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UNIVERSITY INSTITUTE OF COMPUTING

PROJECT REPORT
ON
HEALTH CARE DATA ANALYSIS

Program Name: BCA (Data Science)

Subject Name: R Programming

Subject Code: 24CAP-161

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HEALTH CARE DATA ANALYSIS

- Using correlation analysis to determine the relationship between lifestyle factor and diseases.
- Apply regression model to predict life expectancy based on health data.

ABSTRACT

Objective :

To analyze healthcare data and testing & determine how lifestyle factors (like diet, exercise smoking, etc.) correlate with diseases. Additionally, build a regression model to predict life expectancy based on various health indicators.

Methodology:

- **Data Collection:** Gather relevant data (e.g., blood sugar levels, smoking habits, BMI, cholesterol, life expectancy).
- **Statistical Testing:** Apply statistical tests like t-test (`t.test()`) for comparing groups, correlation (`cor()`) for relationships, and linear regression (`lm()`) for predictive modeling.
- **Result Interpretation:** Analyze outputs (p-values, correlation coefficients, regression summaries) to determine significance and relationships.
- **Assumption Checking:** Ensure data meets assumptions (normality, linearity, etc.) for valid analysis (optional but important).
- **Visualization:** Use plots (histograms, scatter plots, regression lines) with `ggplot2` to visually interpret data trends.

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DESCRIPTION

1 T-Test: Blood Sugar Levels (Diabetics vs Non-Diabetics)

This analysis checks if there's a significant difference in blood sugar levels between diabetics and non-diabetics.

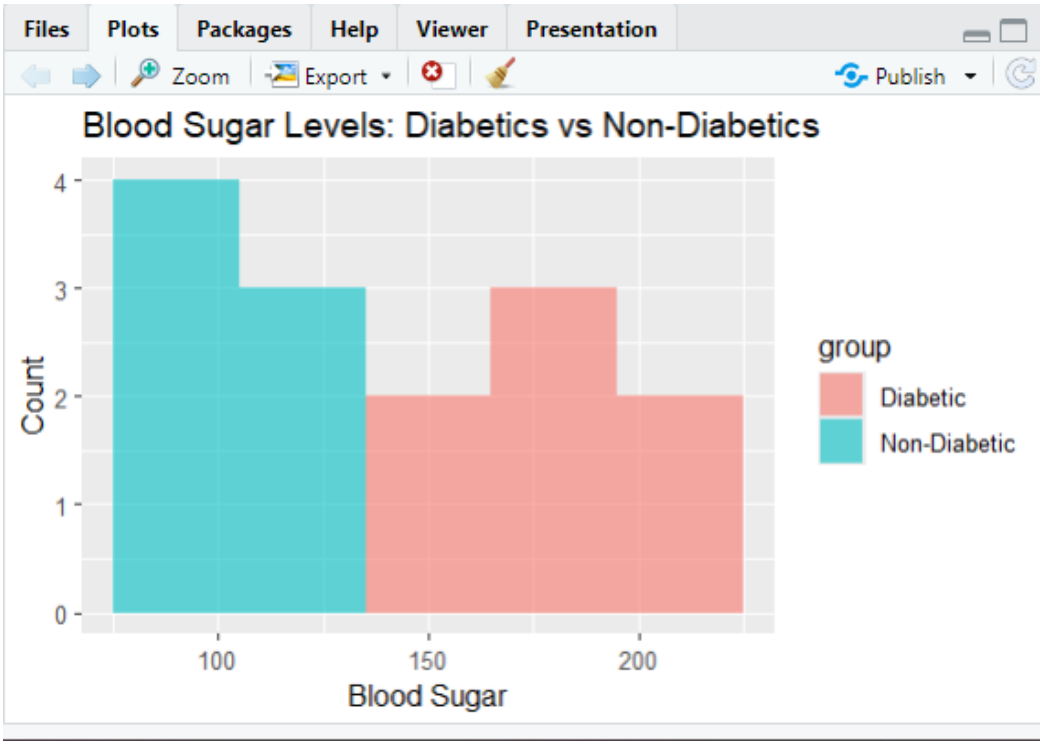
- **`diabetic <- c(150, 160, 170, 180, 190, 200, 210)`**
  Creates a vector of blood sugar levels for diabetics.
- **`non_diabetic <- c(90, 95, 100, 105, 110, 115, 120)`**
  Creates a vector of blood sugar levels for non-diabetics.
- **`t_test_result <- t.test(diabetic, non_diabetic, alternative = "greater")`**
  Performs a one-sided t-test to check if diabetics have significantly higher blood sugar levels than non-diabetics.
- **`print(t_test_result)`**
  Displays the results of the t-test, including p-values and confidence intervals.
- **`blood_sugar <- c(diabetic, non_diabetic)`**
  Combines both groups into one vector for plotting.
- **`group <- c(rep("Diabetic", length(diabetic)), rep("Non-Diabetic", length(non_diabetic)))`**
  Creates a `group` vector to label each observation as either "Diabetic" or "Non-Diabetic".

- **`data <- data.frame(blood_sugar, group)`**

  Combines `blood_sugar` and `group` into a data frame for visualization.

- **`ggplot(data, aes(x = blood_sugar, fill = group)) + geom_histogram(alpha = 0.6, position = "identity", bins = 5) + labs(title = "Blood Sugar Levels: Diabetics vs Non-Diabetics", x = "Blood Sugar", y = "Count")`**

  Creates a histogram comparing blood sugar levels of diabetics and non-diabetics with overlapping bars and labeled axes.

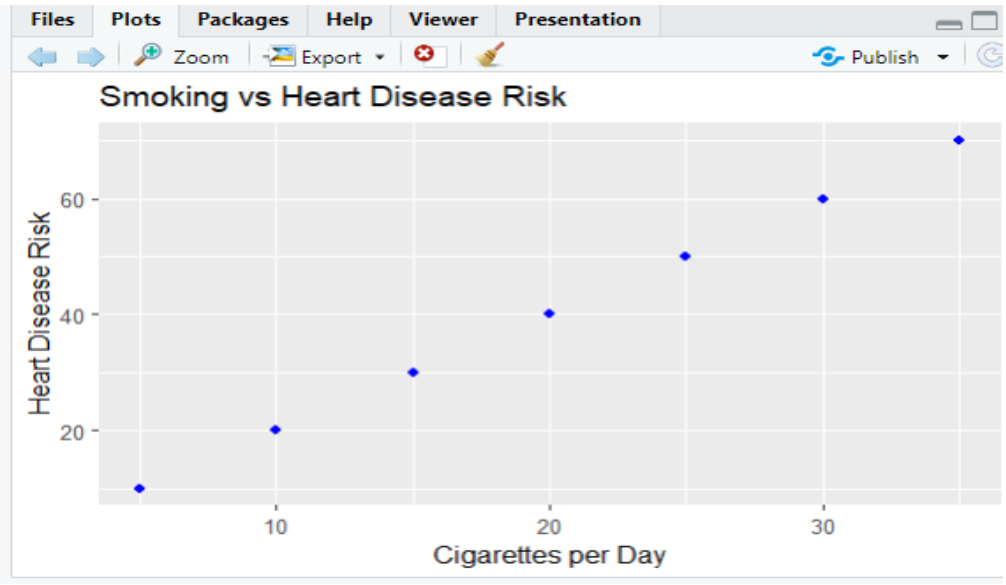


2 Correlation Analysis: Smoking & Heart Disease Risk

This section explores the relationship between smoking and heart disease risk.

- **`smoking <- c(5, 10, 20, 15, 25, 30, 35)`**
  Creates a vector representing the number of cigarettes smoked per day.
- **`heart_disease_risk <- c(10, 20, 40, 30, 50, 60, 70)`**
  Creates a vector representing corresponding heart disease risk scores.
- **`correlation <- cor(smoking, heart_disease_risk)`**
  Calculates the Pearson correlation coefficient to measure the strength and direction of the linear relationship.
- **`print(correlation)`**
  Displays the correlation coefficient.
- **`ggplot(data.frame(smoking, heart_disease_risk), aes(x = smoking, y = heart_disease_risk)) + geom_point(color = "blue") + labs(title = "Smoking vs Heart Disease Risk", x = "Cigarettes per Day", y = "Heart Disease Risk")`**

Creates a scatter plot to visually examine the relationship between smoking and heart disease risk with blue points and labeled axes.



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3 Regression Model: BMI, Cholesterol & Life Expectancy

This analysis models how BMI and cholesterol levels predict life expectancy.

- **`bmi <- c(22, 25, 28, 30, 35, 40, 45)`**
  Creates a vector representing Body Mass Index (BMI) values.
- **`cholesterol <- c(180, 190, 200, 220, 250, 270, 300)`**
  Creates a vector representing cholesterol levels.
- **`life_expectancy <- c(80, 78, 76, 74, 70, 68, 65)`**
  Creates a vector representing life expectancy values.

- `model <- lm(life_expectancy ~ bmi + cholesterol)`

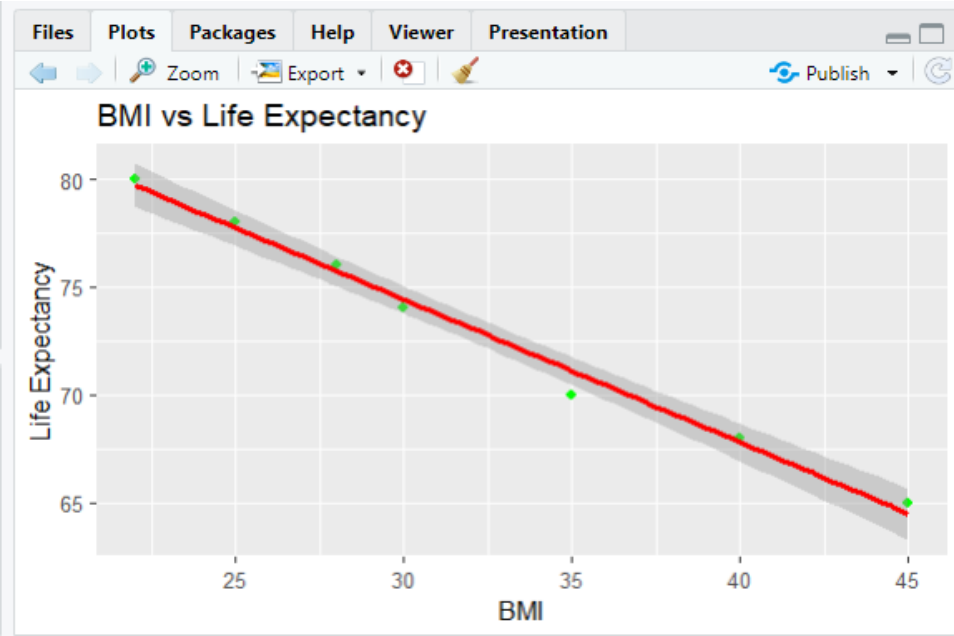
  Builds a multiple linear regression model to predict life expectancy based on BMI and cholesterol.

- `summary(model)`

  Displays the regression model's summary, including coefficients, R-squared, and statistical significance.

- `ggplot(data.frame(bmi, life_expectancy), aes(x = bmi, y = life_expectancy)) + geom_point(color = "green") + geom_smooth(method = "lm", col = "red") + labs(title = "BMI vs Life Expectancy", x = "BMI", y = "Life Expectancy")`

  Creates a scatter plot with a red regression line to visualize the relationship between BMI and life expectancy.



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Technologies Used:

- **R Programming-** Used for data analysis, statistical modeling, and visualization.
- **R Studio-** Integrated Development Environment (IDE) for writing and executing Rcode.
- **ggplot2-** Used for creating visualizations like histograms and scatter plots.
- **Base R Functions:** Functions like `t.test()`, `cor()`, and `lm()` for statistical testing, correlation analysis, and linear regression modeling.
- **Statistical Analysis Techniques:** Application of hypothesis testing, correlation, and regression analysis for data-driven decision-making.

Conclusion

- **Relationship Analysis-** Identified significant correlations between lifestyle factors and life expectancy.
- **Predictive Modeling -** Developed a regression model that effectively predicted life expectancy based on key health indicators.
- **Data Visualization-** Used graphs and heat maps to better understand trends, distributions and relationships.
- **Key Insights-** Highlighted the importance of healthy life style choices and accessible health care in improving life expectancy.
- **Overall Impact-** Demonstrate how data-driven analysis help in making informed health-related decisions and policies.

References/ Tools Used

- **R Studio Documentation-** Official guide for R programming and development.
- **R Programming Language** - Core language for statistical computing and data analysis.
- **ggplot2 Package** - For creating advanced data visualizations like histograms and scatter plots.
- **Base R Functions** - Functions like `t.test()`, `cor()`, and `lm()` for statistical analysis.
- **Statistical Analysis Techniques** - Methods for hypothesis testing, correlation, and regression analysis.