Biomedical Image Investigation: Fall 2024

Homework 9

Due: **12/02 PM 2:10**

1. Taking the provided spreadsheet as materials, please summarize the data by producing diagrams using MATLAB. Comment on what you observe.
   (a) Table: summarize all the parameters in a table as shown in class.
   (b) Pie chart: show the percentage of subjects with each disease.
   (c) Histogram: display the weight of subjects. The width is a rage of 10 kg and the height corresponds to how many samples (i.e., subjects) are in a bin.
   (d) Box plot: display the data of blood flow rate (CBF rate) and plot both "boxes" of group1 and group2 in the same plot. Also overlay the scattered sample points on their corresponding "boxes". What are the values of median, interquartile range, 95% central range, the maximum and minimum in each group? Are there any outliers?
   (e) Bar chart: use mean and standard deviation to produce the bar chart. The bars are separated by small gaps to indicate that the data are categorical (i.e., group1 and group2). The larger gap is used to separate data of different parameters (i.e., blood flow rate and velocity rate). Different colors also have to be assigned to these two groups. In addition, you may want to assign two distinct vertical axes on each side to better demonstrate the bars (as the units of these two parameters are not in the same scale).
   Hint: The MATLAB function commands you might use include: *xlsread, contains, plotyy, errorbar, boxplot, scatter, set…*

2. Body mass index (BMI) is calculated by dividing a person's weight by the square of his or her height; it is a measure of the extent to which the individual is overweight. For the population of middle-aged men who later develop diabetes mellitus, the distribution of baseline BMI is approximately normal with an unknown mean μ and standard deviation σ. A sample of 58 men selected from this group has mean $\bar{x} = 25.0$ kg/m^2 and standard deviation $s = 2.7$ kg/m^2.
   (a) Construct a 95% confidence interval for the population mean μ.
   (b) At the 0.05 significance level, test whether the mean baseline BMI for the population of middle-aged men who do develop diabetes is equal to 24.0 kg/m^2, the mean for the population of men who do not. What is the *p*-value of the test?
   (c) What do you conclude?
   (d) Based on the 95% confidence interval, would you have expected to reject or not to reject the null hypothesis? Why?
   For this exercise, also use MATLAB function commands to verify your results. If the statistical significance is not consistent between your "handwriting" and MATLAB output, comment on possible reasons.