PERSONALITY PREDICTION SYSTEM

REPORT

A MINI PROJECT REPORT

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DECEMBER, 2020

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CERTIFICATE

Certified that this project report "PERSONALITY PREDICTION SYSTEM" is the work of KULWANT SINGH DHAMA (Entry Number 18BCS039) and KANIKA (Entry Number 18BCS038), School of Computer Science Engineering who carried out the mini project work under my supervision.

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Submitted to the Viva-voce Examination held on

INTERNAL EXAMINER EXTERNAL EXAMINER

ABSTRACT

Personality refers to individual differences in characteristic patterns of thinking, feeling and behaving. Currently, there isn't any focus on the mental health of a student in India. So, to make it easier for teachers/counsellors/parents to understand the psychological status of their children and spread awareness, we will be building an application that could serve the purpose. We are going to implement machine learning algorithms to calculate the Big-Five personality factors or OCEAN factors, to eliminate the discreteness present in the current calculation system of personality factors. This application can help teachers/counsellors/parents to provide detailed results on a student's personality instantaneously. This project will be helpful in India's education system, by making it more effective and more focused towards student's wellbeing.

ACKNOWLEDGEMENT

It is our advantage to acknowledge with a deep sense of gratitude to our project guide Dr. Manoj Kumar Gupta whose supervision, inspiration and valuable discussion have helped us to complete our project. The project could not have been implemented without constant inputs and encouragement from him.

We would also like to thank Ms. Aman Bali who guided us for all the psychology-related tasks. Last but not least, this acknowledgement would be incomplete without rendering our sincere gratitude to all those who have helped us in the completion of this project.

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ABBREVIATIONS & SYMBOLS

%	Percentage
OCEAN	Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism
ML	Machine Learning
AI	Artificial Intelligence

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Personality is characterized as the standard of conduct and the trademark perspective and sensation of an individual. In the psychological field, character is ordered in five qualities that are Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism. These characteristics are the essential factors that recognize the character of an individual or a person. Openness characterizes that how much an individual is straightforward and prepared to discuss their sentiments to their companions and associates. It additionally shows how an individual grasps groundbreaking thoughts and curiosity. Conscientiousness is that how much an individual shows to mind and work altogether. The individual having high uprightness factor is normally the person who is coordinated and are proficient. Extraversion is the factor that shows whether the individual is a lot of social or likes to converse with individuals rather than favor being separated from everyone else or disconnected. Suitability is one of the five that shows the individual is warm and careful. People having a high factor of appropriateness shows that they are agreeable and coexist well with others. Neuroticism is the wide character characteristic as the propensity of an individual to be in uneasiness, dissatisfaction, desire, discouraged temperament and depression. This attribute in brain science is the higher-request character quality. In psychology and development, these characteristics are utilized to discover the character and nature of an individual and how and why they do things the manner in which they do. The varieties in individuals are a direct result of these elements.

1.2. PROBLEM MOTIVATION

Every individual has diverse character qualities to various people or soundness that shows conduct in various circumstances. Today, the majority of individuals are impulsive and are battling with the proper behaviour in troublesome circumstances. Character additionally can help guardians, educators and instructors to guide and shape conduct towards a reasonable character.

1.3. PROBLEM STATEMENT

The fundamental goal of this project is to construct an application that performs personality factor prediction using ML algorithms.

1.4 ORGANISATION OF REPORT

The report for the project is structured in the form of chapters, wherein each chapter aims to describe in detail a certain aspect of the project. The chapters are broadly divided into 4 parts (i) Introduction (ii) Implementation & Analysis (iii) Conclusion (iv) Future Goals.

CHAPTER 2

REVIEW OF LITERATURE

Characteristic hypotheses of character have since quite a while ago endeavoured to nail down precisely the number of character attributes exist. Prior speculations have proposed a different number of potential characteristics, including Gordon Allport's rundown of 4,000-character attributes, Raymond Cattell's 16-character variables, and Hans Eysenck's three-factor hypothesis.

However, numerous analysts felt that Cattell's hypothesis was too confounded and Eysenck's was too restricted in extension. Subsequently, the five-factor hypothesis arose to portray the fundamental qualities that fill in as the structure squares of character.

Note that every one of the five-character factors speaks to a reach between two limits. For instance, extraversion speaks to a continuum between extraordinary extraversion and outrageous introspection. In reality, the vast majority lie someplace in the middle of the two polar finishes of each measurement.

These five categories are usually described as follows.

- Openness to experience: in some cases, called mind or creative mind, this speaks to the readiness to attempt new things and consider new ideas. Qualities incorporate smarts, innovation and interest.
- Conscientiousness: the desire to be careful, diligent and to regulate immediate gratification with self-discipline. Conscientiousness include discipline, consistency, ambition and reliability.

- Extraversion: a state where an individual draws energy from others and looks for social associations or communication, instead of being distant from everyone else (introversion). Qualities incorporate being active, fiery and sure.
- Agreeableness: the proportion of how an individual interfaces with others, described by the level of sympathy and co-activity. Characteristics incorporate affability, graciousness and reliability.
- Neuroticism: an inclination towards antagonistic character qualities, enthusiastic insecurity and reckless reasoning. Characteristics incorporate cynicism, tension, uncertainty and dreadfulness.

The model was created between the 1950s and 1990s by a few unique analysts, coming full circle in a 6-2-1 system that surveys every character characteristic on two features and six sub-aspects. Altogether there are five attributes, 10 aspects and 30 sub-features that somebody can be surveyed on.

All speculations of character, the five-factor model is affected by nature and sustain both. Two investigations have discovered that the measure of fluctuation that credited to qualities of the Big Five attributes is 40-60%.

An examination was directed by Jang (1996) with 123 sets of indistinguishable twins and 127 sets of intimate twins. he assessed the heritability of scruples, suitability, neuroticism, receptiveness to experience, and extraversion to be 44%, 41%, 41%, 61%, and 53%, individually.

This finding was like the discoveries of another investigation, where the heritability of principles, suitability, neuroticism, receptiveness to experience and extraversion were assessed to be 49%, 48%, 49%, 48%, and half, separately.

The Big Five model came about because of the commitments of numerous free specialists. Gordon Allport and Henry Odbert first framed elite of 4,500 terms identifying with character attributes in 1936 (Vinney, 2018). Their work gave the establishment to different clinicians to start deciding the essential components of character.

In the 1940s, Raymond Cattell and his partners utilized factor examination (a factual technique) to limit Allport's rundown to sixteen attributes. Nonetheless, various clinicians analyzed Cattell's rundown and discovered that it very well may be additionally diminished to five characteristics. Among these therapists were Donald Fiske, Norman, Smith, Goldberg, and McCrae and Costa (Cherry, 2019).

Five essential components of character were pushed vigorously by Lewis Goldberg. McCrae and Costa developed his work, and they affirmed the model's legitimacy and given the model utilized today: reliability, pleasantness, neuroticism, receptiveness to experience, and extraversion. The model got known as the "Huge Five" and has seen gotten a lot of consideration. It has been investigated across numerous populaces and societies and keeps on being the most generally acknowledged hypothesis of character today.

Every one of the Big Five-character characteristics speaks to incredibly general classes which cover numerous character-related terms. Every characteristic incorporates a large number of different aspects. Extraversion classification contains marks like amiable, strong, vivacious, daring, eager, active.

During the early piece of the twentieth century, analysts got keen on arrangement how characters create and why they contrast between individuals. Somewhere in the range of 1923 and 1928, the American Psychological Association held various shows on the subjects of character a lot. In 1928, a unique issue of the Journal of Abnormal and Social Psychology was given to the character.

The main issue of Character and Personality turned out in 1932. This new diary needed to meld British and American information on individual contracts between individuals with German investigations of individuals' characters. The absolute first issue attempted to figure out what the contrast among "character" and "character" was, in any case. The diary had acclaimed donors, similar to Alfred Adler and Carl Jung, and it included everything from contextual analyses to experimentation. In 1937, American analyst Gordon Allport distributed a book called Personality: A Psychological Interpretation. Allport needed to characterize and arrange character brain science. His book made a dream for how the investigation of character could

be set inside the sociologies.

Henry Murray was another significant figure in the field. An American therapist who extended the limits of character brain research and brain research through his utilization of experimentation, he showed the point to various alumni understudies who might grow the field considerably further in years to come. Murray was so notable as a specialist on the character that the U.S. government enrolled him to make a mental profile of Hitler. Murray built up the hypothesis that an individual's response to explicit components inside their current circumstance is the thing that shapes their character.

The advanced feeling of individual character is an aftereffect of the movements in culture beginning in the Renaissance, a basic component in innovation. Conversely, the Medieval European's self-appreciation was connected to an organization of social jobs: "the family unit, the family relationship organization, the society, the enterprise – these were the structure squares of personhood". Stephen Greenblatt notices, in relating the recuperation (1417) and profession of Lucretius' sonnet De Rerum Natura: "at the centre of the sonnet lay key standards of a cutting-edge comprehension of the world." "Subject to the family, the individual alone was nothing," Jacques Gélis notices. "The trademark characteristic of the cutting-edge man has two sections: one inner, the other outside; one managing his current circumstance, the other with his mentalities, qualities, and emotions." Rather than being connected to an organization of social jobs, the advanced man is to a great extent affected by the ecological factors, for example, "urbanization, training, mass correspondence, industrialization, and politicization."

Crystal gazing, the old Sastra got from Vedangas, additionally talks about character and season of birth. It isn't certain whether soothsaying is causative of a specific character characteristic or an assortment of attributes or whether it affects human character by any stretch of the imagination.

Since antiquated occasions, people have tried to clarify conduct by sorting characters into particular kinds. Character appraisals have been created in the course of recent hundreds of years to portray parts of an individual that stay stable all through

a lifetime: the person's character example of conduct, considerations, and sentiments. Character evaluations have been utilized to sort, group, and classify individuals. References to character appraisals have even advanced into books and motion pictures, for example, Harry Potter, who was sent into the Gryffindor House at the Hogwarts School by an "arranging cap" that could measure the demeanour of every understudy.

CHAPTER 3

IMPLEMENTATION & ANALYSIS

This chapter of the Report focusses on the implementation means taken by the author to reach to the results of the project. The minimum requirements and workflow along with a proposed methodology in detail has been explained in the later sections.

3.1 REQUIREMENTS

The following Software and Hardware Requirements are the minimum requirements before starting with this project.

3.1.1 Software:

- Programming Language: R, Shiny, R markdown.
- Software: RStudio
- Libraries: RCurl, caret, FNN, class, gmodels, splitstackshape, tidyverse, shiny, ggplot2, data.table, shinyWidgets, knitr, shinythemes.

3.1.2 EXPERIMENTAL SETUP:

- Operating System: Windows 10 (64-bit)
- Hardware Requirements: Processor i9-9880H
- RAM: 16 GB
- GPU: 4 GB
- Internal Storage: 1 TB SSD

3.2 DATASET

The dataset chosen contains the questionnaire and metadata from Kaggle, openpsychometrics.org.

This dataset includes attributes as explained: reviews (ratings, text, helpfulness votes), product metadata (descriptions, category information), and links (also viewed/also bought graphs). The key which is used to evaluate the data and calculate the result for the respective columns is from the Goldberg, Lewis R. "The development of markers for the Big-Five factor structure." Psychological assessment 4.1 (1992): 26. Mentioned in Appendix A4

3.3 WORKING & APPROACH

This project is divided into two major components:

- Application
- ML model

3.3.1 WORKFLOW DIAGRAM:

3.3.1.1 Application

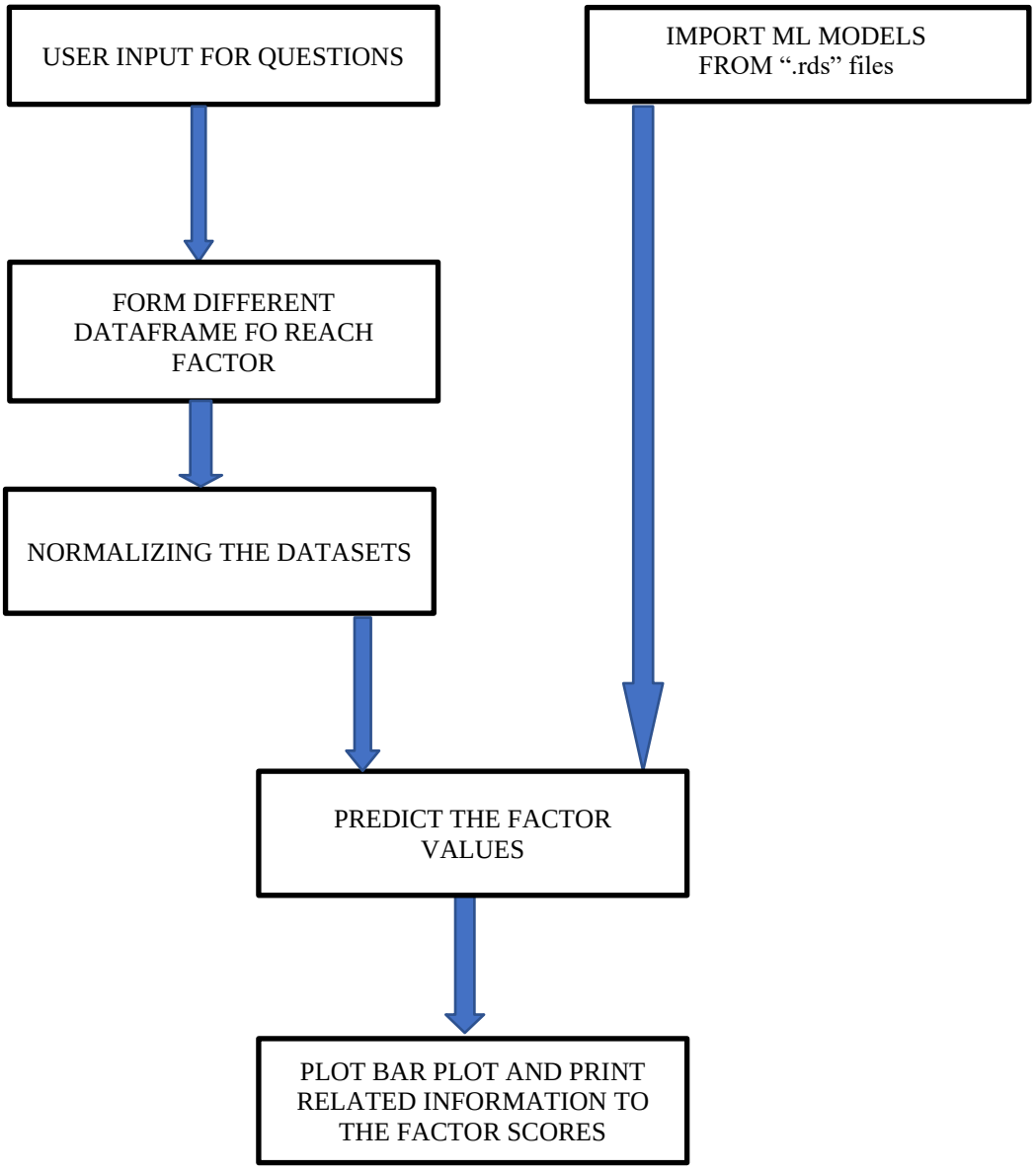

Fig1 (Workflow diagram of application)

3.3.1.2 ML Models

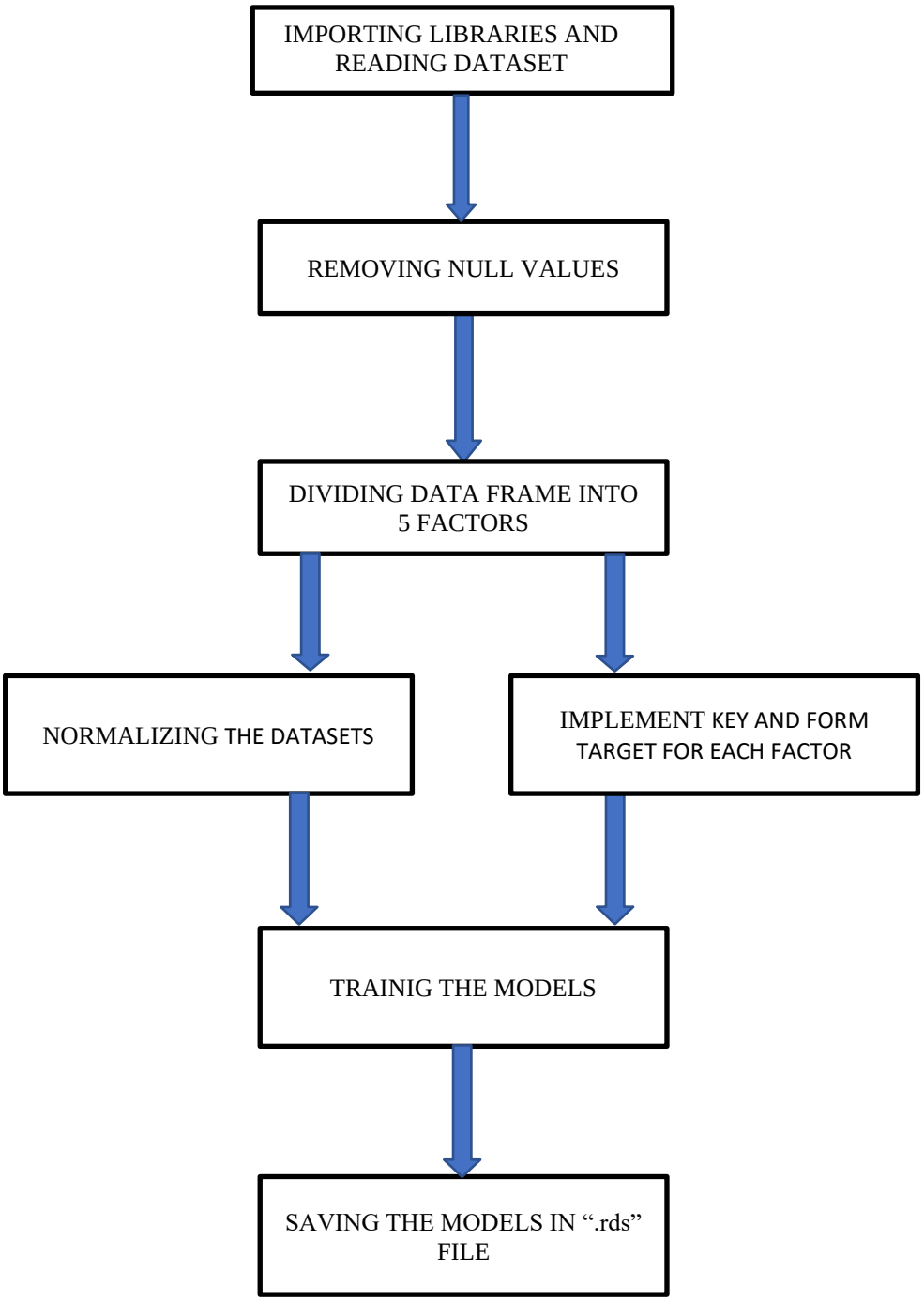

Fig2 (Workflow diagram of ML models)

3.3.2 PROPOSED METHODOLOGY:

3.3.2.1 ML Models:

1. Import required libraries and functions.
2. Read dataset.
3. Subset only first 50 columns from the dataset.
4. Remove rows containing NA, NaN, NULL.
5. Subset the dataset into 5 different factor datasets.
6. Select on the unique rows for each factor and remove the rest.
7. Make 2 copies of factor datasets:
    a. Implement key
        i. Divide the datasets into +ve and -ve according to the respective questions for each factor.
        ii. Implement the scoring key for all the factors and form the target columns.
    b. Normalize the factor datasets.
8. Train different model using Supervised Linear Regression algorithm for each factor, using the normalized datasets and the target column for the respective factors.
9. Save the models in the form of ".rds" file. (to be used in the application)

For more information, see Appendix B

3.3.2.2 Application

1. Home Page (page 1) – Introduction to the application and details of the OCEAN model that we are going to analyze their personality.
2. Questions (page 2) – List of 50 questions to be answered by the user to see the result.
3. Result (page 3) – Bar plot representing the score of reach factor and every factor score is explained in details below the bar plot.
4. About (page 4) – Contains reference links for the source of data, questions and models. There is also an explanation of the Big-Five factor theory.

3.4 Result

3.4.1 Application

3.4.1.1 Home Page

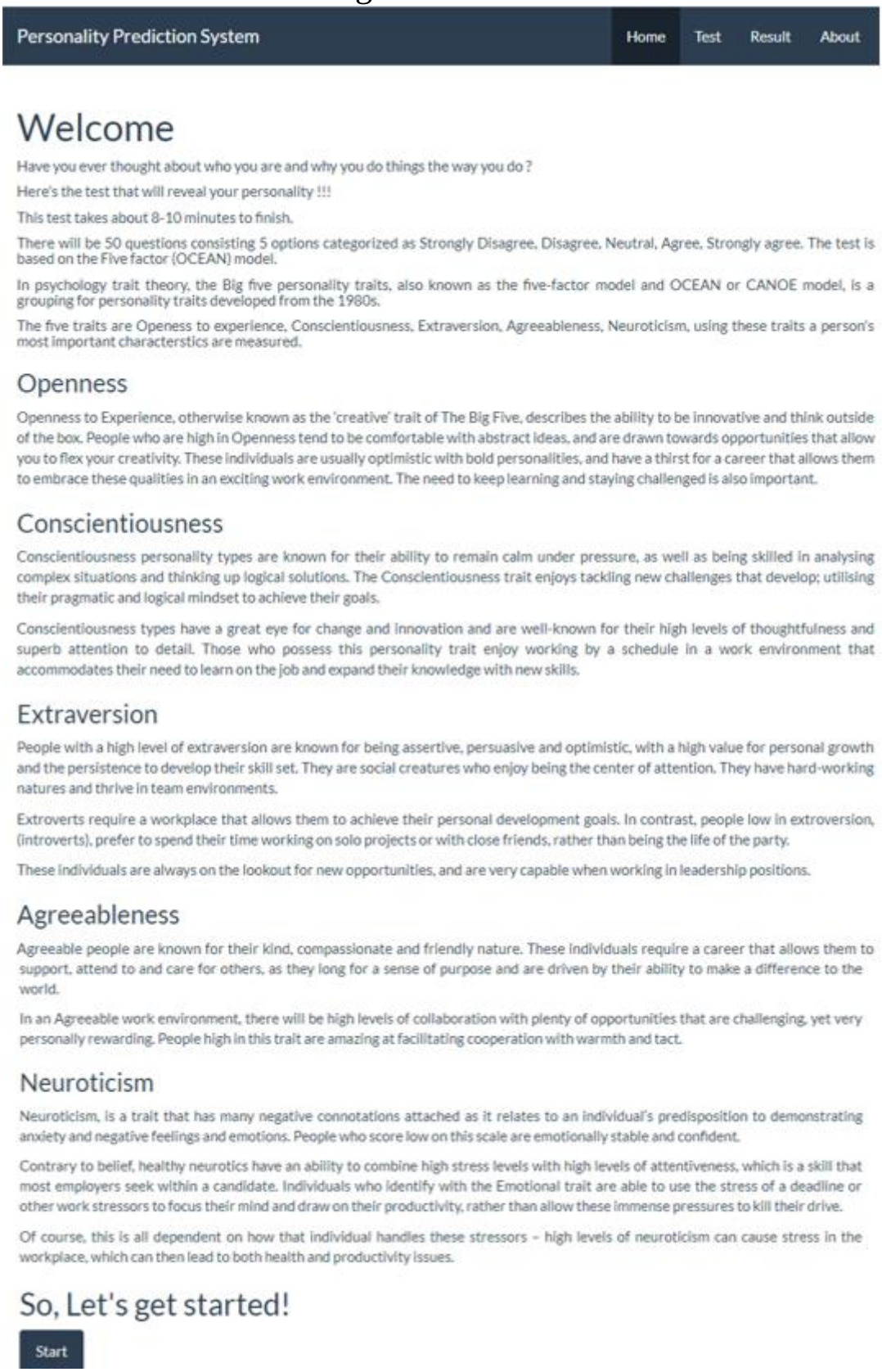

Fig3 (Application's home page)

3.4.1.2 Questions Page

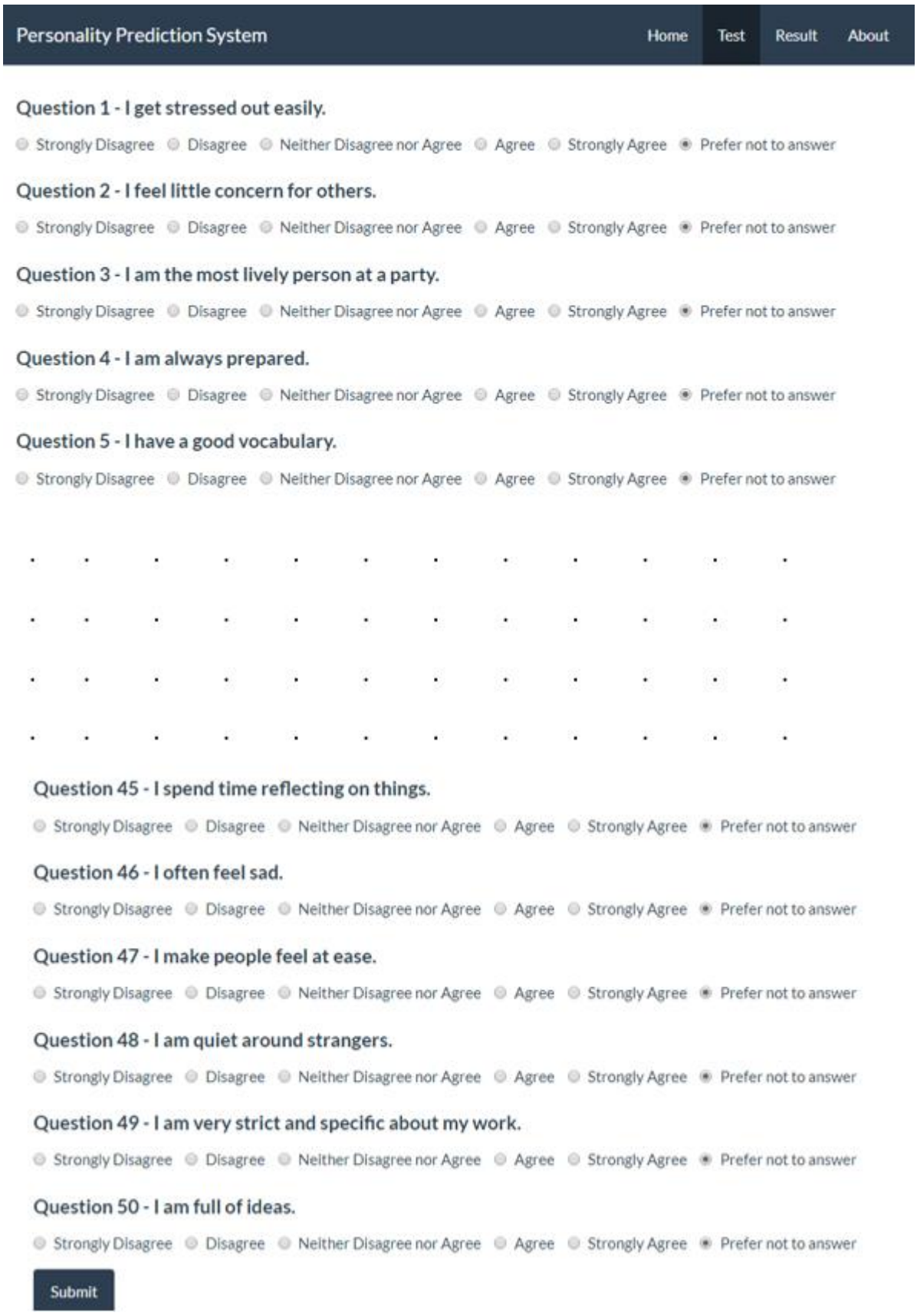

Fig4 (Application's question page)

3.4.1.3 Result Page

Fig5 (Application's result page)

3.4.1.4 About Page

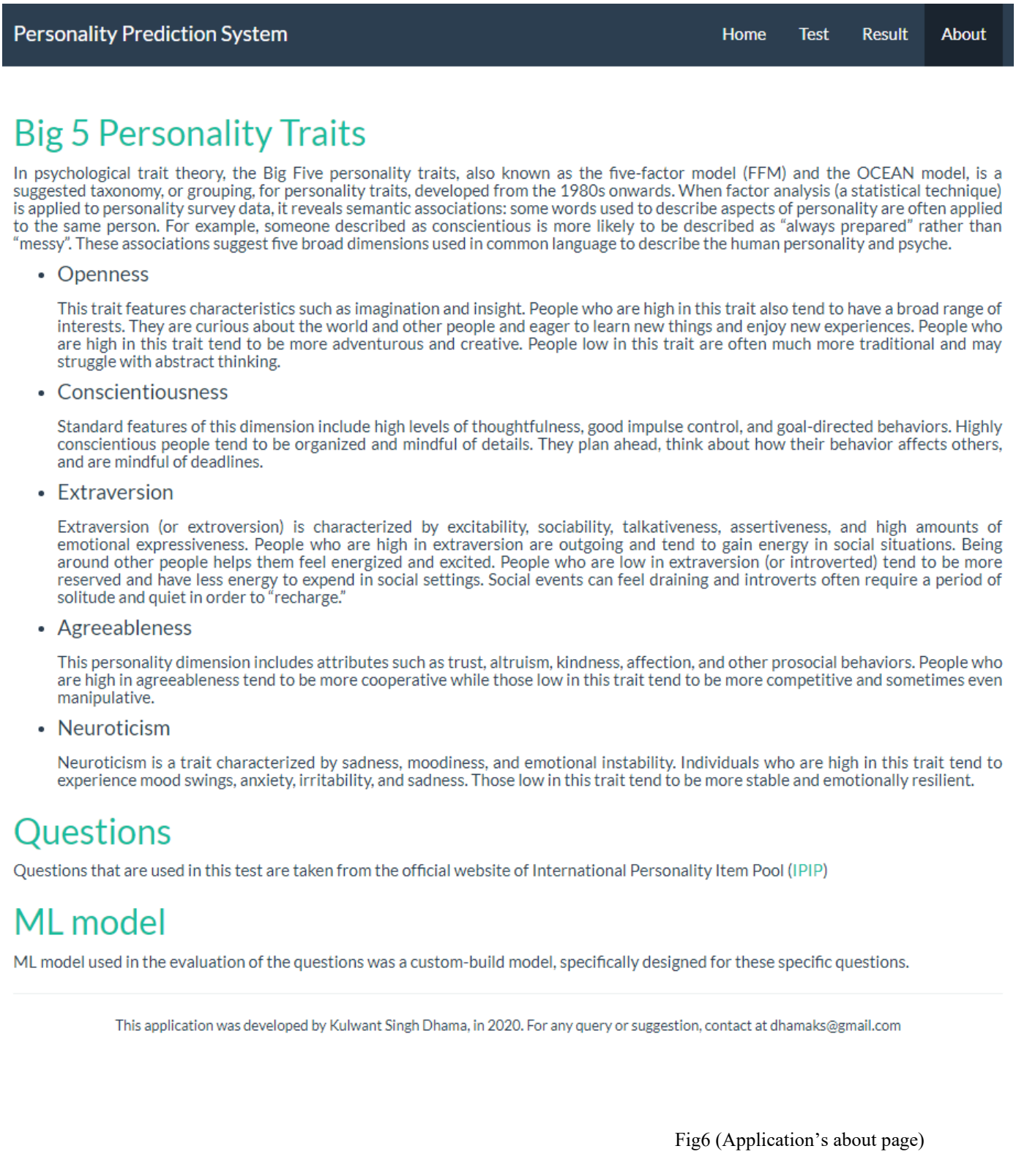

Fig6 (Application's about page)

3.4.2 ML Models

The goal of this project was to determine the personality of an individual Hence, accuracy will be the measure of evaluation, with it being defined as the proportion of the correctly determined reviews out of all the reviews that had been added to the test data. This model gives the highest accuracy of 97% at RMSE and R2 scales. The figure mentioned below represents the result obtained while performing with the algorithm and their accuracy.

```
##           Factors      RMSE        R2
## 1          Openness 0.2513535 0.9997130
## 2 Conscientiousness 0.2549866 0.9997806
## 3     Extraversion 0.2515616 0.9998501
## 4    Agreeableness 0.2509401 0.9997628
## 5      Neuroticism 0.2513456 0.9998294
```

Fig7 (Accuracy score)

4 CONCLUSION

The main objective of this project i.e., to predict the personality of an individual using Machine learning model which is tomorrow's future.

This was successfully performed on the IPIP dataset with a classification accuracy of 97 % approximately.

Personality Prediction was performed successfully using the Linear Regression Algorithm.

Thus, using this ML model the personality was predicted for an individual based on a test of 50 psychological questions and test is evaluated using LIKERT scale, so that one can understand the behavioural patterns and factors.

5 FUTURE GOALS AND APPLICATIONS

Since we were limited to use computing power, this application is limited to only predict the OCEAN factors, but with the use of correct AI/ML technique and more powerful computing resource, this application could be used to any the 16PF factors of a person, just by listening/reading text from a person. This project is combining the techniques of Machine Learning, Personality Prediction by using several algorithms it can be used in the future in predicting behavioural and thinking patterns of humans using more complicated ML/AI techniques. Its usefulness and applicability find not only in computer science/ applications but in the areas of research from psychology. It promises to revolutionize the research process. Personality is key to human. Every individual is conscious of their personal growth and professional success and how they behave and why they do things the way they do. Everyone wants to feel understood. This also helps in the growth of an individual shape as an adult and help in achieving their goals

6 APPENDIX

6.1 Appendix A

Important Links

[A1] The ML model is available at:

https://rpubs.com/Walker_2921/701660

[A2] This dataset used to train the models is available at:

https://openpsychometrics.org/_rawdata/

[A3] The scoring key for evaluation of data is available at:

https://sites.temple.edu/rtassessment/files/2018/10/Table_BFPT.pdf

[A4] The development of markers for the Big-Five factor structure by Goldberg, Lewis R.

https://doi.apa.org/record/1992-25730-001?doi=1

6.2 Appendix B

Since the project is designed with the motive to use Machine Learning, we are going to build a linear regression model and evaluate the dataset to predict the factor values and eliminate the discreteness present in the evaluation and libraries like RCurl, caret, FNN, class, models, etc.

We will conduct this analysis to implement the psychological analysis using the ML algorithms instead of the traditional scoring system used by psychiatrists.

We are going to build a Linear Regression model and evaluate the dataset to predict the factor values and eliminate the discreteness present in the evaluation.

The first step is to import the important libraries and some helpful functions.

```
library(caret)
library(RCurl)
library(FNN)
library(class)
library(gmodels)
library(splitstackshape)
library(tidyverse)
normalize <-function(x) {
   x <- x/5
   x <- format (x, digits = 2, nsmall = 1)
   return (x)
}
```

Now we will read the dataset:

```
data_set <- read.csv ("dataset.csv", header = TRUE)
```

Filter out first 50 columns and remove rows containing NaN, NA and NULL from the dataset.

```
i <- seq (1, 50)
data_set [, i] <- apply (data_set [, i], 2, function(x) as.numeric (as.character(x)))
data_set <- na.omit(data_set)
head(data_set)
```

The next step is to Preview the Dataset-

As you can observe that our dataset has 50 columns. Each column represents the responses by users for a specific question. 5 different column names specify which factor the respective question belongs to.

```
head(data_set)
```

```
##   OPN1 OPN2 OPN3 OPN4 OPN5 OPN6 OPN7 OPN8 OPN9 OPN10 CSN1 CSN2 CSN3 CSN4 CSN5
## 1    5    1    4    1    4    1    5    3    4     5    3    4    3    2    2
## 2    1    2    4    2    3    1    4    2    5     3    3    2    5    3    3
## 3    5    1    2    1    4    2    5    3    4     4    4    2    2    2    3
## 4    4    2    5    2    3    1    4    4    3     3    2    4    4    4    1
## 5    5    1    5    1    5    1    5    3    5     5    5    1    5    1    3
## 6    5    1    5    1    3    1    5    4    5     2    3    2    4    1    3
##   CSN6 CSN7 CSN8 CSN9 CSN10 EXT1 EXT2 EXT3 EXT4 EXT5 EXT6 EXT7 EXT8 EXT9 EXT10
## 1    4    4    2    4     4    4    1    5    2    5    1    5    2    4     1
## 2    1    3    3    5     3    3    5    3    4    3    3    2    5    1     5
## 3    3    4    2    4     2    2    3    4    4    3    2    1    3    2     5
## 4    2    2    3    1     4    2    2    2    3    4    2    2    4    1     4
## 5    1    5    1    5     5    3    3    3    3    5    3    3    5    3     4
## 6    2    4    3    4     3    3    3    4    2    4    2    2    3    3     4
##   AGR1 AGR2 AGR3 AGR4 AGR5 AGR6 AGR7 AGR8 AGR9 AGR10 NEU1 NEU2 NEU3 NEU4 NEU5
## 1    2    5    2    4    2    3    2    4    3     4    1    4    4    2    2
## 2    1    4    1    5    1    5    3    4    5     3    2    3    4    1    3
## 3    1    4    1    4    2    4    1    4    4     3    4    4    4    2    2
## 4    2    4    3    4    2    4    2    4    3     4    3    3    3    2    3
## 5    1    5    1    5    1    3    1    5    5     3    1    5    5    3    1
## 6    2    3    1    4    2    3    2    3    4     4    3    4    3    2    2
##   NEU6 NEU7 NEU8 NEU9 NEU10
## 1    2    2    2    3     2
## 2    1    2    1    3     1
## 3    2    2    2    1     3
## 4    2    2    2    4     3
## 5    1    1    1    3     2
## 6    1    2    1    2     2
```

Fig8 (Preview of the dataset)

Now, the Data Preprocessing will take place: -

To reduce computing cost and still generate a robust ML model, we will be forming 5 data frames from the original dataframe and then removing the duplicate responses for a specific factor.
This will eliminate the possibility of underfitting the model.

```
opn <- data_set [! duplicated (data_set [, 1:10]), 1:10]

csn <- data_set [! duplicated (data_set [, 11:20]), 11:20]

ext <- data_set [! duplicated (data_set [, 21:30]), 21:30]

agr <- data_set [! duplicated (data_set [, 31:40]), 31:40]

neu <- data_set [! duplicated (data_set [, 41:50]), 41:50]


n_opn <- nrow(opn)

n_csn <- nrow(csn)

n_ext <- nrow(ext)

n_agr <- nrow(agr)

n_neu <- nrow(neu)
```

Dividing each factor dataframe into two dataframes that is Positive and Negative dataframes for key evaluation.

Each question in the test is either considered +ve valued or -ve valued, and we are going to group all the +ve and -ve questions for each factor to evaluate them separately.

```
opn_p <- opn [, c (1, 3, 5, 7, 8, 9, 10)]
opn_n <- opn [, c (2, 4, 6)]
csn_p <- csn [, c (1, 3, 5, 7, 9, 10)]
csn_n <- csn [, c (2, 4, 6, 8)]
ext_p <- ext [, c (1, 3, 5, 7, 9)]
ext_n <- ext [, c (2, 4, 6, 8, 10)]
agr_p <- agr [, c (2, 4, 6, 8, 9, 10)]
agr_n <- agr [, c (1, 3, 5, 7)]
neu_p <- neu [, c (2, 4)]
neu_n <- neu [, c (1, 3, 5, 6, 7, 8, 9, 10)]
```

We are going to train 5 different models, one for each factor to achieve higher accuracy for each model.
But first we need to form the TARGET columns for each column by evaluating according to the scoring key of the model.

```
opn$result <- 0
csn$result <- 0
ext$result <- 0
agr$result <- 0
neu$result <- 0
```

```
for (i in seq (max (n_opn, n_csn, n_ext, n_agr, n_neu))) {
    if (i <= n_opn) {
        opn [i, "result"] <- sum (opn_p [i,]) - sum (opn_n [i,]) + 8
    }
    if (i <= n_csn) {
        csn [i, "result"] <- sum (csn_p [i,]) - sum (csn_n [i,]) + 14
    }
    if (i <= n_ext) {
        ext [i, "result"] <- sum (ext_p [i,]) - sum (ext_n [i,]) + 20
    }
    if (i <= n_agr) {
        agr [i, "result"] <- sum (agr_p [i,]) - sum (agr_n [i,]) + 14
    }
    if (i <= n_neu) {
        neu [i, "result"] <- sum (neu_p [i,]) - sum (neu_n [i,]) + 38
    }
}
```

Since the scoring is done on a scale of out of 40, we are converting the results out of 100. Forming the Final dataframes for each factor with their respective result values.

```
opn$result [opn$result > 40] <- 40

opn$result [opn$result < 0] <- 0

opn$result <- ceiling (opn$result * 2.5)


csn$result [csn$result > 40] <- 40

csn$result [csn$result < 0] <- 0

csn$result <- ceiling (csn$result * 2.5)


ext$result [ext$result > 40] <- 40

ext$result [ext$result < 0] <- 0

ext$result <- ceiling (ext$result * 2.5)


agr$result [agr$result > 40] <- 40

agr$result [agr$result < 0] <- 0

agr$result <- ceiling (agr$result * 2.5)


neu$result [neu$result > 40] <- 40

neu$result [neu$result < 0] <- 0

neu$result <- ceiling (neu$result * 2.5)
```

Normalize the feature columns in all dataframes

```
opn_a <- as.data.frame(lapply(opn[1:10], normalize))
opn_a$result <- opn$result
csn_a <- as.data.frame(lapply(csn[1:10], normalize))
csn_a$result <- csn$result
ext_a <- as.data.frame(lapply(ext[1:10], normalize))
ext_a$result <- ext$result
agr_a <- as.data.frame(lapply(agr[1:10], normalize))
agr_a$result <- agr$result
neu_a <- as.data.frame(lapply(neu[1:10], normalize))
neu_a$result <- neu$result
```

Train the different Linear Regression Models for each factor.

```
lr_model_opn <- lm(result ~ ., data = opn_a)
lr_model_csn <- lm(result ~ ., data = csn_a)
lr_model_ext <- lm(result ~ ., data = ext_a)
lr_model_agr <- lm(result ~ ., data = agr_a)
lr_model_neu <- lm(result ~ ., data = neu_a)
```

Finally, storing all the models in the form of ".rds" file for further use.

```
saveRDS(lr_model_opn, "models/lr_model_opn.rds")

saveRDS(lr_model_csn, "models/lr_model_csn.rds")

saveRDS(lr_model_ext, "models/lr_model_ext.rds")

saveRDS(lr_model_agr, "models/lr_model_agr.rds")

saveRDS(lr_model_neu, "models/lr_model_neu.rds")
```

Later these models are used in the application to predict the factor values for random users.

7 REFERENCES

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