

# Cheat Sheet: Linear and Logistic Regression

## Comparing different regression types

Model Name	Description	Code Syntax
Simple linear regression	<p><b>Purpose:</b> To predict a dependent variable based on one independent variable.</p> <p><b>Pros:</b> Easy to implement, interpret, and efficient for small datasets.</p> <p><b>Cons:</b> Not suitable for complex relationships; prone to underfitting.</p> <p><b>Modeling equation:</b> <math>y = b_0 + b_1x</math></p>	<pre>from sklearn.linear_model import LinearRegression model = LinearRegression() model.fit(X, y)</pre>
Polynomial regression	<p><b>Purpose:</b> To capture nonlinear relationships between variables.</p> <p><b>Pros:</b> Better at fitting nonlinear data compared to linear regression.</p> <p><b>Cons:</b> Prone to overfitting with high-degree polynomials.</p> <p><b>Modeling equation:</b> <math>y = b_0 + b_1x + b_2x^2 + \dots</math></p>	<pre>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)</pre>
Multiple linear regression	<p><b>Purpose:</b> To predict a dependent variable based on multiple independent variables.</p> <p><b>Pros:</b> Accounts for multiple factors influencing the outcome.</p> <p><b>Cons:</b> Assumes a linear relationship between predictors and target.</p> <p><b>Modeling equation:</b> <math>y = b_0 + b_1x_1 + b_2x_2 + \dots</math></p>	<pre>from sklearn.linear_model import LinearRegression model = LinearRegression() model.fit(X, y)</pre>
Logistic regression	<p><b>Purpose:</b> To predict probabilities of categorical outcomes.</p> <p><b>Pros:</b> Efficient for binary classification problems.</p> <p><b>Cons:</b> Assumes a linear relationship between independent variables and log-odds.</p> <p><b>Modeling equation:</b> <math>\log(p/(1-p)) = b_0 + b_1x_1 + \dots</math></p>	<pre>from sklearn.linear_model import LogisticRegression model = LogisticRegression() model.fit(X, y)</pre>

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.	<pre>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)</pre>
StandardScaler	Standardizes features by removing the mean and scaling to unit variance.	<pre>from sklearn.preprocessing import StandardScaler scaler = StandardScaler() X_scaled = scaler.fit_transform(X)</pre>
log_loss	Calculates the logarithmic loss, a performance metric for classification models.	<pre>from sklearn.metrics import log_loss loss = log_loss(y_true, y_pred_proba)</pre>
mean_absolute_error	Calculates the mean absolute error between actual and predicted values.	<pre>from sklearn.metrics import mean_absolute_error mae = mean_absolute_error(y_true, y_pred)</pre>
mean_squared_error	Computes the mean squared error between actual and predicted values.	<pre>from sklearn.metrics import mean_squared_error mse = mean_squared_error(y_true, y_pred)</pre>

Function/Method Name	Brief Description	Code Syntax
root_mean_squared_error	Calculates the root mean squared error (RMSE), a commonly used metric for regression tasks.	<pre>from sklearn.metrics import mean_squared_error import numpy as np rmse = np.sqrt(mean_squared_error(y_true, y_pred))</pre>
r2_score	Computes the R-squared value, indicating how well the model explains the variability of the target variable.	<pre>from sklearn.metrics import r2_score r2 = r2_score(y_true, y_pred)</pre>

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