


# Introduction to machine learning

Python

Wrocław, 2025



What is  
artificial  
intelligence?



# Europejska Nagroda Naukowa im. Stanisława Lema

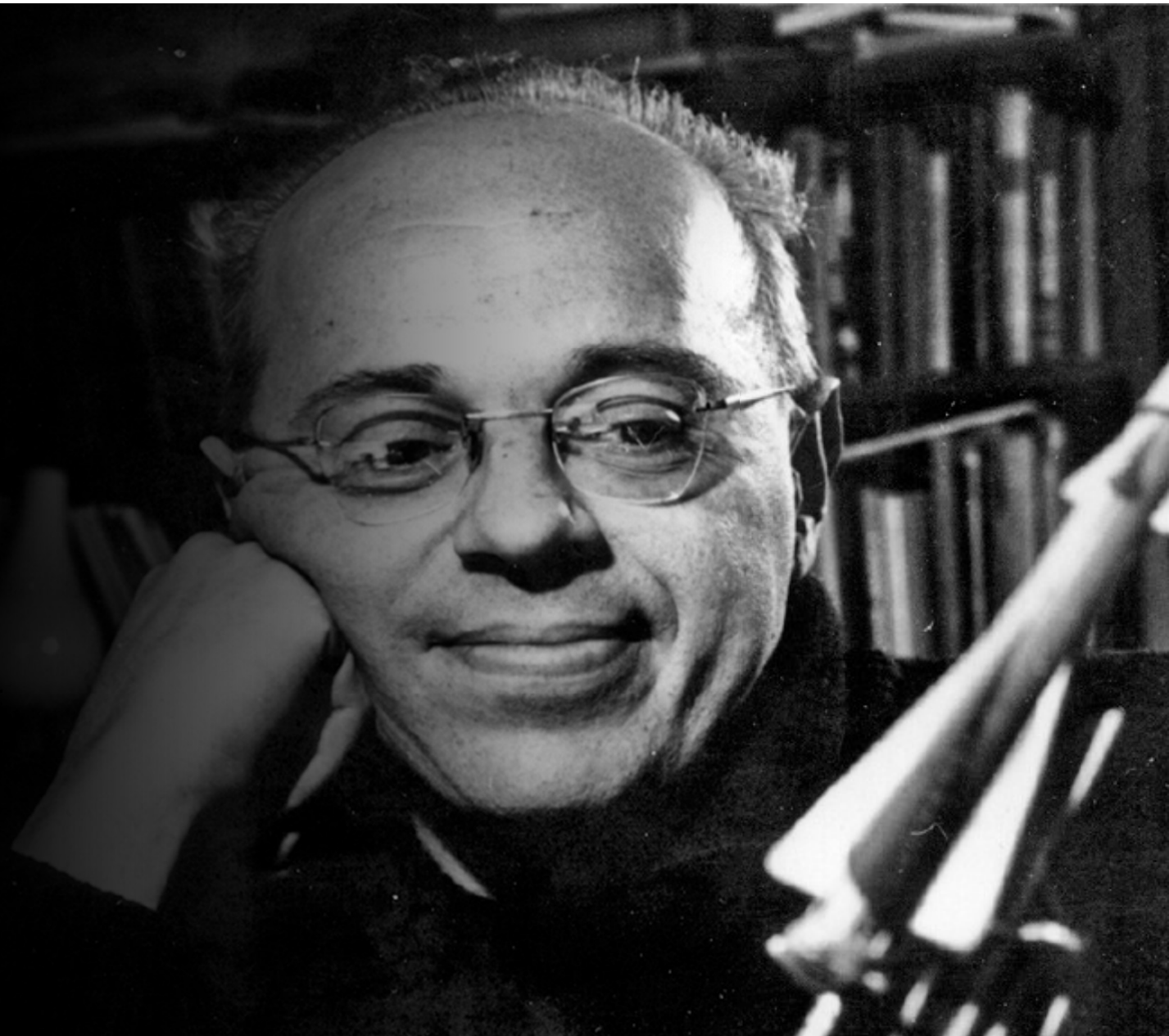
Stanisław Lem European  
Research Prize (Lem Prize)

**#LemPrize**



Politechnika Wrocławska

[lemprize.pwr.edu.pl](http://lemprize.pwr.edu.pl)



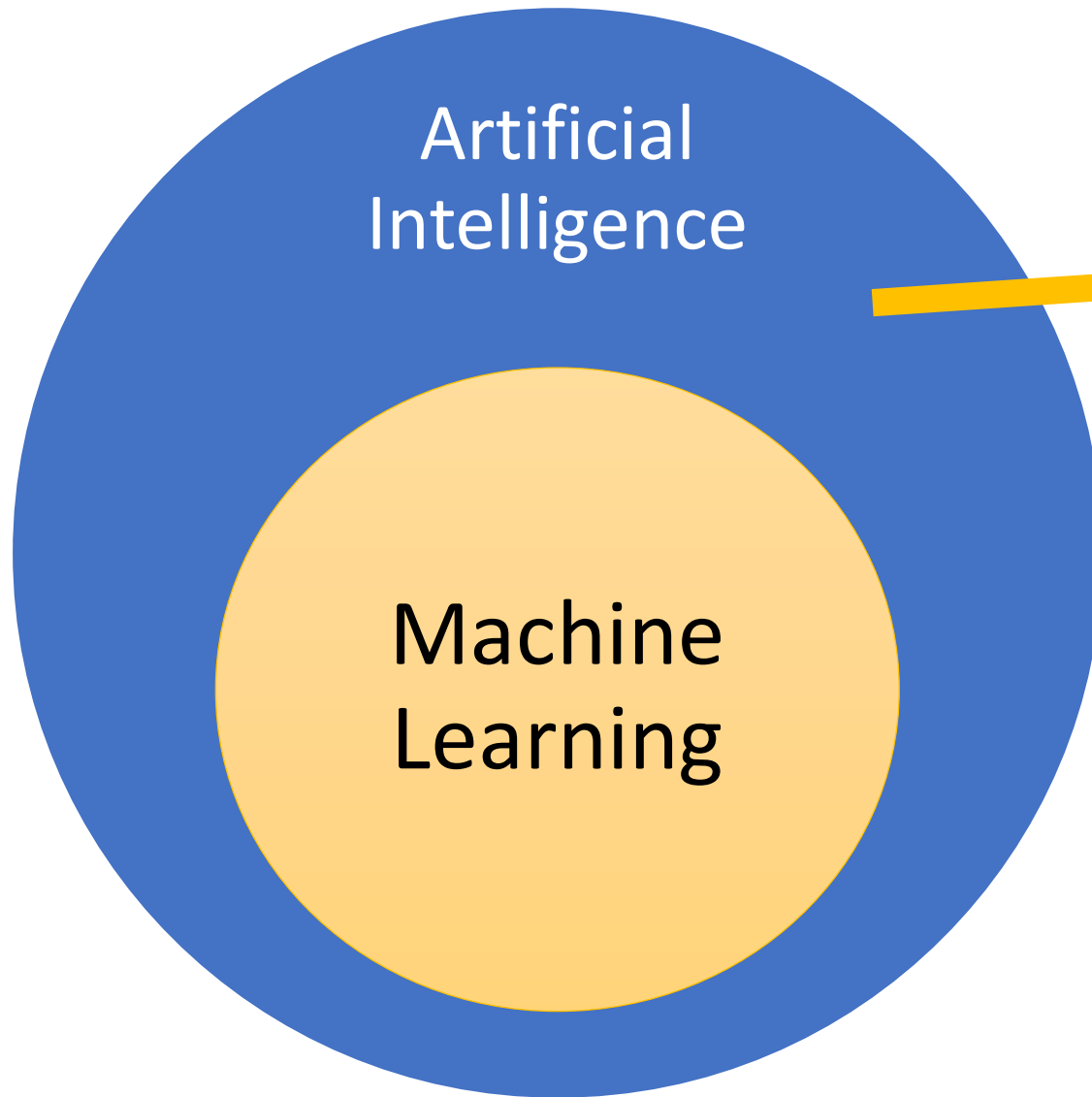
# Czym jest sztuczna inteligencja?



John McCarthy (1927 – 2011)

“[...] the science and technology of creating intelligent machines, especially intelligent computer programs”

“For the present purpose the artificial intelligence problem is taken to be that of making a machine behave in ways that would be called intelligent if a human were so behaving.”

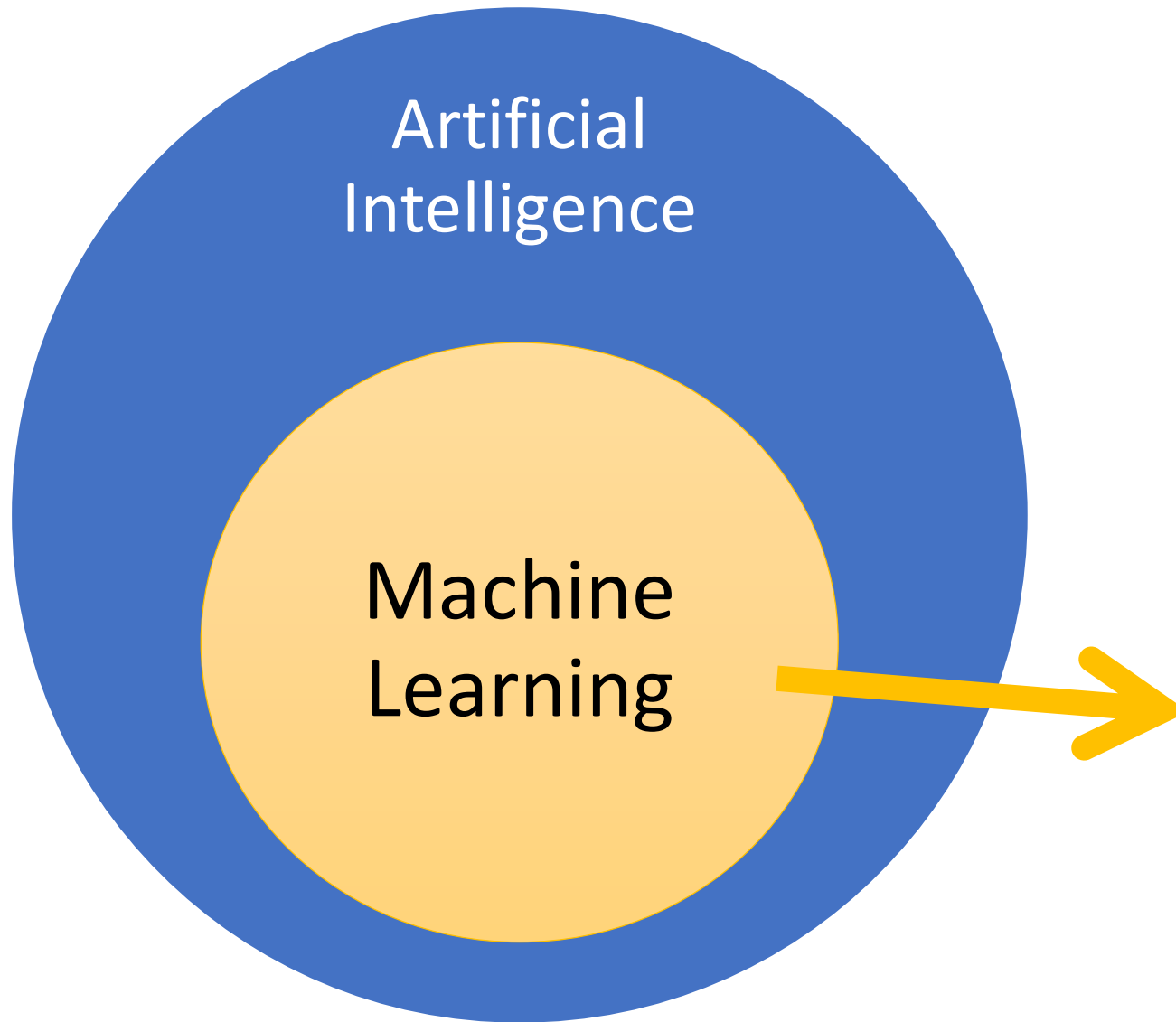


Artificial  
Intelligence

Machine  
Learning

- Reasoning
- Natural Language Processing
- Planning





- Supervised learning
- Unsupervised learning
- Reinforcement learning
- Deep learning



What is this?





KON iáki iest, káždy widzi. Jedne sá *Thracii*, to iest Tureckie, drugie Hiszpańskie, inne *Samogitici*, Zmudy, Albańskie, Poddunayskie, *Frisii* Frizy, Angielskie, Bachmáty Táatarskie, y Czerkieskie, Arabskie, Neápolitańskie, Ałtańskie, &c. *SYBARITOWIE* Nacya Włoska dawnych czasow w roskoszach utopieni, y Koni do głosu trąb Woennych płąać uczyli, podczas częstych Traktamentow tey zążywaiąc krotofili. O czym *Krotoniatow* Nacya wiedząc, Woynę im wypowiedziała, ná nich nie broni, y zbroi, ále trąb zążywszy, Konie pod niemi do tańcu y pomieszania szykow przyprowadzili, *hoc stratagemate Victores. Diodorus, Aelianus, Solinus, y Tympius, testes.* W Polizcze Nálzey rzecz pámięci godna y podziwienia dawnieyszych czasow stála się, co *miraculo adscribendum*, że Koń przedany od Pána Przebysława Srzeniawity, Pánu jednemu do Węgier, potym w lat trzy do przeszłego Pána się powrócił, stádo Koni z sobą przyprowadziwszy, *Paprocki.* Y to w Polzcie *contigit*, że





or





CAT



DOG

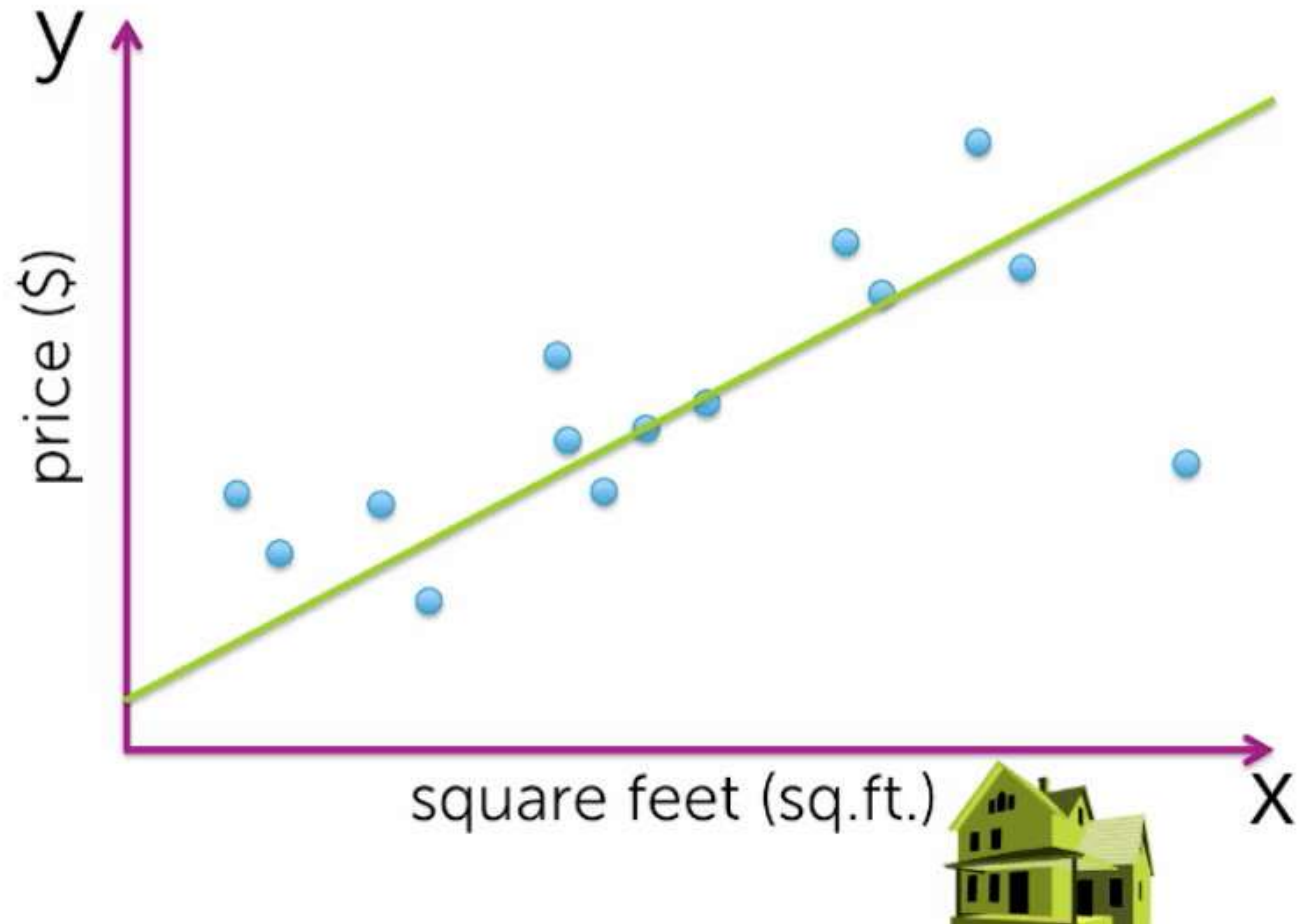


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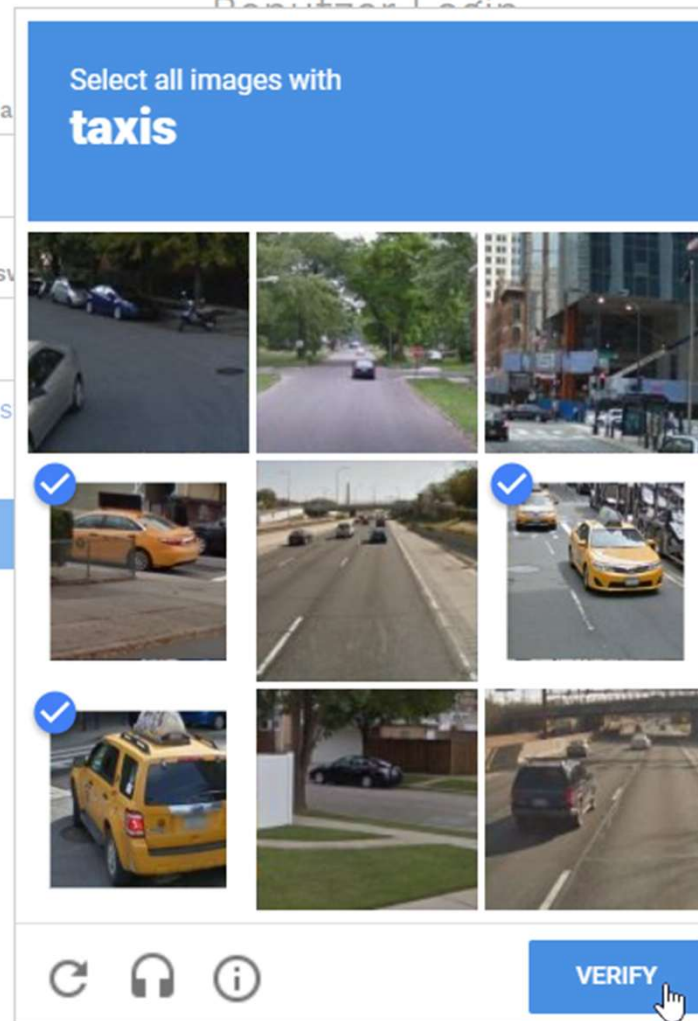




# Supervised le

*Supervised learning is about finding relationships between the target and the input data. We can **predict the output** based on the input data **which it learned from**.*

- predictions
- data is labeled
- regression



*relationships and dependencies between features such that we can learn from those relationships*

# Supervised learning

*Supervised learning algorithms try to model relationships and dependencies between the target prediction output and the input features such that we can **predict the output values for new data based on those relationships which it learned from the previous data sets.***

- predictions
- data is labeled
- regression or classification

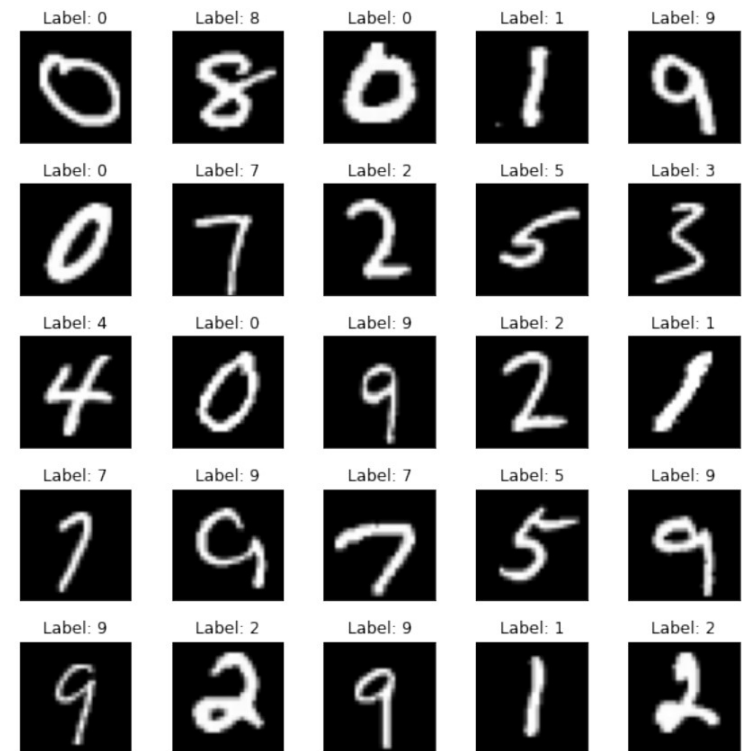
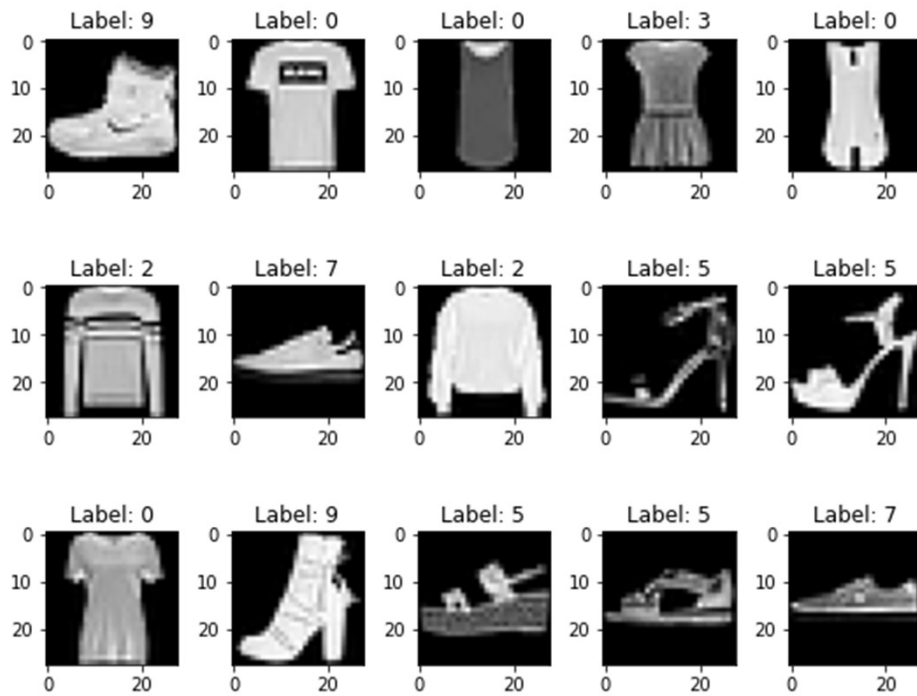


# Supervised learning

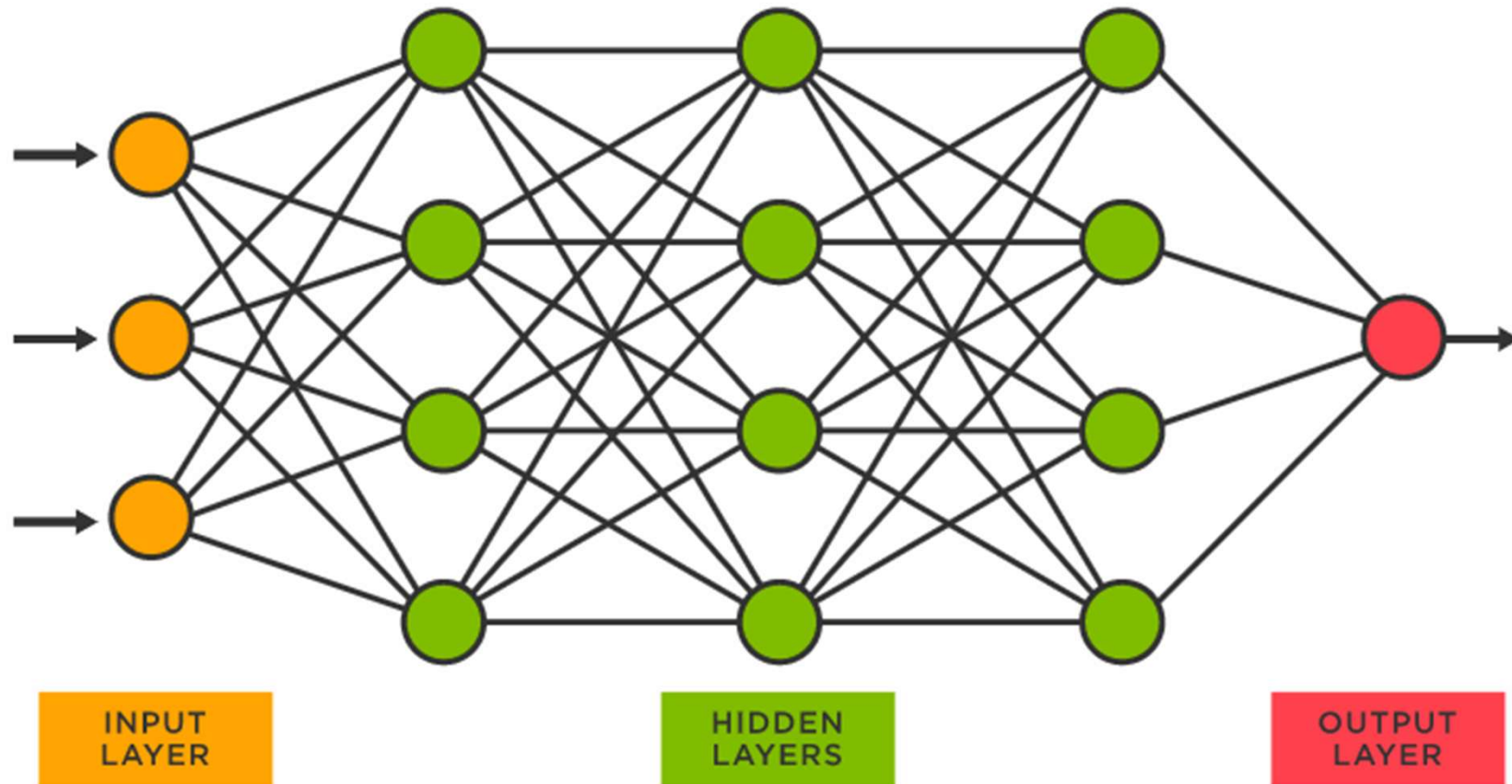
*Supervised learning algorithms try to model relationships and dependencies between the target prediction output and the input features such that we can **predict the output values for new data based on those relationships which it learned from the previous data sets.***

- Nearest neighbour (NN)
- Naive Bayes (NB)
- Decision Tree
- Linear regression
- Support Vector Machines (SVM)
- Neural Network

# Supervised learning

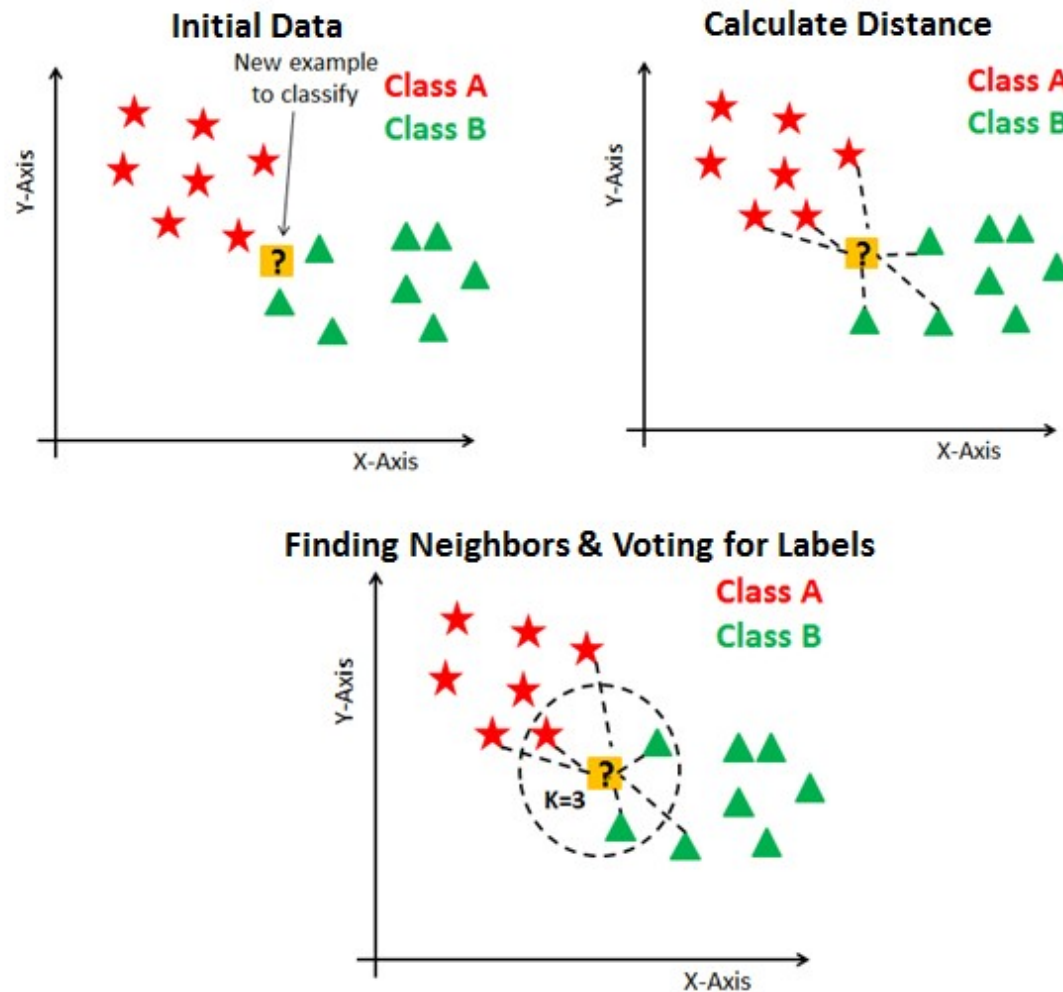


# Neural Networks



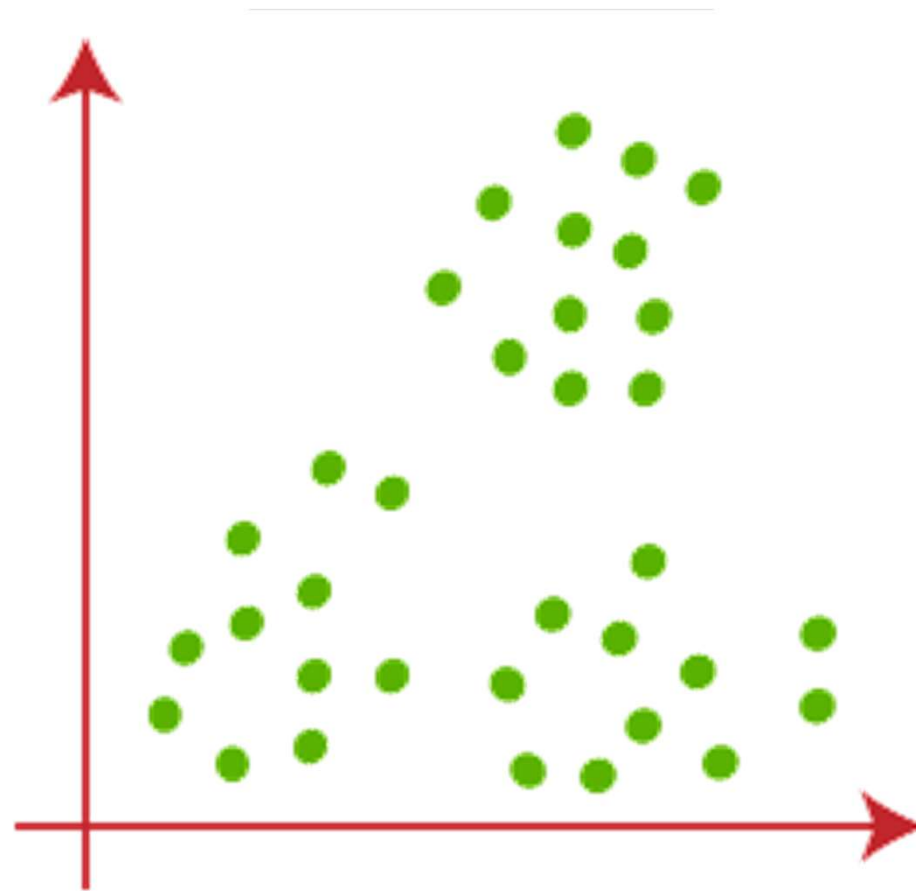


# K – Nearest Neighbours



# Unsupervised learning

*Unsupervised learning algorithms* try to use techniques on the input data to mine for **rules**, **detect patterns**, and **summarize and group the data points** which help in deriving meaningful insights and describe the data better to the users.

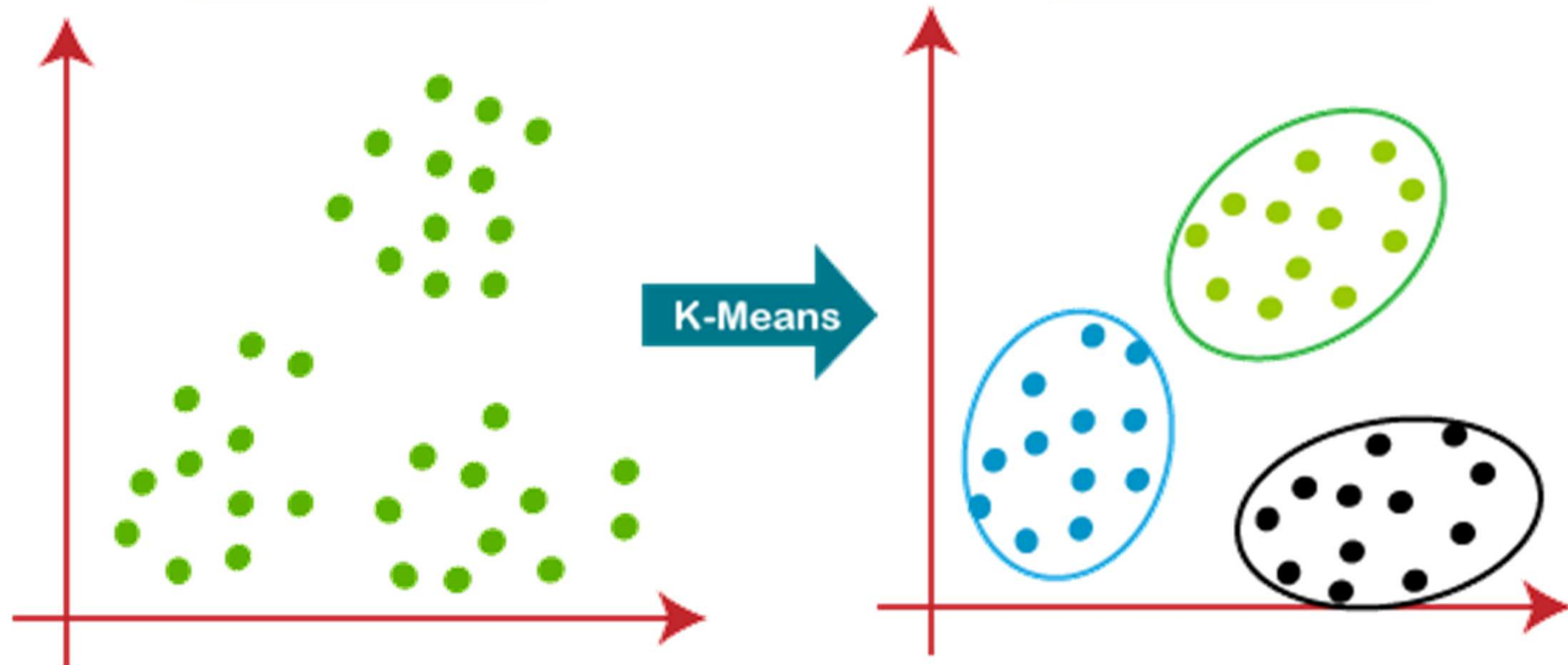




Before K-Means

After K-Means

K-Means



# Unsupervised learning

*Unsupervised learning algorithms* try to use techniques on the input data to *mine for **rules**, **detect patterns**, and **summarize and group the data points*** which help in deriving meaningful insights and describe the data better to the users.

- Descriptions / anomaly detection
- data is not labeled
- Clustering or association rules

Examples of algorithms that are used for **clusterization** :

- K-means
- Hierarchical clustering
- DBSCAN ( density-based spatial clustering of applications with noise)
- Gaussian mixture

Examples of algorithms that are used for **detecting anomalies**:

- SVM (state vector machine)

Examples of algorithms that are used for **visualization and dimensionality reduction**:

- Principal component analysis
- kernel principal component analysis



## Semi-supervised learning

- Part of data is labeled

## Reinforcement learning

- Data is collected

[https://www.youtube.com/watch?v=n2gE7n11h1Y&ab\\_channel=JieTan](https://www.youtube.com/watch?v=n2gE7n11h1Y&ab_channel=JieTan)

# Classical Machine Learning

Task Driven

## Supervised Learning

( Pre Categorized Data )

Classification

( Divide the socks by Color )

Eg. Identity  
Fraud Detection

Regression

( Divide the Ties by Length )

Eg. Market  
Forecasting

Data Driven

## Unsupervised Learning

( Unlabelled Data )

Clustering

( Divide by Similarity )

Eg. Targeted  
Marketing

Association

( Identify Sequences )

Eg. Customer  
Recommendation

Dimensionality  
Reduction

( Wider Dependencies )

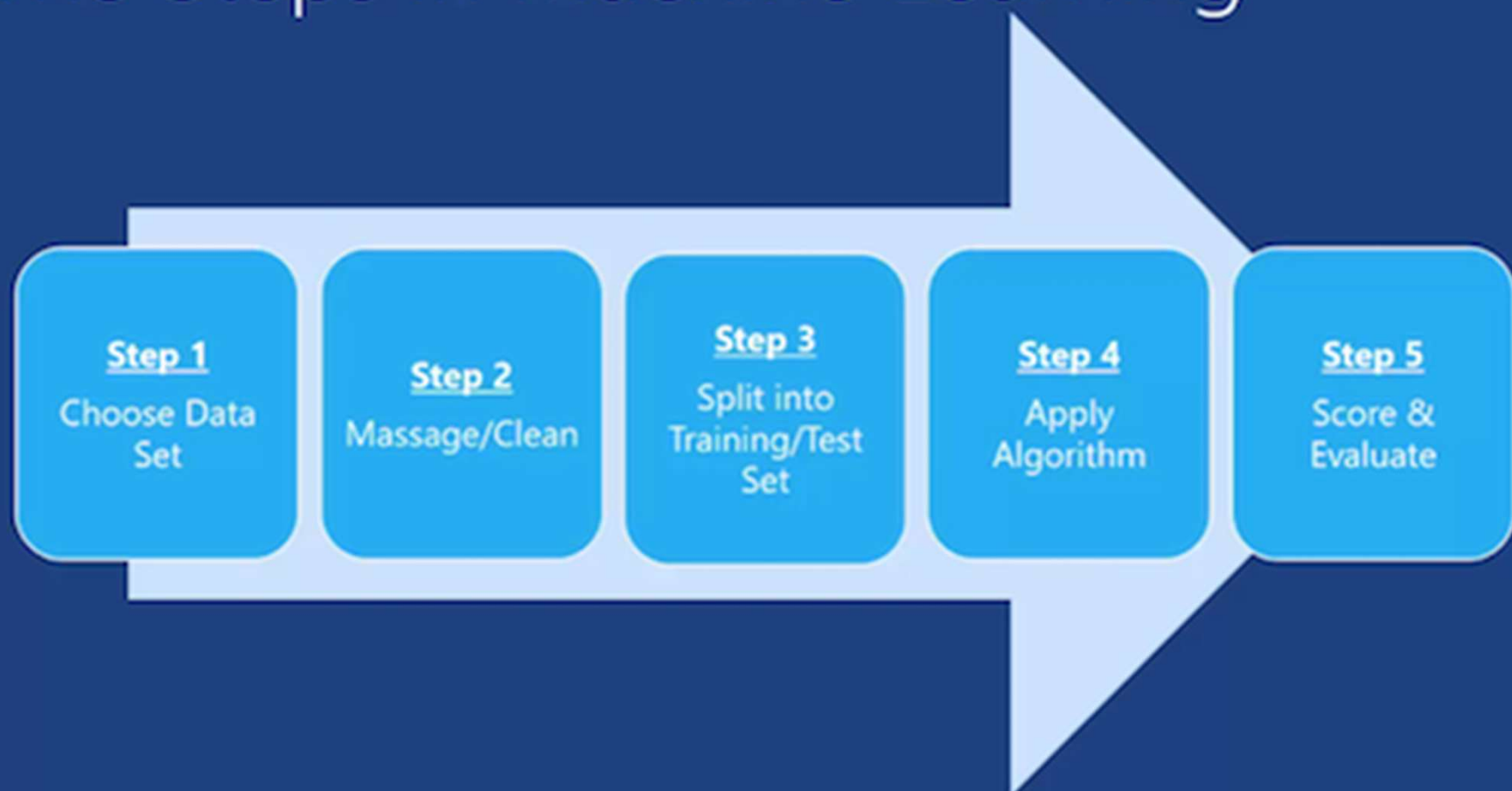
Eg. Big Data  
Visualization

Obj: Predications & Predictive Models

Pattern/ Structure Recognition



# The Steps in Machine Learning



# Basic vocabulary

Dataset

Data types

Mean

Median

Mode

Standard  
deviation

Variance

Distribution

Training/Test  
set



# Exemplary applications

Traffic Alerts

Social Media

Transportation and  
Commuting

Products  
Recommendations

Virtual Personal  
Assistants

Self Driving Cars

Dynamic Pricing

Google Translate

Online Video  
Streaming

Fraud Detection

<https://www.edureka.co/blog/machine-learning-applications/>