

DATA SCIENCE & MACHINE LEARNING BY USING R-PROGRAMMING



CURRICULUM

FUNDAMENTAL OF STATISTICS.

- Population and sample
- Descriptive and Inferential Statistics
- Statistical data analysis
- Variables
- Sample and Population Distributions
- Interquartile range
- Central Tendency
- Normal Distribution
- Skewness.
- Boxplot
- Five Number Summary
- Standard deviation
- Standard Error
- Empirical Formula
- central limit theorem
- Estimation
- Confidence interval
- Hypothesis testing
- p-value
- Scatterplot and correlation coefficient
- Standard Error
- Scales of Measurements and Data Types
- Data Summarization
- Visual Summarization
- Numerical Summarization
- Outliers & Summary

Module 1- Introduction to Data Analytics

Objectives:

- This module introduces you to some of the important keywords in R like Business Intelligence, Business
- Analytics, Data and Information. You can also learn how R can play an important role in solving complex analytical problems.
- This module tells you what is R and how it is used by the giants like Google, Facebook, etc.
- Also, you will learn use of 'R' in the industry, this module also helps you compare R with other software
- in analytics, install R and its packages.

Topics:

Business Analytics, Data, Information

- Understanding Business Analytics and R
- Compare R with other software in analytics
- Install R
- Perform basic operations in R using command line

Module 2- Introduction to R programming

Starting and quitting R

Recording your work

- Basic features of R.
- Calculating with R
- Named storage
- Functions
- R is case-sensitive
- Listing the objects in the workspace
- Vectors
- Extracting elements from vectors
- Vector arithmetic
- Simple patterned vectors
- Missing values and other special values
- Character vectors Factors
- More on extracting elements from vectors
- Matrices and arrays
- Data frames
- Dates and times

Import and Export data in R

- Importing data in to R
- CSV File
- Excel File
- Import data from text table

Topics

- Variables in R
- Scalars
- Vectors
- R Matrices
- List
- R – Data Frames
- Using c, Cbind, Rbind, attach and detach functions in R
- R – Factors
- R – CSV Files
- R – Excel File

NOTE-:

- Assignments
- Business Scenerio/Group Discussion.

R Nuts and Bolts-:

- Entering Input. – Evaluation- R Objects- Numbers- Attributes- Creating Vectors- Mixing Objects- Explicit Coercion- Summary- Names- Data Frames.

Module 3- Managing Data Frames with the dplyr package

- The dplyr Package
- Installing the dplyr package
- select()
- filter()
- arrange()
- rename()
- mutate()
- group_by()
- %>%

NOTE-:

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Module 4- Loop Functions

- Looping on the Command Line
- lapply()
- sapply()
- tapply()
- apply()

NOTE-:

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Module 5- Data Manipulation in R Objectives:

- In this module, we start with a sample of a dirty data set and perform Data Cleaning on it, resulting in a data set, which is ready for any analysis.
- Thus using and exploring the popular functions required to clean data in R.

Topics

- Data sorting
- Find and remove duplicates record
- Cleaning data
- Merging data

Statistical Plotting-:

- Bar charts and dot charts
- Pie charts
- Histograms
- Box plots
- Scatterplots
- QQ plots

Objectives:

- Control Structure Programming with R
- The for() loop
- The if() statement
- The while() loop
- The repeat loop, and the break and next statements
- Apply
- Sapply
- Lapply

Factors

- Using Factors
- Manipulating Factors
- Numeric Factors
- Creating Factors from Continuous Variables
- Convert the variables in factors or in others.

Reshaping

- Data Modifying
- Data Frame Variables
- Recoding Variables
- The recode Function
- Reshaping Data Frames
- The reshape Package

Module 6- Statistical Learning-:

- What Is Statistical Learning?
- Why Estimate f ?
- How Do We Estimate f ?
- The Trade-Off Between Prediction Accuracy and Model Interpretability
- Supervised Versus Unsupervised Learning
- Regression Versus Classification Problems
- Assessing Model Accuracy

Module 7- Basics of Statistics & Linear & Multiple Regression

- This module touches the base of Descriptive and Inferential Statistics and Probabilities & 'Regression Techniques'.
- Linear and logistic regression is explained from the basics with the examples and it is implemented in R using two case studies dedicated to each type of Regression discussed.
- Assessing the Accuracy of the Coefficient Estimates.
- Assessing the Accuracy of the Model.
- Estimating the Regression Coefficients.
- Some Important Questions
- Lab: Linear Regression.
 - Libraries .
 - Simple Linear Regression
 - Multiple Linear Regression
 - Interaction Terms
 - Qualitative Predictors
 - Writing Functions

NOTE-:

- Assignments with Different Datasets.
- Business Scenerio/Group Discussion

Module 8- Classification-:

- An Overview of Classification.
- Why Not Linear Regression?
- Logistic Regression
- The Logistic Model
- Estimating the Regression Coefficients
- Making Predictions
- Logistic Regression for >2 Response Classes
- Lab: Logistic Regression.
- The Stock Market Data
- Logistic Regression

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Module 9- Variance Inflation Factor-:

- Introduction
- Multicollinearity.
- How we can detect the multicollinearity.
- Effects of multicollinearity
- Lab: VIF
 - Mutiple Datasets.
 - Applications.
 - Applications.Reduce the features.

NOTE-:

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Correlation

- Types of Correlation
- Properties of Correlation
- Methods of Calculating Correlation

Module 10- Best Model Selection-:

- Subset Selection
- Best Subset Selection
- Stepwise Selection

- Choosing the Optimal Model
- Lab 1: Subset Selection Methods
- Best Subset Selection
- Forward and Backward Stepwise Selection
- Choosing Among Models Using the Validation Set Approach and Cross-Validation

NOTE-:

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Explore many algorithms and models:

- Popular algorithms: Classification, Regression, Clustering, and Dimensional Reduction.
- Popular models: Train/Test Split, Root Mean Squared Error, and Random Forests. Get ready to do more learning than your machine!

Module-11-Machine Learning vs Statistical Modeling & Supervised vs Unsupervised Learning

- Machine Learning Languages, Types, and Examples
- Machine Learning vs Statistical Modelling
- Supervised vs Unsupervised Learning
- Supervised Learning Classification
- Unsupervised Learning

Module 12 - Supervised Learning I

- K-Nearest Neighbors
- Decision Trees
- Random Forests
- Reliability of Random Forests
- Advantages & Disadvantages of Decision Trees

Module 13 - Supervised Learning II

- Regression Algorithms
- Model Evaluation
- Model Evaluation: Overfitting & Underfitting
- Understanding Different Evaluation Models

Module 14 - Unsupervised Learning

- K-Means Clustering plus Advantages & Disadvantages
- Hierarchical Clustering plus Advantages & Disadvantages
- Measuring the Distances Between Clusters - Single Linkage Clustering
- Measuring the Distances Between Clusters - Algorithms for Hierarchy Clustering
- Density-Based Clustering

Module 15 - Dimensionality Reduction & Collaborative Filtering

- Dimensionality Reduction: Feature Extraction & Selection
- Collaborative Filtering & Its Challenges

Module 16- Tree-Based Methods-:

- The Basics of Decision Trees
- Regression Trees
- Classification Trees
- Trees Versus Linear Models
- Advantages and Disadvantages of Trees
- Bagging, Random Forests, Boosting
- Bagging
- Random Forests
- Lab: Decision Trees
- Fitting Classification Trees
- Fitting Regression Trees

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Module 17- Time Series & Forecasting:-

- Time series
- Estimating and Eliminating the Deterministic Components if they are present in the Model.
- Estimating and Eliminating Seasonality if it is present in the Model
- Modeling the Remainder using Auto Regressive Moving Average (ARMA) Models
- Identify 'order' of the ARMA model
- 'Forecast' or Predict for Future Values
- Practise on R

NOTE:-

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Business Scenerio/Group Discussion.

Module-18:-Support Vector Machines – Outline

- Understand when the Support Vector family of methods are an appropriate method of analysis.
- Understand what a hyperplane is and how they are used with the Support Vector methods.
- Identify the differences between Maximal Margin Classifiers, Support Vector Classifiers, and Support Vector Machines.
- Know how each of the algorithms determines the best separating hyperplane.
- Distinguish between hard and soft margins and when each is to be used.
- Know how to extend the method for nonlinear cases.

NOTE:-

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- Business Scenerio/Group Discussion.

Module-19-Principal Component Analysis – Outline

- Understand what principal components are and when principal component analysis is appropriate.
- Describe eigenvalues and eigenvectors and how they are used to calculate principal components.
- Understand loading and loading vectors.
- Know how to decide how many principal components to use in the analysis.
- Be able to use principal component analysis for regression.

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