Cheat Sheet: Linear and Logistic Regression

Comparing different regression types

Model Name	Description	Code Syntax

Simple linear regression	**Purpose:** To predict a dependent variable based on one independent variable.
	Pros: Easy to implement, interpret, and efficient for small datasets.
	Cons: Not suitable for complex relationships; prone to underfitting.
	Modeling equation: $y = b_0 + b_1x$
		`from sklearn.linear_model import LinearRegression`
		`model = LinearRegression()`
		`model.fit(X, y)`

Polynomial regression	**Purpose:** To capture nonlinear relationships between variables.
	Pros: Better at fitting nonlinear data compared to linear regression.
	Cons: Prone to overfitting with high-degree polynomials.
	Modeling equation: $y = b_0 + b_1x + b_2x^2 + ...$
		`from sklearn.preprocessing import PolynomialFeatures`
		`from sklearn.linear_model import LinearRegression`
		`poly = PolynomialFeatures(degree=2)`
		`X_poly = poly.fit_transform(X)`
		`model = LinearRegression().fit(X_poly, y)`

Multiple linear regression	**Purpose:** To predict a dependent variable based on multiple independent variables.
	Pros: Accounts for multiple factors influencing the outcome.
	Cons: Assumes a linear relationship between predictors and target.
	Modeling equation: $y = b_0 + b_1x_1 + b_2x_2 + ...$
		`from sklearn.linear_model import LinearRegression`
		`model = LinearRegression()`
		`model.fit(X, y)`

Logistic regression	**Purpose:** To predict probabilities of categorical outcomes.
	Pros: Efficient for binary classification problems.
	Cons: Assumes a linear relationship between independent variables and log-odds.
	Modeling equation: $\log(p/(1-p)) = b_0 + b_1x_1 + ...$
		`from sklearn.linear_model import LogisticRegression`
		`model = LogisticRegression()`
		`model.fit(X, y)`

Associated functions commonly used

Function/Method Name	Brief Description	Code Syntax
train_test_split	Splits the dataset into training and testing subsets to evaluate the model's performance.	`from sklearn.model_selection import train_test_split` `X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)`

StandardScaler	Standardizes features by removing the mean and scaling to unit variance.	`from sklearn.preprocessing import StandardScaler`
		`scaler = StandardScaler()`
		`X_scaled = scaler.fit_transform(X)`

log_loss	Calculates the logarithmic loss,	`from sklearn.metrics import log_loss` `loss = log_loss(y_true, y_pred_proba)`

Function/Method Name	Brief Description	Code Syntax
	a performance metric for classification models.	
mean_absolute_error	Calculates the mean absolute error between actual and predicted values.	`from sklearn.metrics import mean_absolute_error` `mae = mean_absolute_error(y_true, y_pred)`
mean_squared_error	Computes the mean squared error between actual and predicted values.	`from sklearn.metrics import mean_squared_error` `mse = mean_squared_error(y_true, y_pred)`

root_mean_squared_error	Calculates the root mean squared error (RMSE), a commonly used metric for regression tasks.	`from sklearn.metrics import mean_squared_error`
		`import numpy as np`
		`rmse = np.sqrt(mean_squared_error(y_true, y_pred))`

r2_score	Computes the R-squared value, indicating how well the model explains the variability of the target variable.	`from sklearn.metrics import r2_score` `r2 = r2_score(y_true, y_pred)`

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