# PREDICTIVE MODELING- WEEK-1

# DSBA CURRICULUM DESIGN

## FOUNDATIONS

- Python for Data Science
- Statistical Methods for Decision Making

## CORE COURSES

- Advanced Statistics
- Data Mining
- Predictive Modelling(Week-1/ 5)
- Machine Learning
- Time Series Forecasting
- Data Visualization

## DOMAIN APPLICATIONS

- Finance and Risk Analytics
- Marketing and Retail Analytics

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# LEARNING OBJECTIVE

- Linear Regression
- Logistic Regression
- Linear Discriminant Analysis

# LEARNING OBJECTIVES OF THIS SESSION

- Multiple Linear Regression
- Concept of $R^2$
- Concept of RMSE

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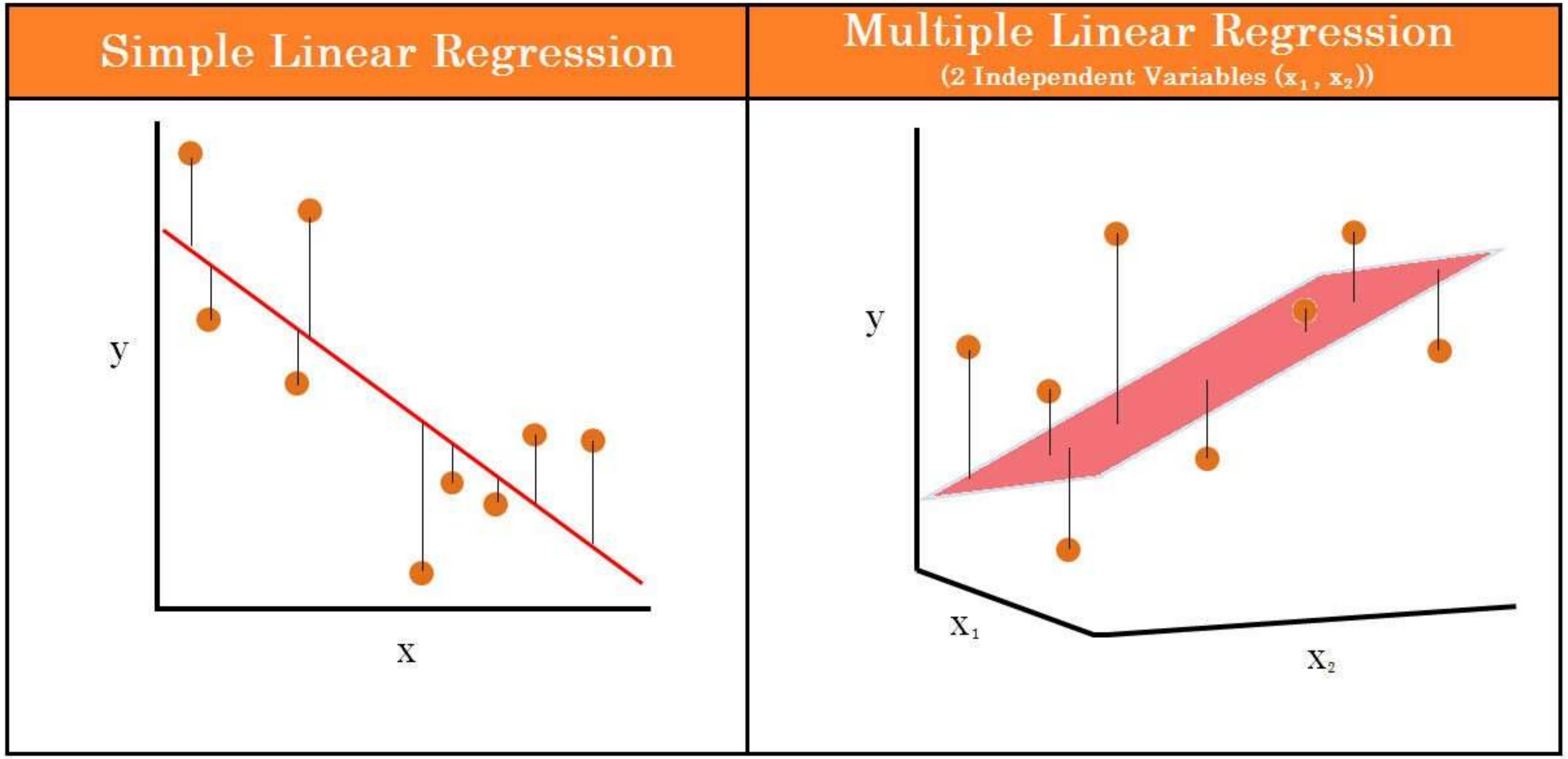
# TRY ANSWERING THE FOLLOWING

- What is the equation of simple linear regression?

- Can we have >2 independent variables in simple linear regression?

- Name few techniques to deal with multicollinearity in a data.

# BROAD OVERVIEW



Simple Linear Regression

Multiple Linear Regression
(2 Independent Variables ($x_1$, $x_2$))

$y = b_0 + b_1 * x_1$

$y = b_0 + b_1 * x_1 + b_2 * x_2 + \ldots + b_n * x_n$

# Industry Application - Linear Regression in Sports Analytics

Sports analytics is a booming field. Owners, coaches, and fans are using statistical measures and models of all kinds to study the performance of players and teams.

Billy Beane the manager of Oakland As met Peter Brand, a young Yale econ
about how to assess player value. Rather than relying on selector's ex
Linear Regression, selecting players based on their on- base percer
perceived weaknesses. Brand and Beane use this methodology to hire und

With one third the budget Billy Beans' team performed at par with the
evolution of a new stream of Analytics known as Sabermetics.
**You may watch the Brad Pitt starrer Moneyball for Reference.**

Reference: https://en.wikipedia.org/wiki/Sabermetrics

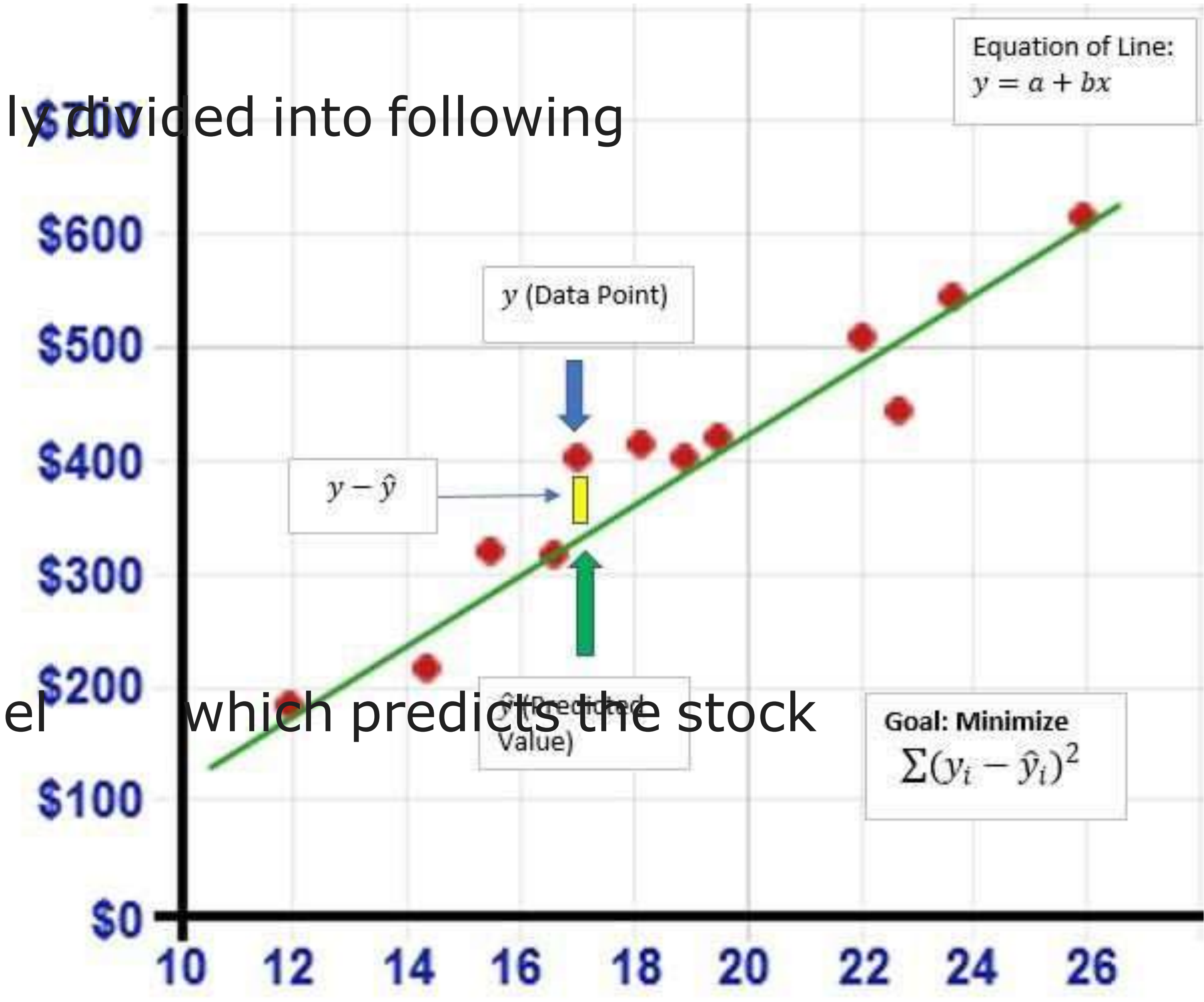
# Industry Application - Linear Regression in Financial Markets

The financial performance of a company is a primary concern for every stakeholder especially for investors. The measurement of the financial health of a company through the reported financial statements gives a qualitative analysis of the company’s position as well as an account of how the company has utilised its capital in production.

These Financial Statements can be used to derive critical ratios that are broadly divided into following categories:

- Liquidity ratios
- Leverage ratios
- Efficiency ratios
- Profitability ratios
- Market value ratios

We can obtain these ratios and the corresponding stock prices of various listed companies to create a Linear Regression model which predicts the stock price given we know the ratios.



Reference: https://pdfs.semanticscholar.org/0a82/305452d2fa7cdca91bdbbe6f409905ace42a.pdf

# CASE STUDY - Price Prediction(Airbnb)

Airbnb, Inc is an online marketplace for arranging or offering lodging, primarily homestays, or tourism experiences. Airbnb has close to 150 million customers across the world. Price is the most important factor considered by the customer while making booking into a property. Strategic pricing of the properties is important to avoid losing customers to the competitors.

We have a data of 74111 Airbnb properties across the nations. Based on this data build a simple and multiple linear regression model to predict the strategic pricing of a new listed property on Airbnb.

# Assumptions of Linear Regression

| Assumption | How to test | How to fix |
|---|---|---|
| No multicollinearity in independent variables | Heatmaps of correlations or VIF (Variance inflation factor) | Remove correlated variables |
| There should be a linear relationship between dependent and independent variables | Plot residuals vs. fitted values and check the plot | Transform variables that appear non-linear (log, square root, etc. ) |
| The residuals should be independent of each other | Plot residuals vs. fitted values and check the plot | Transform variables (log, square root, etc. ) |
| Residuals must be normally distributed | Plot residuals or use Q-Q plot | Non-linear transformation of the independent or dependent variable |
| No heteroscedasticity, i.e., residuals should have constant variance | Use statistical test (like goldfeldquandt test) | Non-linear transformation of the dependent variable or add other important variables |

?

# ANY QUESTIONS

# Data Science @ Work

Apply **Data Science at your workplace** to gain some instant benefits:

- Get noticed by your management with your outstanding analysis backed by data science.

- Create an impact in your organization by taking up small projects/initiatives to solve critical issues using data science.

- Network with members from the data science vertical of your organization and seek opportunities to contribute in small projects.

- Share your success stories with us and the world to position yourself as a subject matter expert in data science.

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# HAPPY LEARNING