Supervised Learning Algorithms:

Algorithm	Type	Definition	Where to Use	Cross Validation	Cost Function	Evaluation Metrics	Score Type	Example
Linear Regression	Regression	Predicts continuous output based on linear relationship	House price prediction, sales forecasting	K-Fold CV, Leave-one-out CV	Mean Squared Error (MSE), MAE, RMSE	MSE, RMSE, R^2	R^2 Score (%)	Predicting sales based on ad budget
Logistic Regression	Classification	Predicts probability of categorical outcomes	Spam detection, disease prediction	Stratified K-Fold CV	Log Loss, Cross-Entropy Loss	Accuracy, Precision, Recall, F1-score, ROC-AUC	Accuracy (%)	Predicting customer churn (Yes/No)
Decision Tree	Classification / Regression	Tree-based splits for prediction	Credit risk assessment, Fraud detection	K-Fold CV, Grid Search CV	Gini Impurity, Entropy (classification), MSE (regression)	Accuracy, F1-score, RMSE	Accuracy, R^2	Classifying loan defaulters
Random Forest	Classification / Regression	Ensemble of decision trees to improve performance	Medical diagnosis, Stock prediction	K-Fold CV, Grid Search CV	Gini Impurity, Entropy, MSE	Accuracy, F1, ROC-AUC, RMSE	Accuracy, R^2	Predicting disease from symptoms
K-Nearest Neighbors (KNN)	Classification / Regression	Uses proximity to make predictions	Recommendation systems, Image recognition	K-Fold CV	N/A (distance-based)	Accuracy, F1-score, RMSE	Accuracy, R^2	Handwritten digit classification
Support Vector Machine (SVM)	Classification / Regression	Maximizes margin between classes	Face detection, Text categorization	K-Fold CV, Grid Search CV	Hinge Loss (classification), MSE (regression)	Accuracy, Precision, Recall, F1, ROC-AUC	Accuracy, R^2	Email spam detection
Naive Bayes	Classification	Based on Bayes' theorem assuming feature independence	Sentiment analysis, Document classification	K-Fold CV	Log Loss, Cross-Entropy Loss	Accuracy, Precision, Recall, F1	Accuracy (%)	Sentiment detection in tweets

Unsupervised Learning Algorithm:

Algorithm	Type	Definition	Where to Use	Cross Validation	Cost Function	Evaluation Metrics	Score Type	Example
K-Means Clustering	Clustering	Groups data into K clusters based on distance from centroids	Customer segmentation, Market basket analysis	Not traditional, use elbow method + silhouette validation	Within-Cluster Sum of Squares (WCSS)	Silhouette Score, Davies-Bouldin Index, Inertia	Silhouette Score (0-1)	Segmenting online retail customers
Hierarchical Clustering	Clustering	Builds nested clusters by merging or splitting them	Social network analysis, Bioinformatics	Dendrogram + silhouette validation	Agglomerative/Divisive linkage distance sum	Silhouette Score, Cophenetic Correlation Coefficient	Silhouette Score (0-1)	Clustering gene expression data
DBSCAN	Clustering	Groups closely packed points; identifies outliers	Anomaly detection, Spatial clustering	Hyperparameter tuning via Grid search	Epsilon radius + MinPts clustering density	Silhouette Score, Number of clusters formed	Number of clusters	Detecting fraud clusters in transaction data
PCA (Principal Component Analysis)	Dimensionality Reduction	Reduces data dimensions while preserving variance	Image compression, Noise filtering	Scree plot, Cumulative explained variance plot	Reconstruction error	Explained Variance Ratio, Cumulative Variance	Variance explained (%)	Compressing image datasets
t-SNE (t-Distributed Stochastic Neighbor Embedding)	Dimensionality Reduction	Visualizes high-dimensional data in 2D/3D space	Data visualization, Pattern discovery	Perplexity tuning + multiple runs	Kullback-Leibler Divergence	Visual cluster separation	Visual clusters in plot	Visualizing clusters in customer purchase behavior
Autoencoders	Dimensionality Reduction / Anomaly Detection	Neural network to reconstruct input minimizing error	Anomaly detection in images, Sensor monitoring	Training-validation split + Reconstruction error	Reconstruction Loss (MSE, MAE)	ROC-AUC (anomaly detection), Reconstruction error	AUC, Reconstruction loss	Detecting abnormal medical images