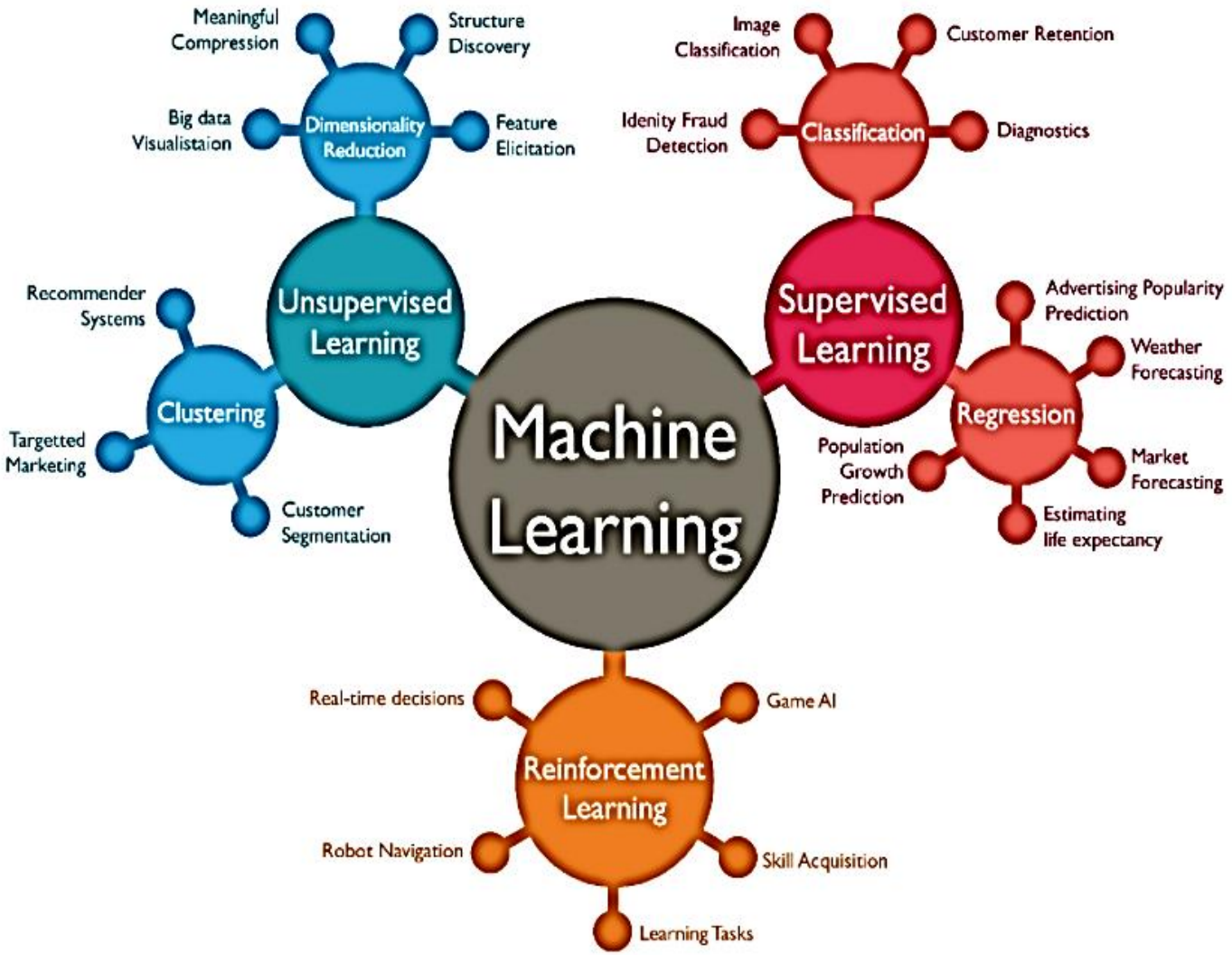
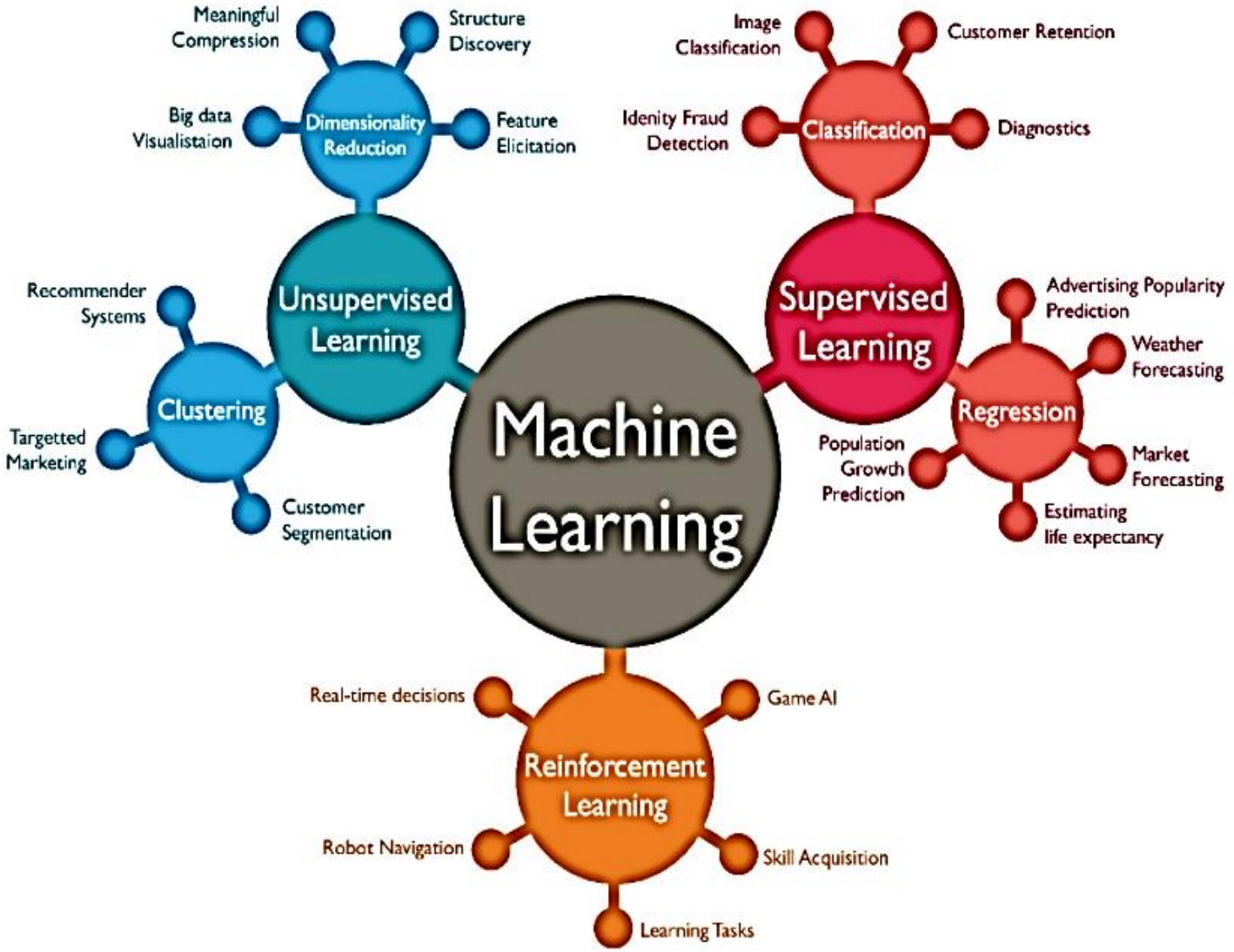
Introduction to Machine Learning

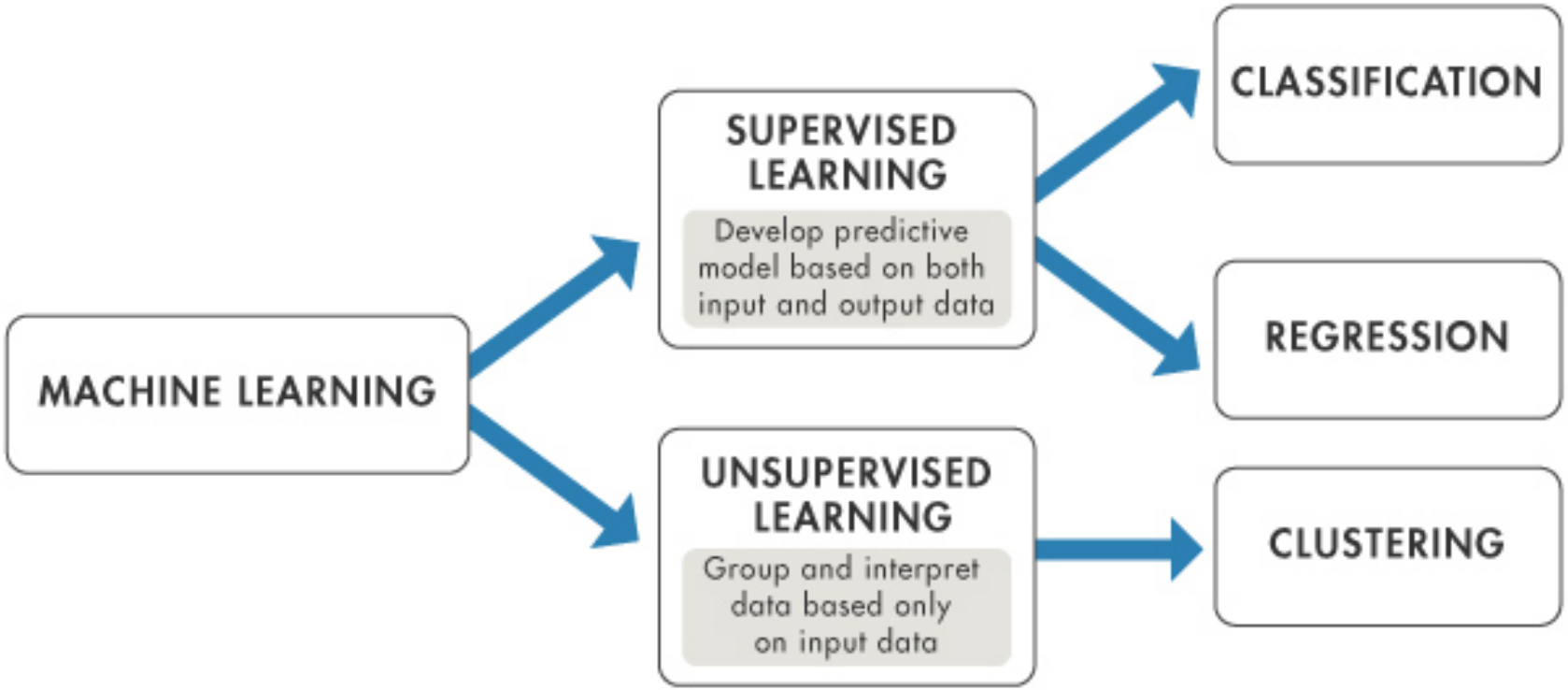


Machine Learning

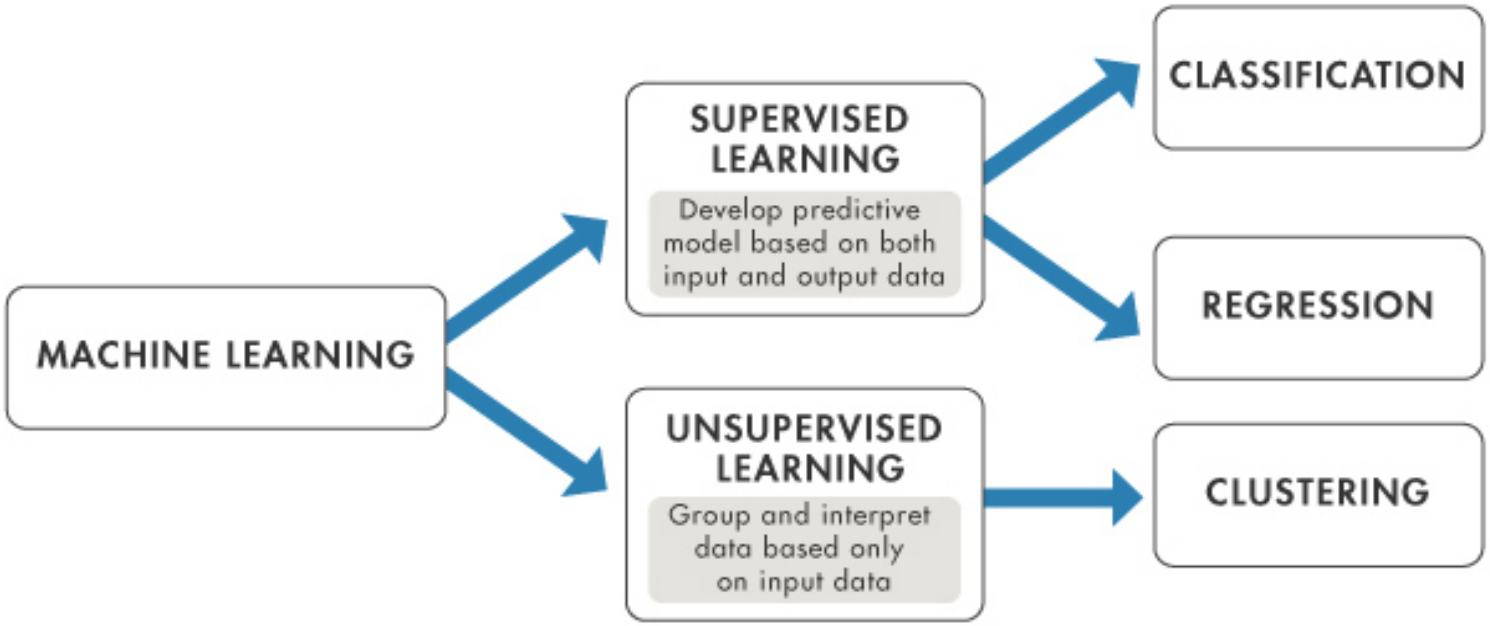
What Is Machine Learning teaches computers to do what comes naturally to humans: learn from experience. Machine learning algorithms use computational methods to “learn” information directly from data without relying on a predetermined equation as a model. The algorithms adaptively improve their performance as the number of samples available for learning increases.



Machine learning uses two types of techniques: supervised learning, which **trains a model** on known input and output data so that it can predict future outputs, and unsupervised learning, which finds hidden patterns or intrinsic structures in input data.



The aim of supervised machine learning is to **build a model that makes predictions based on evidence**. A supervised learning algorithm takes a known set of input data and known responses to the data (output) and trains a model to generate reasonable predictions for the response to new data.



Classification techniques predict categorical responses, for example, whether an email is genuine or spam, or whether a tumor is cancerous or benign. Classification models classify input data into categories. Typical applications include medical imaging, image and speech recognition, and credit scoring.

Machine Learning Onramp

6 modules | 2 hours | Languages

Learn the basics of practical machine learning methods for classification problems.

1. Overview of Machine Learning

Familiarize yourself with machine learning concepts and the course.

2. Classification Workflow

Build a simple model to perform a classification task.

3. Importing and Preprocessing Data

Import data from multiple files.

4. Engineering Features

Calculate features from raw signals.

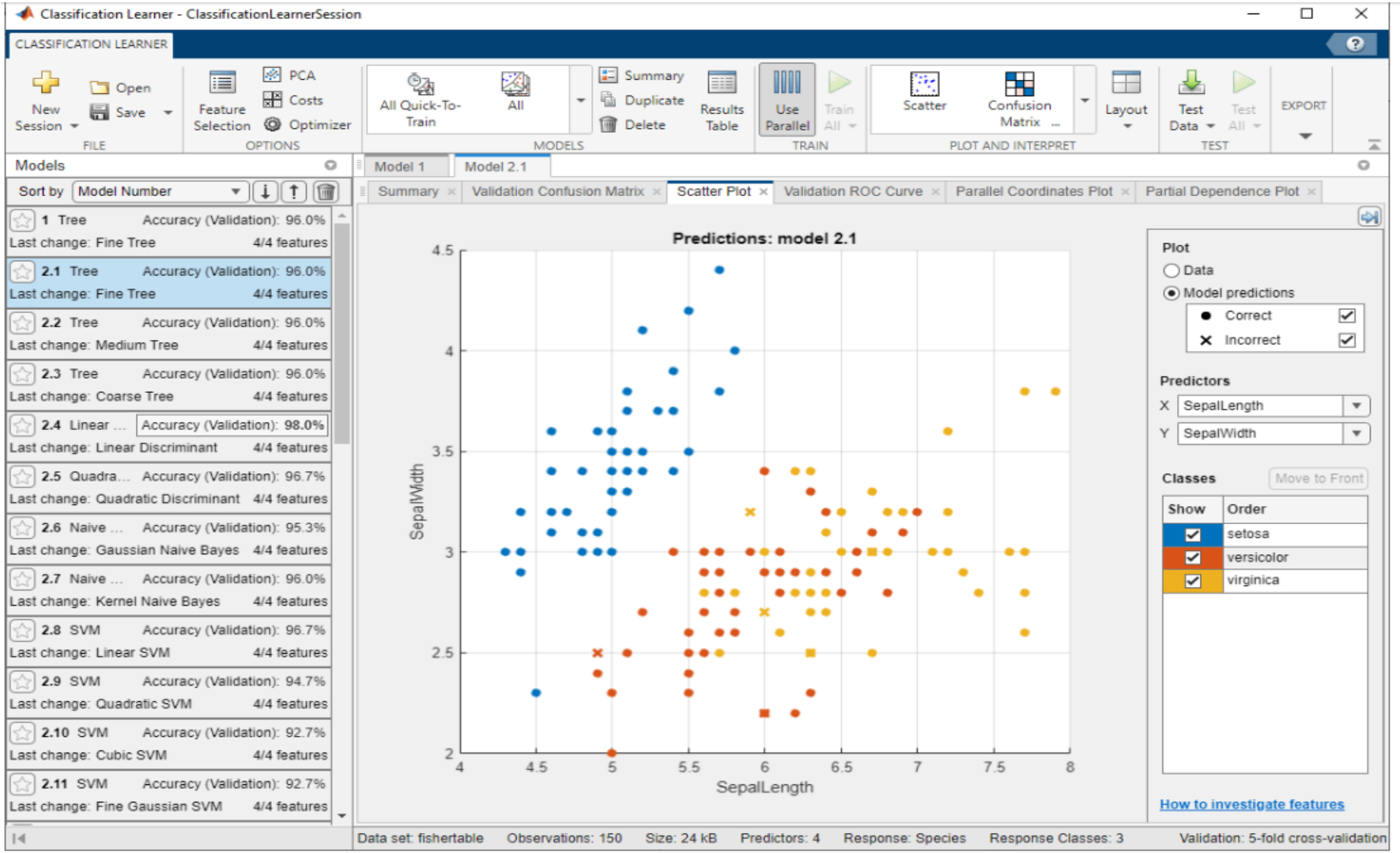
5. Classification Models

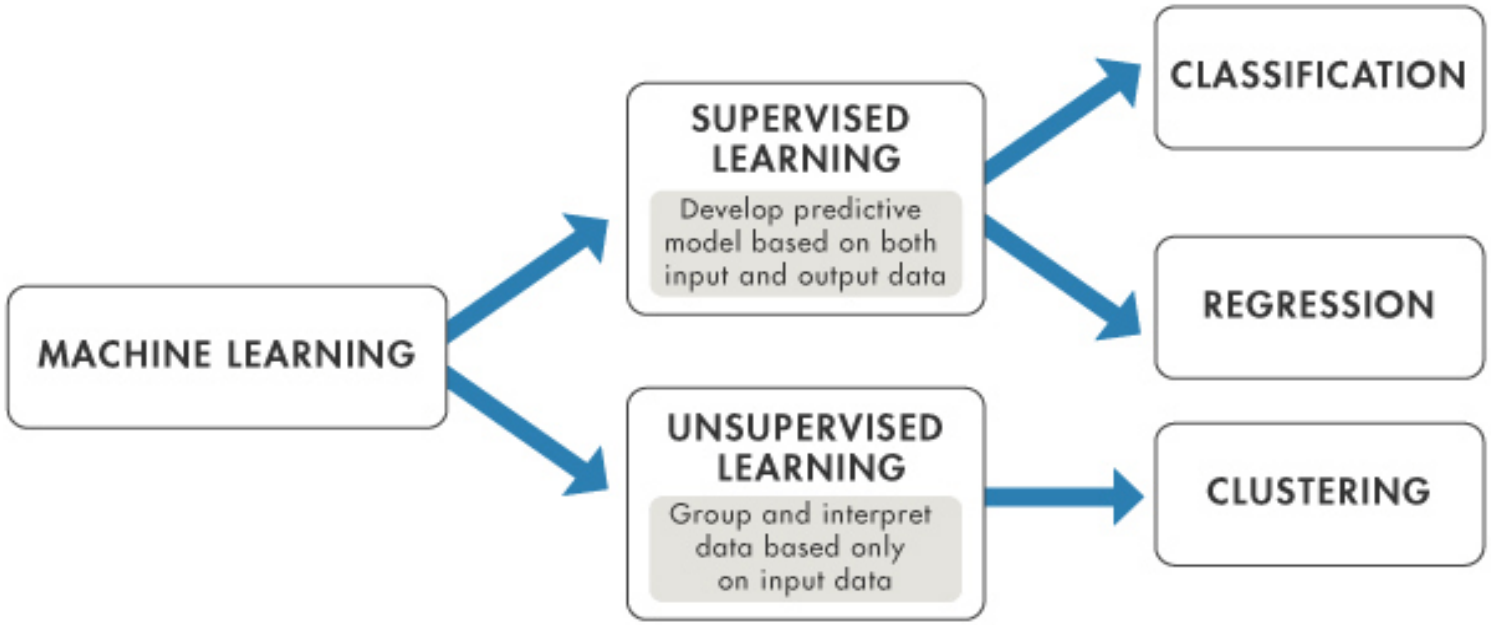
Train and use machine learning models to make predictions.

Train Classification Models in Classification Learner App

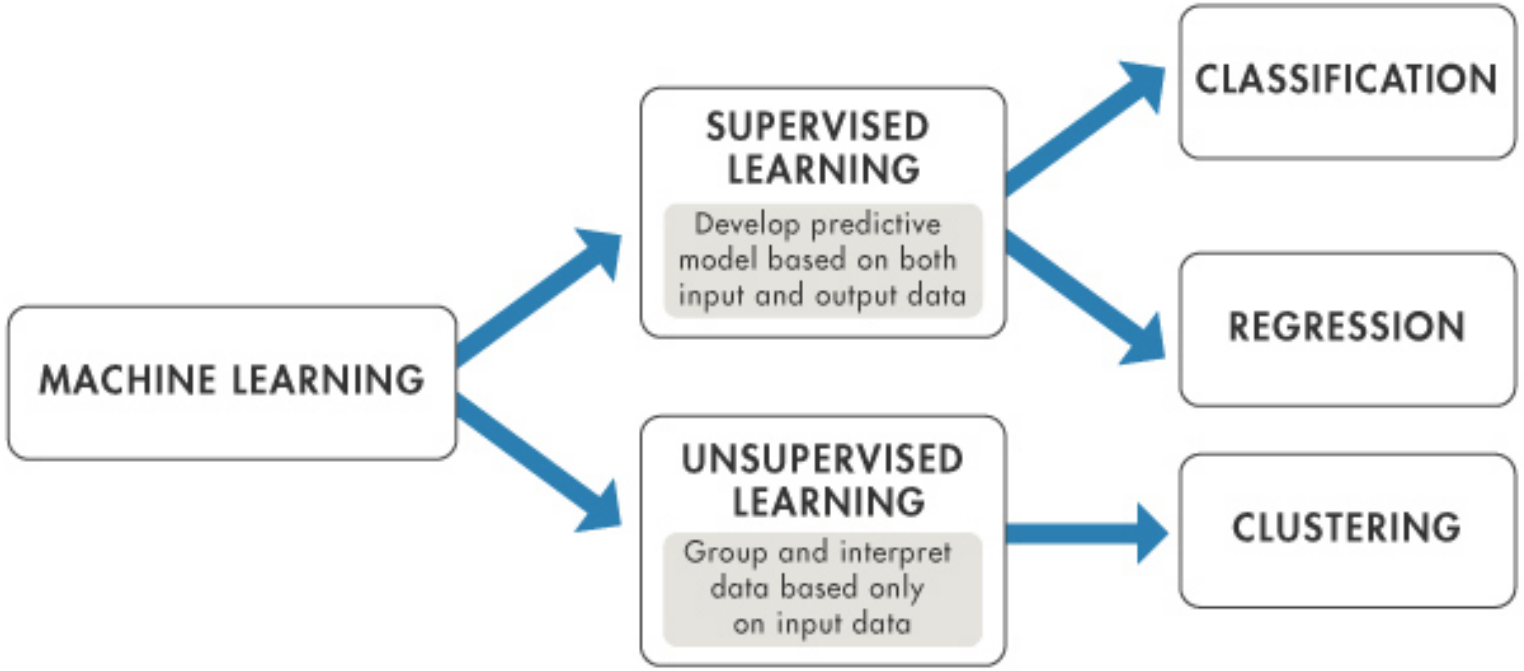
Use the Classification Learner app to train models to classify data using supervised machine learning. The app lets you explore supervised machine learning interactively using various classifiers.

https://www.mathworks.com/help/stats/train-classification-models-in-classification-learner-app.html

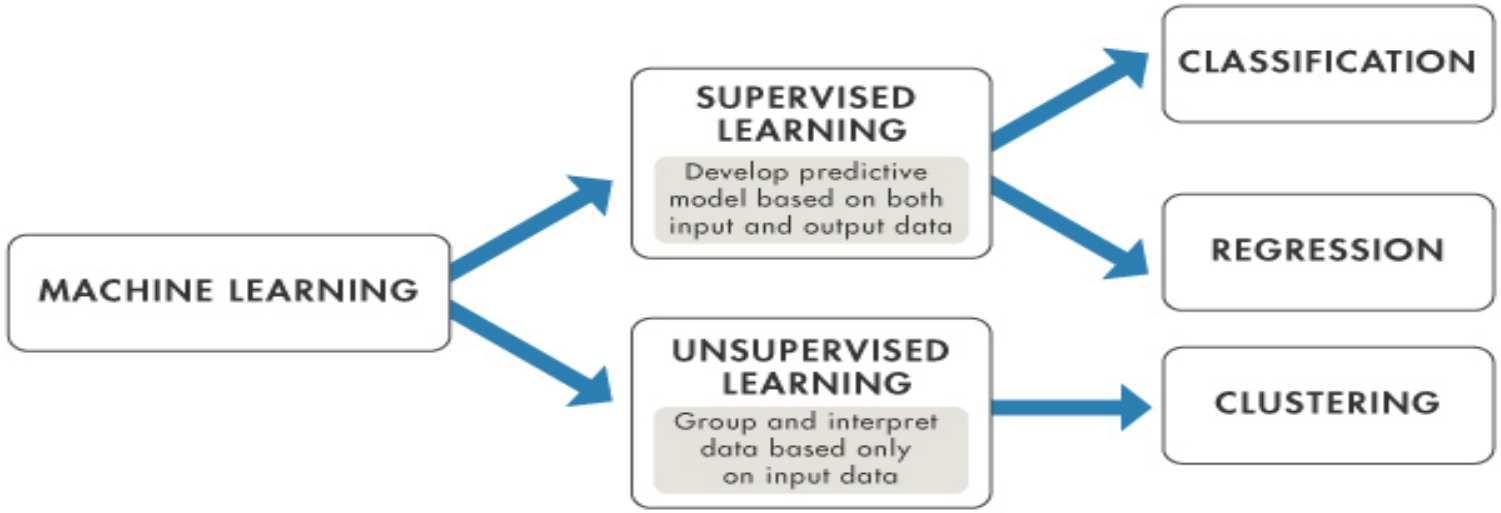




Regression techniques **predict continuous responses**, for example, changes in temperature or fluctuations in power demand. Typical applications include electricity load forecasting and algorithmic trading.



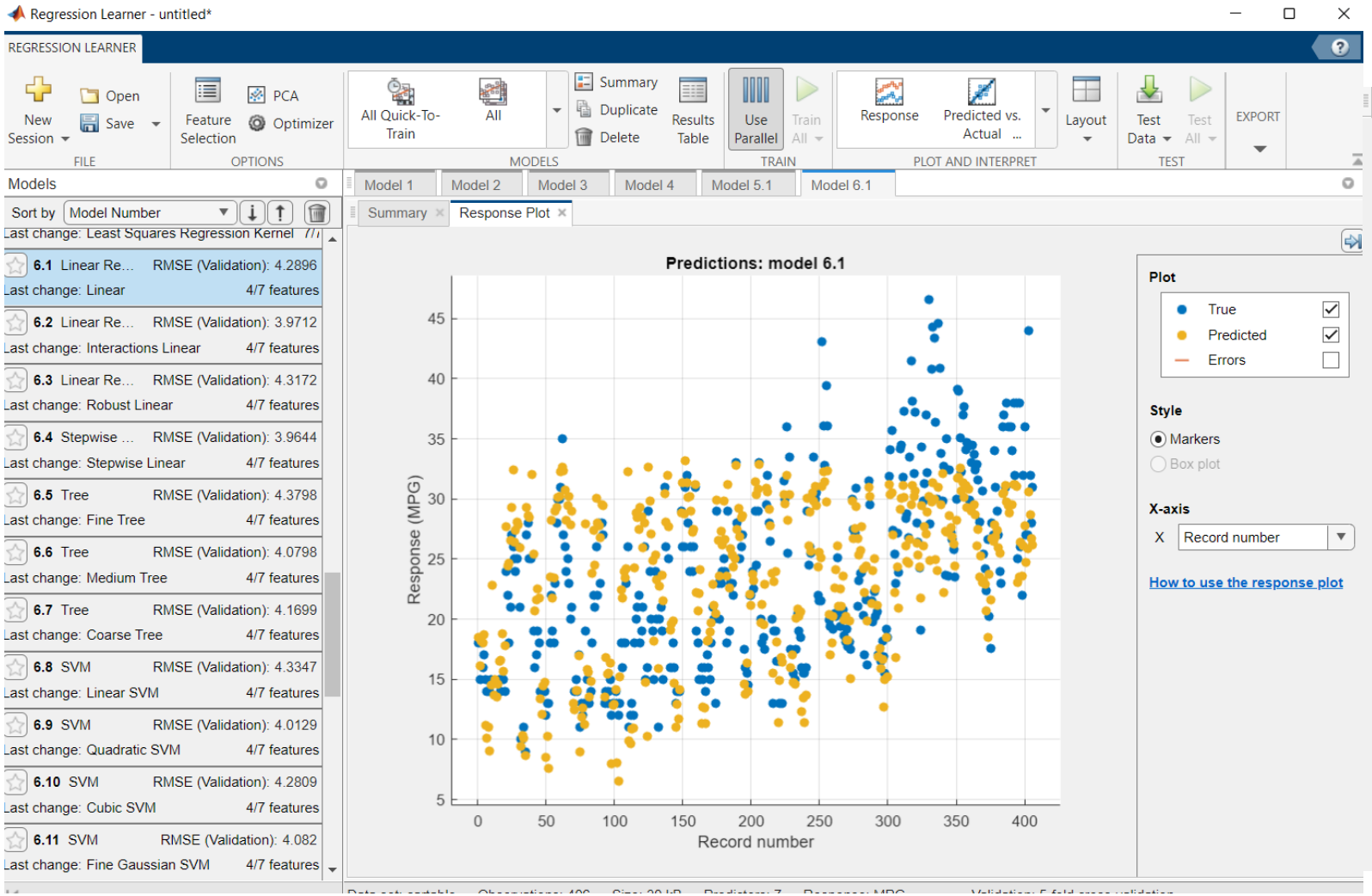
Unsupervised learning **finds hidden patterns or intrinsic structures in data**. It is used to **draw inferences from datasets consisting of input data without labeled responses.** *Clustering* is the most common unsupervised learning technique. It is used for exploratory data analysis to find hidden patterns or groupings in data. Applications for clustering include gene sequence analysis, market research, and object recognition.

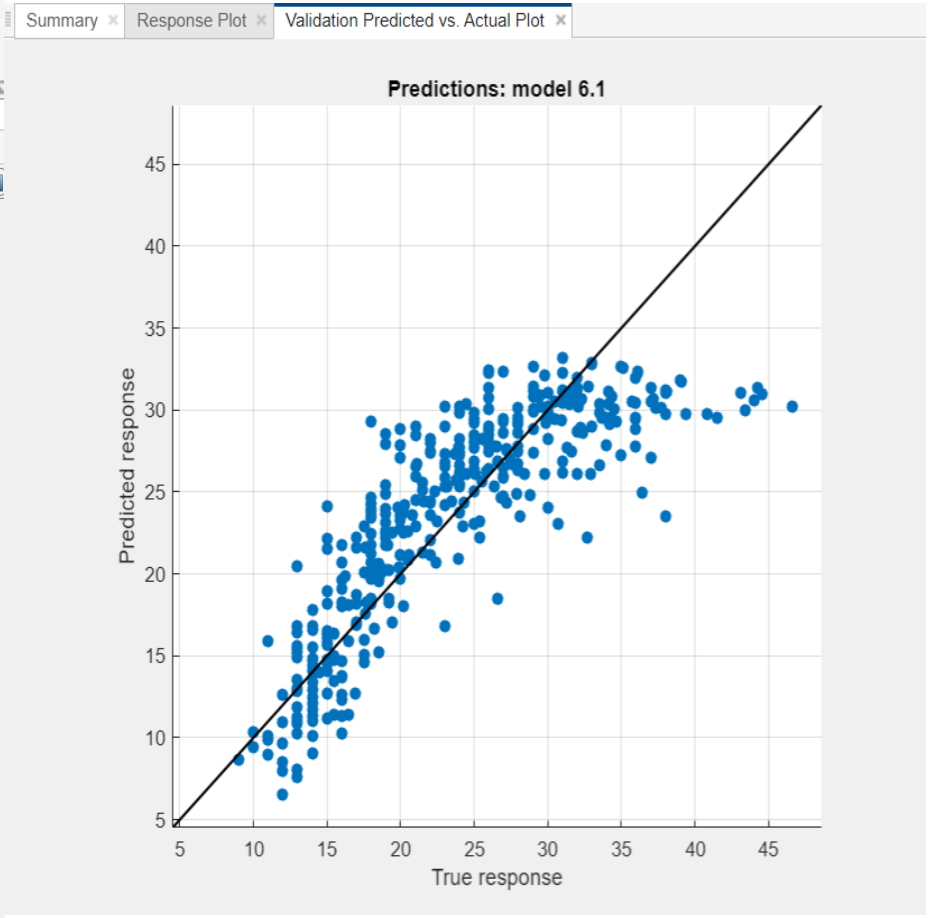


Regression to predict continuous responses	Use the Regression Learner app to automatically train a selection of models and help you choose the best. You can generate MATLAB code to work with scripts and other function options. For more options, you can use the command-line interface.	Statistics and Machine Learning Toolbox	Train Regression Models in Regression Learner App Regression Functions
Clustering	Use cluster analysis functions.	Statistics and Machine Learning Toolbox	Cluster Analysis

Train Regression Models in Regression Learner App

You can use Regression Learner to train regression models including linear regression models, regression trees, Gaussian process regression models, support vector machines, kernel approximation, ensembles of regression trees, and neural network regression models. In addition to training models, you can explore your data, select features, specify validation schemes, and evaluate results.

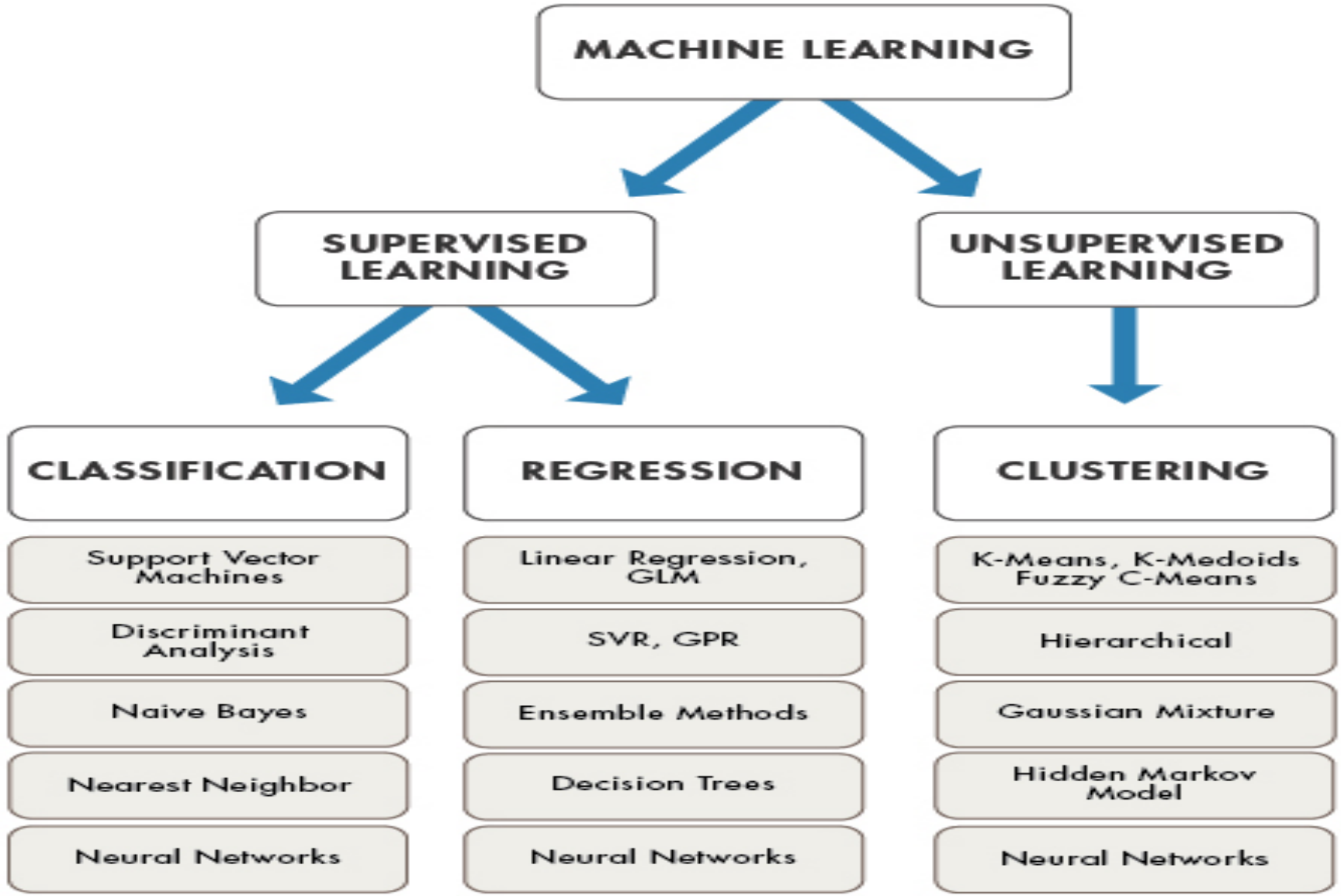




Selecting the Right Algorithm

There are dozens of supervised and unsupervised machine learning algorithms, and each takes a different approach to learning. There is no best method or one size fits all. Finding the right algorithm is partly based on trial and error—even highly experienced data scientists cannot tell whether an algorithm will work without trying it out.

Highly flexible models tend to overfit data by modeling minor variations that could be noise. Simple models are easier to interpret but might have lower accuracy. Therefore, choosing the right algorithm requires trading off one benefit against another, including model speed, accuracy, and complexity. Trial and error is at the core of machine learning—if one approach or algorithm does not work, you try another.


MACHINE LEARNING
SUPERVISED LEARNING
UNSUPERVISED LEARNING
CLASSIFICATION
REGRESSION
CLUSTERING
Support Vector Machines
Discriminant Analysis
Naive Bayes
Nearest Neighbor
Neural Networks
Linear Regression, GLM
SVR, GPR
Ensemble Methods
Decision Trees
Neural Networks
K-Means, K-Medoids Fuzzy C-Means
Hierarchical
Gaussian Mixture
Hidden Markov Model
Neural Networks