Linear Regression in Machine Learning: Types, Uses & Examples

In ML, linear regression predicts future values using past data. It constructs an equation in a straight line that mathematically expresses the relation between what goes in and what comes out. What is the linear regression in machine learning used for? A linear regression in machine learning is used to find trends and make relevant predictions utilizing historic data.

It is one of the simplest and most commonly used machine learning algorithms. All the possible areas in which you can use, such as business, science, and weather forecasting. It is a good choice when you have knowledge of the data pattern.

Linear Regression in Machine Learning

In this section, you will explain the working of linear regression in machine learning for freshers. It describes how it generates predictions through data points and basic mathematics.

What is Linear Regression?

A linear regression is a method that fits a straight line to our points. This line gives us a relation between the input and the output. The equation of the line is:

$Y = mX + b$

Here, Y is the output, X is the input, m is slope and b is the intercept.

The algorithm returns best fit values for m, and b that allow the line to fit the data. It utilizes least square method. That means it selects a line that minimizes the difference between actual and predicted values.

You train your model based on data. Then the model learns the patterns. You get it new input, and it gives you output essentially based on where it learned the line after training.

Why is Linear Regression Important?

It helps in:

- Making predictions about sales, prices, or trends in the future.
- The relationships between two factors affect one another
- Making decisions using data.

This is why this algorithm is the algorithm with which most people start machine learning. This will lay the foundation for more advanced models later. If you are a beginner, learn it thoroughly before moving on to the ML skills.

Simple Linear Regression in Machine Learning with Real-Life Examples

Now let's grasp what is simple linear regression in machine learning. This is the most basic form. When you have one input and one output, it works.

Explanation of Simple Linear Regression

The simplest case is simple linear regression which fits a straight line between two variables. If you want to predict how much a student gets score by how many hours he/she studies, this method works great.

Consider that the input (X) is study hours and the output (Y) is the exam score. The line it draws is the expected score function based on hours studied.

It accomplishes this by discovering the slope and intercept that cause the line to fit best. Loss functions such as Mean Squared Error are used to see how close its guesses come to ground truth values. Then it tweaks slope and intercept until it finds the best fit.

An example of using Linear Regression in Machine Learning

For example, in machine learning we have the following linear regression:

Study Hours (X)	Exam Score (Y)
1	50
2	60
3	65
4	70
5	75

The algorithm will fit a straight line through these points. For instance, if a new student studies for 6 hours, it can predict a score of 80.

When you have clean data, and only one factor drives the output, simple linear regression does well. When multiple factors interact, that is not supportive.

How to Use Multiple Linear Regression in Machine Learning?

Machine learning multiple linear regression: when more than one input has an effect on the outcome It makes you understand how many something together can have an impact on the output.

How Multiple Linear Regression Works?

So where the original formula had one X, we now have many. The formula becomes:

$$Y = b_0 + b_1X_1 + b_2X_2 + ... + b_nX_n$$

Each X is an input feature. Each b is the weight/effect of that feature on the outcome. The model trains this data and learns the optimal values of these weights.

Multiple Linear Regression Example

We'll say we are trying to predict housing prices. Things like size of the house, number of bedrooms, and location all come into play.

Size (sqft)	Bedrooms	Distance to City	Price (Y)
1000	2	5 km	₹30 lakhs
1200	3	3 km	₹45 lakhs

900	2	7 km	₹28 lakhs
1500	4	2 km	₹60 lakhs

Now the algorithm will adjust a model to fit all the inputs. It understands the impact of every input on price, and automatically gives correct predictions.

Multiple regression gives more power than simple regression. It suggests that real-world problems don't always have a single cause.

Types of Machine Learning Linear Regression

Now, let's understand what are the types of linear regression in machine learning? Each one applies to different data conditions.

Simple Linear Regression

It consists of one input and one output. It fits a straight line. It Particularly applies to simple data with one main impulse.

Multiple Linear Regression

It uses multiple inputs to predict the output. It embeds a plane or hyperplane in higher dimensionality. It is applicable for data with a large number of factors.

Polynomial Regression

This is an extension. It is molded around curves, not lines. It is useful whenever the data is not linear but still follows some sort of a trend.

Ridge Regression

This technique places a penalty on the loss function. It prevents overfitting when the model becomes complex.

Lasso Regression

It also adds a penalty, like Ridge. However, it can also make certain input weights zero. It eliminates unessential features.

Use in Real Life

All these variants solve different real world problems. So when your data has too many variables or has the curves, choose wisely.

In machine learning, linear regression types give you freedom. You can choose the appropriate approach for your data.

 Relevance to ACCA Syllabus

The ACCA syllabus is widely regarded as very rich in financial analysis, forecasting, and data-driven business decision-making. By supporting predictive modeling processes, trend analysis, and budgeting, linear regression in machine learning is instrumental in forming the basis of financial planning and strategic decision-making. ACCA students with an understanding of regression can tell how much of an entity's costs, revenues, and corporate performance in its reports is explained by data analysis.

Linear Regression in Machine Learning ACCA Questions

Q1. What is the primary use of linear regression in finance?

A) Calculating tax liabilities

B) To use patterns from the past to forecast financial values

C) For accounting purposes to measure depreciation of assets

D) To audit internal controls

Ans: Predict future financial values based on past trends

Q2. In what direction does the slope trends in a simple linear regression?

A) The fixed cost

B) The change rate is variable

C) The interest rate

D) The balance sheet total

Ans: B) Variable rate of change

Q3. Q4: What kind of variable does linear regression predict?

A) Categorical

B) Binary

C) Continuous

D) Nominal

Ans: C) Continuous

Q4. Which ACCA paper typically deals with the use of linear regression in business contexts?

A) Taxation (TX)

B) Financial Reporting (FR)

C) Strategic Business Leader (SBL)

D) PM (Performance Management)

Ans: (D): Performance Management (PM)

Q5. The most important assumption in linear regression?

A) Data must be seasonal

B) Residuals have a constant variance

C) IVs should be negative

D) Output should be binary

Ans: B) Constant variance of residuals

Relevance to US CMA Syllabus

The US CMA syllabus includes performance management, cost analysis, and budgeting. In machine learning, linear regression is used for prediction, variance analysis, cost behavior analysis. To model this, candidates apply regression to forecast future expenses, revenue trends and profitability factoring in multiple scenarios.

Linear Regression in Machine Learning CMA Questions

Q1. What's the dependent variable in regression analysis?

A) The known outcome

B) Expected value based on given inputs

C) The control factor

D) The fixed constant

Ans: (B) Value predicted as per the inputs

Q2. What part of CMA syllabus includes regression for budgeting and forecasting?

A) Part 1 — Financial Planning, Performance assessment, and Analytics

B) Part 2 — Strategic Financial Management

C) Ethics in Business

D) Taxation and Reporting

Ans: A) Part 1 – Business Financial Planning, Performance, and Analytics

Q3. What does R-squared tell me in regression?

A) The level of risk

B) Proportion of variance explained by the model

C) Interest coverage ratio

D) The depreciation schedule

Ans: B) The proportion of variance explained by the model

Q4. The slope has a high p-value (slope p-value = {p_value}) as seen in the regression output. What is a manager to make of this?

A) The variable predicts the outcome significantly

B) The variable is not statistically significant

C) The model regression is perfect

D) The data set is incomplete

Q: Ans: B) The variable is not statistically significant

Q5. I know that managers can use linear regression in variance analysis.

A) To compute tax rates

B) As a means of measurement of production errors

C) Predicting cost behavioral changes with volume

D) Prepare Legal Statements

Ans: C) For predicting how cost changes with volume

Relevance to CPA Syllabus

CPA Topics include audit data analytics, financial forecasting and indicators, and management accounting concepts. Machine learning —— In transaction analysis, auditors can use machine learning algorithms If they will use linear regression etc, they can find patterns and detect unusual transactions. It helps in data-driven assurance and financial forecasting, especially the Business Environment and Concepts (BEC) section.

Linear Regression in Machine Learning CPA Questions

Q1. Which section of the CPA exam usually includes stuff on linear regression?

A) Regulation (REG)

B) Financial Accounting and Reporting (FAR)

C) Business Environment and Concepts (BEC)

D) AUDIT AND ATTESTATION (AUD)

Q): Which of the following are parts of the CPA exam? Ans : C) Business Environment and Concepts (BEC)

Q2. Auditors use linear regression to:

A) Identify tax fraud

B) Estimating Expected Balances of Theory Accounts

C) Review legal contracts

D) Restated financial statements

Q. Aca: Predict future balances (of the accounts)

Q3. What is the term for the difference between actual and predicted values in regression?

A) Forecast

B) Intercept

C) Residual

D) Correlation

Ans: C) Residual

Q4. Under what condition linear regression is valid?

A) Data has to be in a text format

B) The variables must have a linear relationship

C) Independence and Zero-Correlation

D) The firm is obligated to use GAAP

Ans: B) The Variables atleast need to have a linear relation with each other

Q5. What you need to know about multicollinearity in regression

A) Autocorrelation: A variable that predicts itself

B) Towards intervention between actors

Nominal Analysis: C) With binary dependent variables

4) Residuals are negative

Q: When would you use the style of set distinguished regressor?

Relevance to CFA Syllabus

Quantitative methods, financial modeling, and risk analysis are core tenets of the CFA curriculum. In this series of notes we are also going to cover machine learning linear regression which is a fundamental topic in Quantitative Methods especially for Level I, but makes its entrances at Levels II and III for all sorts of studies such as portfolio analysis, asset pricing and economic forecasting.

Linear Regression in Machine Learning CFA Questions

Q1. Well so the other important part ofthis is about what type of model simple linear regression is.

A) Non-parametric

B) Time-series model

C) Supervised learning model

D) Unsupervised model

Ans: C) Pattern of supervised learning

Q2. The CFA curriculum contains material relating to linear regression, which isused to:

A) Draft ethical standards

B) Test financial forecasts and risk assessment

C) Set tax brackets

D) Determine interest fix income

Q: Which of these provides the best description of the role of a Financial Analyst?

Q3. When building a regression model one of the possible issues you will encounter is autocorrelation in the residuals.

A) The model assumptions failed

B) The models is more precise

C) The intercept increases

D) Multicollinearity reduces

Q: In the event of a model failure, what statement can we make about the model assumption?

Q4. How to make your model more reliable in regression?

A) Increasing model bias

B) Including more dependent variables

C) Using large sample size

D) Reducing the R-squared

Ans: C) Application of Big sample size
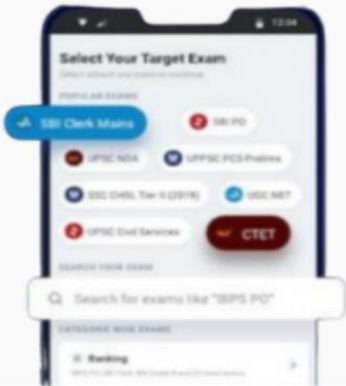
Q5. What Is Heteroskedasticity in Regression?

A) The residuals are constant across observations

B) Residuals are large and vary greatly as values of X are altered

C) Can be use for very correlated variables

D) If model is underfitted

Ans: B) Among other things Y.