Machine Learning Algorithms Cheat Sheet

Quick reference for definitions and usage of major ML algorithms.

Supervised Learning

Algorithm	Definition
Linear Regression	Predicts a continuous value by fitting a straight line to data.
Logistic Regression	Predicts probabilities for classification (yes/no) using a sigmoid function.
Decision Tree	Splits data into branches based on feature values to make predictions.
Random Forest	Many decision trees combined; takes the majority vote or average.
Support Vector Machine (SVM)	Finds the best boundary that separates classes with maximum margin.
K-Nearest Neighbors (KNN)	Predicts based on the majority class or average of the k closest data points.
Naive Bayes	Probabilistic model using Bayes' theorem assuming features are independent.
Gradient Boosting	Builds models in sequence, each fixing errors of the previous.
XGBoost	Optimized, fast version of gradient boosting.
LightGBM	Gradient boosting optimized for large datasets and speed.
CatBoost	Gradient boosting that handles categorical features automatically.
Elastic Net	Linear model with both L1 and L2 regularization.

Unsupervised Learning

Algorithm	Definition
K-Means Clustering	Groups data into k clusters by minimizing distance to cluster centers.
Hierarchical Clustering	Builds a tree of clusters by merging or splitting based on similarity.
DBSCAN	Groups points that are close together and ignores outliers.
PCA	Reduces dimensions by finding principal components that capture most variance.
t-SNE	Visualizes high-dimensional data in 2D/3D keeping similar points close.
Autoencoders	Neural networks that compress and reconstruct data for dimensionality reduction.
Gaussian Mixture Model (GMM)	Models data as a mix of multiple Gaussian distributions.

Reinforcement Learning

Algorithm	Definition
Q-Learning	Learns value of actions to maximize rewards without knowing environment model.
SARSA	Updates values based on the action actually taken.
Deep Q-Network (DQN)	Uses neural networks to approximate Q-values for large state spaces.
Policy Gradient	Learns a policy directly by optimizing expected rewards.
Actor-Critic	Combines policy learning (actor) and value learning (critic).

Special/Advanced ML

Algorithm	Definition
Linear Discriminant Analysis (LDA)	Reduces dimensions while keeping class separability.
Quadratic Discriminant Analysis (QDA)	Like LDA but allows curved decision boundaries.
Time Series ARIMA	Models time-dependent data using autoregression and moving averages.
Prophet	Forecasting tool for time series with trends and seasonality.
Isolation Forest	Detects anomalies by randomly partitioning data.
One-Class SVM	Learns boundary for normal data to detect outliers.