Empirical Software Engineering (SE-404)

LAB A1-G2

Laboratory Manual

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Empirical Software Engineering LAB – A1 G2
EXPERIMENT 1

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Experiment Objective:- Consider any empirical study of your choice (Experiments, Survey Research, Systematic Review, Postmortem analysis and case study). Identify the following components for an empirical study:
a. Identify parametric and nonparametric tests.
b. Identify Independent, dependent and confounding variables.
c. Is it Within-company and cross-company analysis?
d. What type of dataset is used? Proprietary and open-source software.

Introduction:-

- **Parametric and non-parametric tests:** Parametric tests are used for data samples having normal distribution (bell-shaped curve), whereas non-parametric tests are used when the distribution of data samples is highly skewed.

- **Independent variables:** Independent variables (or predictor variables) are input variables that are manipulated or controlled by the researcher to measure the response of the dependent variable.

- **Dependent variables:** The dependent variable (or response variable) is the output produced by analyzing the effect of the independent variables. The dependent variables are presumed to be influenced by the independent variables.

- **Confounding variables:** A confounding variable is a third variable that influences both the independent and dependent variables. Failing to account for confounding variables can cause you to wrongly estimate the relationship between your independent and dependent variables.

- **Within-company analysis:** In within-company analysis, the empirical study collects the data from the old versions/ releases of the same software, predicts models, and applies the predicted models to the future versions of the same project.

- **Cross-company analysis:** The process of validating the predicted model using data collected from different projects from which the model has been derived is known as cross-company analysis.

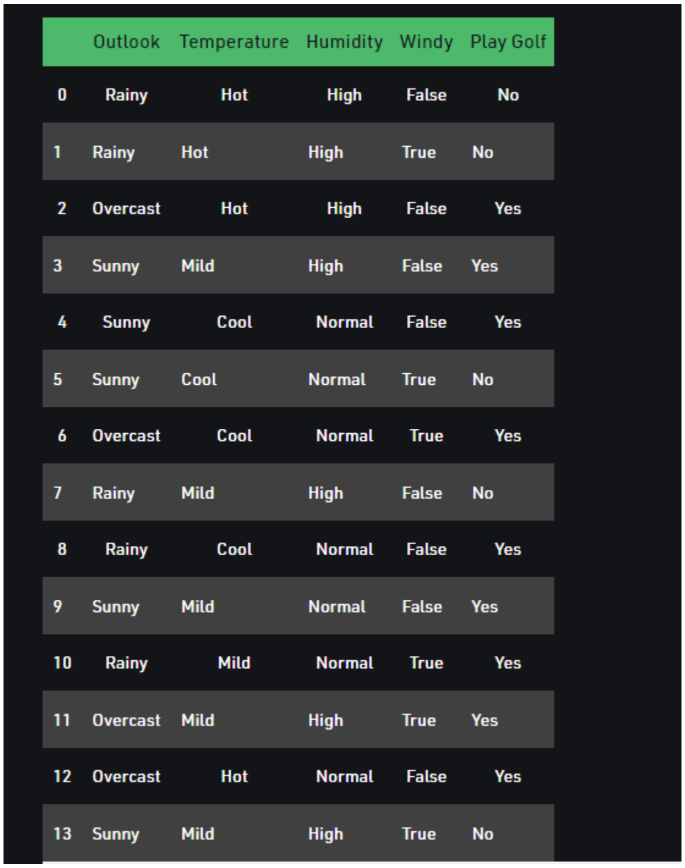
- **Proprietary software:** Proprietary software is licensed software owned by a company. For example, Microsoft.

- **Open source software:** Open source software is usually a freely available software, developed by many developers from different places in a collaborative manner. For example, Google Chrome, Android operating system, and Linux operating system.

I have chosen **Naïve Bayes Classifier** as a case study for this experiment.
Naive Bayes classifiers are a collection of classification algorithms based on Bayes' Theorem. It is not a single algorithm but a family of algorithms where all of them share a common principle, i.e. every pair of features being classified is independent of each other.

To start with, let us consider a dataset.
Consider a fictional dataset that describes the weather conditions for playing a game of golf. Given the weather conditions, each tuple classifies the conditions as fit ("Yes") or unfit ("No") for playing golf.

Here is a tabular representation of chosen dataset:



	Outlook	Temperature	Humidity	Windy	Play Golf
0	Rainy	Hot	High	False	No
1	Rainy	Hot	High	True	No
2	Overcast	Hot	High	False	Yes
3	Sunny	Mild	High	False	Yes
4	Sunny	Cool	Normal	False	Yes
5	Sunny	Cool	Normal	True	No
6	Overcast	Cool	Normal	True	Yes
7	Rainy	Mild	High	False	No
8	Rainy	Cool	Normal	False	Yes
9	Sunny	Mild	Normal	False	Yes
10	Rainy	Mild	Normal	True	Yes
11	Overcast	Mild	High	True	Yes
12	Overcast	Hot	Normal	False	Yes
13	Sunny	Mild	High	True	No

[Source: Geeksforgeeks]

Result:-

In the given case study of Naive Bayes' Classifier, following are the identified attributes:

1. **Parametric Test:** Since the attributes mentioned in the dataset have normal distribution. So, parametric test can be used is t-test since dataset is small and have normal distribution of data.
2. **Non-Parametric Test:** None
3. **Independent Variables: '**Outlook', 'Temperature', 'Humidity' and 'Windy'.
4. **Dependent Variables:** 'Play Golf'
5. **Cofounding variables:** None as no variable is there that influences both the independent and dependent variables.
6. **Within Company and cross-company analysis:** Since the data is taken from single source, hence it is within company.
7. **Dataset:** The dataset is an open-source dataset, publicly available on the Geeksforgeeks website. This dataset describes the weather conditions whether for playing golf is fit ("Yes") or unfit ("No").

Learning from experiment:- We have successfully learned about parametric and non-parametric test. I was able to identify dependent and independent variables in chosen case study. There is no cofounding variable. It was open-source software and has conducted i.e. parametric and non-parametric tests as well. We have also learned about the Difference between within-company and cross-company analysis.