Introduction to Machine Learning

Agenda

- What is Data Science
- Data
- Components of Data Science
- Machine Learning
- Types of Machine Learning
- Steps to do Machine Learning
- Hands-on Problem Solving

Presenter

/arifmazumder

Mohammed Arif, PhD

Senior Technical Consultant

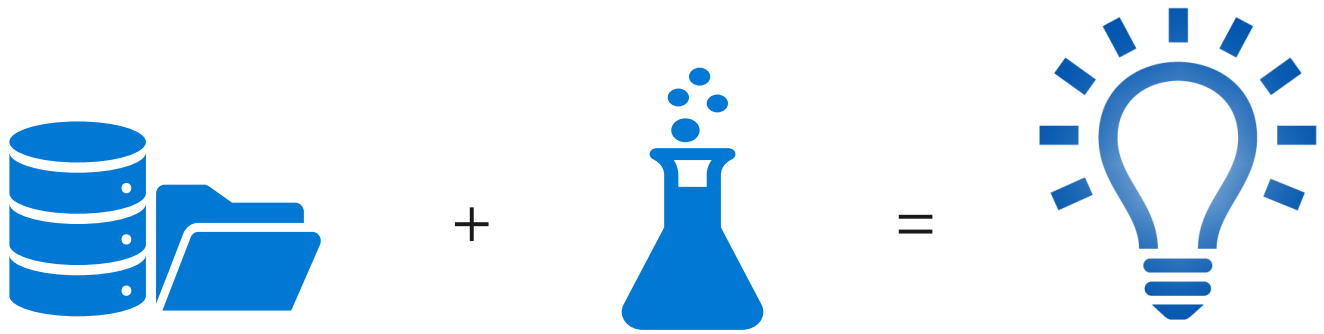
Big Data | Machine Learning | AI

Mohammed Arif has more than twelve (13) years of working experience in Information Communication and Technology (ICT) industry. The highlights of his career are more than six (7) years of holding various senior management and/or C-Level and had five (5) years of international ICT consultancy exposure in various countries (APAC and Australia), specially on Big Data, Data Engineering, Machine Learning and AI arena.

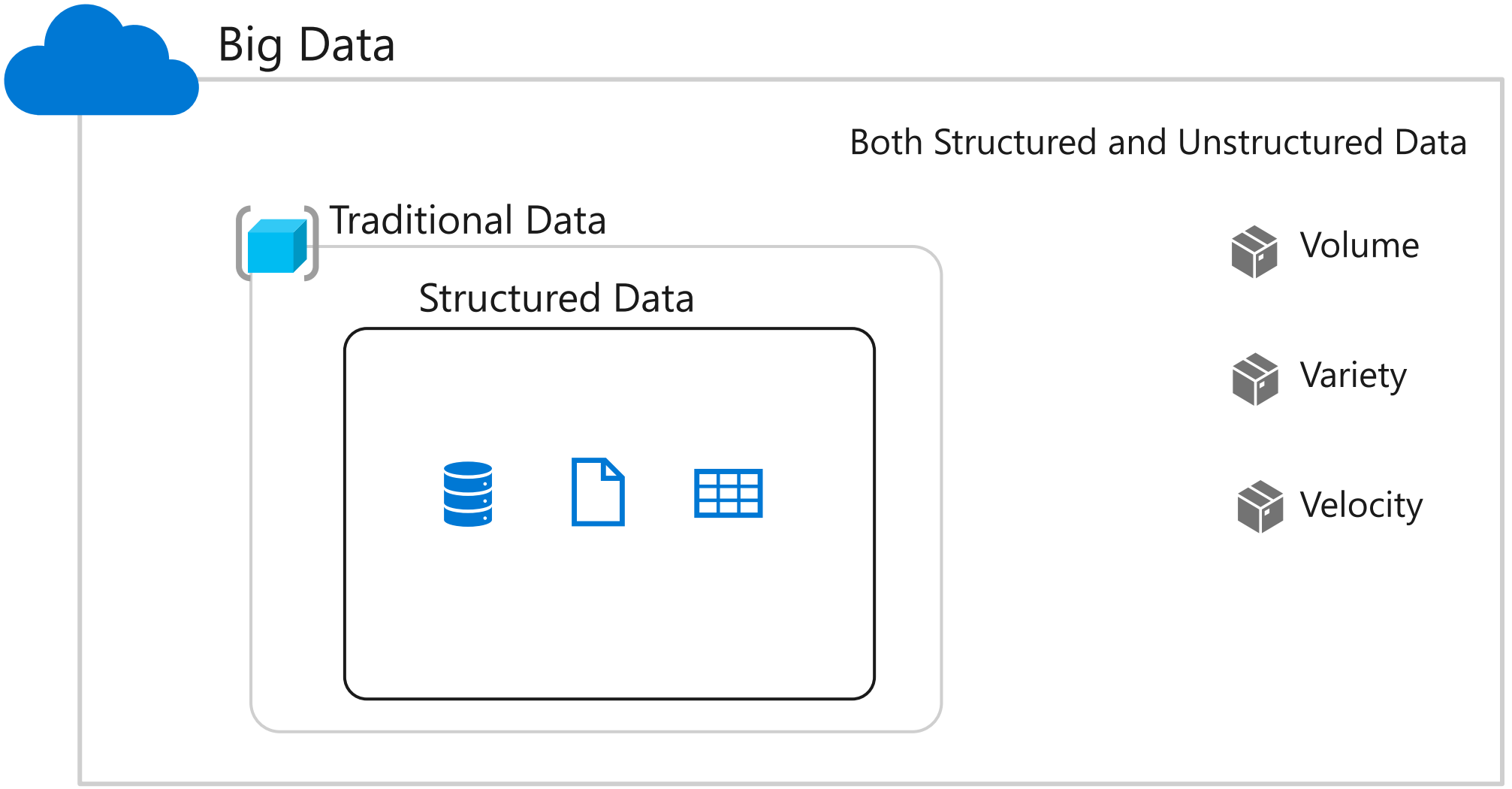
He is also Certified Trainer for Microsoft.

What is Data Science?

Apply Scientific Methods to extract Knowledge from Data.



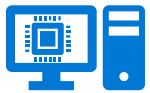
Data


Big Data
Both Structured and Unstructured Data
Traditional Data
Structured Data
Volume
Variety
Velocity

Scientific Methods

Statistics

Designed for inference about the relationships between variables



Machine Learning

Designed to make the most accurate predictions possible

Artificial Intelligence

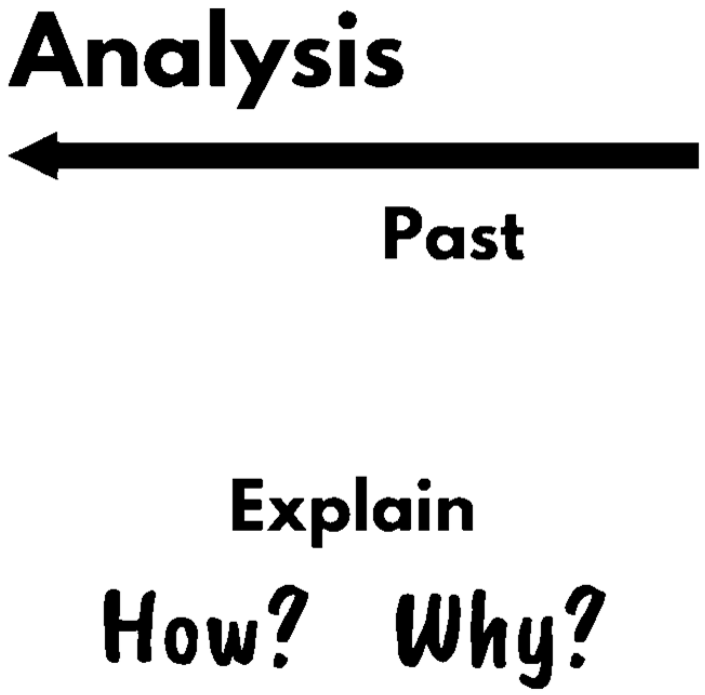
Designed to mimic human behavior using ML and Deep Learning

Machine Learning

Machine (computer) tries to find the pattern (self-learn) from the data without being explicitly programmed.

When we need to apply Machine Learning

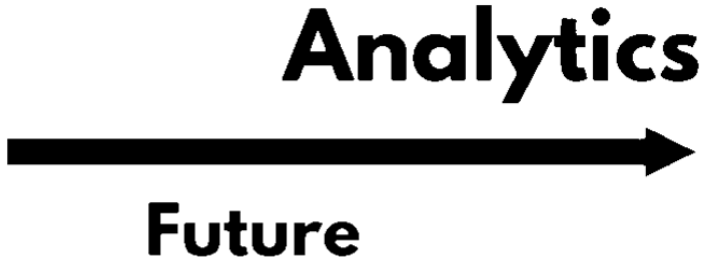
When we need to apply Machine Learning



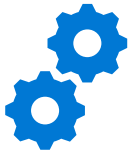
BI

We can use different tools to explain the previous trends like, PowerBI, Tableau, Qlikview etc.

When we need to apply Machine Learning



Explore potential future events

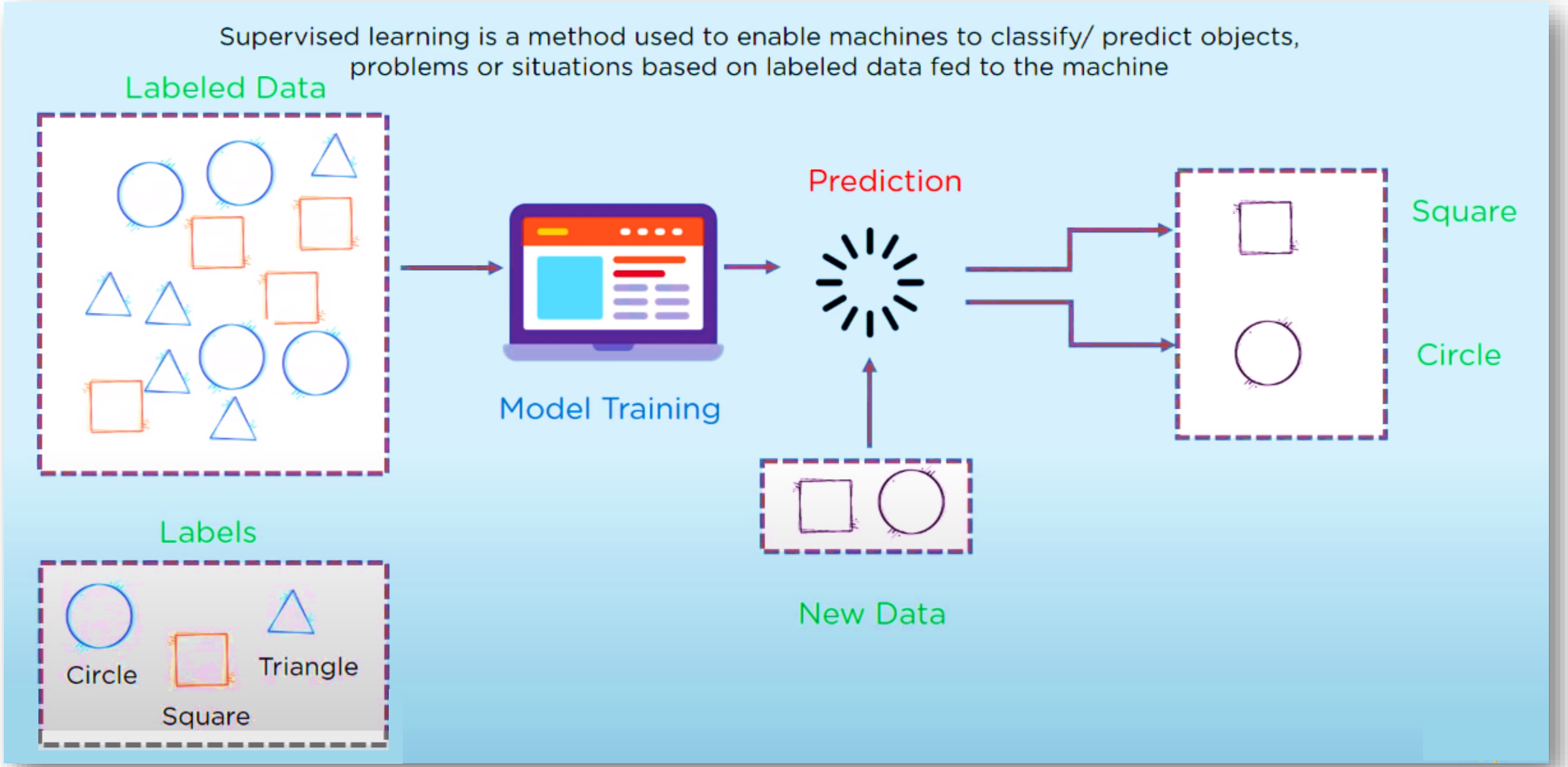


ML/AI

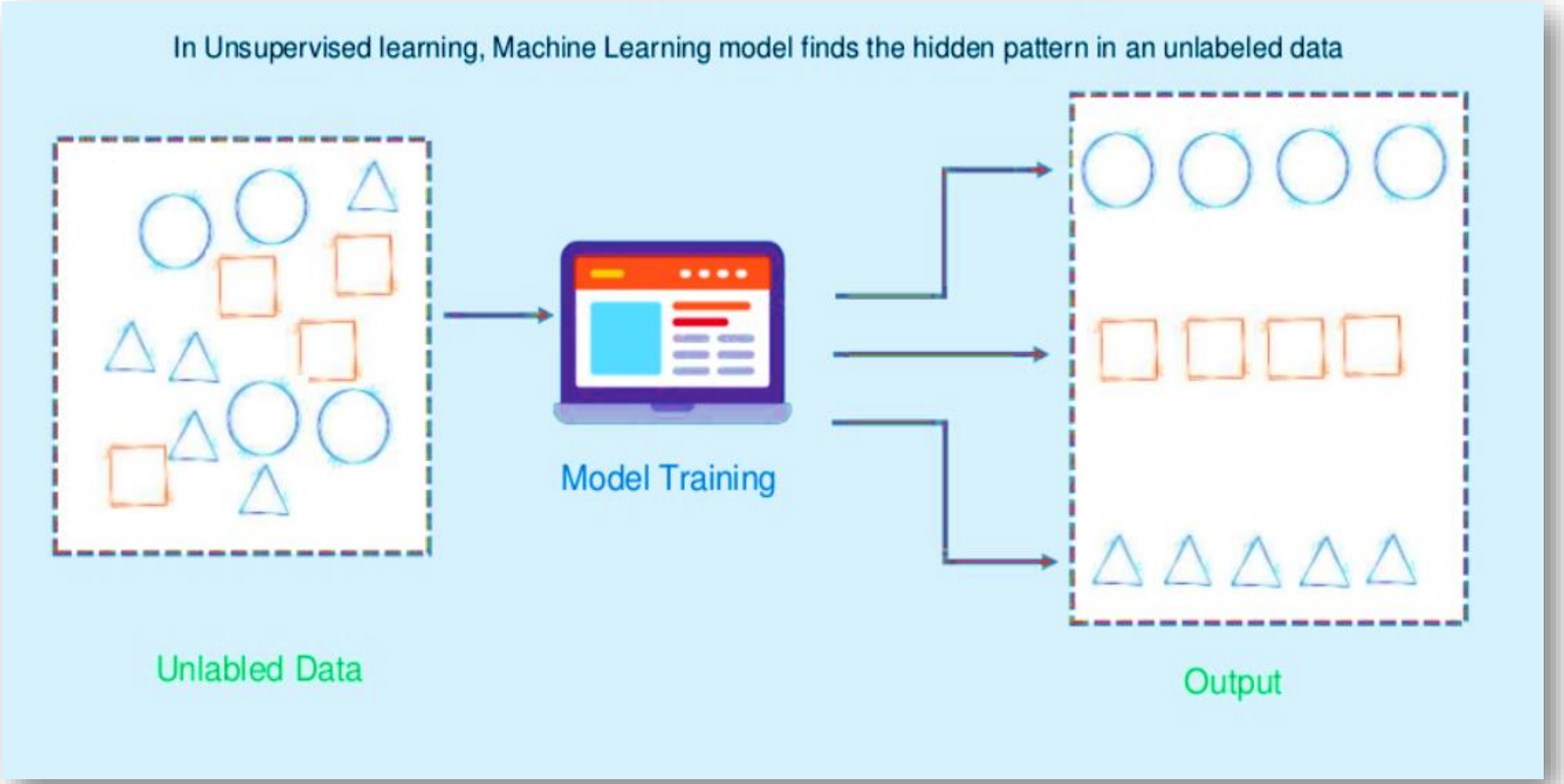
We can use different language packages and framework to implement ML/AI model.

Types of Machine Learning

Supervised Learning

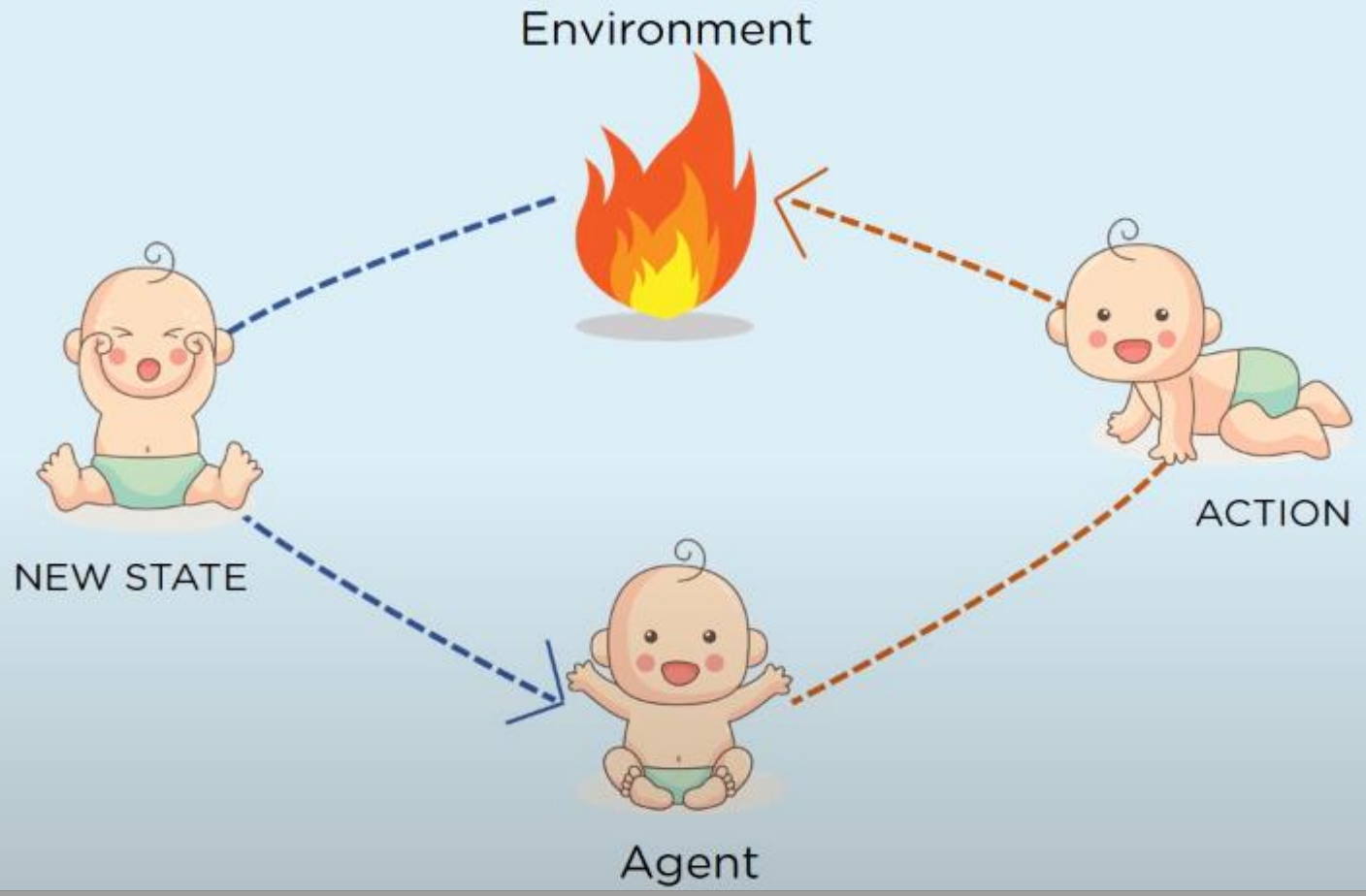


Unsupervised Learning



Reinforcement Learning

Reinforcement learning is an important type of Machine Learning where an agent learns how to behave in an environment by performing actions and seeing the results



Types of Machine Learning

Classification

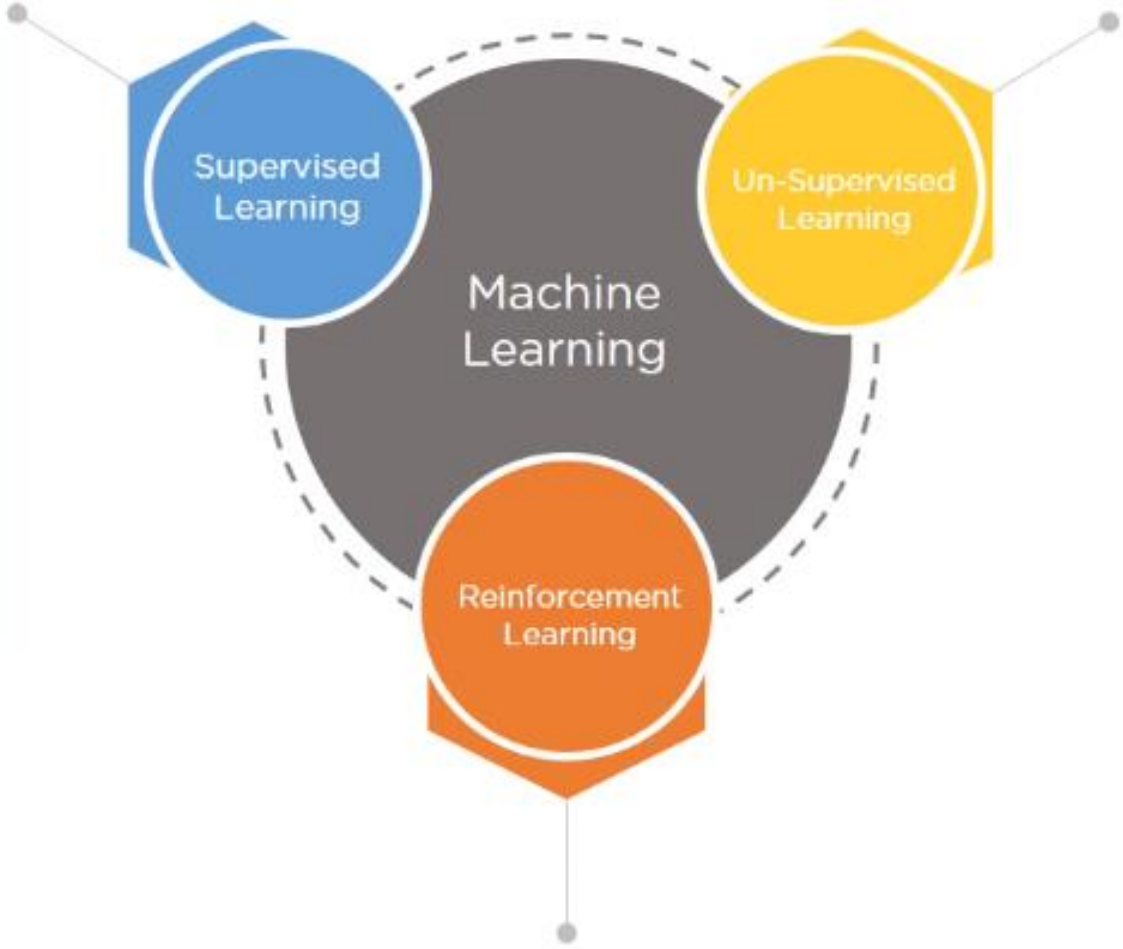
- Fraud Detection
- Email Spam Detection
- Image Classification

Categorical

Regression

- Weather Forecasting
- Risk Assessment
- Score Prediction

Numerical



Types of Machine Learning

Supervised learning, algorithms are trained using marked data, where the input and the output are known.

ID	Clump	UnifSize	UnifShape	MargAdh	SingEpiSize	BareNuc	BlandChrom	NormNucl	Mit	Class
1000025	5	1	1	1	2	1	3	1	1	benign
1002945	5	4	4	5	7	10	3	2	1	benign
1015425	3	1	1	1	2	2	3	1	1	malignant
1016277	6	8	8	1	3	4	3	7	1	benign
1017023	4	1	1	3	2	1	3	1	1	benign
1017122	8	10	10	8	7	10		7	1	malignant
1018099	1	1	1	1	2	10	3	1	1	benign
1018561	2	1	2	H	2	1	3	1	1	benign
1033078	2	1	1	1	2	1	1	1	5	benign
1033078	4	2	1	1	2	1	2	1	1	benign

labels

- Set of inputs ~ [Features] / [Independent Variables] / [X]
- Outputs ~ [Labels] / [Dependent Variables] / [Y]

Types of Machine Learning

User ID	Gender	Age	Salary	Purchased
15624510	Male	19	19000	0
15810944	Male	35	20000	1
15668575	Female	26	43000	0
15603246	Female	27	57000	0
15804002	Male	19	76000	1
15728773	Male	27	58000	1
15598044	Female	27	84000	0
15694829	Female	32	150000	1
15600575	Male	25	33000	1
15727311	Female	35	65000	0
15570769	Female	26	80000	1
15606274	Female	26	52000	0
15746139	Male	20	86000	1
15704987	Male	32	18000	0
15628972	Male	18	82000	0
15697686	Male	29	80000	0
15733883	Male	47	25000	1

Figure A: CLASSIFICATION

Temperature	Pressure	Relative Humidity	Wind Direction	Wind Speed
10.69261758	986.882019	54.19337313	195.7150879	3.278597116
13.59184184	987.8729248	48.0648859	189.2951202	2.909167767
17.70494885	988.1119385	39.11965597	192.9273834	2.973036289
20.95430404	987.8500366	30.66273218	202.0752869	2.965289593
22.9278274	987.2833862	26.06723423	210.6589203	2.798230886
24.04233986	986.2907104	23.46918024	221.1188507	2.627005816
24.41475295	985.2338867	22.25082295	233.7911987	2.448749781
23.93361956	984.8914795	22.35178837	244.3504333	2.454271793
22.68800023	984.8461304	23.7538641	253.0864716	2.418341875
20.56425726	984.8380737	27.07867944	264.5071106	2.318677425
17.76400389	985.4262085	33.54900114	280.7827454	2.343950987
11.25680746	988.9386597	53.74139903	68.15406036	1.650191426
14.37810685	989.6819458	40.70884681	72.62069702	1.553469896
18.45114201	990.2960205	30.85038484	71.70604706	1.005017161
22.54895853	989.9562988	22.81738811	44.66042709	0.264133632
24.23155922	988.796875	19.74790765	318.3214111	0.329656571

Figure B: REGRESSION

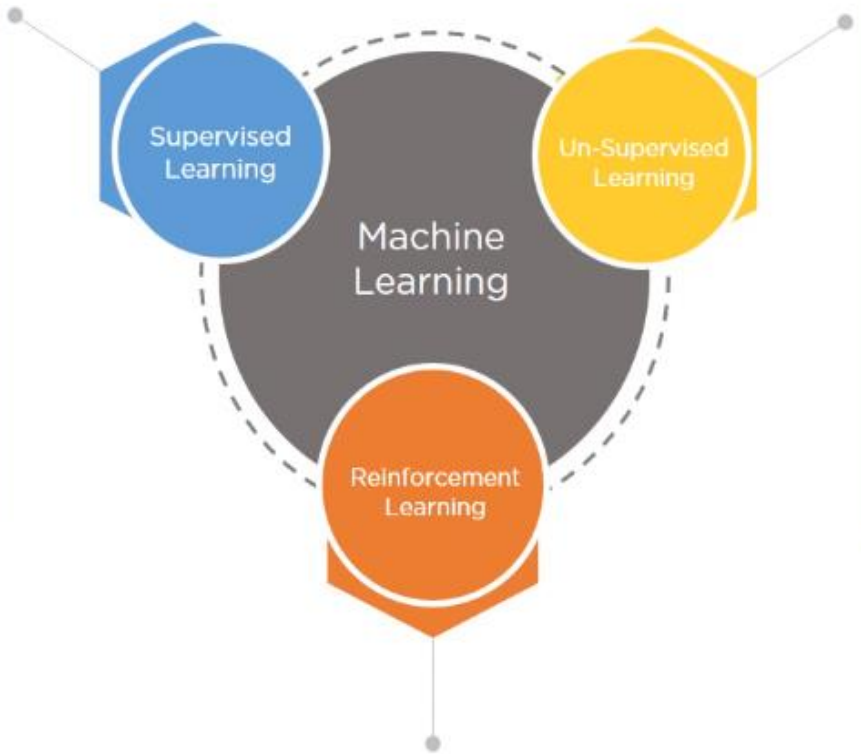
Types of Machine Learning

Classification

- Fraud Detection
- Email Spam Detection
- Image Classification

Regression

- Weather Forecasting
- Risk Assessment
- Score Prediction



Association

- Market Basket Analysis
- Text Mining
- Face Recognition

Clustering

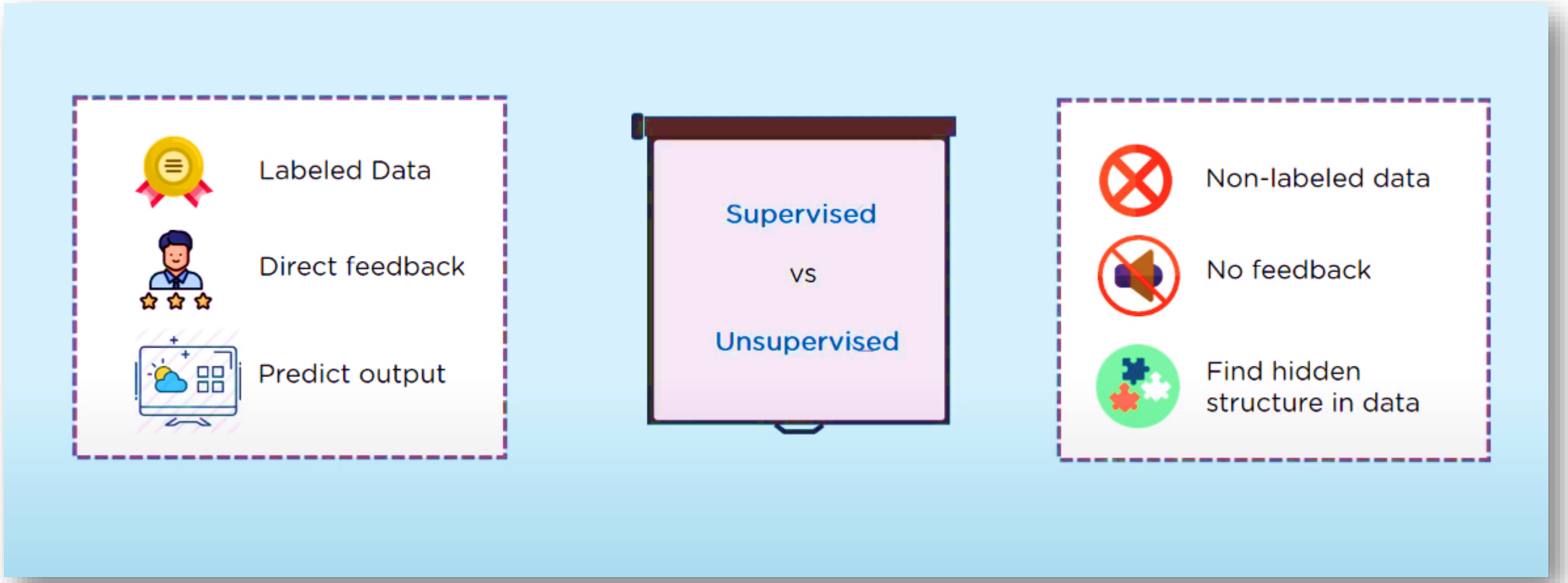
- Medical Research
- City Planning
- Targeted Marketing

Types of Machine Learning

Customer Id	Age	Edu	Years Employed	Income	Card Debt	Other Debt	Address	DebtIncomeRatio
1	41	2	6	19	0.124	1.073	NBA001	6.3
2	47	1	26	100	4.582	8.218	NBA021	12.8
3	33	2	10	57	6.111	5.802	NBA013	20.9
4	29	2	4	19	0.681	0.516	NBA009	6.3
5	47	1	31	253	9.308	8.908	NBA008	7.2
6	40	1	23	81	0.998	7.831	NBA016	10.9
7	38	2	4	56	0.442	0.454	NBA013	1.6
8	42	3	0	64	0.279	3.945	NBA009	6.6
9	26	1	5	18	0.575	2.215	NBA006	15.5
10	47	3	23	115	0.653	3.947	NBA011	4
11	44	3	8	88	0.285	5.083	NBA010	6.1
12	34	2	9	40	0.374	0.266	NBA003	1.6

unlabeled

Types of Machine Learning



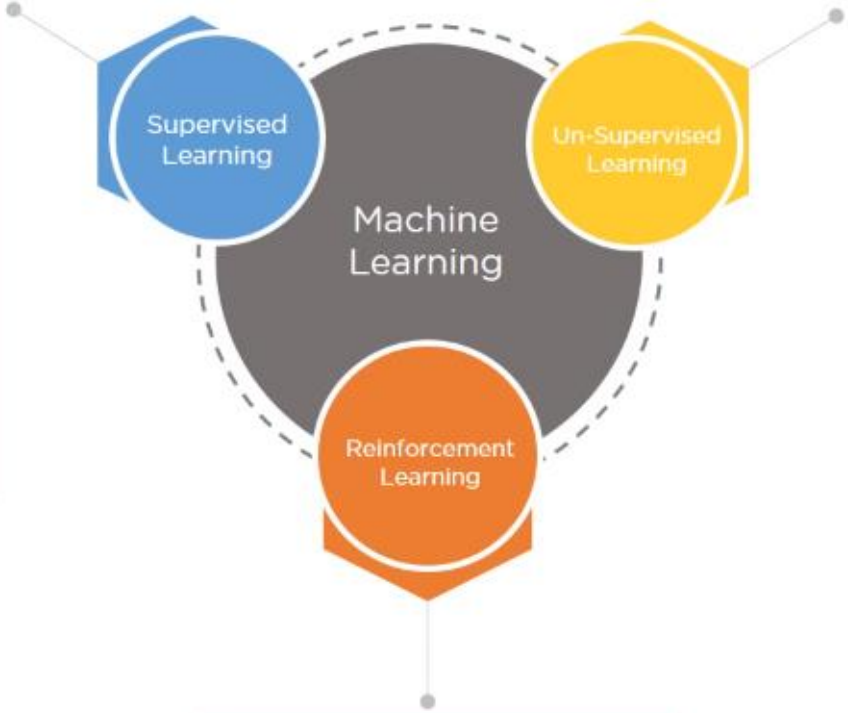
Types of Machine Learning (Examples)

Classification

- Fraud Detection
- Email Spam Detection
- Image Classification

Regression

- Weather Forecasting
- Risk Assessment
- Score Prediction



Association

- Market Basket Analysis
- Text Mining
- Face Recognition

Clustering

- Medical Research
- City Planning
- Targeted Marketing

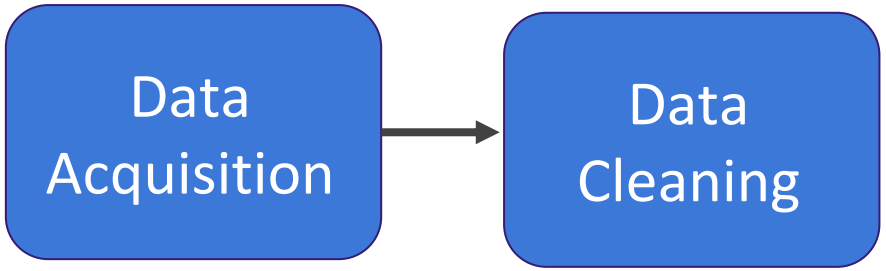
Reinforcement Learning

- Gaming
- Robot Navigation
- Stock Trading
- Assembly Line Processes

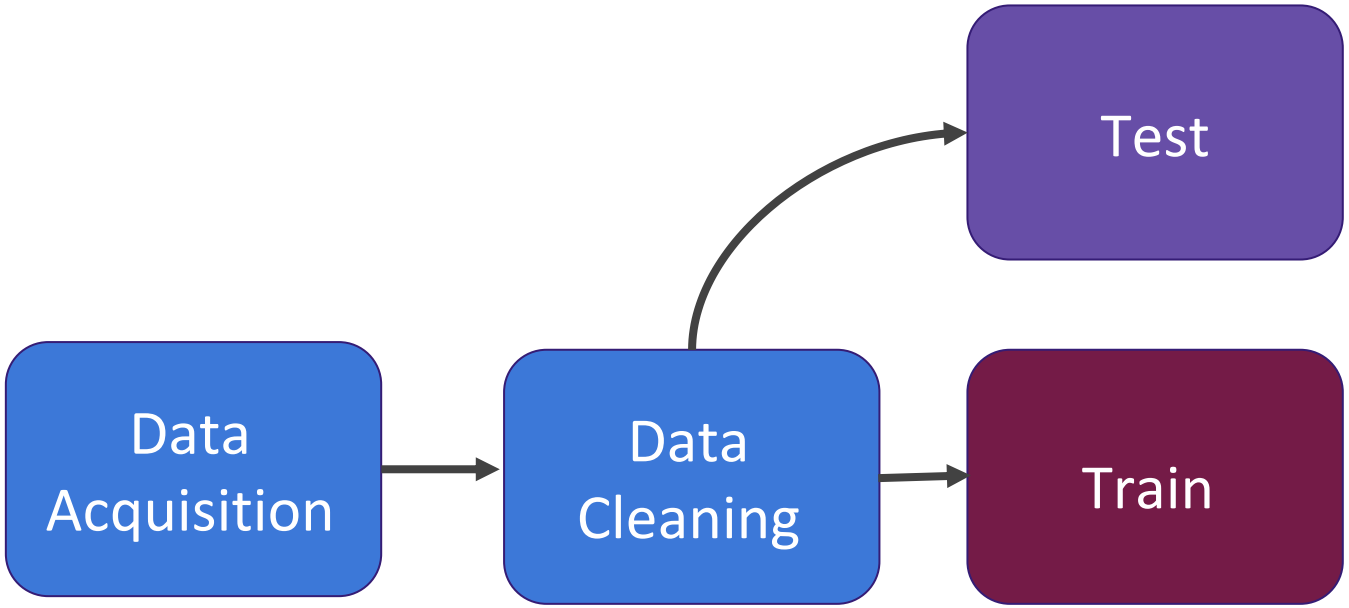
Let’s walk through the basic machine learning process for a supervised learning problem

Acquire Data from Some Source

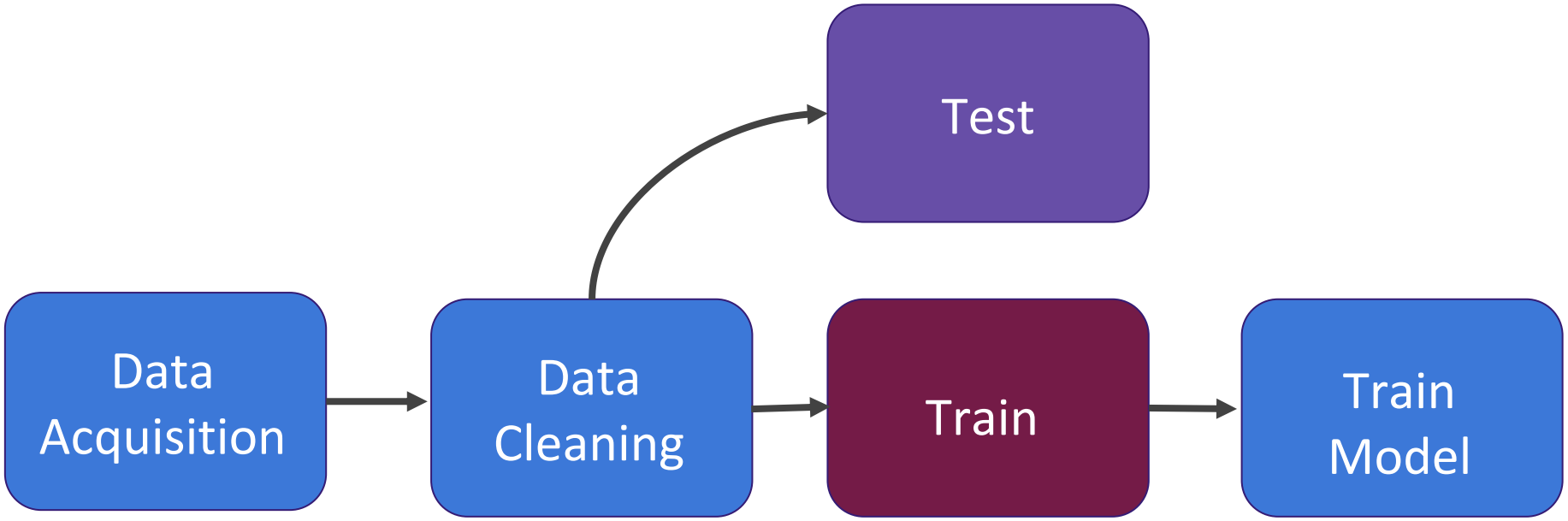
Clean **and** Organize the Data



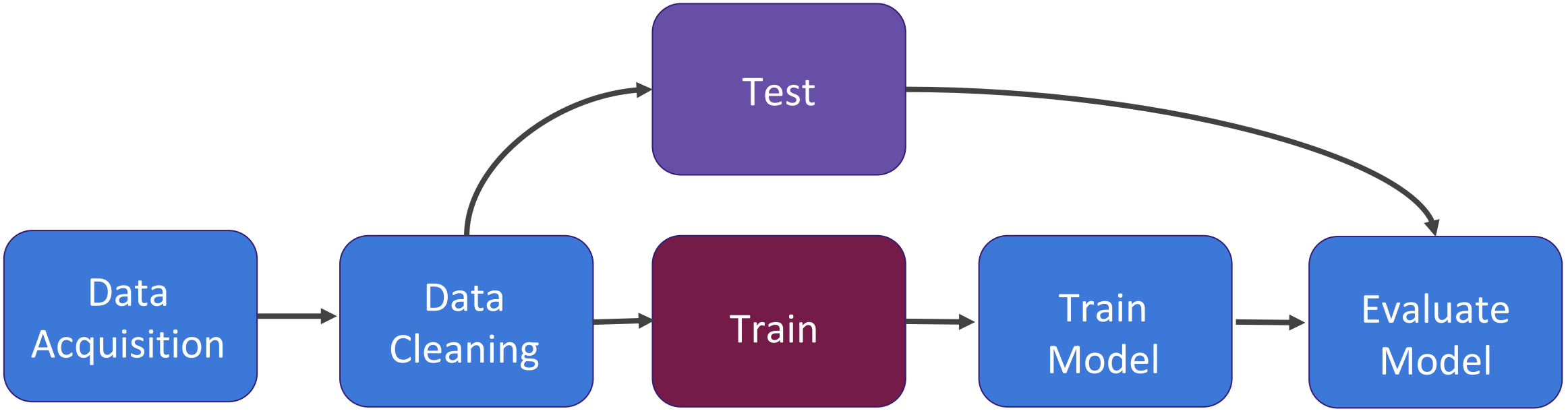
Train Test Split



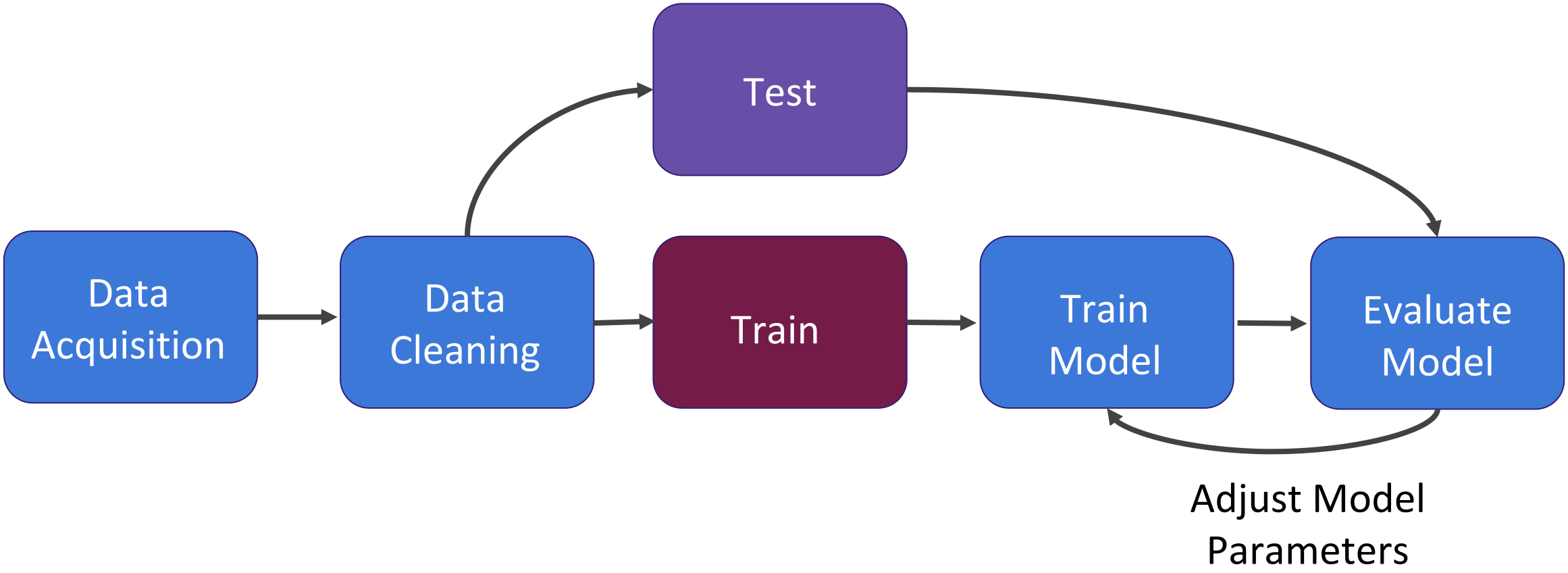
Train/Fit Model on Training Data



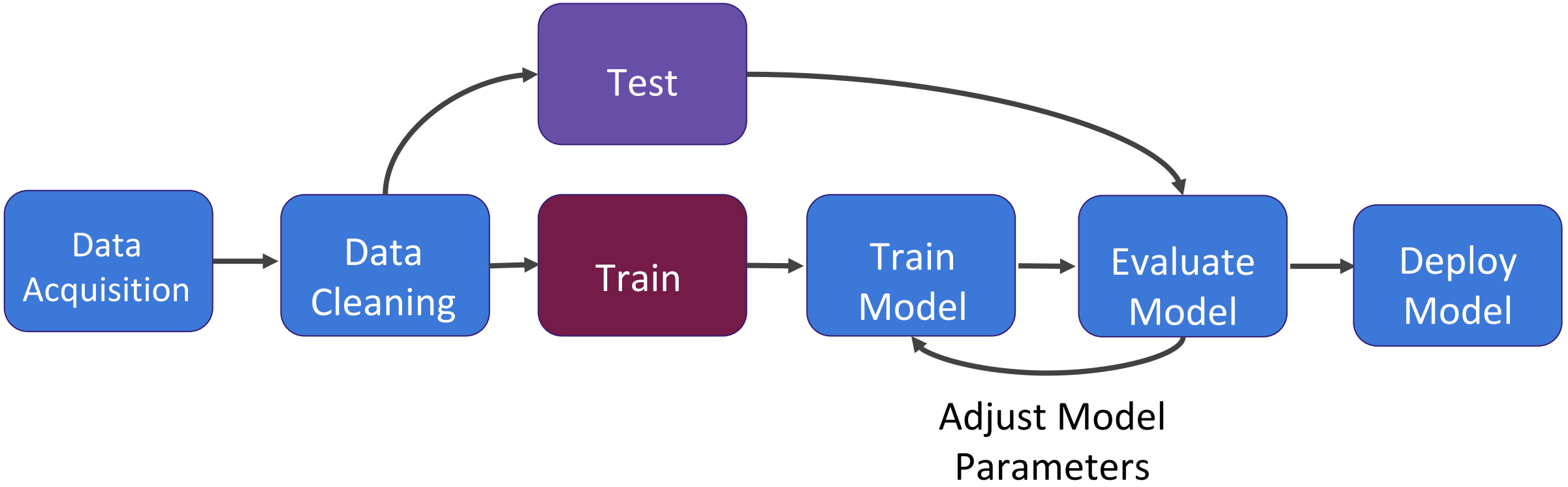
Evaluate Model on Test Data



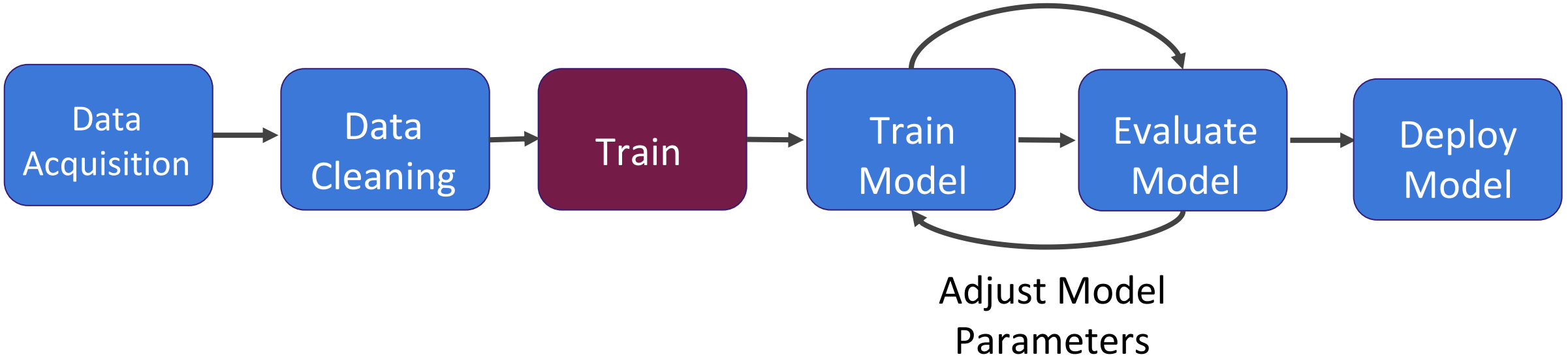
Adjust Model Parameters



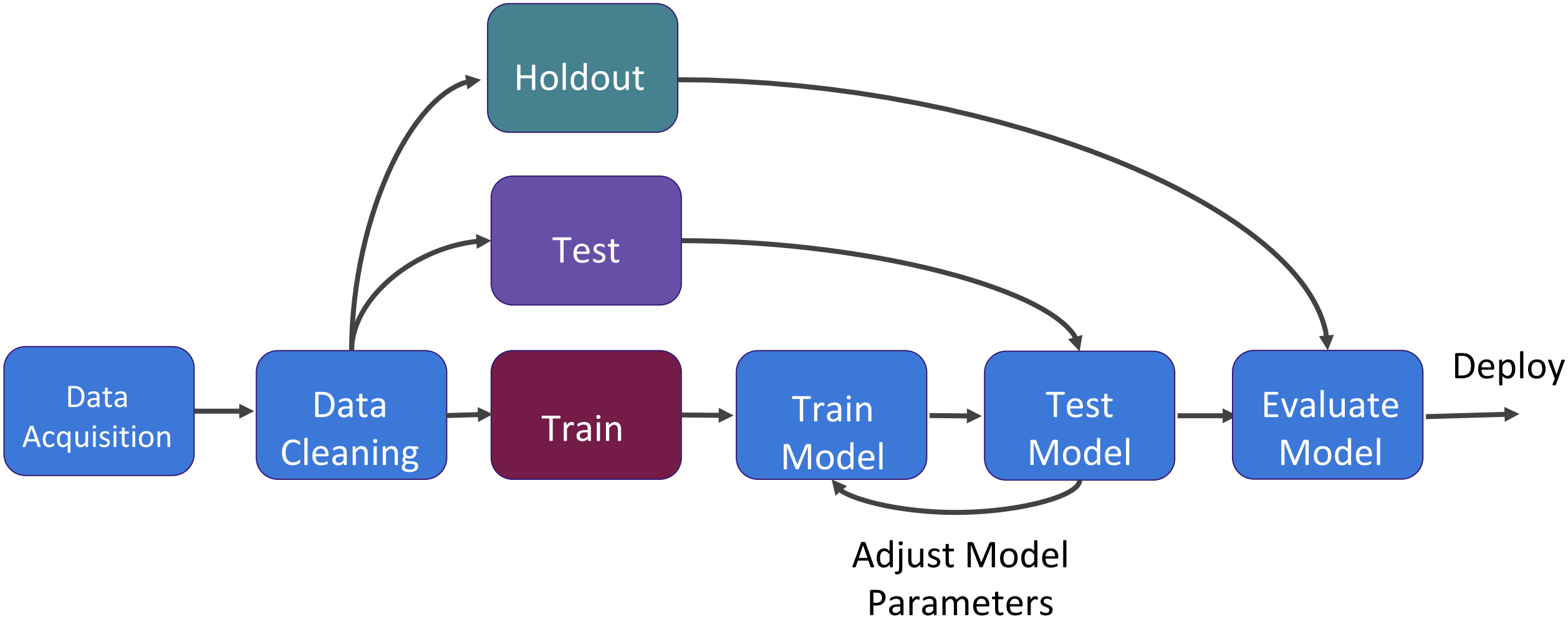
Deploy Model on New Incoming Data



Unsupervised Learning



Hold Out Sets



Finally let’s quickly discuss model evaluation,
we’ll dive into more details for certain problems later in the course.

Machine Learning – Model Evaluation

- Supervised Learning -Classification Evaluation
  - Accuracy , Recall, Precision
  - Accuracy - Correctly Classified divided by total samples.

- Which metric is the most important - depends on the specific situation

Machine Learning – Model Evaluation

- Supervised Learning -Regression Eval
  - MAE, MSE, RMSE
  - All are measurements of: On average, how far off are you from the correct continuous value.

Machine Learning – Model Evaluation

Please visit this page to get more intuition on Supervised Learning Model Evaluation

Machine Learning – Model Evaluation

- Unsupervised Learning - Evaluation
  - Much harder to evaluate, depends on overall goal of the task
  - Never had “Correct Labels” to compare to
  - Cluster Homogeneity, Rand Index

Machine Learning – Model Evaluation

- Reinforcement Learning - Evaluation
  - Usually more obvious, since the “evaluation” is built into the actual training of the model.
  - How well the model performs the task its assigned.

Review

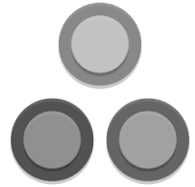
- Machine Learning
- Types of Machine Learning
- Machine Learning Process
- Evaluation Metrics

Major ML supported Languages

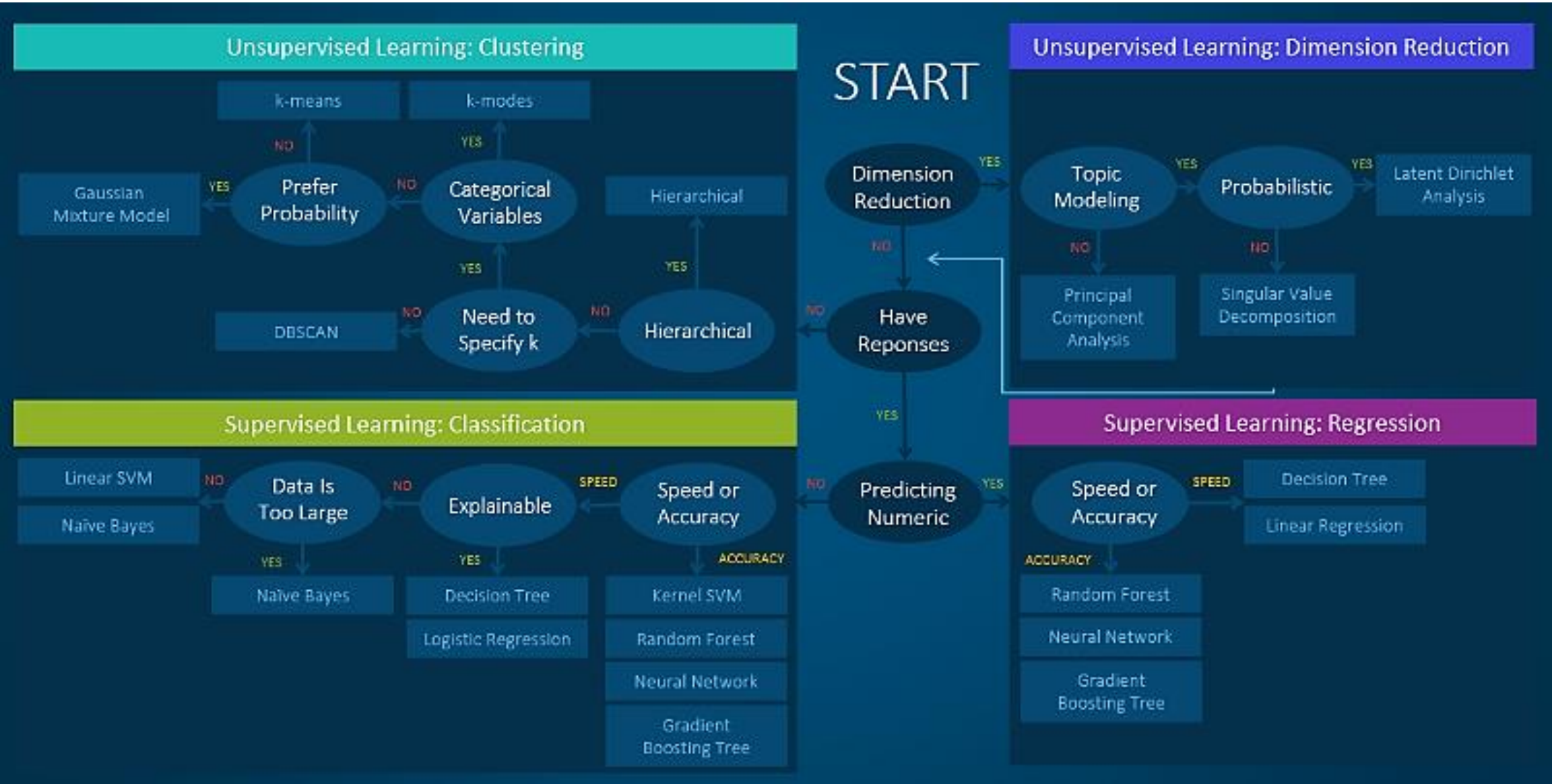
Python / R / Java / Scala / Spark / Julia / No Code

These language provide all necessary ML packages





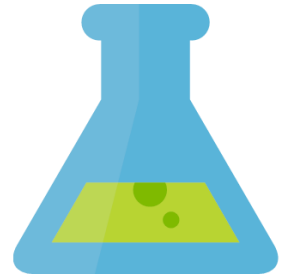
Algorithms


Unsupervised Learning: Clustering
k-means
k-modes
NO
YES
Gaussian Mixture Model
YES
Prefer Probability
NO
Categorical Variables
Hierarchical
YES
YES
DBSCAN
NO
Need to Specify k
NO
Hierarchical
START
Dimension Reduction
YES
NO
Have Reponses
NO
YES
Predicting Numeric
NO
YES
Unsupervised Learning: Dimension Reduction
Topic Modeling
YES
Probabilistic
YES
Latent Dirichlet Analysis
NO
NO
Principal Component Analysis
Singular Value Decomposition
Supervised Learning: Classification
Linear SVM
Naïve Bayes
NO
Data Is Too Large
NO
Explainable
SPEED
Speed or Accuracy
YES
YES
ACCURACY
Naïve Bayes
Decision Tree
Logistic Regression
Kernel SVM
Random Forest
Neural Network
Gradient Boosting Tree
Supervised Learning: Regression
Speed or Accuracy
SPEED
Decision Tree
Linear Regression
ACCURACY
Random Forest
Neural Network
Gradient Boosting Tree

Hands-on

Supervised Machine Learning

IDE : No Code Machine Learning with **Azure Machine Learning Studio (Classic)**



Hands-on

Step 1 : Please go to this site https://studio.azureml.net/

Step 2 : Use any Microsoft Account to Register and Login

Step 3 : Let’s do some Prediction

Hands-on

Supervised Machine Learning

IDE : Anaconda