Artificial Intelligence (Machine Learning & Deep Learning) [Course]

Week 4 – Machine Learning Core - Foundation

[See examples / code in GitHub code repository]

It is not about Theory, it is 20% Theory and 80% Practical – Technical/Development/Programming [Mostly Python based]

Machine Learning - Meaning

Machine learning (ML) is a branch of artificial intelligence (AI) focused on enabling computers and machines to imitate the way that humans learn, to perform tasks autonomously, and to improve their performance and accuracy through experience and exposure to more data.

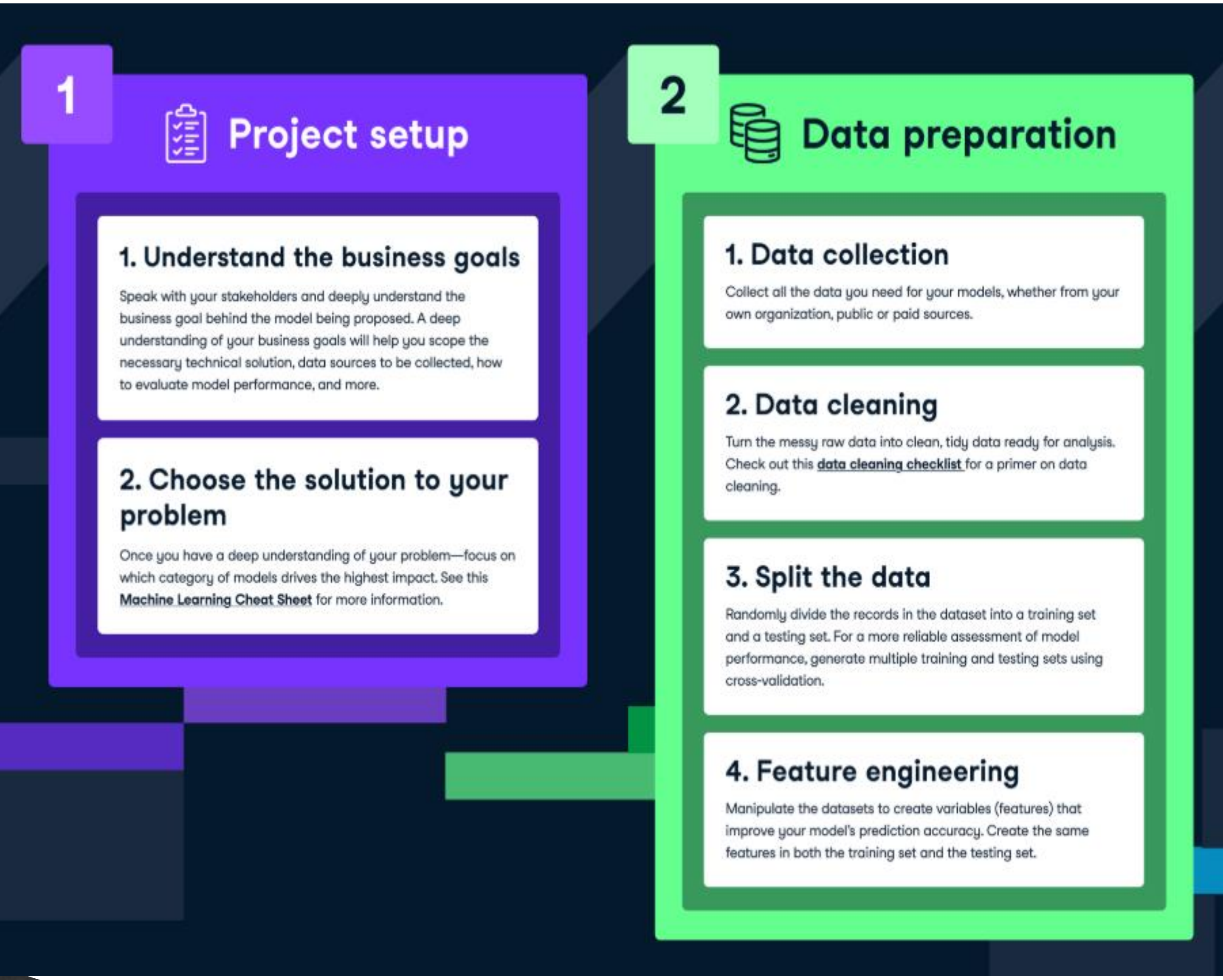
Machine learning (ML) is a discipline of artificial intelligence (AI) that provides machines with the ability to automatically learn from data and past experiences while identifying patterns to make predictions with minimal human intervention.

Machine learning methods enable computers to operate autonomously without explicit programming. ML applications are fed with new data, and they can independently learn, grow, develop, and adapt.

Examples

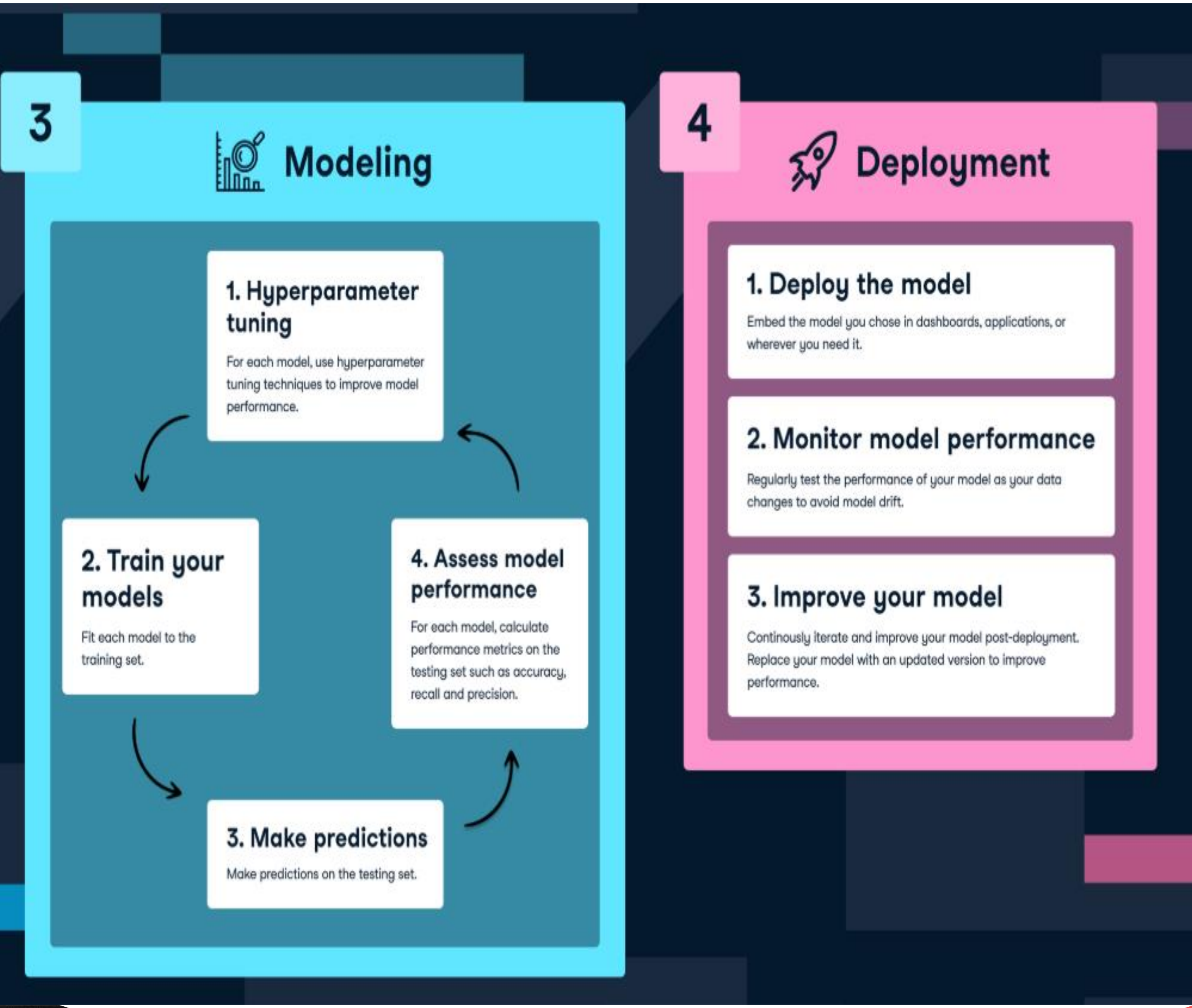
Reference:
https://www.datacamp.com/blog/what-is-machine-learning
https://www.ibm.com/think/topics/machine-learning
https://www.coursera.org/articles/what-is-machine-learning

Machine Learning – Workflow - 1



Reference:
https://www.datacamp.com/blog/a-beginner-s-guide-to-the-machine-learning-workflow

Machine Learning – Workflow - 2

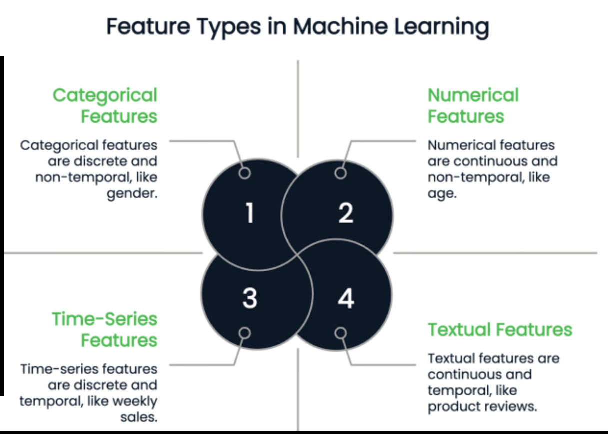


Reference:
https://www.datacamp.com/blog/a-beginner-s-guide-to-the-machine-learning-workflow

Feature Engineering

Feature engineering is the process of turning raw data into useful features that help improve the performance of machine learning models. It includes choosing, creating and adjusting data attributes to make the model's predictions more accurate. The goal is to make the model better by providing relevant and easy-to-understand information.

Feature Engineering Techniques



1. Feature scaling

Feature scaling ensures that numerical features lie within a standardized range, preventing some features from dominating the learning process due to their larger values.

Machine learning models that rely on distance-based calculations (e.g., linear regression, k-nearest neighbors, and neural networks) can be affected when features have vastly different scales.

https://www.datacamp.com/tutorial/normalization-vs-standardization

2. Encoding categorical variables

Machine learning models cannot directly process categorical variables, so they must be converted into numerical representations. Below, we discuss some popular encoding techniques.

- **One-hot encoding:**
- **Label encoding:**
- **Ordinal encoding:**
- **Target encoding:**

Tools and Libraries for Feature Engineering

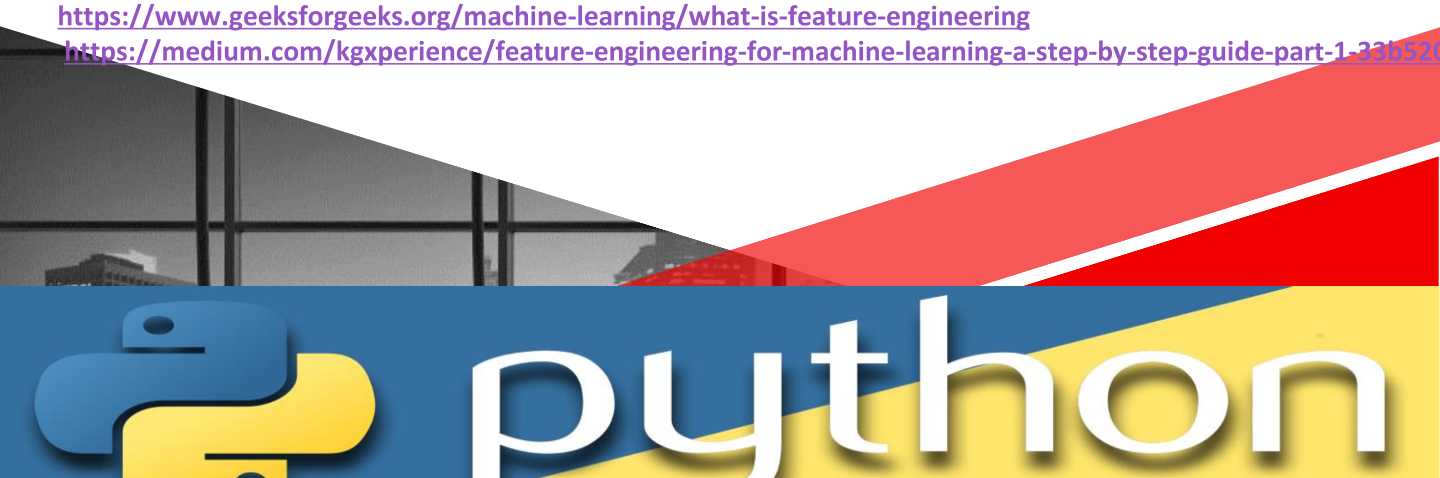
- **Pandas**
- **Scikit-Learn**
- **Feature-Engine**

Automated feature engineering tools

- **Featuretools:**
- **TSFresh:**
- **Autofeat:**

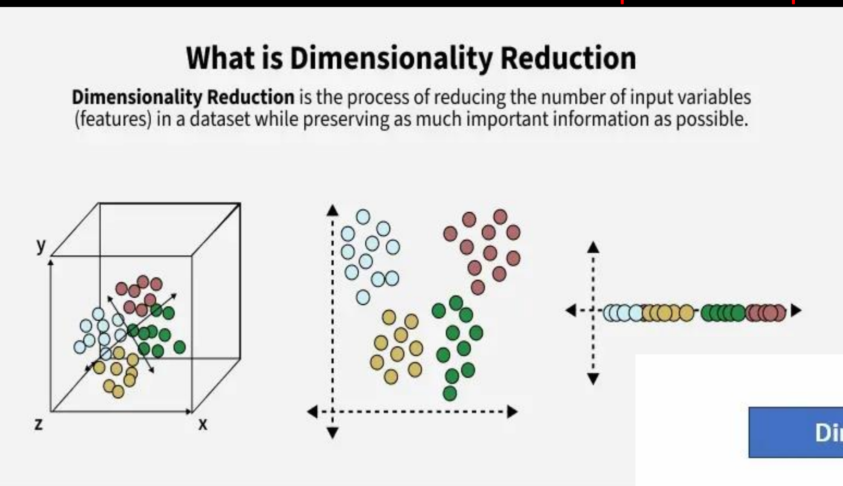
Reference:

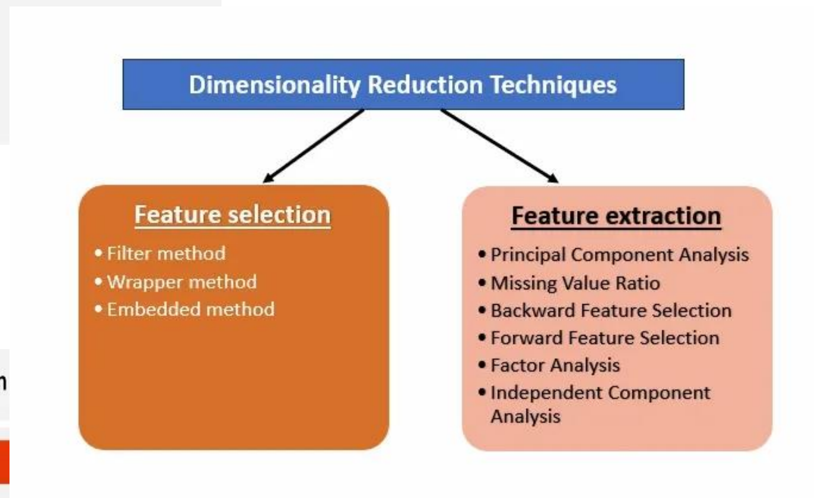
https://www.ibm.com/think/topics/feature-engineering
https://www.datacamp.com/tutorial/feature-engineering
https://www.geeksforgeeks.org/machine-learning/what-is-feature-engineering
https://medium.com/kgxperience/feature-engineering-for-machine-learning-a-step-by-step-guide-part-1-33b52

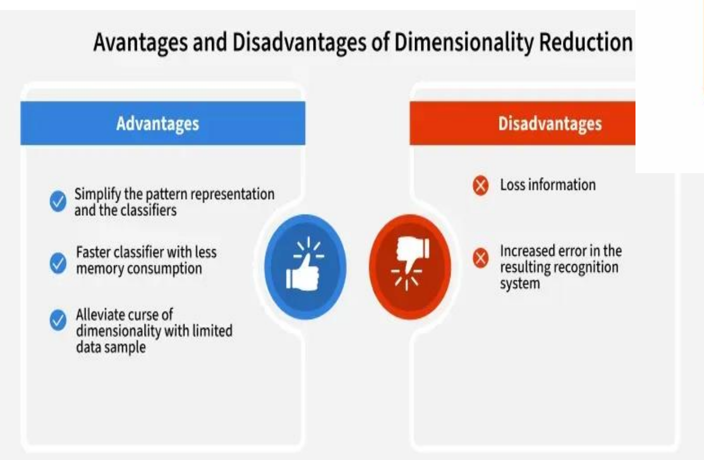


Dimensionality Reduction

When working with machine learning models, datasets with too many features can cause issues like slow computation and overfitting. Dimensionality reduction helps to reduce the number of features while retaining key information. Techniques like principal component analysis (PCA), singular value decomposition (SVD) and linear discriminant analysis (LDA) convert data into a lower-dimensional space while preserving important details.



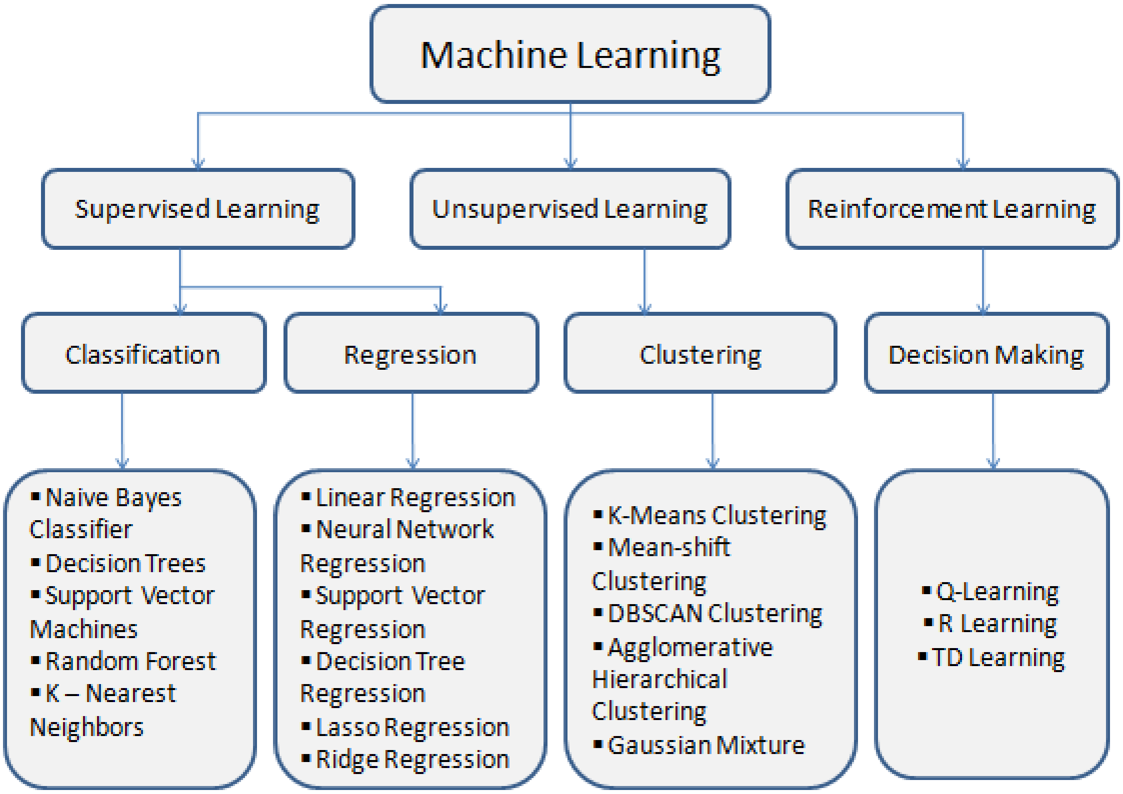




Reference:

https://www.geeksforgeeks.org/machine-learning/dimensionality-reduction/
https://learninglabb.com/dimensionality-reduction-in-machine-learning/
https://www.ibm.com/think/topics/dimensionality-reduction
https://machinelearningmastery.com/dimensionality-reduction-for-machine-learning/
https://learninglabb.com/dimensionality-reduction-in-machine-learning/

Machine Learning - Types



https://www.geeksforgeeks.org/types-of-machine-learning/
https://www.datacamp.com/blog/what-is-machine-learning
https://www.ibm.com/think/topics/machine-learning
https://www.coursera.org/articles/what-is-machine-learning

Important Term

References:

https://www.geeksforgeeks.org/50-machine-learning-terms-explained/

https://www.w3schools.com/ai/ai_ml_terminology.asp

https://developers.google.com/machine-learning/glossary

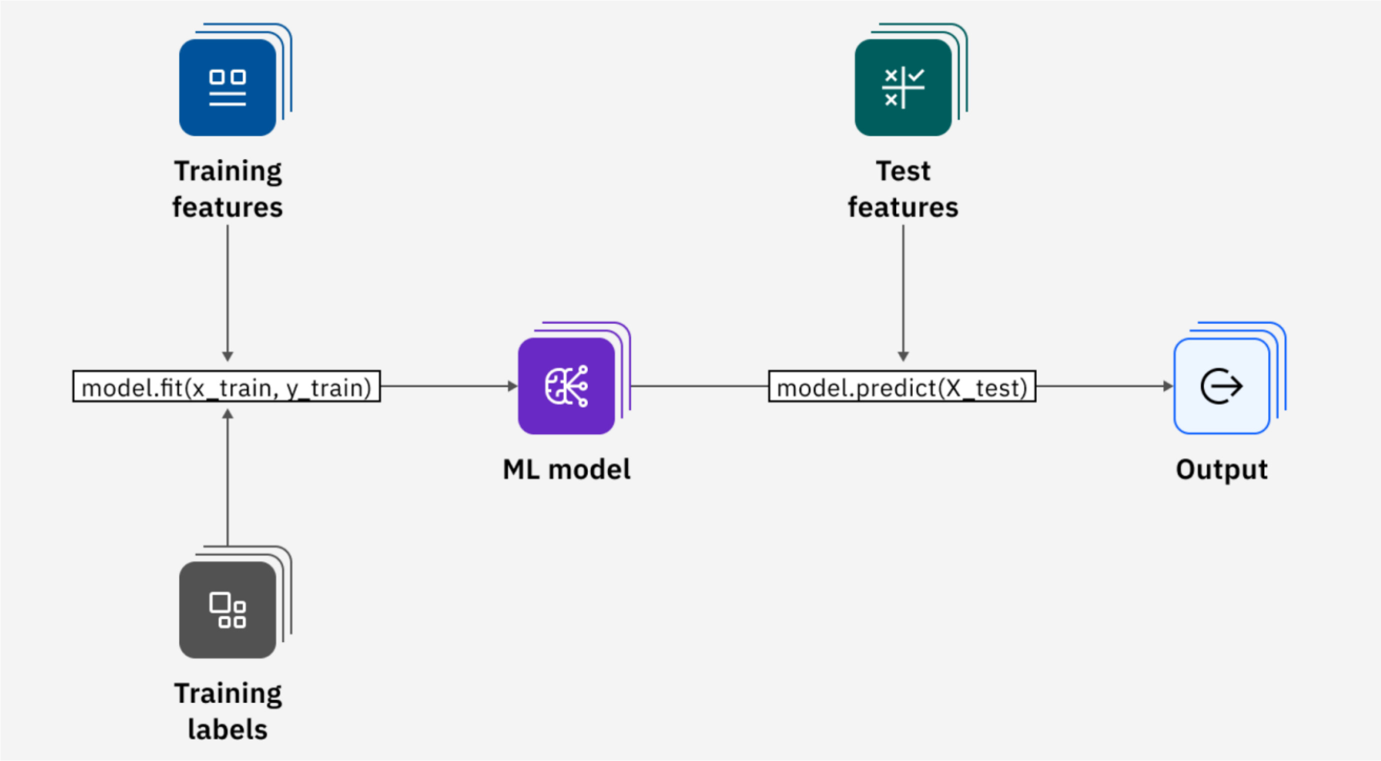
https://www.springboard.com/blog/data-science/machine-learning-terminology/

Machine Learning Cheat Sheet

Reference:
https://www.datacamp.com/cheat-sheet/machine-learning-cheat-sheet
https://www.datacamp.com/cheat-sheet/category/machine-learning
https://www.geeksforgeeks.org/machine-learning-algorithms-cheat-sheet/
https://www.tutorialspoint.com/machine_learning/machine_learning_cheatsheet.htm
https://datasciencedojo.com/blog/machine-learning-algorithms/

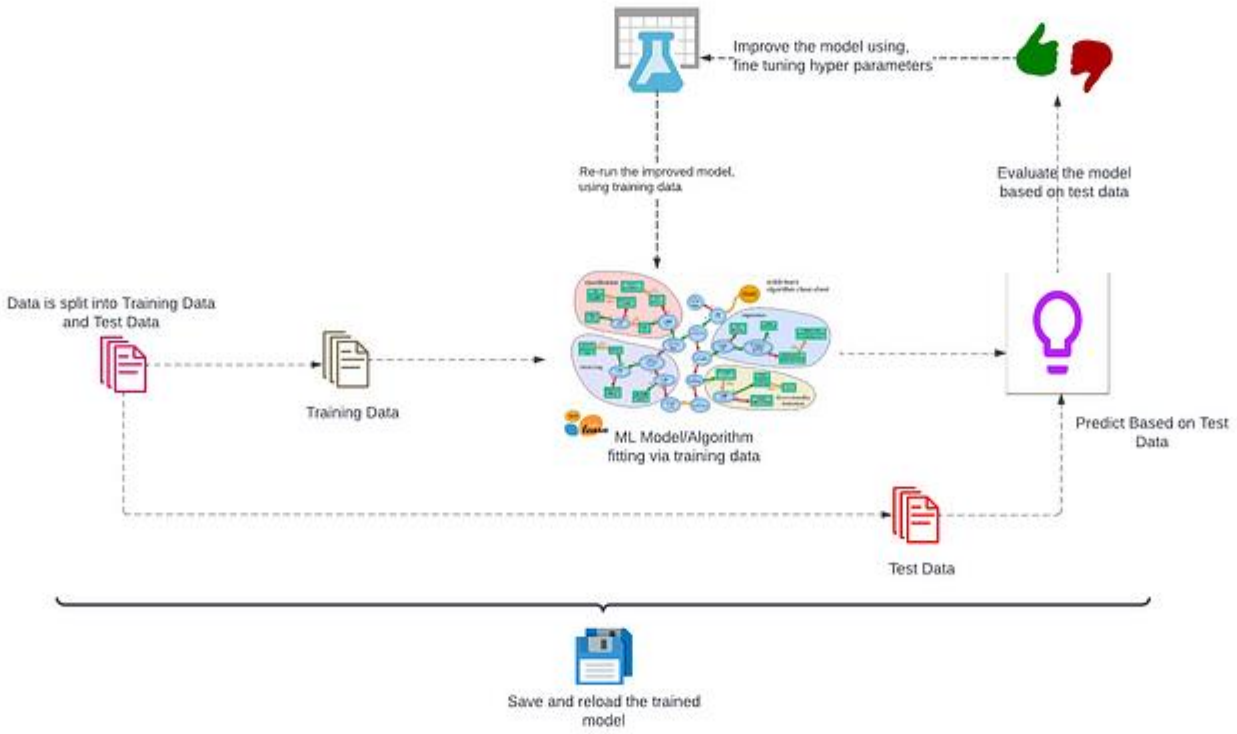
scikit-learn Overview

- Simple and efficient tools for predictive data analysis
- Accessible to everybody, and reusable in various contexts
- Built on NumPy, SciPy, and matplotlib
- Open source, commercially usable - BSD license



Reference:
https://www.ibm.com/think/topics/scikit-learn
https://scikit-learn.org/

scikit-learn - Workflow



Reference:
https://medium.com/codenx/machine-learning-using-scikit-learn-sklearn-high-level-wor
and-preparing-the-data-ecb3b6af4425

scikit-learn – cheat sheet

Reference:

https://intellipaat.com/blog/tutorial/python-tutorial/scikit-learn-cheat-sheet/
https://www.datacamp.com/cheat-sheet/scikit-learn-cheat-sheet-python-machine-learning
https://www.geeksforgeeks.org/scikit-learn-cheatsheet/
https://scikit-learn.org/stable/machine_learning_map.html
https://s3.amazonaws.com/assets.datacamp.com/blog_assets/Scikit_Learn_Cheat_Sheet_Python.pdf

Parameters/Hyperparameter

A model parameter is a configuration variable that is internal to the model and whose value can be estimated from the given data.
They are required by the model when making predictions.
Their values define the skill of the model on your problem.
They are estimated or learned from data.
They are often not set manually by the practitioner.
They are often saved as part of the learned model.

Some examples of model parameters include:
•The weights in an artificial neural network.
•The coefficients in a linear regression or logistic regression.

What is a Hyperparameter in a Machine Learning Model?
A model hyperparameter is a configuration that is external to the model and whose value cannot be estimated from data.
•They are often used in processes to help estimate model parameters.
•They are often specified by the practitioner.
•They can often be set using heuristics.
•They are often tuned for a given predictive modeling problem

Some examples of model hyperparameters include:
•The learning rate for training a neural network.
•The C and sigma hyperparameters for support vector machines.
•The k in k-nearest neighbors.

Reference:
https://www.datacamp.com/tutorial/parameter-optimization-machine-learning-models

ML Foundation

Difference between training data and testing data
https://www.geeksforgeeks.org/training-data-vs-testing-data/
https://testsigma.com/blog/difference-between-training-data-and-testing-data/
https://www.zams.com/blog/the-difference-between-training-data-vs-test-data-in-machine-learning

Machine learning feature engineering
https://www.ibm.com/think/topics/feature-engineering
https://www.geeksforgeeks.org/what-is-feature-engineering/
https://www.analyticsvidhya.com/blog/2021/10/a-beginners-guide-to-feature-engineering-everything-you-need-to-know/

Parameters and Hyperparameters in Machine Learning and Deep Learning
https://www.geeksforgeeks.org/difference-between-model-parameters-vs-hyperparameters/
https://towardsdatascience.com/parameters-and-hyperparameters-aa609601a9ac/
https://machinelearningmastery.com/difference-between-a-parameter-and-a-hyperparameter/
https://www.datacamp.com/tutorial/parameter-optimization-machine-learning-models

Thank you - for listening and participating

- ❑Questions / Queries
- ❑Suggestions/Recommendation
- ❑Ideas…..?

Shahzad Sarwar
Cognitive Convergence
https://cognitiveconvergence.com
shahzad@cognitiveconvergence.com
voice: +1 4242530744 (USA) +92-3004762901 (Pak)