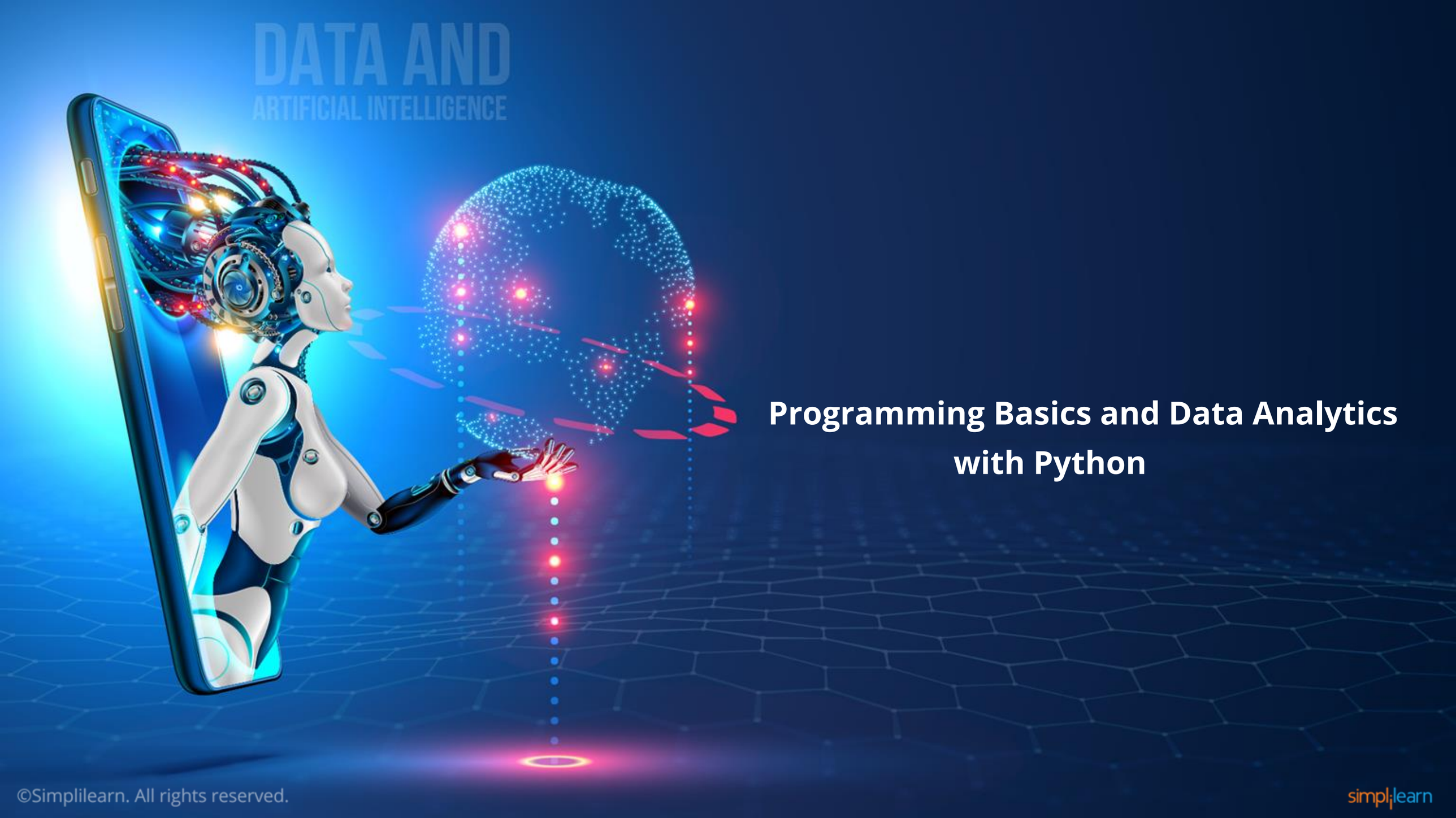


Programming Basics and Data Analytics with Python

simplilearn

Introduction to Model Building

Learning Objectives

By the end of this lesson, you will be able to:

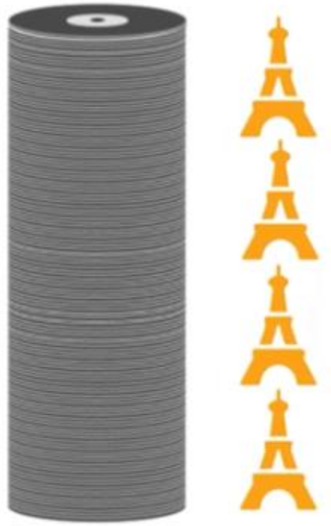
- Define machine learning
- Explain the machine learning approach
- List relevant terminologies that help you understand a dataset
- Discuss the features of supervised and unsupervised learning models
- Explain algorithms such as regression, classification, clustering, and dimensionality reduction

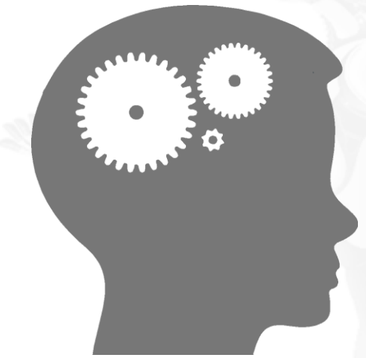
DATA AND
ARTIFICIAL INTELLIGENCE

Introduction to Machine Learning

Why Machine Learning?

If we stored the data generated in a day on Blu-ray disks and stacked them up, it would be equal to the height of four Eiffel towers. Machine learning helps analyze this data easily and quickly.



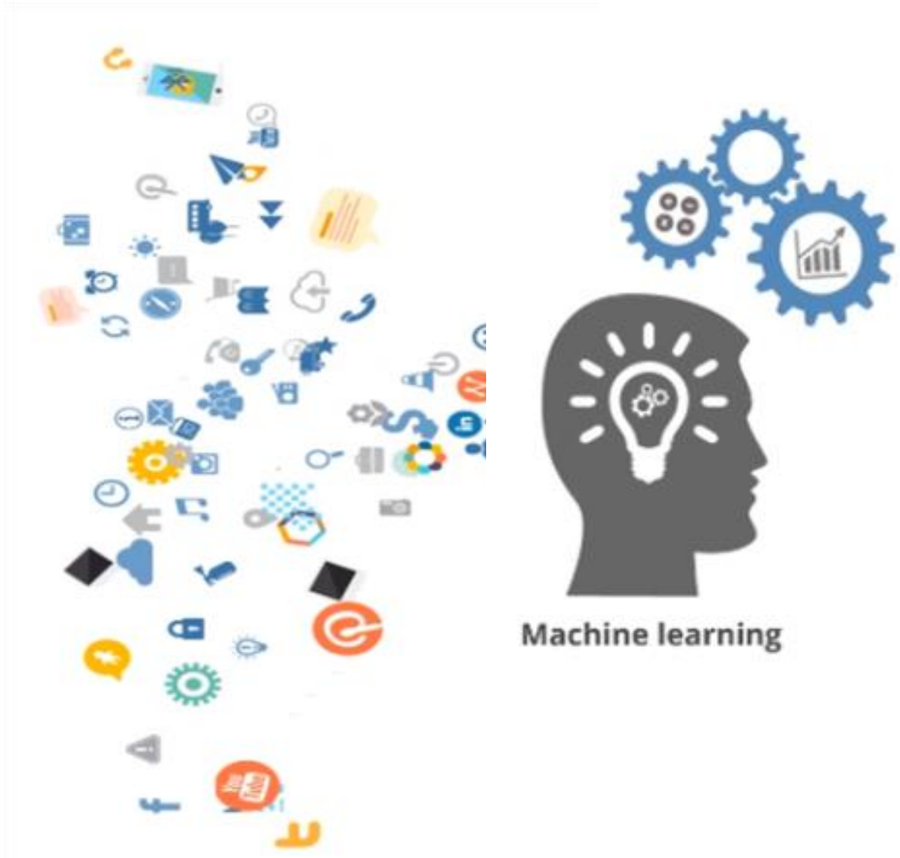


Machine Learning

Purpose of Machine Learning

Machine learning is a great tool to analyze data, find hidden data patterns and relationships, and extract information to enable information-driven decisions and provide insights.

Data



Identify patterns and relationships

Gain insights into unknown data

Take information-driven decisions

Machine Learning Terminologies

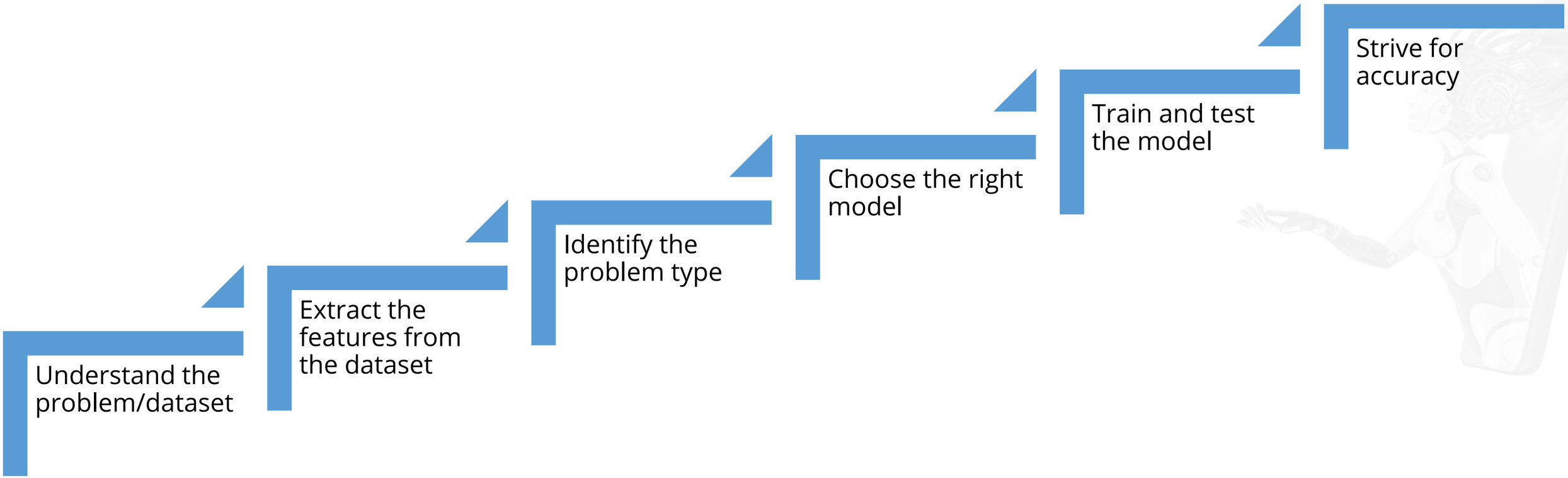
These are some machine learning terminologies that you will come across in this lesson:

DATA AND
ARTIFICIAL INTELLIGENCE

Machine Learning Approach

Machine Learning Approach

The machine learning approach starts with either a problem that you need to solve or a given dataset that you need to analyze.



Steps 1 and 2: Understand the Dataset and Extract Its Features

Let us look at a dataset and understand its features in terms of machine learning.

Features (attributes)

Response (label)

Education (Yrs.)	Professional Training (Yes/No)	Hourly Rate (USD)
16	1	90
15	0	65
12	1	70
18	1	130
16	0	110
16	1	100
15	1	105
31	0	70

Observations (records)

Predictors

Steps 3 and 4: Identify the Problem Type and Learning Model

Machine learning can either be supervised or unsupervised. The problem type should be selected based on the type of learning model.

Concept	Problem Types	Example

Supervised Learning

- In supervised learning, the dataset used to train a model should have observations, features, and responses. The model is trained to predict the right response for a given set of data points.
- Supervised learning models are used to predict an outcome.
- The goal of this model is to **generalize** a dataset so that the general rule can be applied to new data as well.

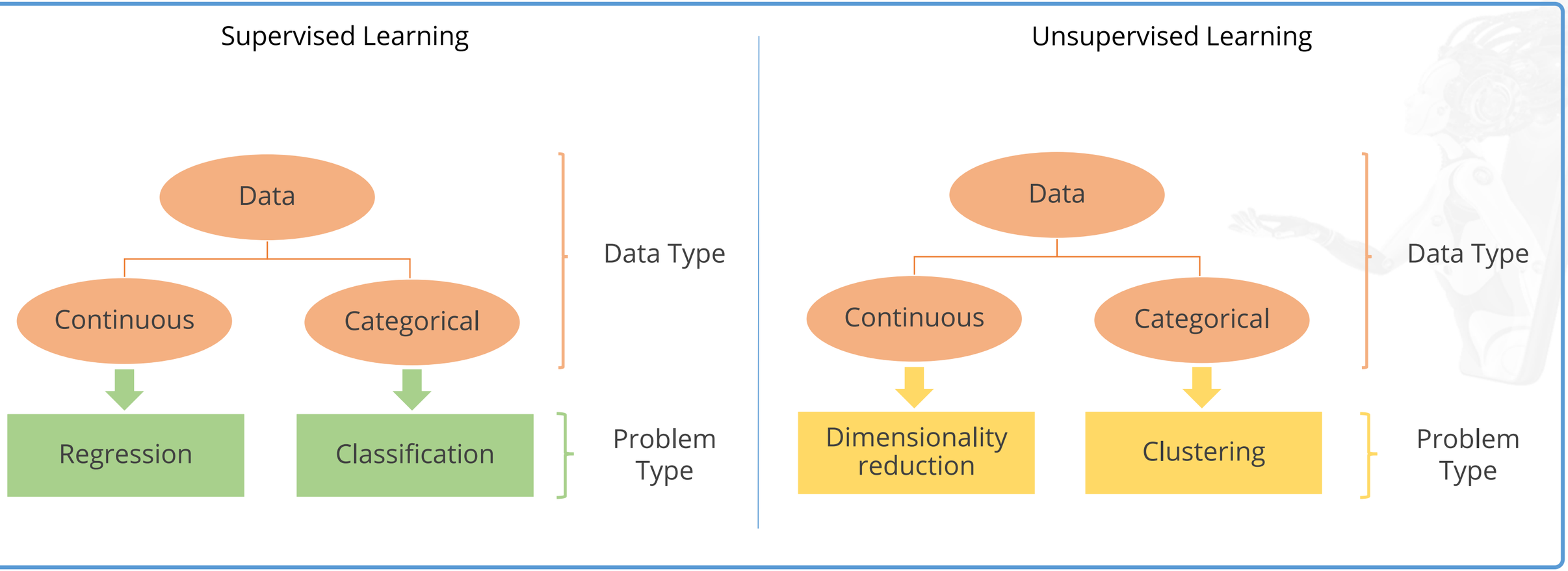
Unsupervised Learning

- In unsupervised learning, the response or the outcome of the data is not known.
- Unsupervised learning models are used to identify and visualize patterns in data by grouping similar types of data.
- The goal of this model is to **represent** data in a way that meaningful information can be extracted.

Steps 3 and 4: Identify the Problem Type and Learning Model

Data can either be continuous or categorical. Based on whether it is supervised or unsupervised learning, the problem type will differ.

Concept | Problem Types | Example

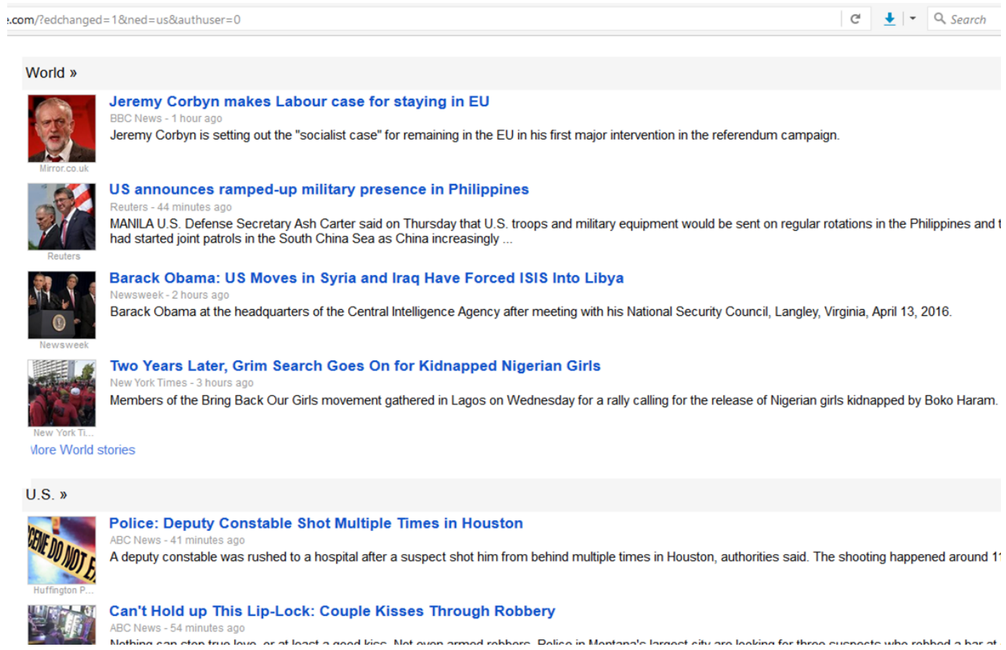


Steps 3 and 4: Identify the Problem Type and Learning Model

Some examples of supervised and unsupervised learning models are:

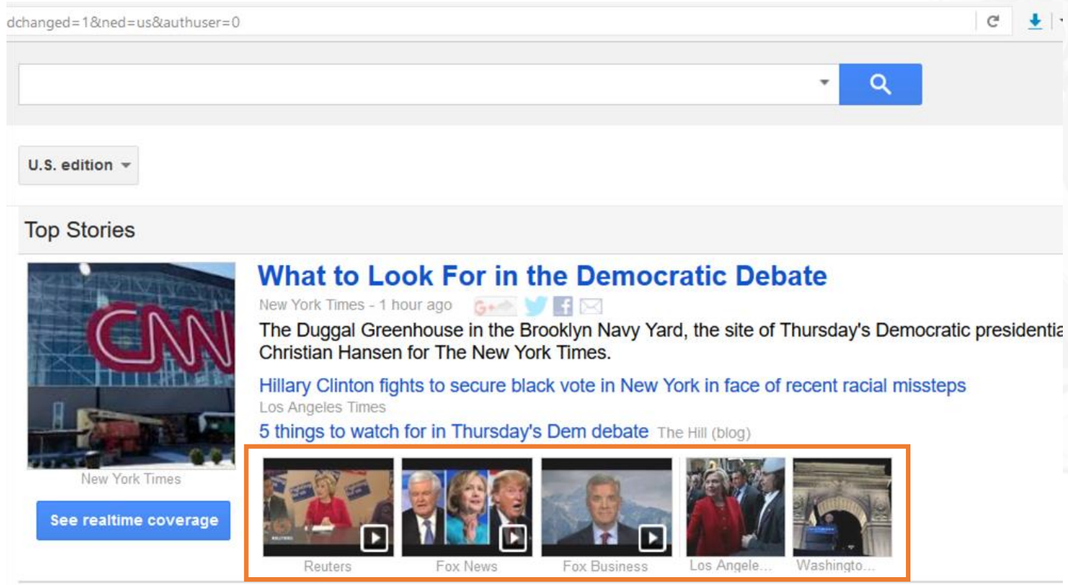
Concept	Problem Types	Example

Supervised Learning



Categories of news based on the topics

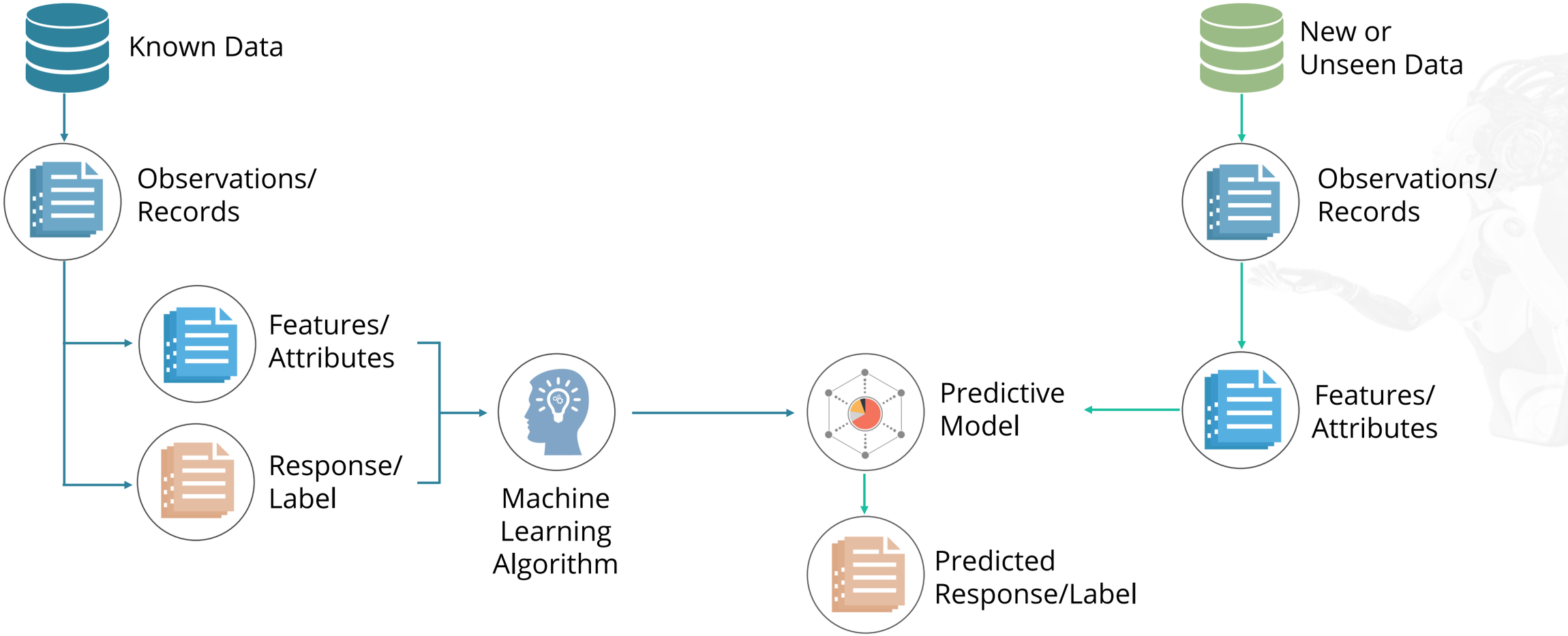
Unsupervised Learning



Grouping of similar stories on different news networks

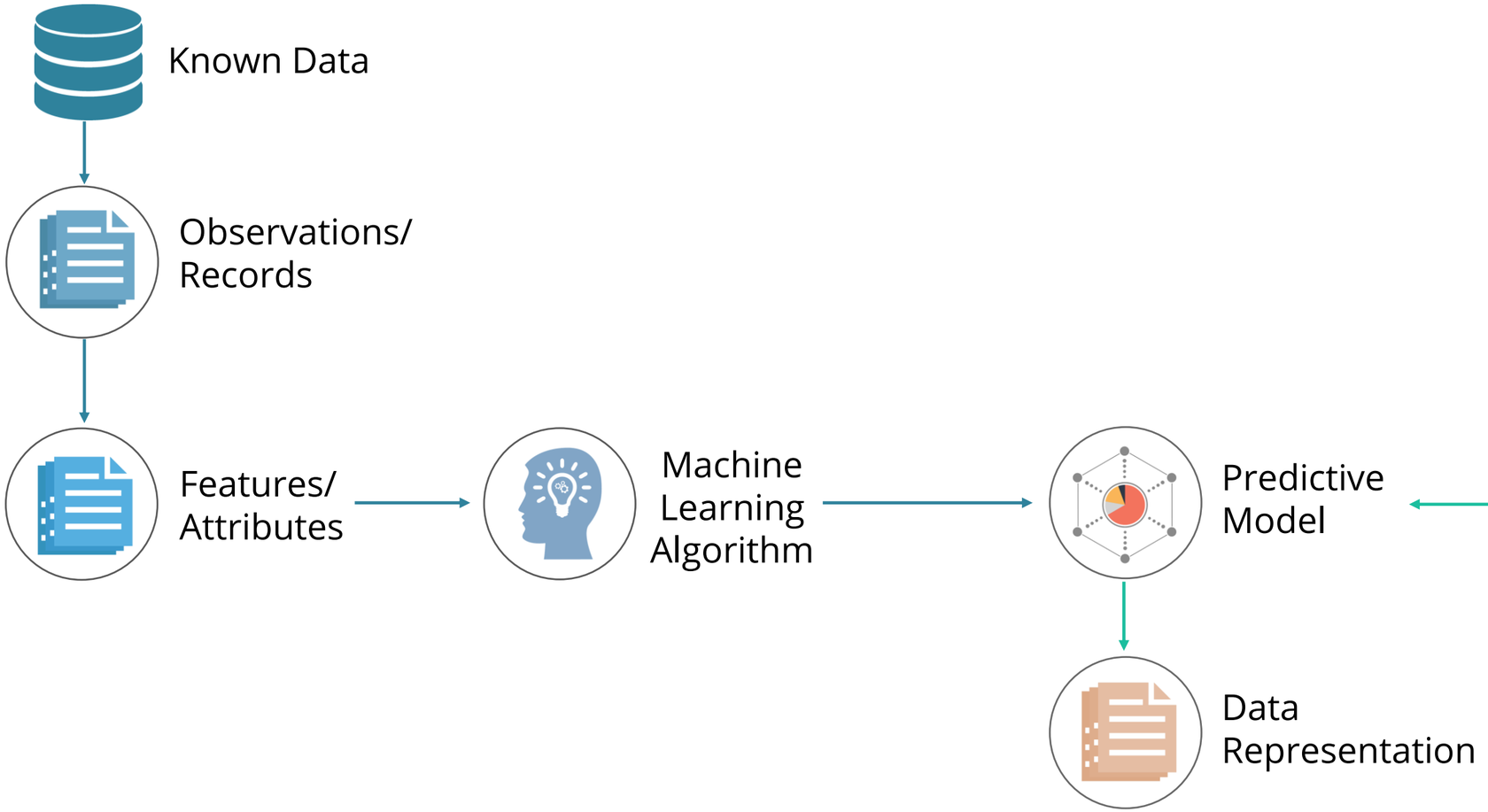
Working of Supervised Learning Model

In supervised learning, a known dataset with observations, features, and response is used to create and train a machine learning algorithm. A predictive model, built on top of this algorithm, is then used to predict the response for a new dataset that has the same features.



Working of Unsupervised Learning Model

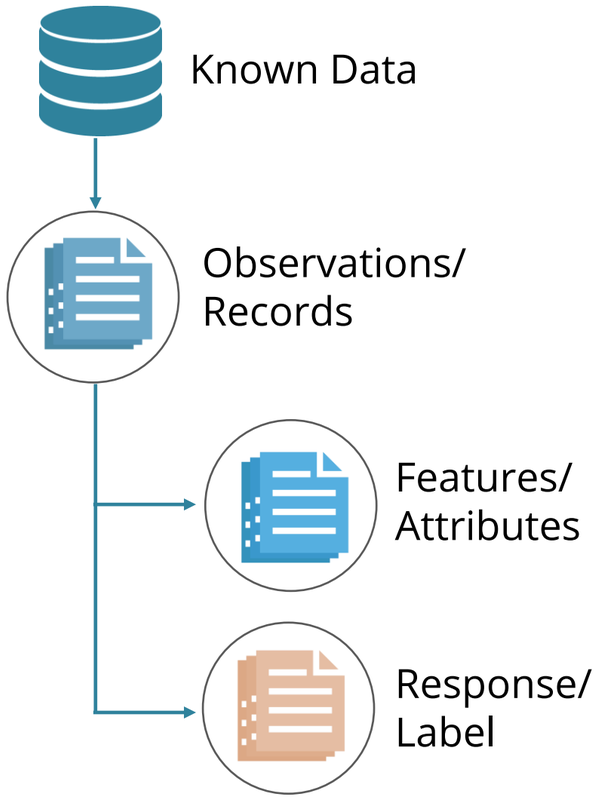
In unsupervised learning, a known dataset has a set of observations with features, but the response is not known. The predictive model uses these features to identify how to classify and represent the data points of new or unseen data.



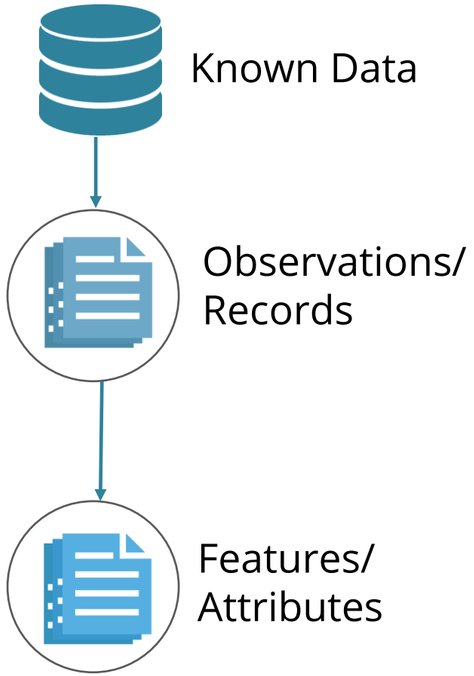
Steps 5 and 6: Train, Test, and Optimize the Model

To train supervised learning models, data analysts usually divide a known dataset into training and testing sets.

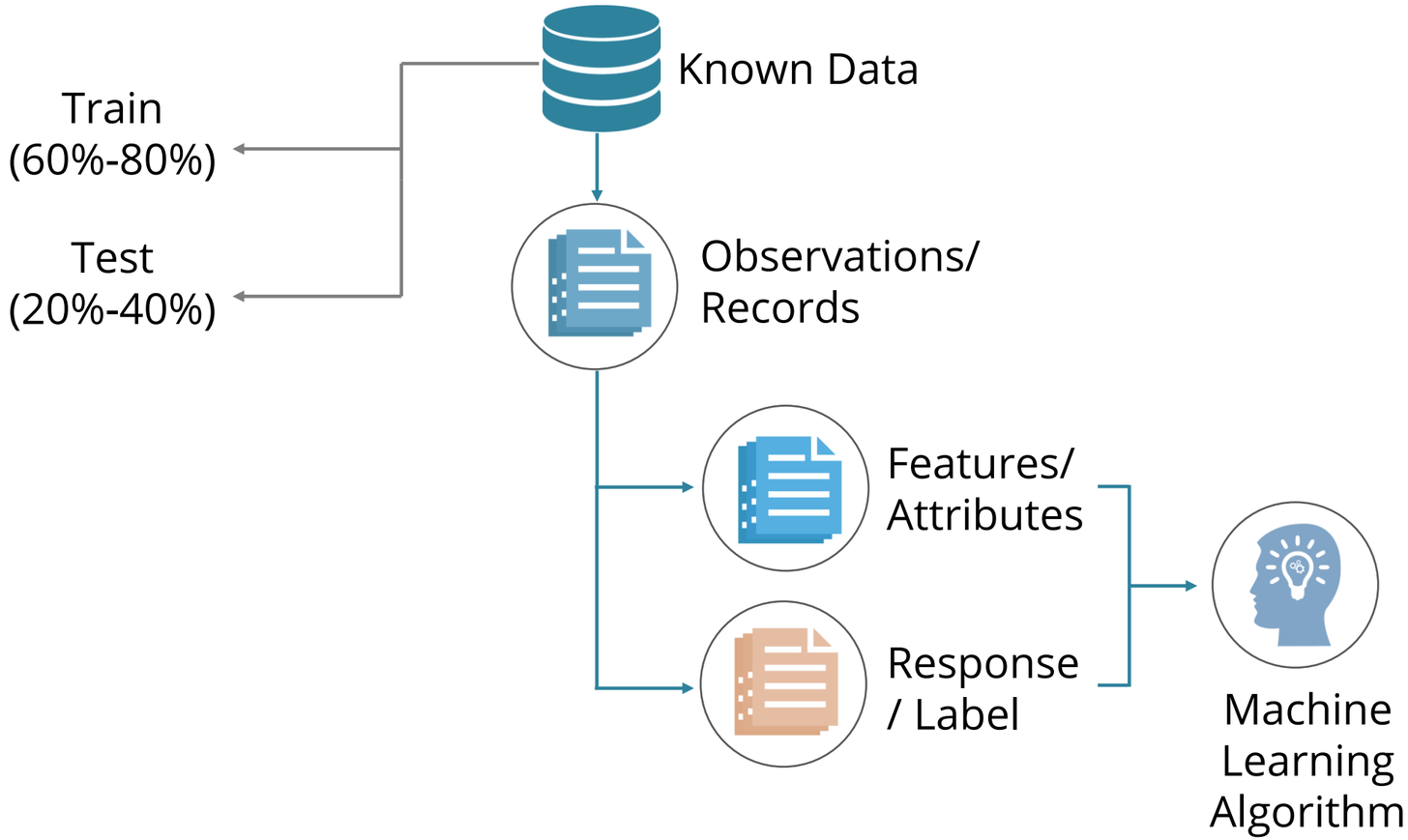
Supervised Learning



Unsupervised Learning



Steps 5 and 6: Train, Test, and Optimize the Model



Steps 5 and 6: Train, Test, and Optimize the Model

Let us look at an example to see how the split approach works.

Observation

Train set

Test set

Model Training

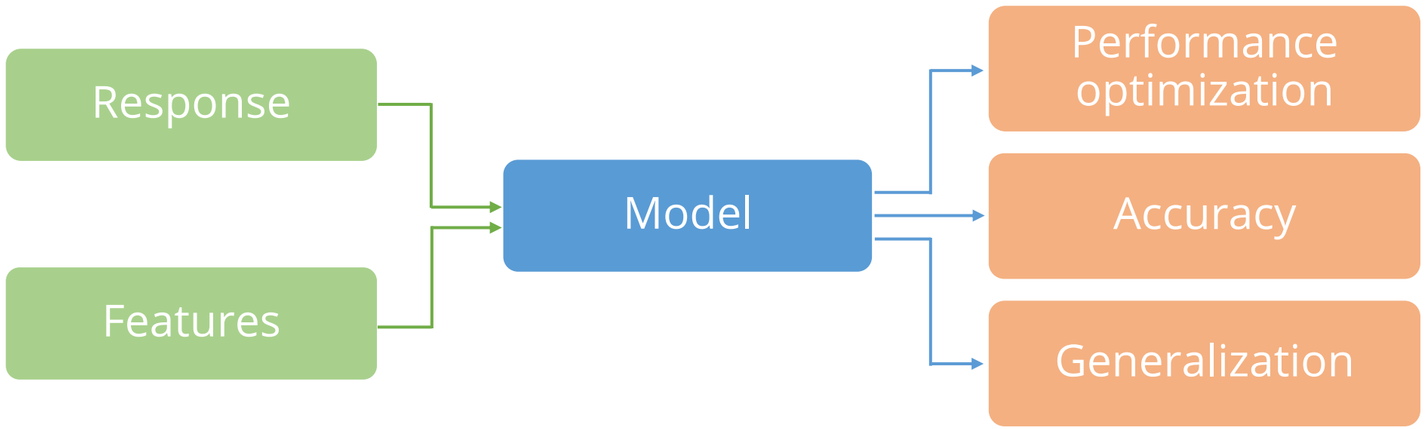
ID	Education	Professional training	Hourly rate
10	16	1	90
45	15	0	65
83	12	1	70
45	18	1	130
54	16	0	110
67	16	1	100
71	15	1	105
31	15	0	70

Response

Train set

Test set

Supervised Learning Model Considerations



DATA AND
ARTIFICIAL INTELLIGENCE

Scikit-Learn

Scikit-Learn

Scikit is a powerful and modern machine learning Python library for fully and semi-automated data analysis and information extraction.

Efficient tools to identify and organize problems (Supervised/Unsupervised)

Free and open datasets

Rich set of libraries for learning and predicting

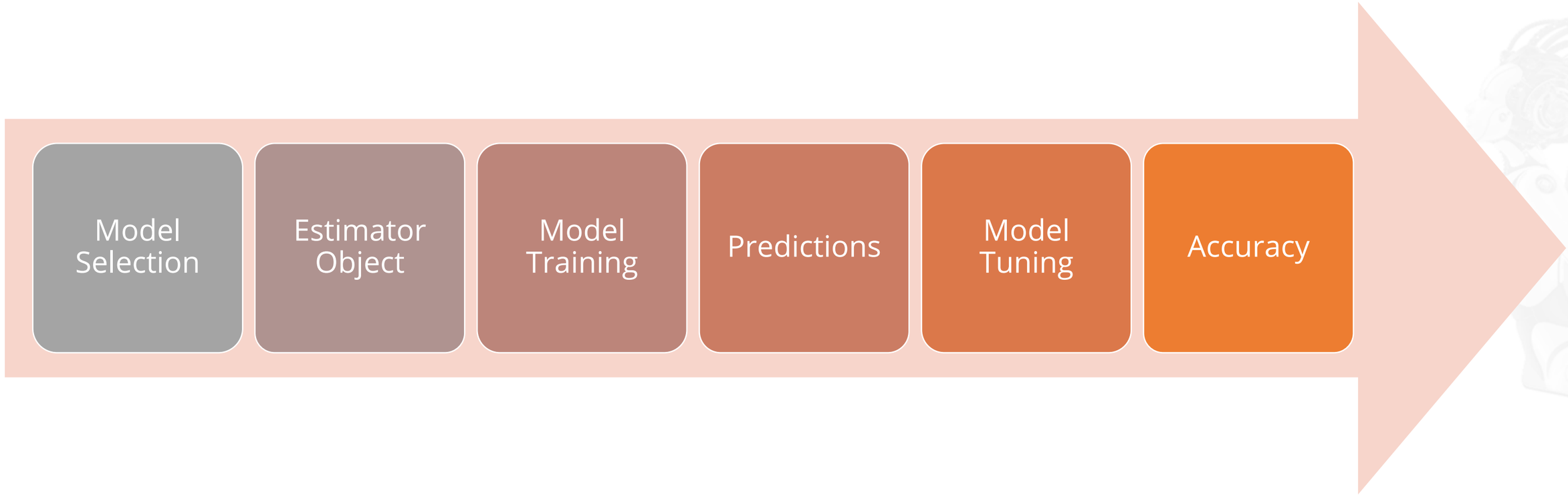
Model support for every problem type

Model persistence

Open source community and vendor support

Scikit-Learn: Problem-Solution Approach

Scikit-learn helps data scientists organize their work through its problem-solution approach.



Scikit-Learn: Problem-Solution Considerations

While working with a Scikit-Learn dataset or loading your own data to Scikit-Learn, consider these points:

- Create separate objects for feature and response
- Ensure that features and response have only numeric values
- Features and response should be in the form of a NumPy ndarray
- Since features and response would be in the form of arrays, they would have shapes and sizes
- Features are always mapped as *x* and response is mapped as *y*

DATA AND
ARTIFICIAL INTELLIGENCE

Supervised Learning Models: Linear Regression

Supervised Learning Models: Linear Regression

Linear regression is a supervised learning model used to analyze continuous data.

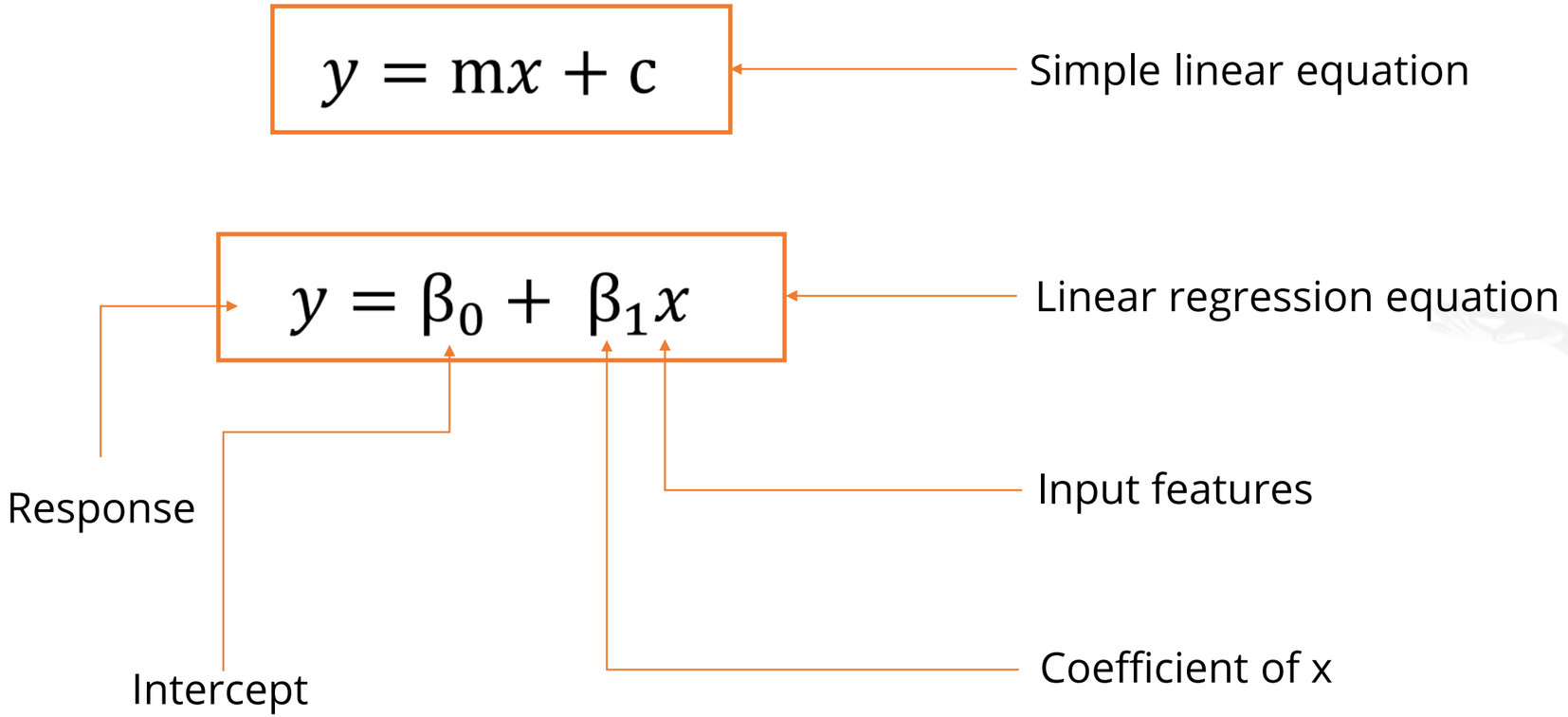
It is easy to use as the model does not require a lot of tuning

It is the most basic and widely used technique to predict a value of an attribute

It runs very fast, which makes it time-efficient

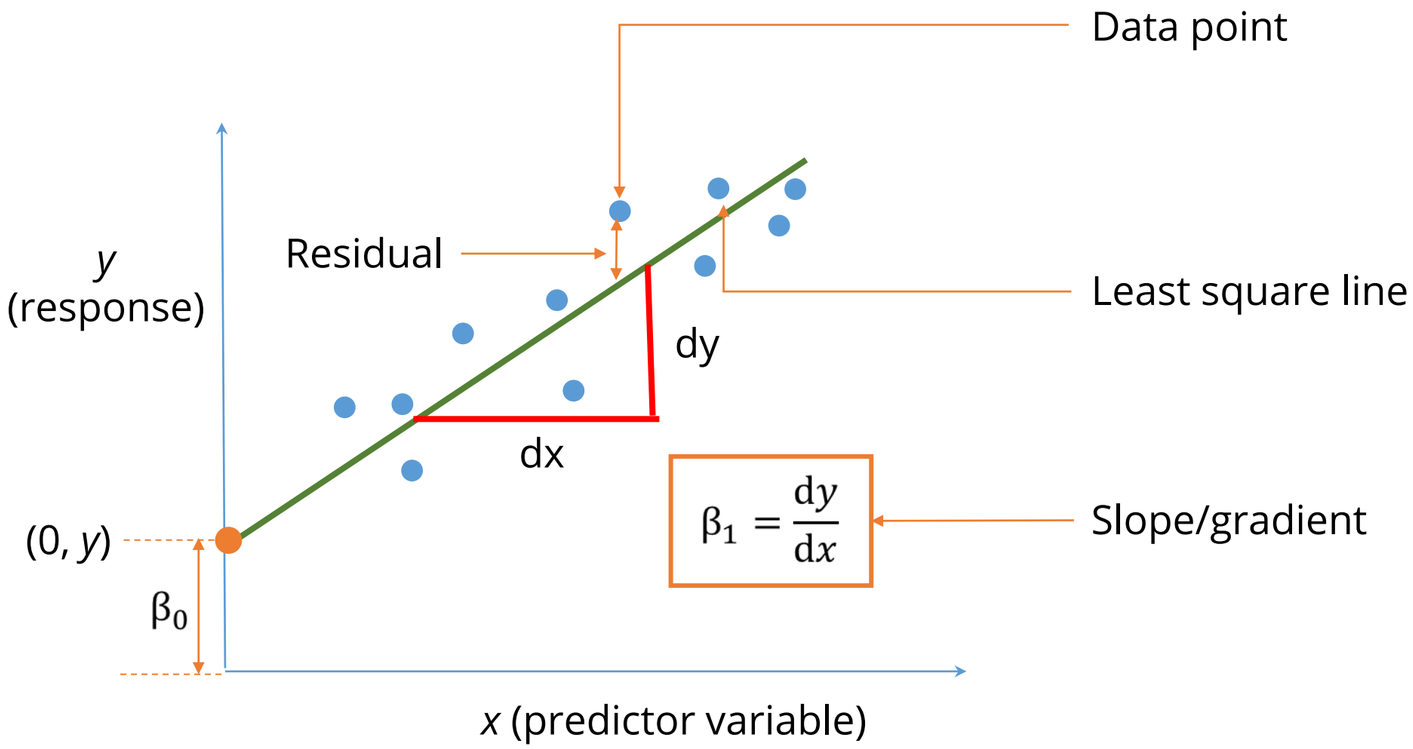
Supervised Learning Models: Linear Regression

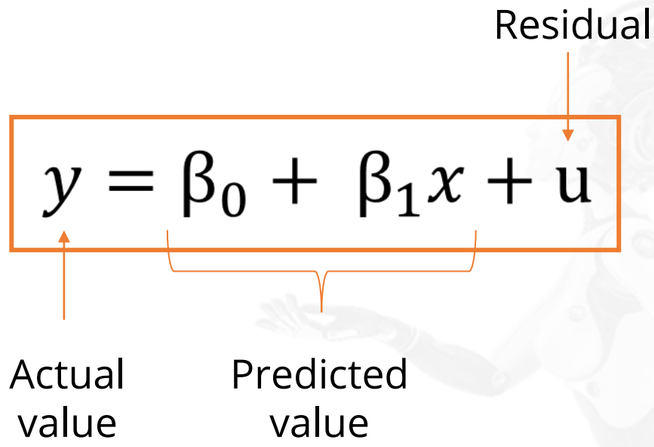
The linear regression equation is based on the formula for a simple linear equation.



Supervised Learning Models: Linear Regression

Linear regression is the most basic technique to predict a value of an attribute.

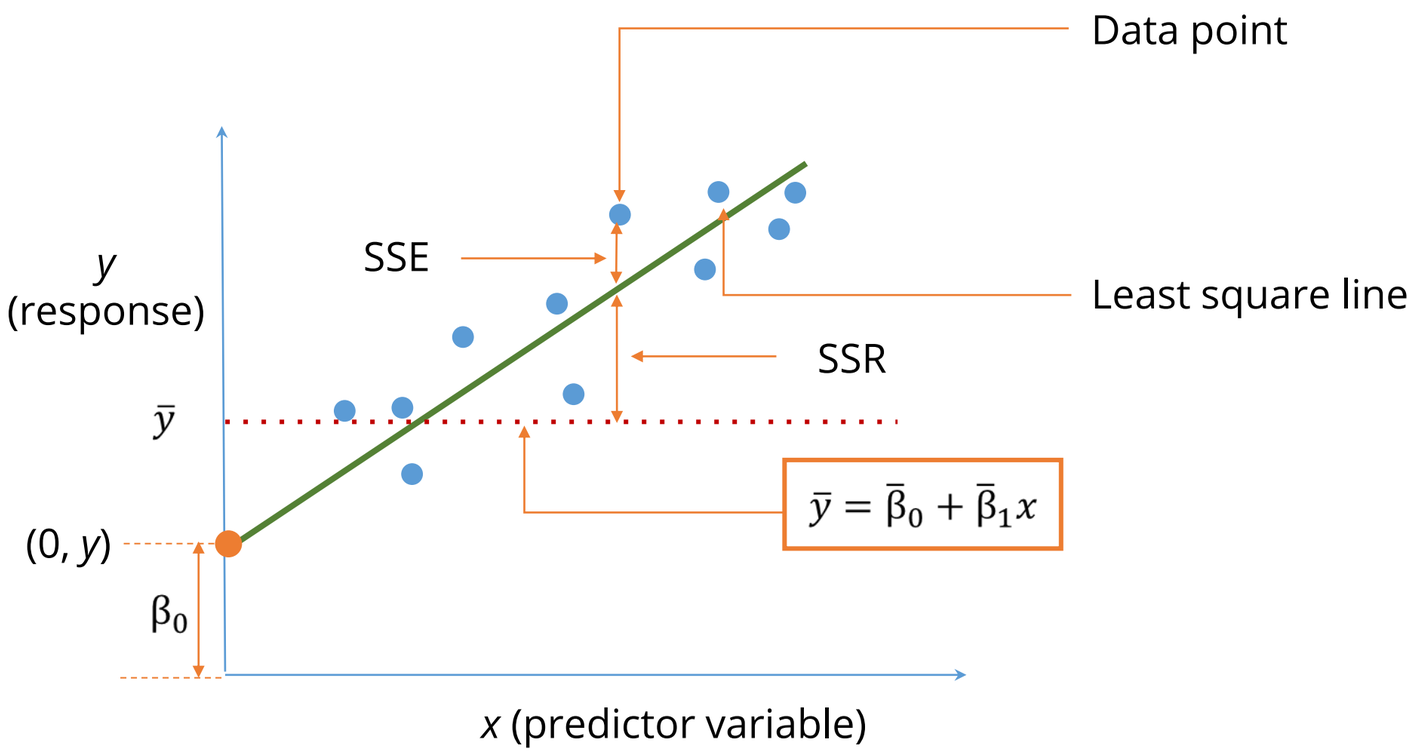




!

The attributes are usually fitted using the least square approach.

Supervised Learning Models: Linear Regression



$$y = \beta_0 + \beta_1 x + u$$

$$SSR = \sum (\hat{y}_i - \bar{y})^2$$

Regression of sum of squares

$$SSE = \sum (y_i - \hat{y}_i)^2$$

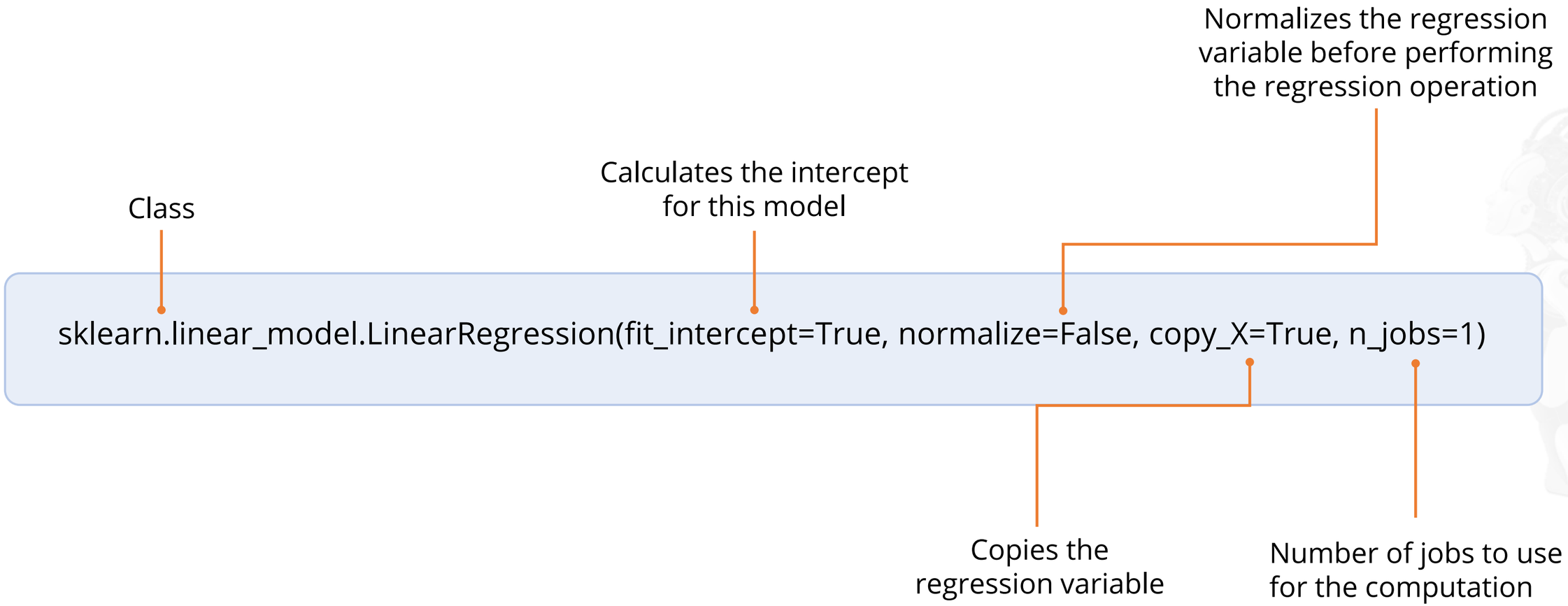
Error of sum of squares

!

Smaller the value of SSR or SSE, the more accurate the prediction will be, which would make the model the best fit.

Supervised Learning Models: Linear Regression

Let us see how linear regression works in scikit-learn.



Loading a Dataset

Problem Statement: Demonstrate how to load a built-in scikit-learn dataset.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

ASSISTED PRACTICE

Linear Regression Model

Problem Statement: Demonstrate how to create and train a linear regression model.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

ASSISTED PRACTICE

DATA AND
ARTIFICIAL INTELLIGENCE

Supervised Learning Models: Logistic Regression

Supervised Learning Models: Logistic Regression

Logistic regression is a generalization of the linear regression model used for classification problems.

$$\pi = \Pr(y = 1|x) = \frac{e^{\beta_0+\beta_1 x}}{1 + e^{\beta_0+\beta_1 x}}$$

Probability of *y* = 1, given *x*

Change in the log-odds for a unit change in x

The above equation is the simplest logistic function used for performing logistic regression.

Supervised Learning Models: Logistic Regression

To interpret the outputs of a logistic function, you must understand the difference between probability and odds.

$$\text{Odds} = \frac{\pi}{1-\pi}$$

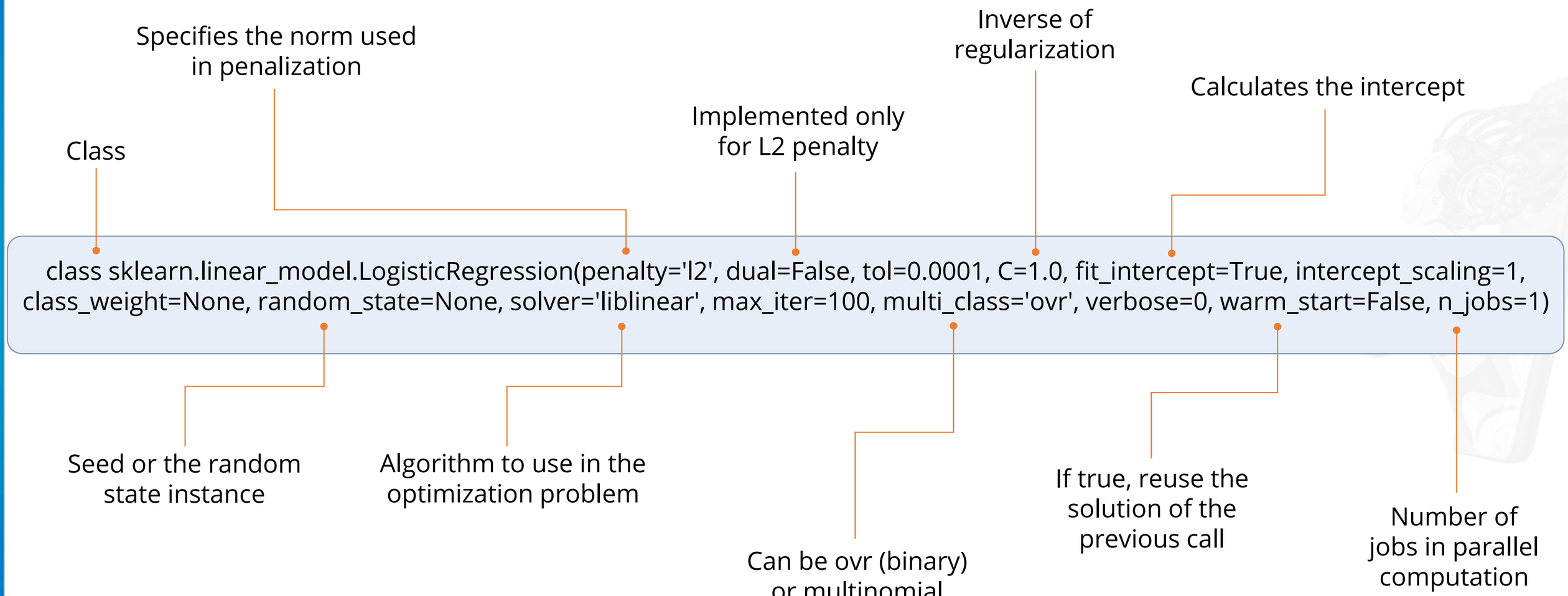
Probability

$$\log\left(\frac{\pi}{1-\pi}\right) = \log\left(e^{\beta_0+\beta_1 x}\right) = \beta_0 + \beta_1 x$$

Logarithm of odds

Linear regression

Supervised Learning Models: Logistic Regression



DATA AND
ARTIFICIAL INTELLIGENCE

Supervised Learning Models: K-Nearest Neighbors

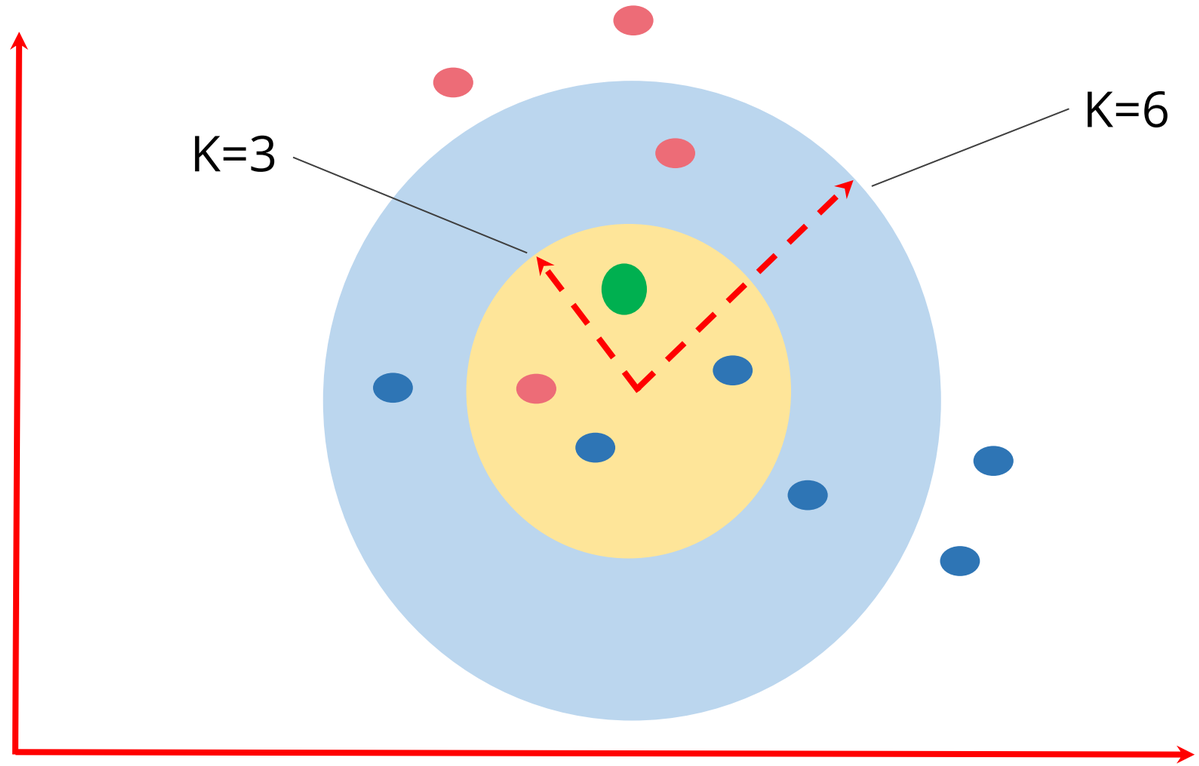
Supervised Learning Models: K-Nearest Neighbors (K-NN)

K-Nearest Neighbors, or K-NN, is one of the simplest machine learning algorithms used for both classification and regression problem types.

Features
(Attributes)

Education (Yrs.)	Professional Training (Yes/No)	Hourly Rate (USD)
16	1	90
15	0	65
12	1	70
18	1	130
16	0	110
16	1	100
15	1	105
31	0	70

Supervised Learning Models: K-Nearest Neighbors



If you are using this method for binary classification, choose an odd number for k to avoid the case of a **tied** distance between two classes.

Supervised Learning Models: K-Nearest Neighbors

It looks at the inputs or features of the training dataset to identify the attributes of any new or unseen data. Based on how similar a data point is to an attribute, the algorithm classifies it.

Features (Attributes)

Response (label)

Education (Yrs.)	Professional Training (Yes/No)	Hourly Rate (USD)
16	1	90
15	0	65
12	1	70
18	1	130
16	0	110
16	1	100
15	1	105
31	0	70

K-NN and Logistic Regression Models

Problem Statement: Demonstrate the use of K-NN and logistic regression models.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

ASSISTED PRACTICE

DATA AND
ARTIFICIAL INTELLIGENCE

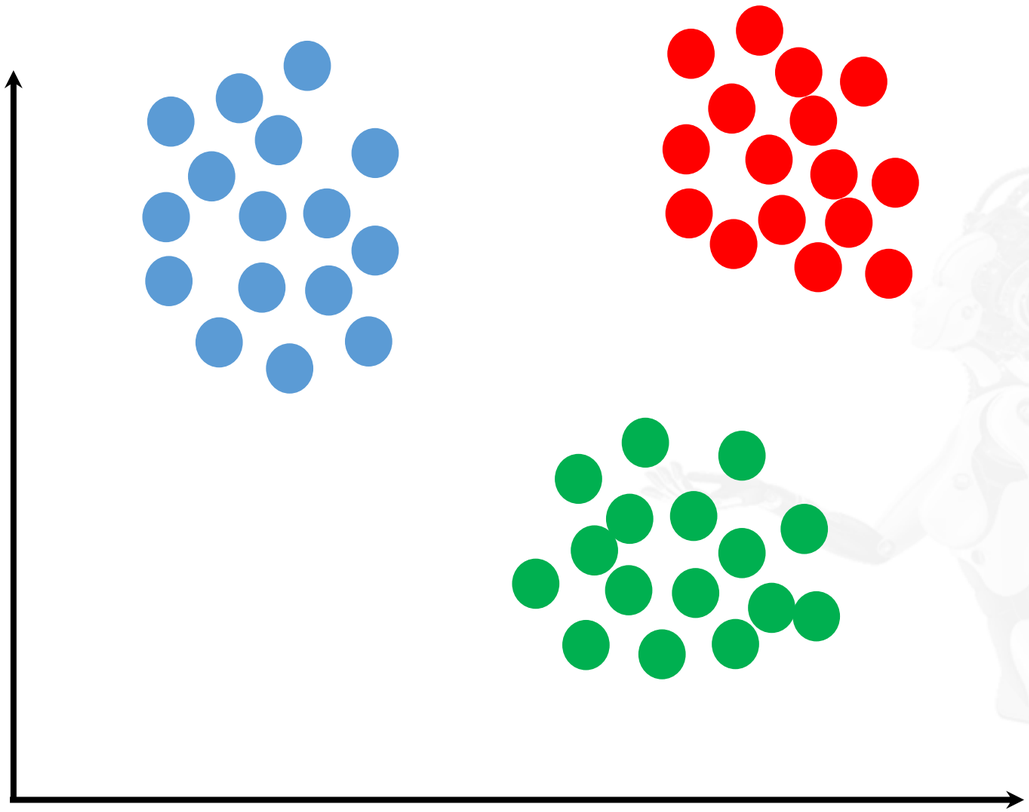
Unsupervised Learning Models: Clustering

Unsupervised Learning Models: Clustering

A cluster is a group of similar data points.

Clustering is used to:

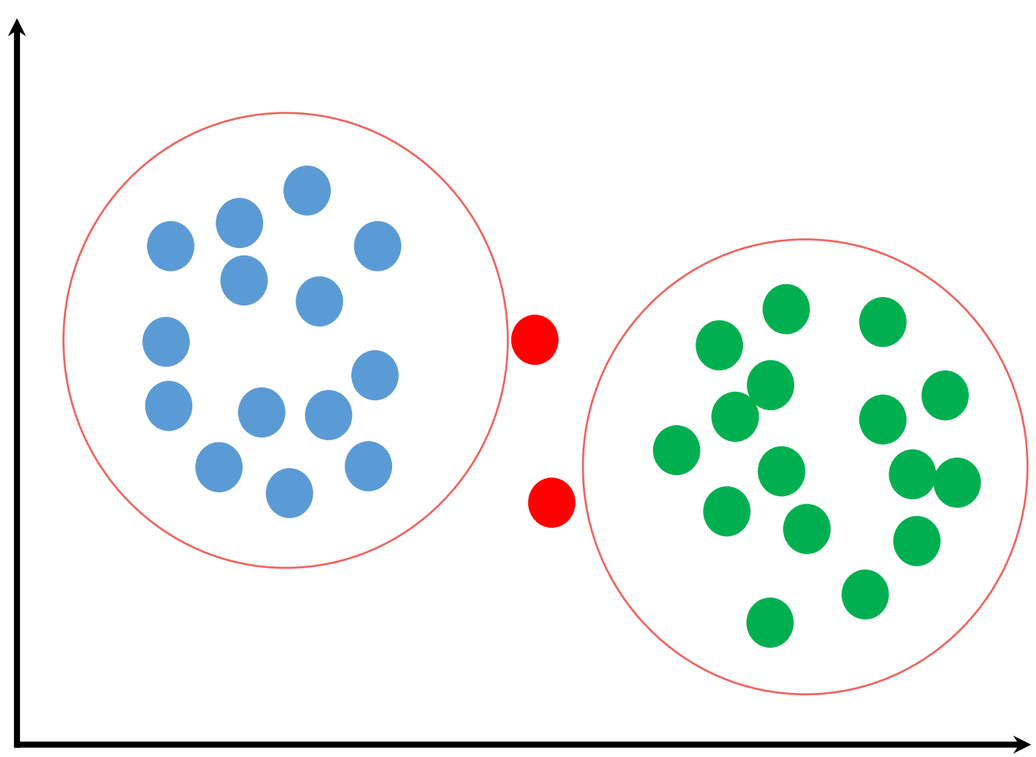
- Extract the structure of the data
- Identify groups in the data



Greater similarity between data points results in better clustering.

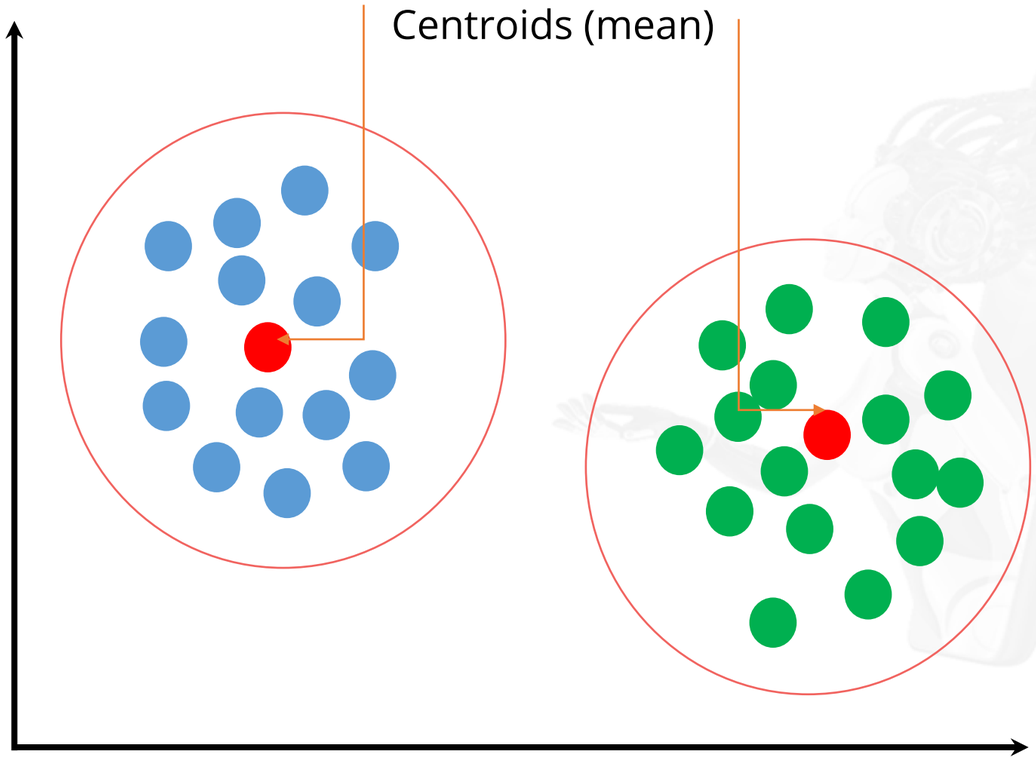
Unsupervised Learning Models: K-Means Clustering

Scenario: You are given a dataset where each observed example has a set of features but has no labels or response attached to it. So, in the absence of a response, you can identify which data points in a dataset are similar. Each similar group of data points is called a cluster.



Assign

Find the number of clusters and assign mean

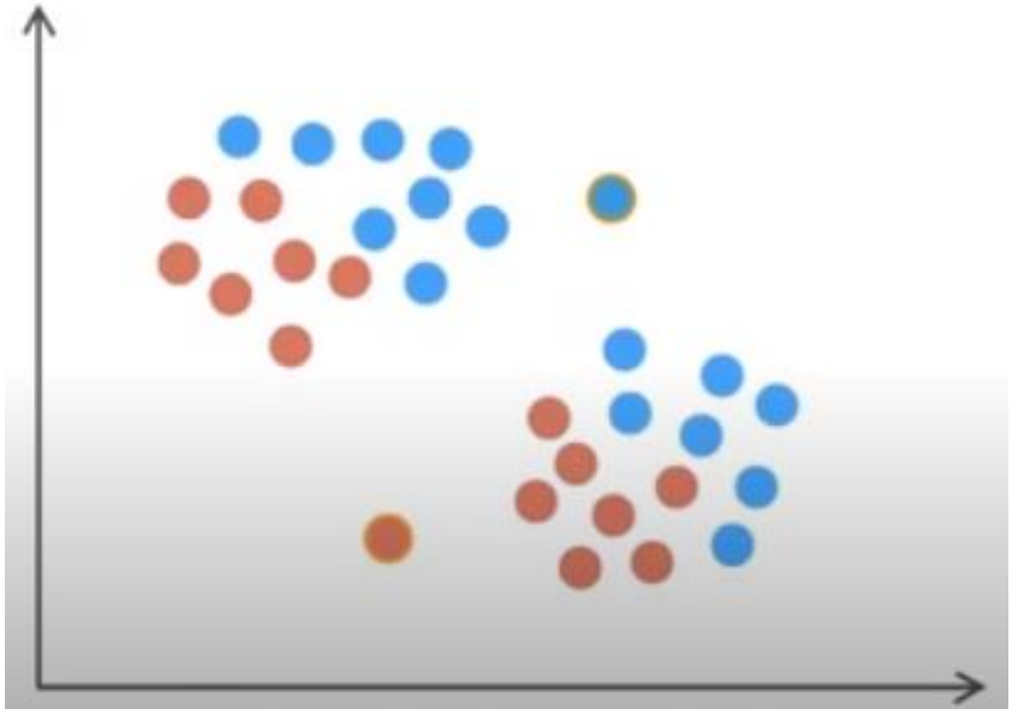


Optimize

Iterate and optimize the mean for each cluster for its respective data points

Unsupervised Learning Models: K-Means Clustering

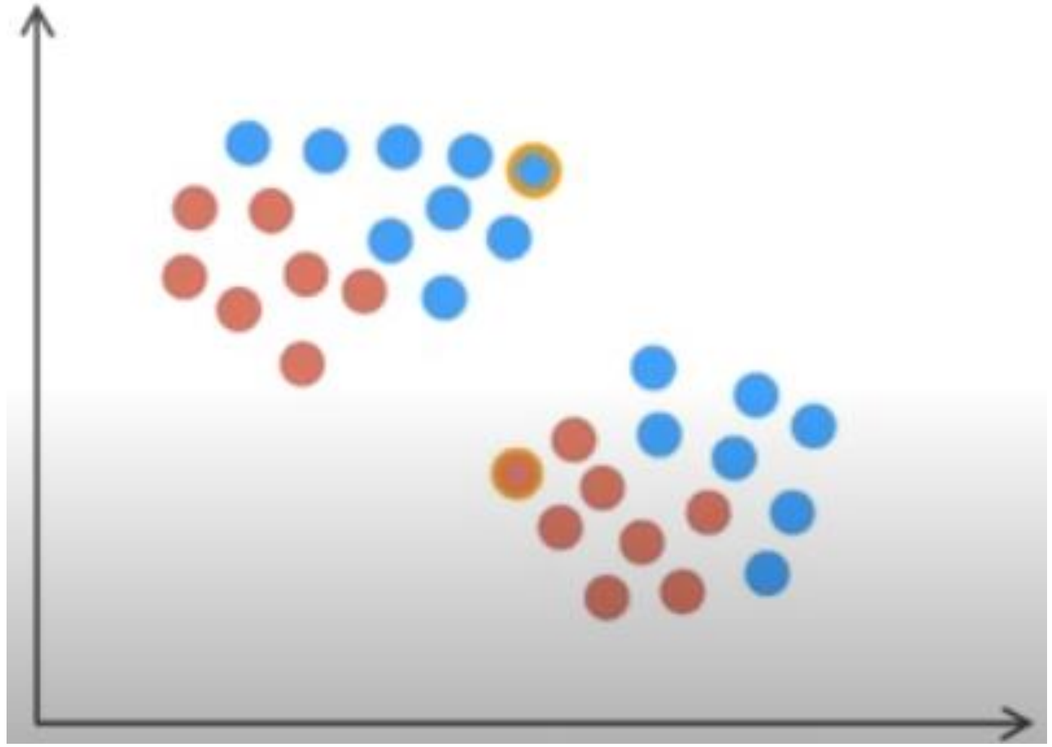
K-means finds the best centroids by alternatively assigning random centroids to a dataset and selecting mean data points from the resulting clusters to form new centroids. It continues this process iteratively until the model is optimized.



Assign data points to the centroids

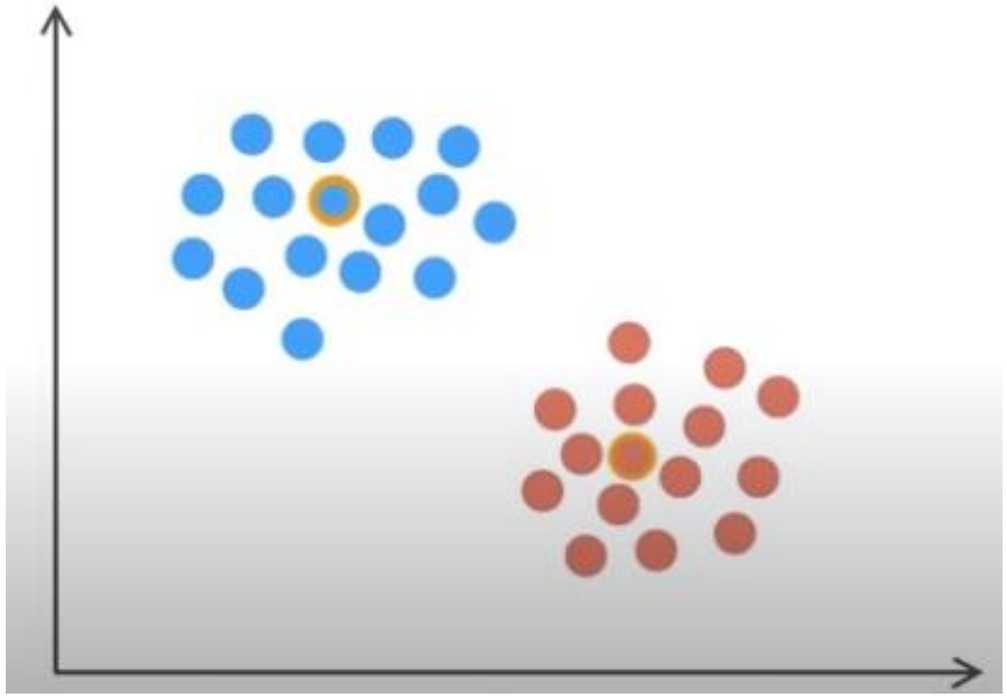
Unsupervised Learning Models: K-Means Clustering

Choose a mean from each cluster as a centroid



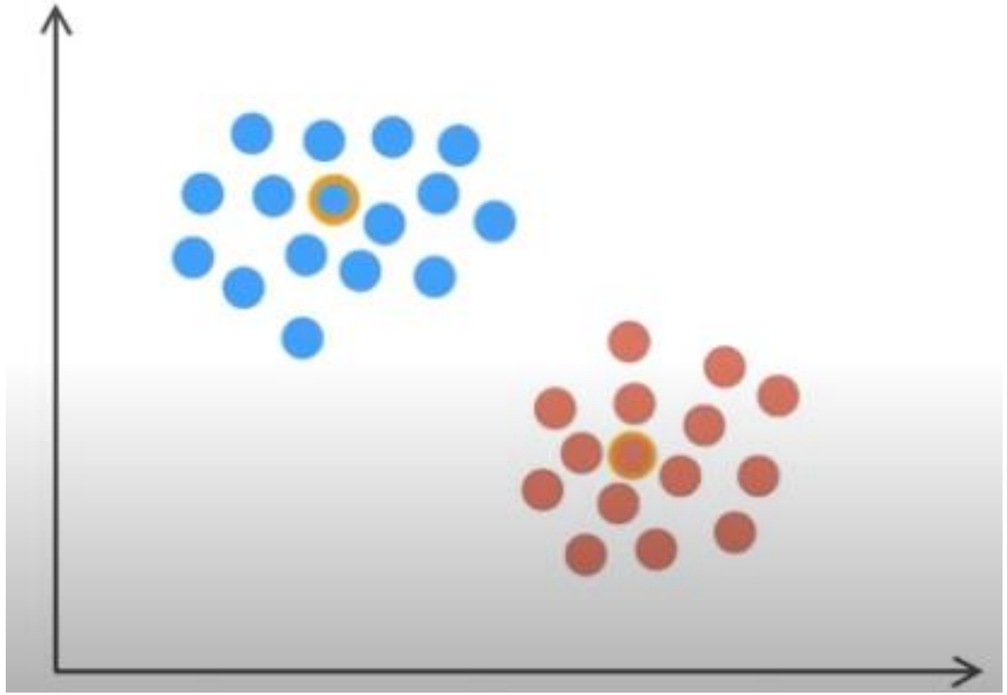
Unsupervised Learning Models: K-Means Clustering

Reassign data points to new centroids



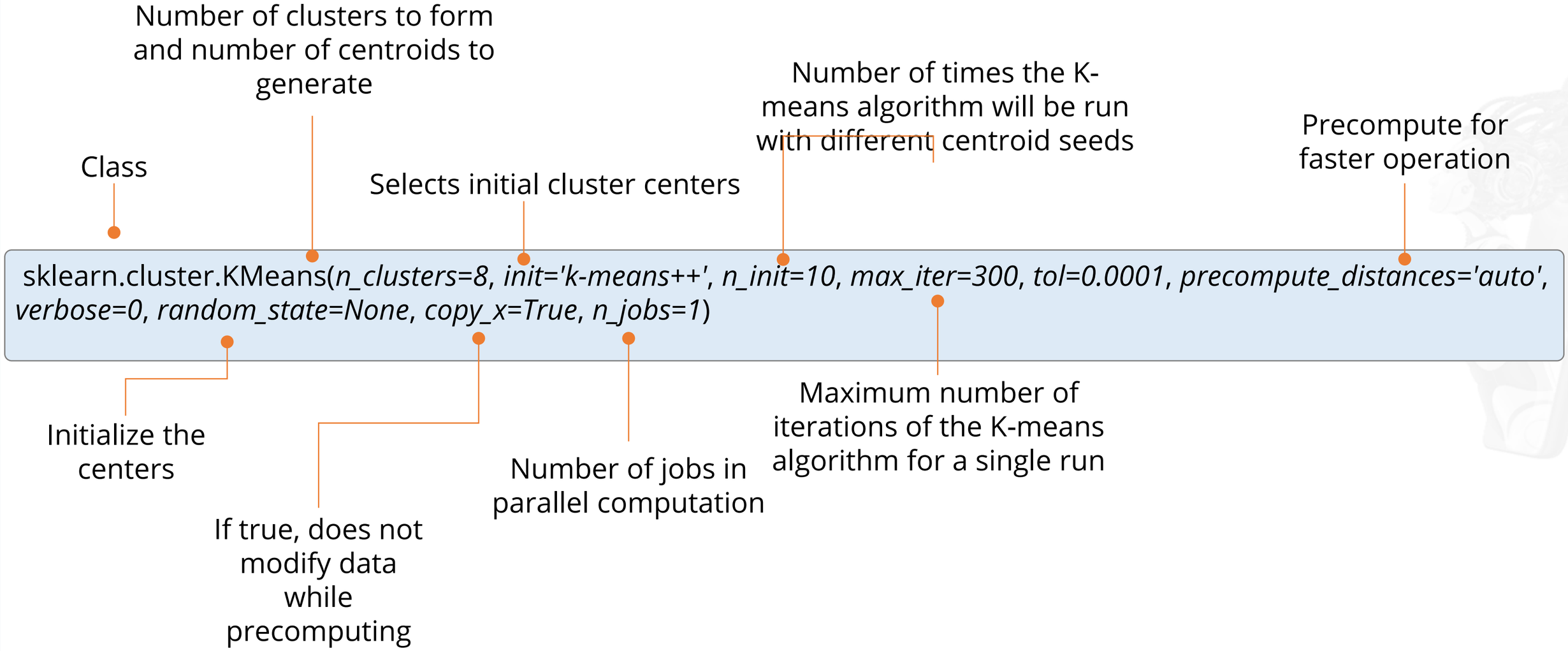
Unsupervised Learning Models: K-Means Clustering

Iterate the process till the model is optimized



Unsupervised Learning Models: K-Means Clustering

Let us see how the K-means algorithm works in scikit-learn.



K-Means Clustering to Classify Data Points

Problem Statement: Demonstrate how to use K-means clustering to classify data points.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

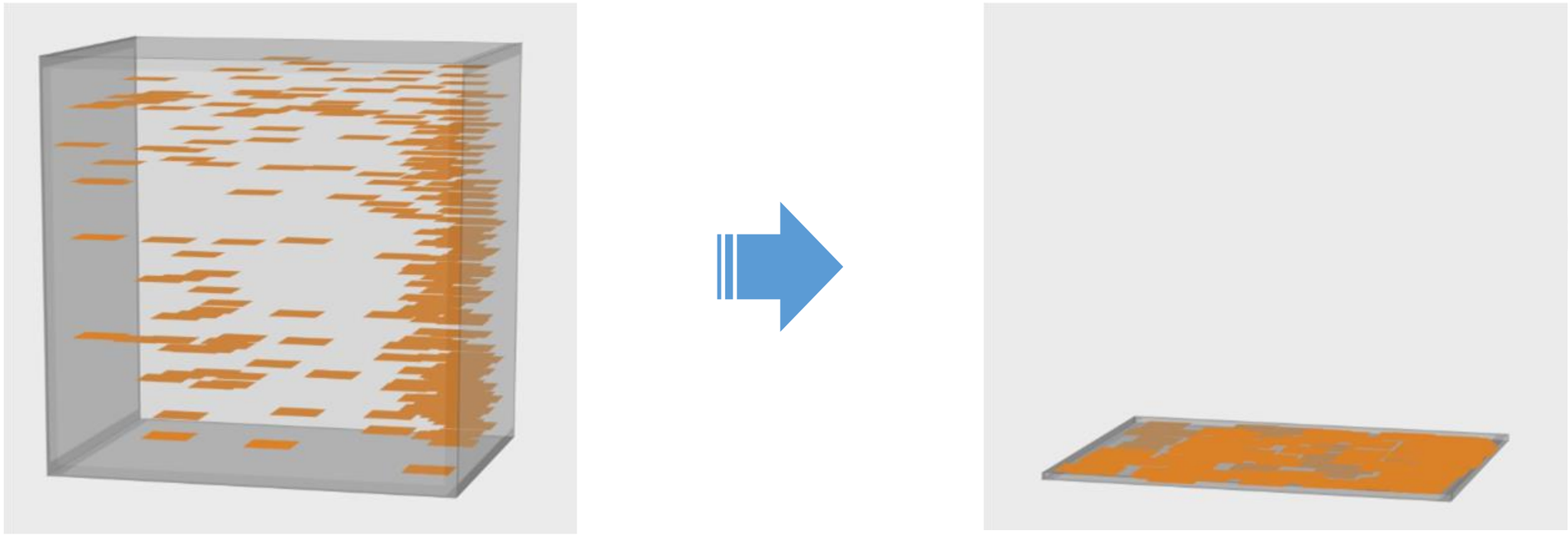
ASSISTED PRACTICE

DATA AND
ARTIFICIAL INTELLIGENCE

Unsupervised Learning Models: Dimensionality Reduction

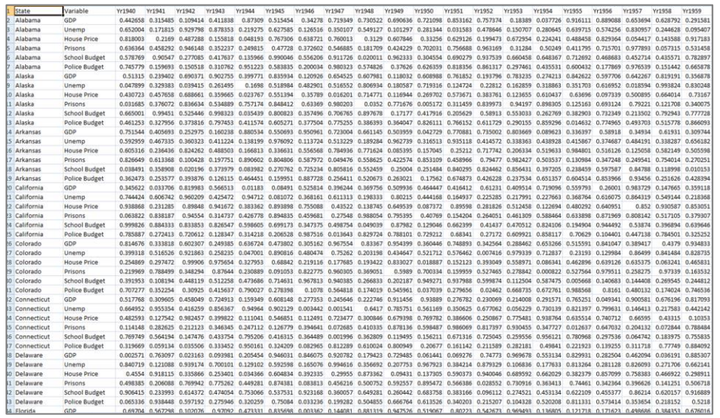
Unsupervised Learning Models: Dimensionality Reduction

It reduces a high-dimensional dataset into a dataset with fewer dimensions. This makes it easier and faster for the algorithm to analyze the data.



Unsupervised Learning Models: Dimensionality Reduction

These are some techniques used for dimensionality reduction:



State	Variable	Yr1940	Yr1941	Yr1942	Yr1943	Yr1944	Yr1945	Yr1946	Yr1947	Yr1948	Yr1949	Yr1950	Yr1951	Yr1952	Yr1953	Yr1954	Yr1955	Yr1956	Yr1957	Yr1958	Yr1959
Alabama	GDP	0.442658	0.315485	0.109414	0.411838	0.87309	0.515454	0.34278	0.719349	0.730522	0.690636	0.721098	0.853162	0.757374	0.18389	0.037726	0.916111	0.889088	0.653694	0.628792	0.291581
Alabama	Unemp	0.652004	0.171813	0.929798	0.878353	0.219275	0.627585	0.126516	0.350107	0.549127	0.101297	0.281344	0.031583	0.478646	0.150707	0.280645	0.659715	0.574256	0.830957	0.244628	0.095407
Alabama	House Price	0.818003	0.2169	0.487288	0.155818	0.048193	0.767306	0.638721	0.760013	0.3129	0.607846	0.33256	0.629126	0.199473	0.672954	0.224241	0.488458	0.829364	0.054417	0.143588	0.917183
Alabama	Prisons	0.636364	0.458292	0.946148	0.352237	0.249815	0.47728	0.372602	0.546885	0.181709	0.434229	0.702031	0.756688	0.963169	0.31284	0.50249	0.411795	0.715701	0.977893	0.057315	0.531458
Alabama	School Budget	0.578769	0.90547	0.277085	0.417617	0.135966	0.990046	0.356206	0.911726	0.020011	0.962333	0.304554	0.690279	0.937539	0.660458	0.648367	0.712692	0.468883	0.452714	0.435571	0.782897
Alabama	Police Budget	0.745779	0.159693	0.150518	0.310762	0.951223	0.583835	0.200034	0.980323	0.574826	0.37626	0.626359	0.818356	0.861317	0.297461	0.435531	0.600432	0.127869	0.976539	0.151442	0.665878
Alaska	GDP	0.51315	0.239402	0.690371	0.902755	0.399771	0.835934	0.120926	0.654525	0.807981	0.118032	0.608988	0.761852	0.193796	0.783235	0.274213	0.842622	0.597706	0.642267	0.819191	0.356878
Alaska	Unemp	0.047899	0.329383	0.039415	0.265495	0.1698	0.518984	0.482901	0.518552	0.806934	0.180587	0.759516	0.124724	0.22812	0.162859	0.318863	0.351703	0.616952	0.018594	0.993824	0.830248
Alaska	House Price	0.430723	0.457658	0.668661	0.359665	0.023767	0.551394	0.35789	0.016201	0.714771	0.116944	0.269702	0.573671	0.383761	0.123655	0.610437	0.63696	0.097339	0.500895	0.664014	0.73167
Alaska	Prisons	0.031685	0.376072	0.836634	0.534889	0.757174	0.848412	0.63369	0.980203	0.0352	0.771676	0.005172	0.311459	0.839973	0.94197	0.898305	0.125163	0.693124	0.79221	0.121706	0.340075
Alaska	School Budget	0.665001	0.99451	0.525446	0.998323	0.035439	0.800823	0.357496	0.706765	0.897678	0.17177	0.417916	0.205629	0.58913	0.553033	0.262769	0.382903	0.732349	0.213002	0.792943	0.777728
Alaska	Police Budget	0.461253	0.327956	0.373816	0.797453	0.411574	0.605271	0.377504	0.775255	0.386393	0.364047	0.826111	0.766152	0.611729	0.290155	0.859296	0.014632	0.774965	0.493703	0.515778	0.866093
Arkansas	GDP	0.751544	0.405693	0.252975	0.160238	0.880534	0.550693	0.950961	0.723004	0.661145	0.503959	0.042729	0.770881	0.755002	0.803669	0.089623	0.336397	0.58918	0.34934	0.61911	0.309744
Arkansas	Unemp	0.592959	0.467135	0.360323	0.411224	0.138199	0.976092	0.113724	0.513229	0.185094	0.962739	0.316513	0.935118	0.414572	0.338363	0.438928	0.415867	0.376687	0.484191	0.3382827	0.656182
Arkansas	House Price	0.605316	0.236436	0.824262	0.488503	0.166813	0.336631	0.556568	0.784936	0.771624	0.085395	0.157045	0.25212	0.717742	0.206334	0.519633	0.984801	0.516126	0.125058	0.582149	0.505598
Arkansas	Prisons	0.826649	0.613368	0.100428	0.197751	0.890602	0.804806	0.587972	0.049476	0.556825	0.422574	0.853109	0.458966	0.79477	0.983427	0.503537	0.130984	0.347248	0.249541	0.754014	0.270251
Arkansas	School Budget	0.018491	0.358908	0.020196	0.373979	0.083982	0.270762	0.725234	0.805816	0.552459	0.25004	0.251484	0.840295	0.824482	0.856431	0.397205	0.238459	0.597587	0.84788	0.118998	0.010153
Arkansas	Police Budget	0.362473	0.253577	0.393876	0.126115	0.464451	0.159951	0.887728	0.256411	0.520673	0.263021	0.17562	0.674873	0.426228	0.237534	0.651357	0.604514	0.853966	0.93456	0.251626	0.428394
California	GDP	0.345622	0.031706	0.819983	0.566513	0.01183	0.08491	0.525814	0.396244	0.369756	0.509936	0.464447	0.416412	0.61231	0.409514	0.719096	0.559793	0.26001	0.983729	0.147665	0.359118
California	Unemp	0.744424	0.606742	0.960209	0.425472	0.94712	0.081072	0.368161	0.611313	0.198333	0.80215	0.444168	0.164937	0.225285	0.217991	0.227663	0.368764	0.616075	0.884419	0.549144	0.218368
California	House Price	0.938868	0.231285	0.89848	0.941672	0.383362	0.893898	0.755088	0.43522	0.138745	0.649539	0.087372	0.89598	0.281826	0.512458	0.122694	0.480292	0.640951	0.852	0.930587	0.853051
California	Prisons	0.063822	0.838187	0.94554	0.114737	0.426778	0.894835	0.459681	0.27548	0.988054	0.795395	0.40769	0.154204	0.264051	0.461309	0.588464	0.633898	0.871969	0.808142	0.517105	0.379307
California	School Budget	0.999826	0.884333	0.833853	0.826547	0.598605	0.699173	0.347175	0.498754	0.049039	0.87982	0.129046	0.662399	0.414137	0.470512	0.824106	0.194904	0.944492	0.53874	0.196894	0.639646
California	Police Budget	0.785887	0.272413	0.720612	0.128347	0.314218	0.206528	0.987516	0.013643	0.829724	0.788101	0.729212	0.68341	0.27172	0.609921	0.858117	0.70629	0.104401	0.447138	0.784501	0.325252
Colorado	GDP	0.814676	0.333818	0.602307	0.349385	0.636724	0.473802	0.305162	0.967554	0.83367	0.954199	0.360446	0.748893	0.342564	0.288462	0.653266	0.515591	0.841047	0.389417	0.4379	0.934833
Colorado	Unemp	0.399318	0.516526	0.921863	0.258235	0.047001	0.890816	0.480474	0.75262	0.203198	0.434647	0.521712	0.576462	0.007416	0.979139	0.712837	0.23193	0.129984	0.86499	0.841484	0.828735
Colorado	House Price	0.254869	0.297472	0.99906	0.975654	0.327953	0.68842	0.219116	0.177685	0.193422	0.833027	0.018887	0.152123	0.393049	0.558971	0.086341	0.462896	0.639126	0.635575	0.063241	0.465831
Colorado	Prisons	0.219969	0.788499	0.348294	0.87644	0.230889	0.091053	0.822775	0.960305	0.369051	0.5989	0.700334	0.159959	0.527465	0.278842	0.000822	0.527564	0.979511	0.258275	0.97339	0.163532
Colorado	School Budget	0.191953	0.108194	0.448119	0.512258	0.473686	0.714631	0.967813	0.940385	0.266833	0.202187	0.949271	0.917968	0.599874	0.112504	0.587475	0.005668	0.140483	0.144408	0.2695445	0.244812
Colorado	Police Budget	0.707277	0.352254	0.30925	0.415637	0.790027	0.278198	0.1078	0.564818	0.174019	0.545961	0.037039	0.279656	0.02462	0.668735	0.672761	0.988568	0.8161	0.480132	0.174024	0.746536
Connecticut	GDP	0.517768	0.309605	0.458049	0.724913	0.159349	0.608148	0.277353	0.245646	0.222746	0.911456	0.93889	0.276782	0.230069	0.214008	0.291571	0.765251	0.049341	0.900581	0.676196	0.817093
Connecticut	Unemp	0.664952	0.955354	0.416259	0.8563867	0.94964	0.902129	0.003442	0.001541	0.6417	0.785751	0.561189	0.350625	0.677062	0.056229	0.730139	0.821397	0.799631	0.146413	0.217583	0.442142
Connecticut	House Price	0.482593	0.127542	0.982457	0.399822	0.111041	0.546851	0.112491	0.723477	0.300846	0.679396	0.769782	0.386606	0.250867	0.775481	0.938764	0.635514	0.740712	0.66595	0.43315	0.10353
Connecticut	Prisons	0.114148	0.282625	0.212123	0.346345	0.247112	0.126779	0.394641	0.072685	0.410335	0.878136	0.598487	0.980069	0.817397	0.930455	0.347727	0.012637	0.647032	0.204132	0.072844	0.788484
Connecticut	School Budget	0.769749	0.564194	0.187476	0.433754	0.795206	0.416315	0.364489	0.002996	0.362809	0.119495	0.156211	0.671316	0.725045	0.259556	0.956121	0.780968	0.297536	0.064742	0.183975	0.755835
Connecticut	Police Budget	0.319669	0.059134	0.035506	0.333452	0.950161	0.324209	0.082965	0.812289	0.610024	0.800949	0.20677	0.161142	0.211589	0.282181	0.49841	0.221923	0.139255	0.311718	0.77749	0.884092
Delaware	GDP	0.002571	0.763097	0.023163	0.093981	0.205454	0.946031	0.846075	0.920782	0.179423	0.729485	0.061441	0.069276	0.74773	0.969678	0.553134	0.829931	0.282504	0.462094	0.036191	0.885307
Delaware	Unemp	0.840719	0.122088	0.939174	0.700101	0.129102	0.592398	0.165076	0.994616	0.356692	0.207753	0.967923	0.384214	0.879329	0.106836	0.177833	0.811264	0.281128	0.826093	0.271706	0.662141
Delaware	House Price	0.4554	0.918115	0.335866	0.253401	0.034366	0.604834	0.392335	0.29955	0.873362	0.09431	0.137305	0.590373	0.940046	0.689592	0.662029	0.382379	0.857099	0.758383	0.466922	0.298911
Delaware	Prisons	0.498385	0.206088	0.789942	0.775262	0.449281	0.874381	0.088313	0.456216	0.500752	0.592557	0.895472	0.566386	0.028552	0.730916	0.363413	0.74461	0.342364	0.396826	0.141251	0.506718
Delaware	School Budget	0.909415	0.233993	0.614372	0.474054	0.753066	0.537551	0.923168	0.360057	0.449281	0.260442	0.683756	0.383166	0.096112	0.274521	0.453134	0.622109	0.455377	0.86214	0.620157	0.916889
Delaware	Police Budget	0.065336	0.938448	0.597192	0.275946	0.320259	0.75084	0.033236	0.199282	0.504855	0.666764	0.613526	0.340203	0.215207	0.104328	0.520208	0.811331	0.573414	0.353654	0.218152	0.5218
Florida	GDP	0.69704	0.567296	0.103076	0.93092	0.473331	0.835698	0.003367	0.144081	0.881319	0.947526	0.519067	0.80231	0.542673	0.969493	0.136805	0.121718	0.171623	0.496686	0.384351	0.670016

Large dataset
(a few thousand columns and rows)

- Drop data columns with missing values
- Drop data columns with low variance
- Drop data columns with high correlations
- Apply statistical functions - PCA

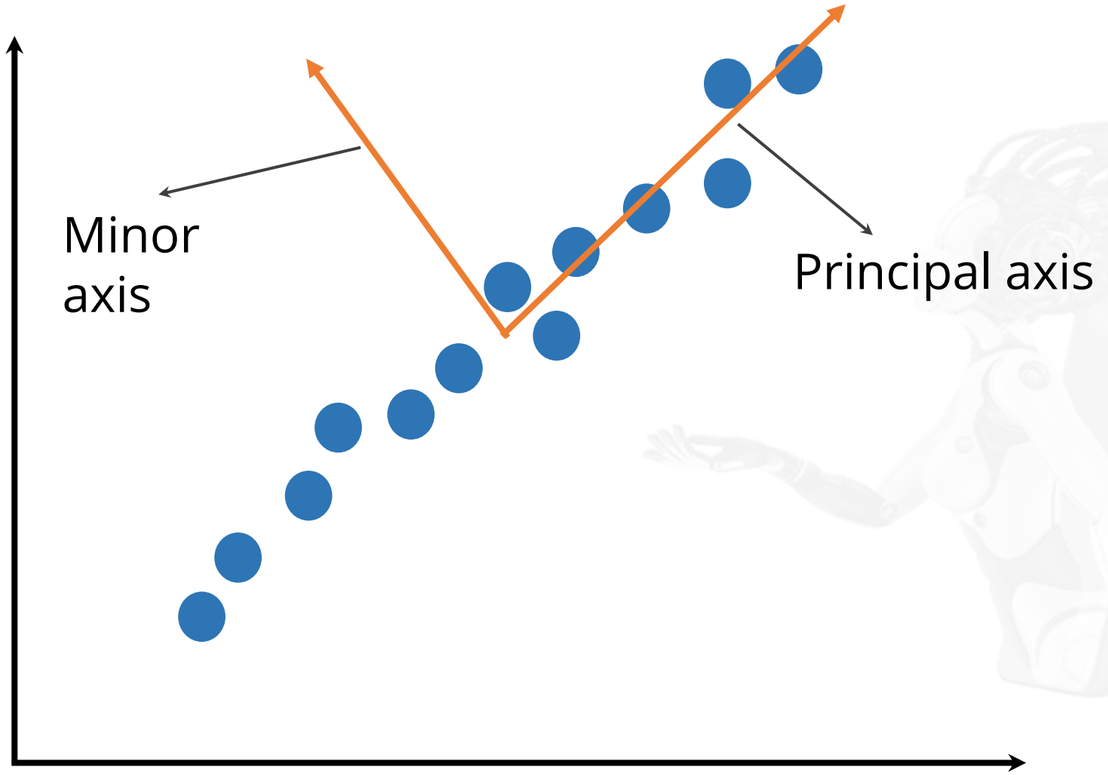
DATA AND
ARTIFICIAL INTELLIGENCE

Unsupervised Learning Models: Principal Component Analysis

Unsupervised Learning Models: Principal Component Analysis (PCA)

It is a linear dimensionality reduction method which uses singular value decomposition of the data and keeps only the most significant singular vectors to project the data to a lower dimensional space.

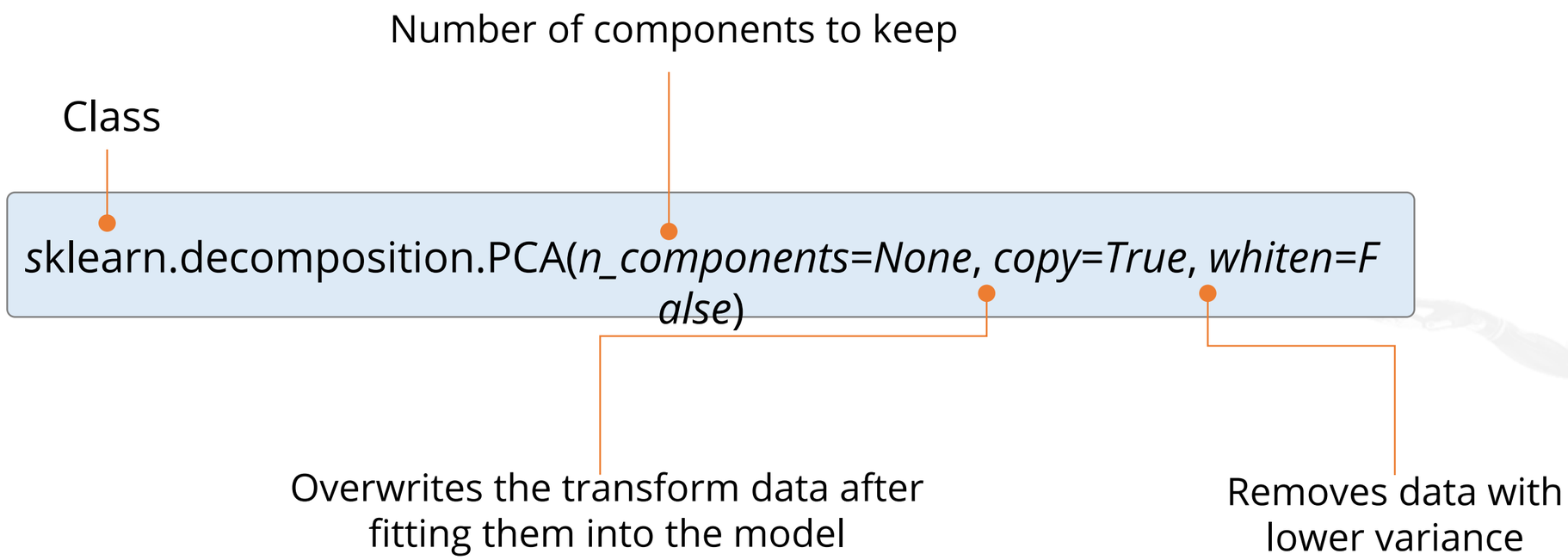
- It is primarily used to compress or reduce the data.
- PCA tries to capture the variance which helps it pick up interesting features.
- PCA is used to reduce dimensionality in the dataset and to build feature vector.
- Here, the principal axis in the feature space represents the direction of maximum variance in the data.



This method is used to capture variance.

Unsupervised Learning Models: Principal Component Analysis

Let us look at how the PCA algorithm works in scikit-learn.



Principal Component Analysis (PCA)

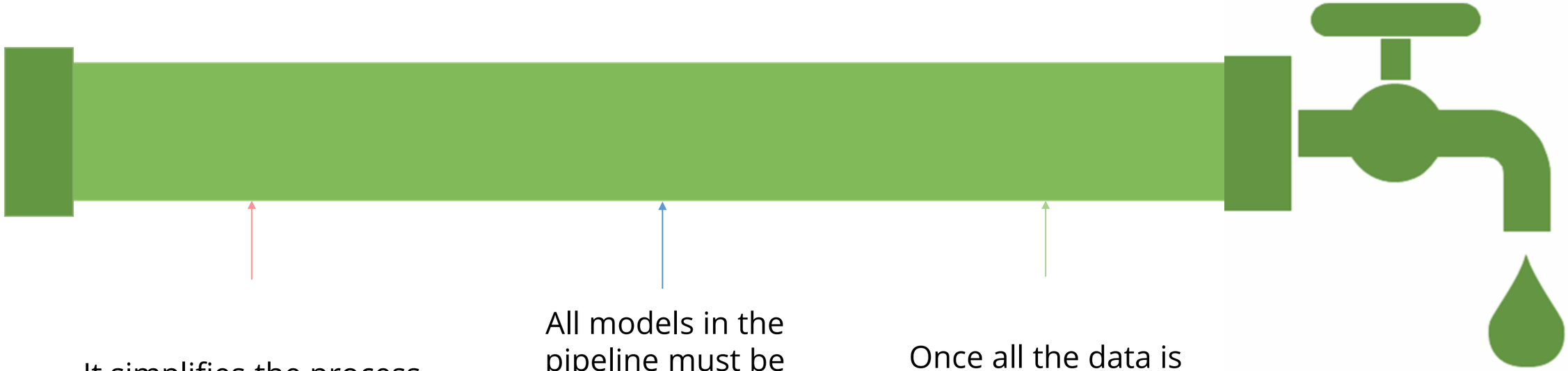
Problem Statement: Demonstrate how to use the PCA model to reduce the dimensions of a dataset.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

ASSISTED PRACTICE

Pipeline



It simplifies the process where more than one model is required or used.

All models in the pipeline must be transformers. The last model can either be a transformer or a classifier, regressor, or other such objects.

Once all the data is fit into the models or estimators, the predict method can be called.

Estimators are known as model instance.

Build Pipelines

Problem Statement: Demonstrate how to build a pipeline.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

ASSISTED PRACTICE

Model Persistence

You can save your model for future use. This avoids the need to retrain the model.

- This can be saved using the Pickle method.
- It can also be replaced with the joblib of scikit team.
- Both joblib.dump and joblib.load can be used.
- These would be efficient for Big Data.

Persist a Model for Future Use

Problem Statement: Demonstrate how to persist a model for future use.

Access: To execute the practice, follow these steps:

- Go to the **PRACTICE LABS** tab on your LMS
- Click the **START LAB** button
- Click the **LAUNCH LAB** button to start the lab

ASSISTED PRACTICE

Model Evaluation: Metric Functions

You can use the metrics function to evaluate the accuracy of your model's predictions.

Classification	`metrics.` **accuracy_score** `metrics.`**average_precision_score**
Clustering	`metrics.`**adjusted_rand_score**
Regression	`metrics.`**mean_absolute_error** `metrics.`**mean_squared_error** `metrics.`**median_absolute_error**

Project 1: Create a Model to Predict the Sales Outcome

Problem Statement:

The given dataset contains ad budgets for different media channels and the corresponding ad sales of the firm. Evaluate the dataset to:

- Find the features or media channels used by the firm
- Find the sales figures for each channel
- Create a model to predict the sales outcome
- Split as training and testing datasets for the model
- Calculate the Mean Square Error (MSE)

Instructions to perform the assignment:

Download the FAA dataset from the “Resource” tab. Upload the dataset to the JupyterLab to view and evaluate it.

LESSON-END PROJECT

Project 2: List the Glucose Level Readings

Problem Statement:

The given dataset lists the glucose level readings of several pregnant women taken either during a survey examination or routine medical care. It specifies if the two hours post-load plasma glucose was at least 200 mg/dl. Analyze the dataset to:

- Find the features of the dataset
- Find the response label of the dataset
- Create a model to predict the diabetes outcome
- Use training and testing datasets to train the model
- Check the accuracy of the model

LESSON-END PROJECT

Project 2: List the Glucose Level Readings

Instructions to perform the assignment:

- Download the “pima-Indians-diabetes.DATA” and “pima-Indians-diabetes.NAMES” files from the “Resources” tab. Load the .DATA file to the JupyterLab notebook to work on it.
- Open the .NAMES file with a notepad application to view its text. Use this file to view the features of the dataset and add them manually in your code.

LESSON-END PROJECT

Key Takeaways

You are now able to:

- Define machine learning
- Explain the machine learning approach
- List relevant terminologies that help you understand a dataset
- Discuss the features of supervised and unsupervised learning models
- Explain algorithms such as regression, classification, clustering, and dimensionality reduction

Knowledge Check

Knowledge Check

1

In machine learning, which one of the following is an observation?

a. Features

b. Attributes

c. Records

d. Labels

Knowledge Check

1

In machine learning, which one of the following is an observation?

a. Features

b. Attributes

c. Records

d. Labels

The correct answer is **c**

An observation is a set of examples, records, or samples.

Knowledge Check

2

If data is continuous and has labels (response), then it fits which of the following problem types?

a. Supervised learning: Classification

b. Unsupervised learning: Clustering

c. Unsupervised learning: Dimensionality reduction

d. Supervised learning: Regression

Knowledge Check

2

If data is continuous and has labels (response), then it fits which of the following problem types?

a. Supervised learning: Classification

b. Unsupervised learning: Clustering

c. Unsupervised learning: Dimensionality reduction

d. Supervised learning: Regression

The correct answer is **d**

The regression algorithm belonging to the supervised learning model is best suited to analyze continuous data.

Knowledge Check

3

Identify the goal of unsupervised learning. Select all that apply.

a. To predict the outcome

b. To understand the structure of the data

c. To generalize the dataset

d. To represent the data

Knowledge Check

3

Identify the goal of unsupervised learning. Select all that apply.

a. To predict the outcome

b. To understand the structure of the data

c. To generalize the dataset

d. To represent the data

The correct answer is **b, d**

The goal of unsupervised learning is to understand the structure of the data and represent it. There is no right or certain answer in unsupervised learning.

Knowledge Check

4

The estimator instance in scikit-learn is a _____.

a. Model

b. Feature

c. Dataset

d. Response

Knowledge Check

4

The estimator instance in scikit-learn is a _____.

a. Model

b. Feature

c. Dataset

d. Response

The correct answer is **a**

The estimator instance or object is a model.

Knowledge Check

5

What is the best way to train a model?

a. Use the entire dataset as both training and testing set

b. Split the known dataset into separate training and testing sets

c. Ask the source to provide continuous data

d. Ask the source to provide categorical data

Knowledge Check

5

What is the best way to train a model?

a. Use the entire dataset as both training and testing set

b. Split the known dataset into separate training and testing sets

c. Ask the source to provide continuous data

d. Ask the source to provide categorical data

The correct answer is **b**

The best way to train a model is to split the known dataset into training and testing sets. The testing set varies from 20% to 40%.

Knowledge Check

6

Which of the following is true with a greater value of SSR or SSE? Select all that apply.

a. The prediction will be more accurate, making it the best fit model.

b. The prediction will start becoming less accurate.

c. The outcome remains unaffected.

d. The model will not be the best fit for the attributes.

Knowledge Check

6

Which of the following is true with a greater value of SSR or SSE? Select all that apply.

a. The prediction will be more accurate, making it the best fit model.

b. The prediction will start becoming less accurate.

c. The outcome remains unaffected.

d. The model will not be the best fit for the attributes.

The correct answer is **b, d**

With higher SSR or SSE, the prediction will be less accurate and the model will not be the best fit for the attributes.

Knowledge Check

7

Class sklearn.linear_model.LogisticRegression, random_state ____.

a. Indicates the seed of the pseudo random number generator used to shuffle data

b. Defines the features state

c. Represents the number of random iterations

d. Specifies a random constant to be added to the decision function

Knowledge Check

7

Class sklearn.linear_model.LogisticRegression, random_state ____.

a. Indicates the seed of the pseudo random number generator used to shuffle data

b. Defines the features state

c. Represents the number of random iterations

d. Specifies a random constant to be added to the decision function

The correct answer is **a**

The class "sklearn.linear_model.LogisticRegression, random_state" indicates the seed of the pseudo random number generator used to shuffle data.

Knowledge Check

8

What are the requirements of the K-means algorithm? Select all that apply.

a. Number of clusters should be specified

b. More than one iteration should meet requisite criteria

c. Centroids should minimize inertia

d. Features should be labeled

Knowledge Check

8

What are the requirements of the K-means algorithm? Select all that apply.

a. Number of clusters should be specified

b. More than one iteration should meet requisite criteria

c. Centroids should minimize inertia

d. Features should be labeled

The correct answer is **a, b, c**

The K-means algorithm requires the number of clusters to be specified and the centroids to minimize inertia. It requires several iterations to fine tune itself and meet the required criteria to become the best fit model.

Knowledge Check

9

In Class sklearn.decomposition.PCA, the transform(X) method, where X is multi-dimensional, _____.

a. Fits the model with X and applies the dimensionality reduction on X

b. Transforms the data back to its original space

c. Applies the dimensionality reduction on X

d. Computes data co-variance with the generative model

Knowledge Check

9

In Class sklearn.decomposition.PCA, the transform(X) method, where X is multi-dimensional, _____.

a. Fits the model with X and applies the dimensionality reduction on X

b. Transforms the data back to its original space

c. Applies the dimensionality reduction on X

d. Computes data co-variance with the generative model

The correct answer is **c**

In Class "sklearn.decomposition.PCA," the transform(X) method applies the dimensionality reduction on X.

DATA AND
ARTIFICIAL INTELLIGENCE

Thank You