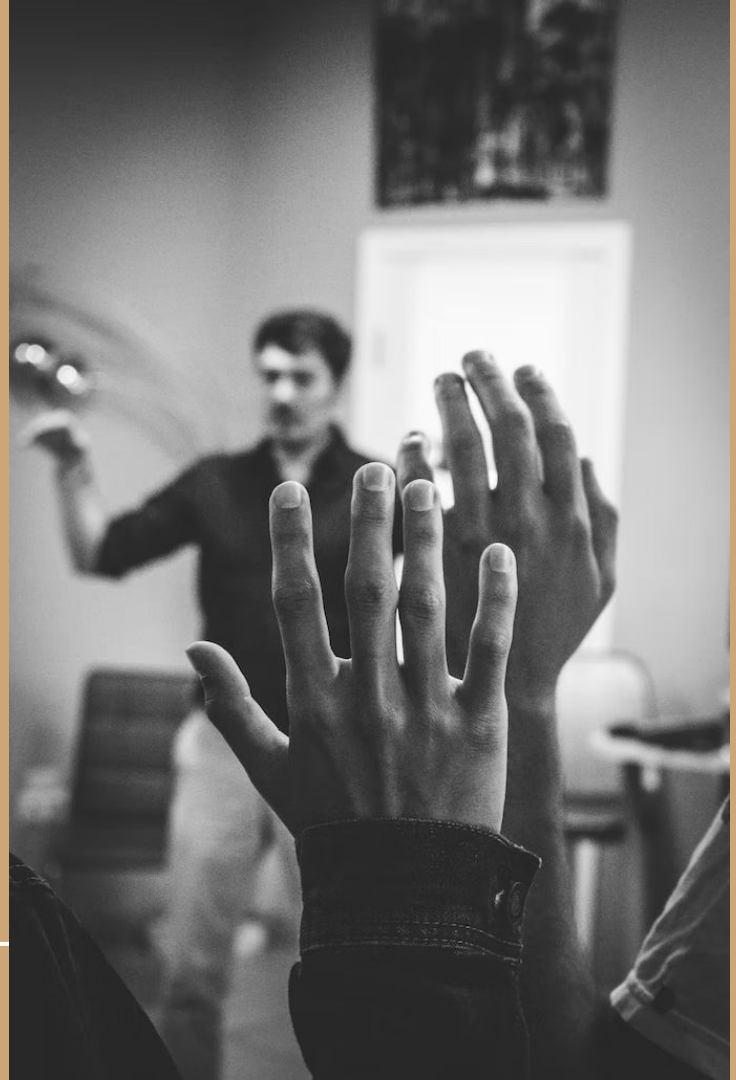
Source: IBM

SML - Classifications Use Case



- Vehicle Classifications
- Email Spam Filtering
- Credit Risk Assessment
- Disease Diagnosis
- etc

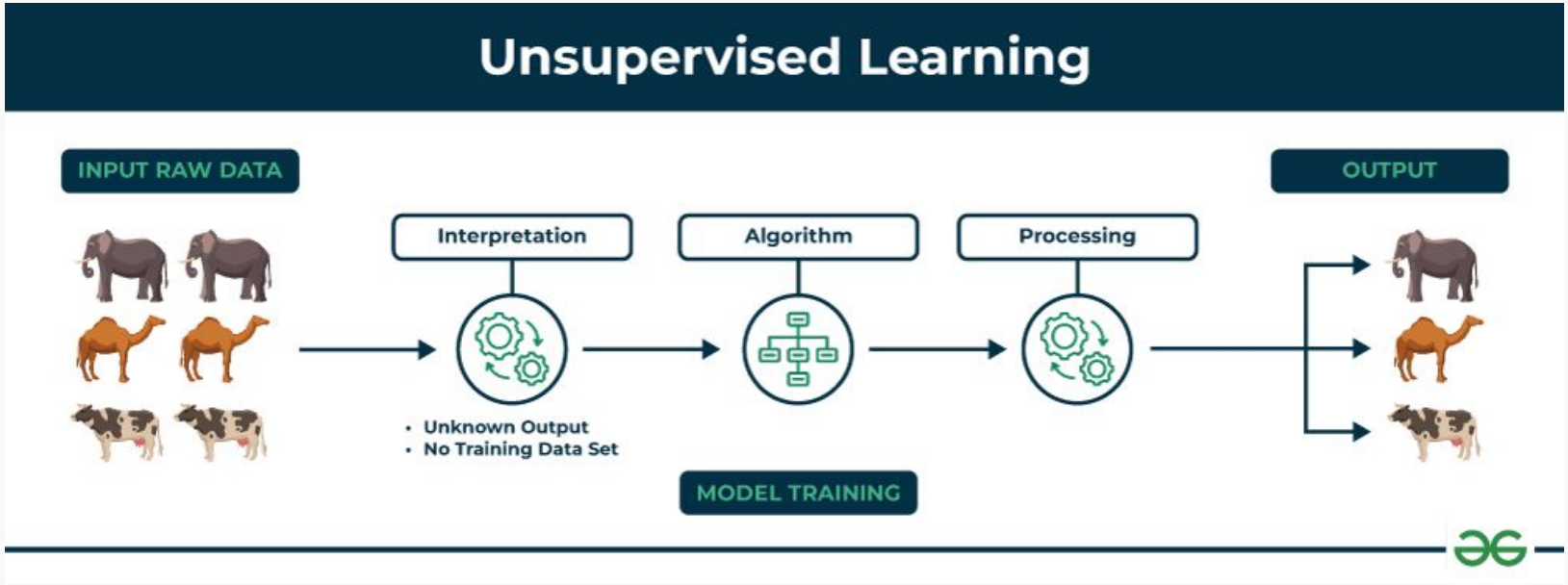
Demo - SML



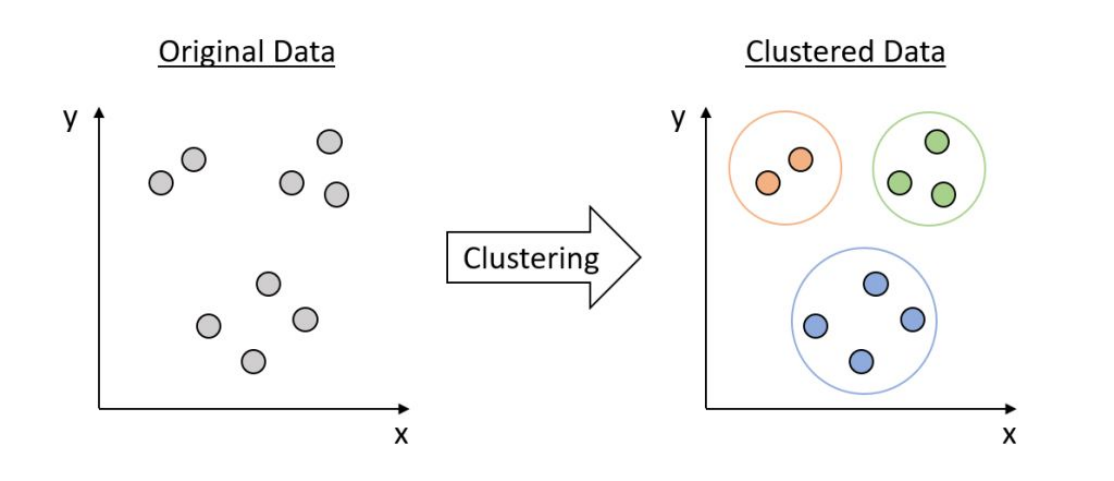
Unsupervised Machine Learning

- Unsupervised learning deals with unlabeled data, where data points lack predefined categories.
- The goal is to identify inherent patterns, structures, or groupings within the data.
- Unsupervised learning algorithms act like explorers, uncovering hidden relationships and characteristics in the data.

Unsupervised Machine Learning



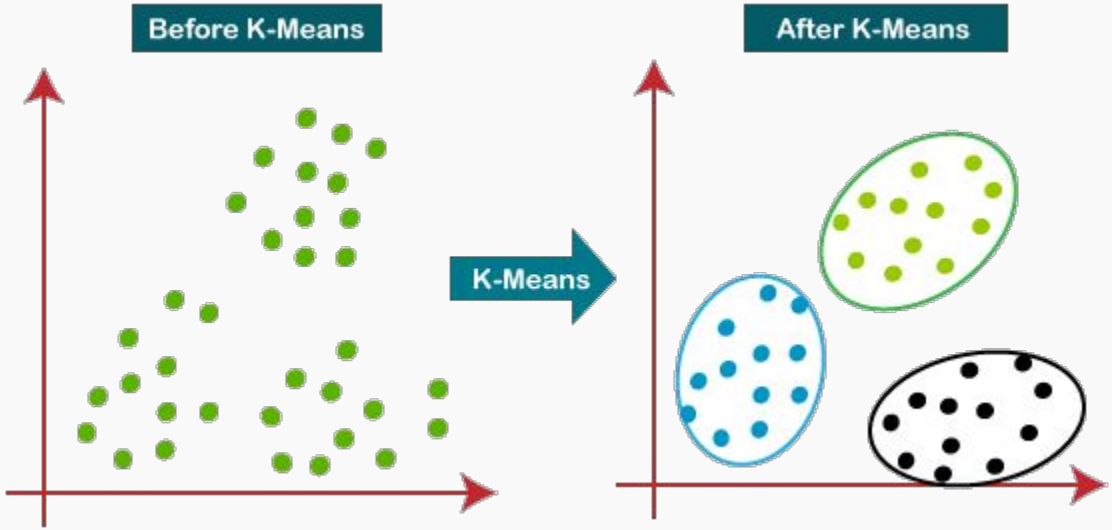
Unsupervised Machine Learning - Clustering



- Clustering is a fundamental technique in unsupervised learning that groups data points with similar characteristics into clusters.
- These clusters represent underlying structures or patterns within the data.
- Clustering algorithms measure similarities between data points using various distance metrics like Euclidean distance.

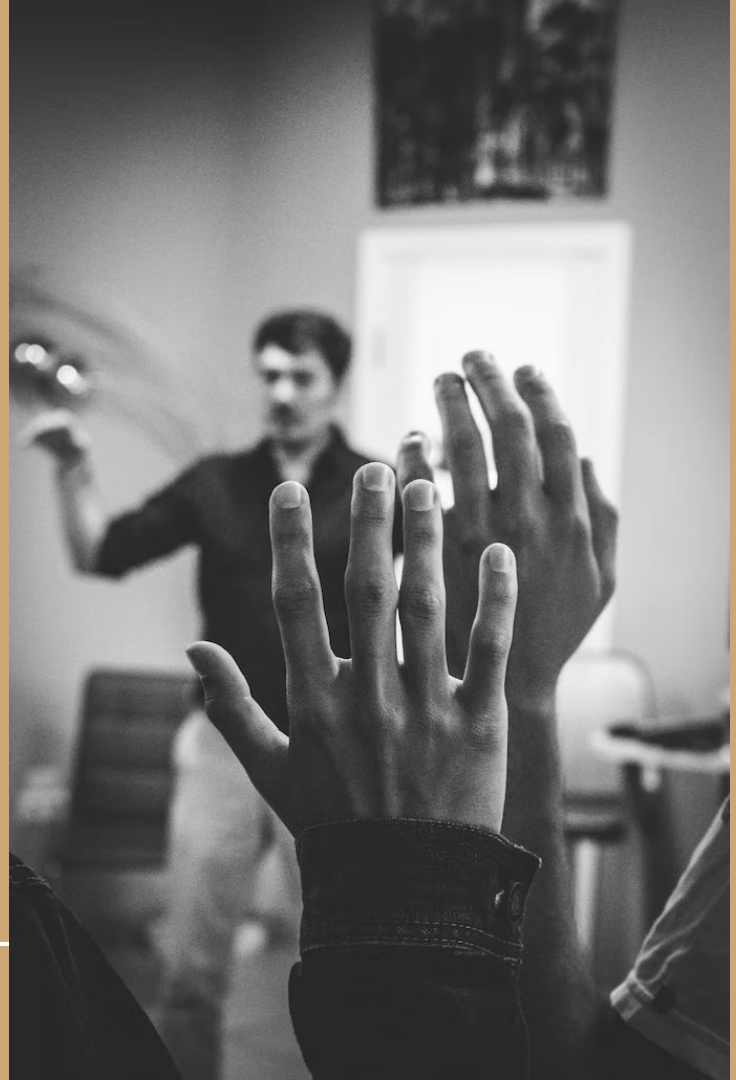
Unsupervised Machine Learning - Clustering

K-Means Clustering



Source: kaggle

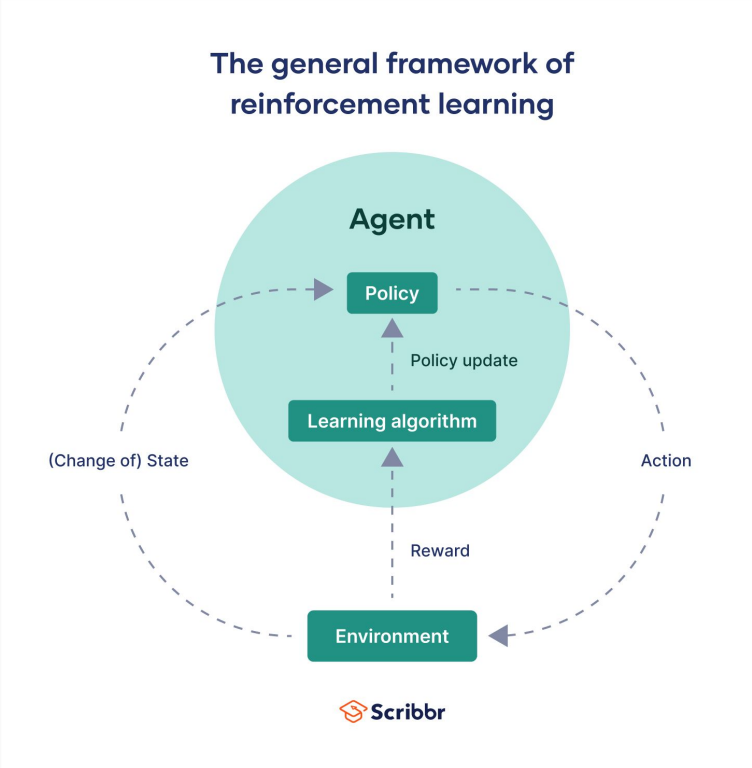
Demo - Unsupervised Machine Learning



Reinforcement Learning

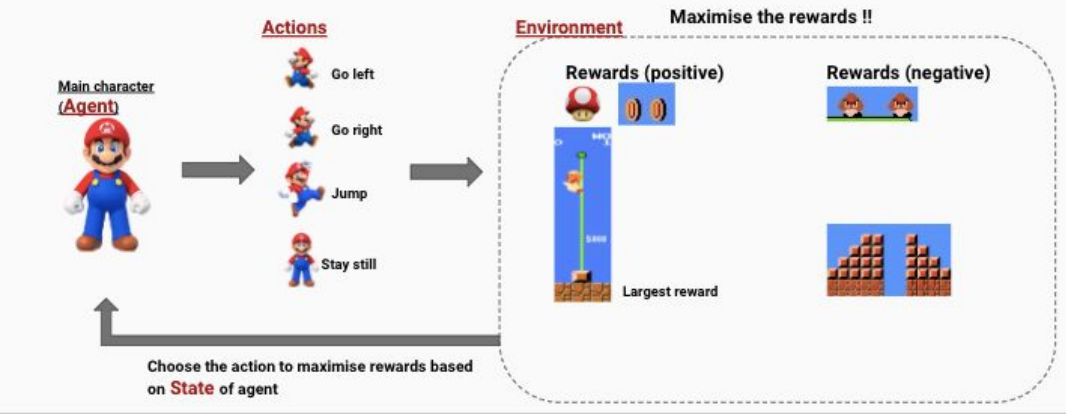
- RL is a machine learning technique that trains software to make optimal decisions through trial and error, similar to how humans learn.
- RL uses a reward-and-punishment system.
- The software receives positive reinforcement (rewards) for actions that move it closer to the goal and no reward (or punishment) for actions that don't.

Reinforcement Learning



Source: Scribbr

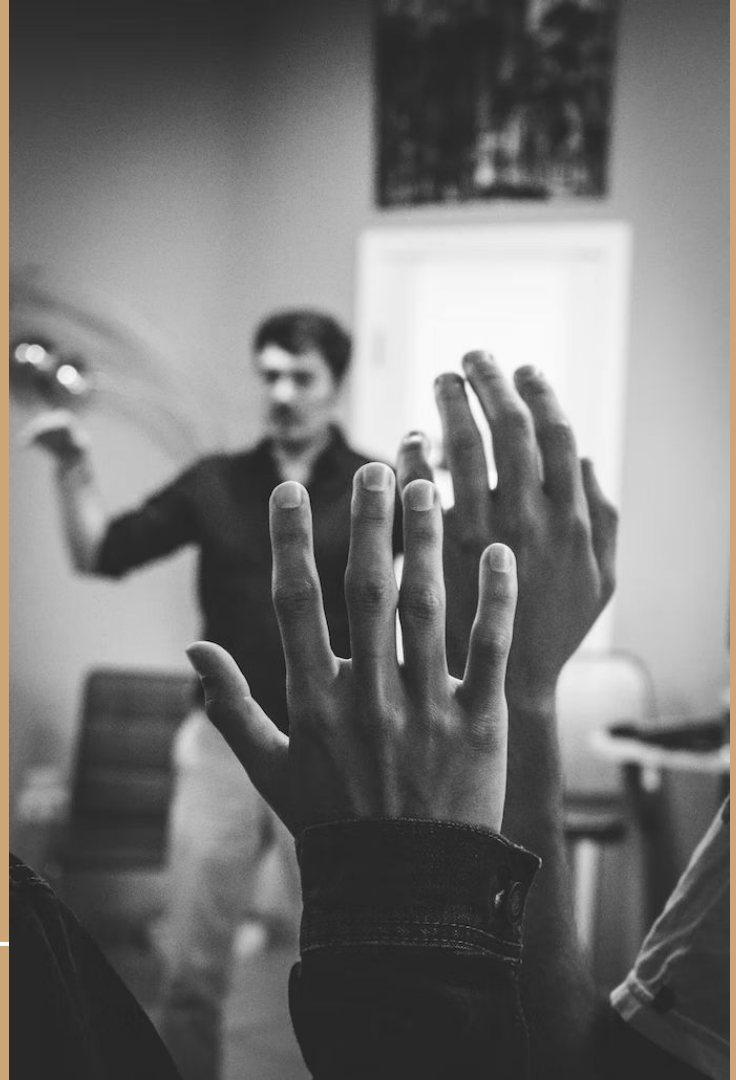
Reinforcement Learning - Use Case



Source: Scribbr

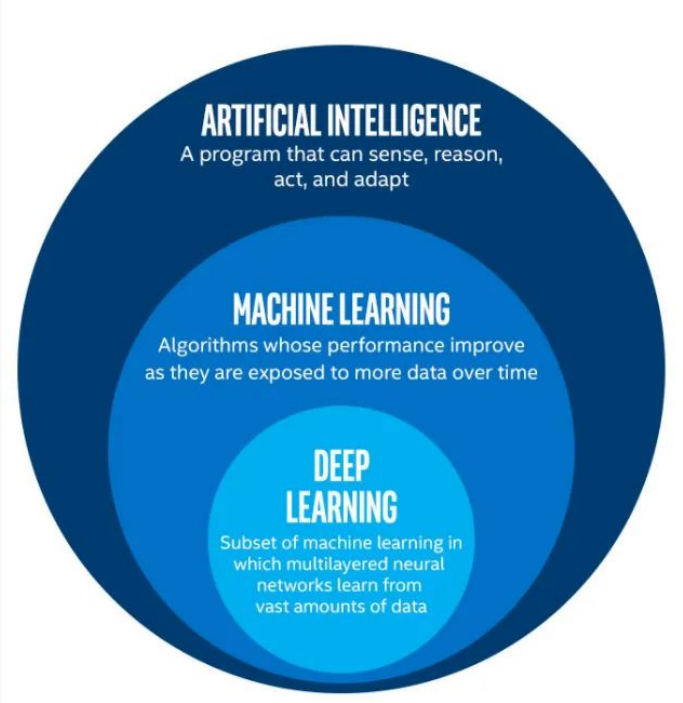
Source: Chatgpt

Demo - RL



Deep Learning

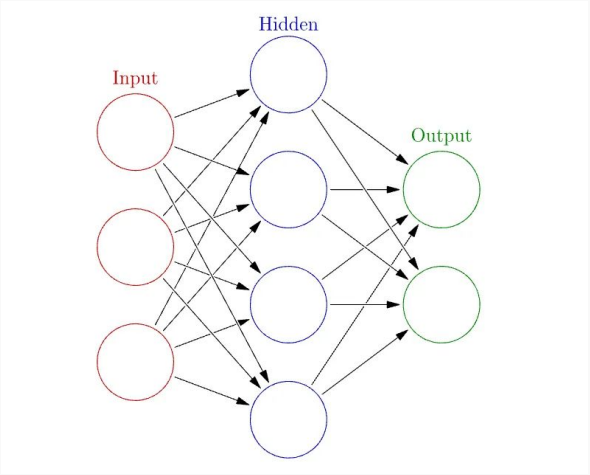
“Deep learning is a subset of machine learning that uses multi-layered neural networks, called deep neural networks, to simulate the complex decision-making power of the human brain” - IBM

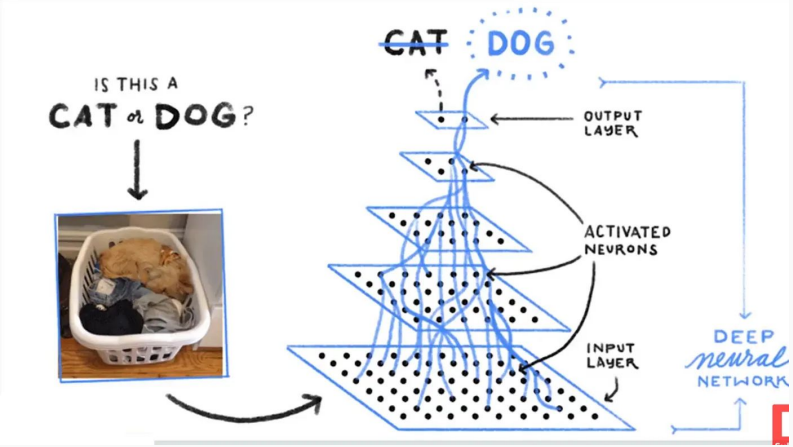


Source: towardsdatascience.com

How it Works?

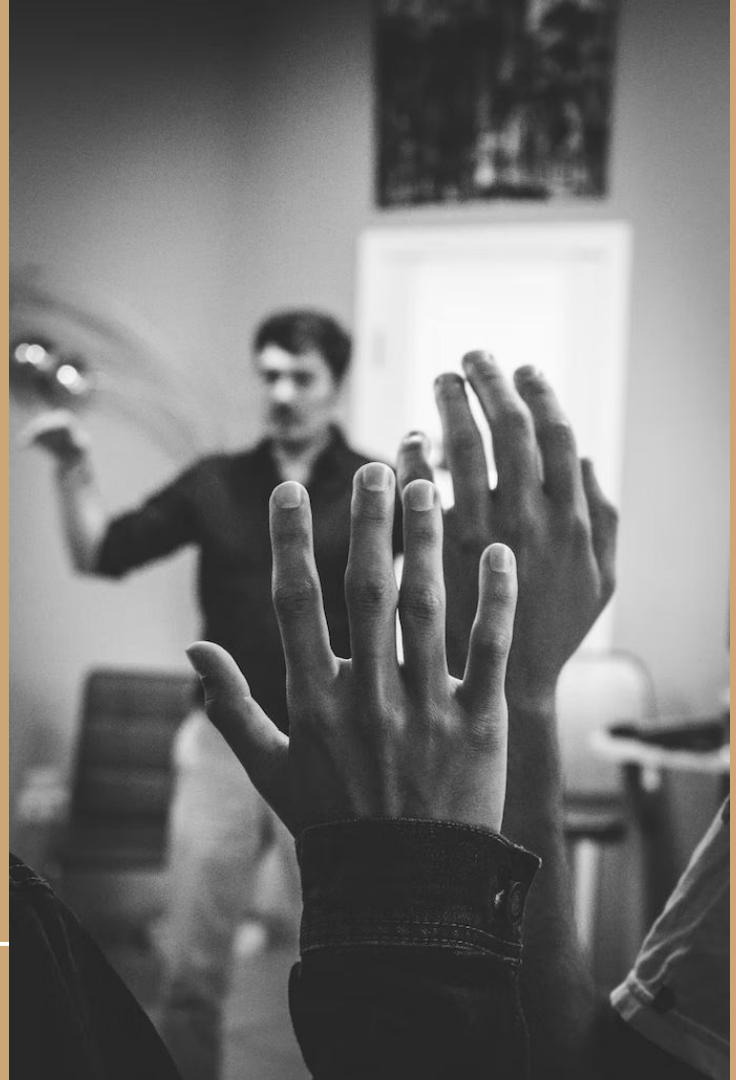
- **Mimic the Brain**: Deep learning neural networks are inspired by the structure and function of the human brain.
- **Learn & Refine**: Data flows through interconnected layers, with each layer improving on the last (forward propagation).
- **Self-Correction**: Backpropagation analyzes errors and adjusts the network internally (weights & biases) for better results.
- **Powerful & Adaptable**: This layered learning allows deep learning models to tackle complex tasks.
- **Example:**
    - Convolutional Neural Networks (CNNs): excel in image recognition.
    - Recurrent Neural Networks (RNNs): handle sequential data like language.





Source: towardsdatascience.com

Demo - Deep Learning



AI Do’s and Don’ts

Do

Focus First: Clearly define goals and communicate with stakeholders to ensure everyone's aligned.

Start Smart: Begin with a small-scale project to gain experience before scaling up.

Data Matters: Use high-quality, clean, and unbiased data to train your AI models.

Continuous Improvement: Regularly test, refine, and gather feedback to optimize performance.

Ethics in Mind: Address potential biases and ensure responsible AI use with clear guidelines.

Don’t

Human Expertise Matters: Don't replace human judgment in critical tasks. Leverage AI to augment human capabilities.

AI Isn't Magic: Be realistic about what AI can and cannot do given limitations of technology, data, and engineering resources

Beware Overfitting: Ensure diverse data to avoid inaccurate AI models.

Security First: Protect sensitive data with robust security measures.

Applications of AI

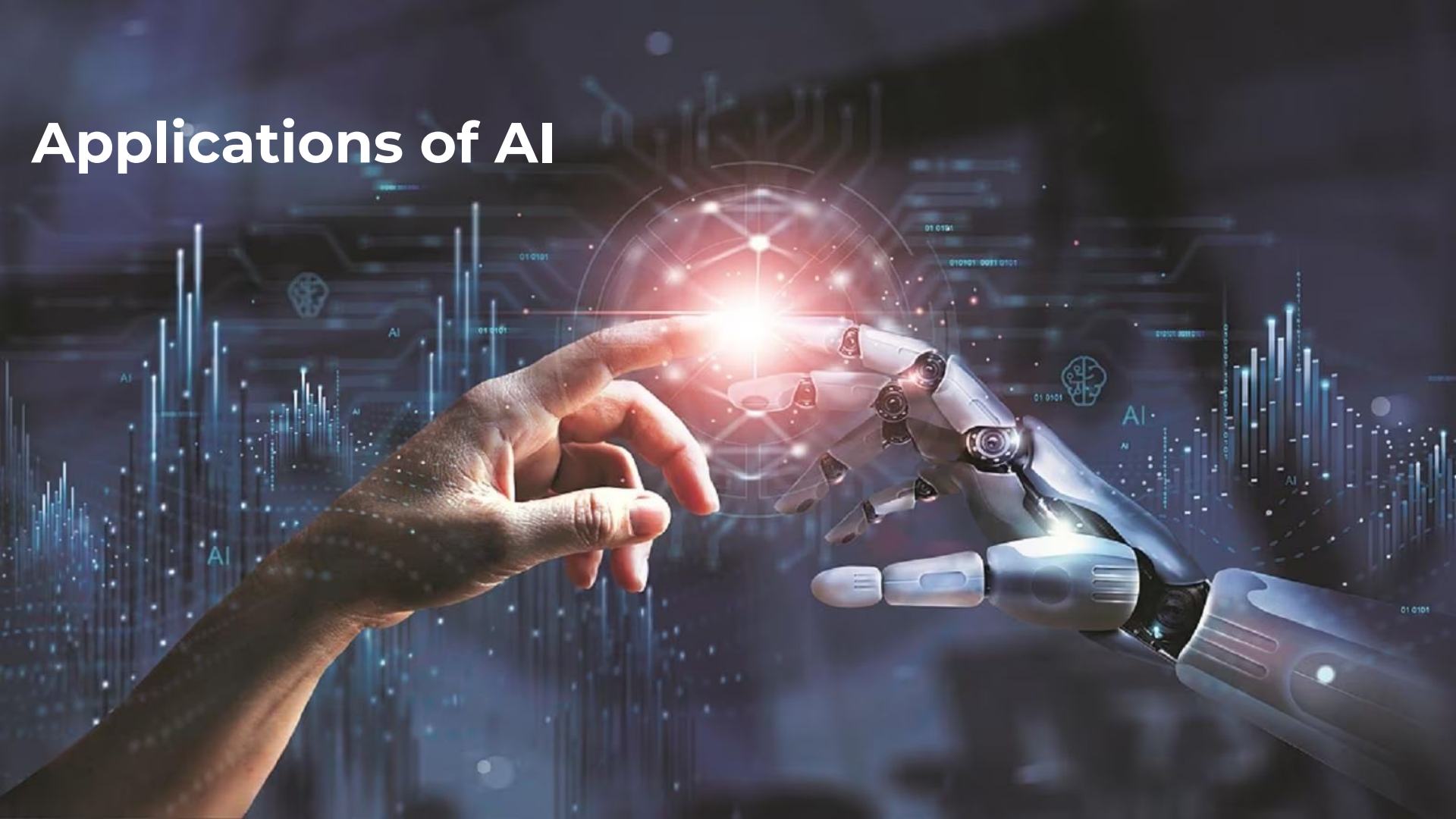
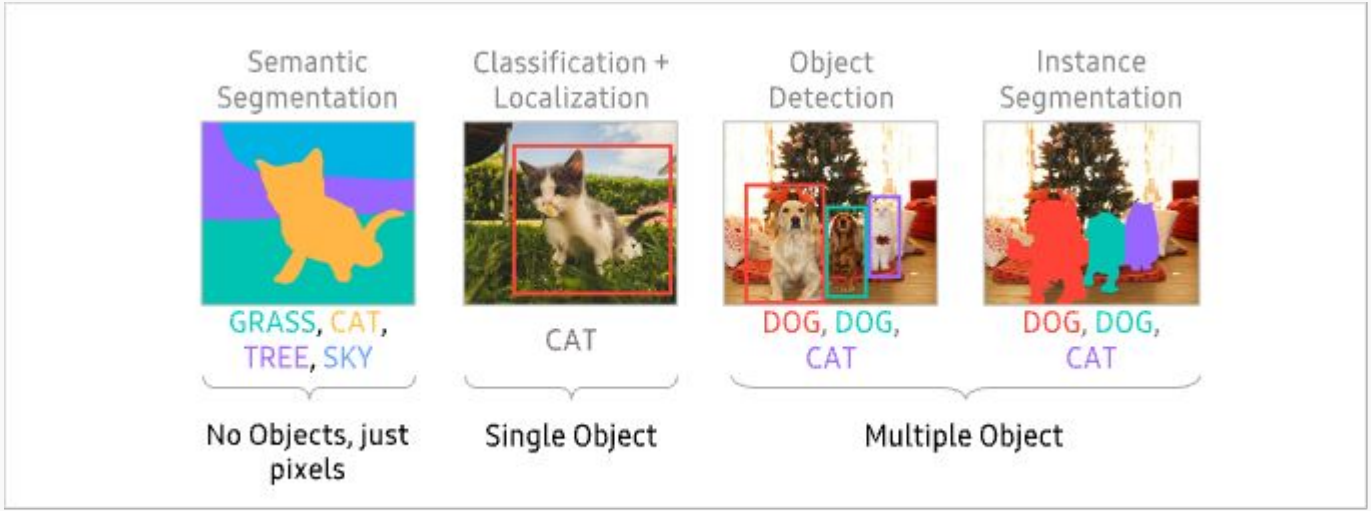


Image Recognition

- Image recognition refers to technologies that identify places, logos, people, objects, buildings, and other variables in images.
- Besides image recognition, computer vision also includes event detection, object recognition, learning, image reconstruction, and video tracking.



https://mlwhiz.com/blog/2018/09/22/object_detection/

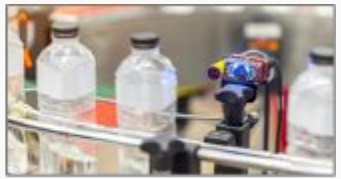
Machine Vision

- Machine vision as a systems engineering discipline is distinct from computer vision, a form of computer science. It attempts to integrate existing technologies in new ways and apply them to solve real-world problems.
- Machine vision refers to many technologies, software and hardware products, integrated systems, actions, methods, and expertise.
- Machine vision (MV) is a technology and method often used in industry to provide imaging-based automatic inspection and analysis for such applications as automatic inspection, process control, and robot guidance.

Guidance

Gauging

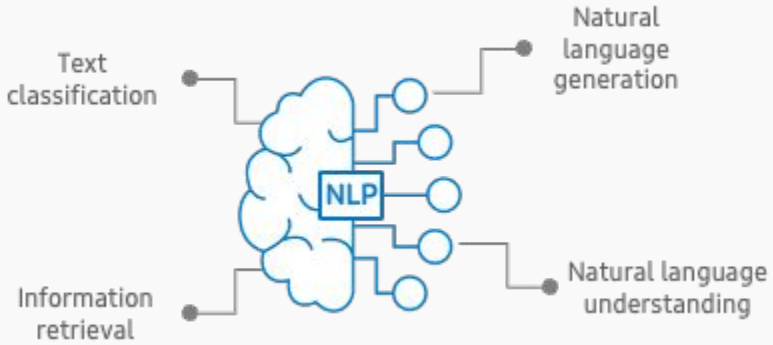
Defect Detection



Packaging Inspection

NLP

- **Natural language processing (NLP)** is a subfield of linguistics, computer science, information engineering, and artificial intelligence concerned with the interactions between computers and human (natural) languages, particularly how to program computers to process and analyze large amounts of natural language data.
- Challenges in NLP frequently involve speech recognition and natural language understanding and generation.
- Machine Translation, Information Retrieval, Question Answering, Information Extraction, and Summarization are the main applications of natural language processing techniques



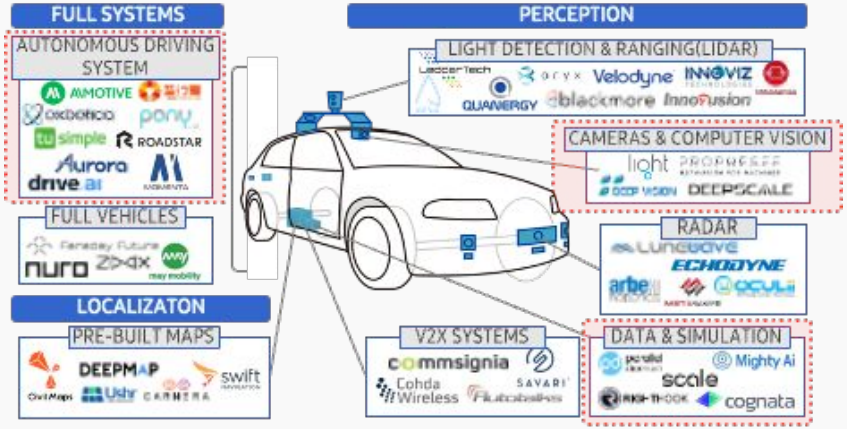
Speech and Voice Recognition

- **Speech Recognition**: Recognize words, sentences, and contents spoken by anyone.
    - General dictation, transcribing, using a computer hands-free, medical transcription, automated customer service, etc.
- **Voice Recognition**: Recognize the accent, pitch, or intonation of a person regardless of the language spoken.
    - Speaker verification and speaker identification

Portable Ophthalmoscope Based on AI (Project Powered by Samsung)

- Developed a portable diagnostic device and diagnosis support algorithm based on image processing for underserved people in Vietnam.
- 40,000 images are being accumulated per month.
- Detect anomalies from eye images based on Machine learning and classify the image for triage.

Autonomous Car



https://www.forbes.com/sites/alanohnsman/2018/03/02/waymo-is-millions-of-miles-ahead-in-robot-car-tests-does-it-need-a-billion-more/#c854b381ef4c