FOOD PREFERENCES OF STUDENTS BASED ON THEIR EMOTIONAL STATE

Submitted by

Nadia Nasrin

(171-35-1800)

Department of Software Engineering

Daffodil International University

Supervised by

Nusrat Jahan

Lecturer (Senior)

Department of Software Engineering

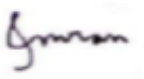
Daffodil International University

This Project report has been submitted in fulfillment of the requirements for the Degree of Bachelor of Science in Software Engineering.

APPROVAL

This thesis titled "**Food preferences of students based on their emotional state**", submitted by **Nadia Nasrin**, **171-35-1800** to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.

BOARD OF EXAMINERS



Chairman

Dr. Imran Mahmud
Associate Professor and Head
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

Internal Examiner 1

K. M. Imtiaz-Ud-Din
Assistant Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

Internal Examiner 2

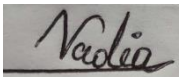
Md Fahad Bin Zamal
Assistant Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

External Examiner

Professor Dr. Md. Nasim Akhtar
Professor
Department of Computer Science and Engineering
Dhaka University of Engineering and Technology, Gazipur

DECLARATION

It hereby declares that this thesis has been done by me or us under the supervision of **Nusrat Jahan**, Lecturer (Senior Scale), Department of Software Engineering, Daffodil International University. It also declared that neither this thesis nor any part of this has been submitted elsewhere for the award of any degree.



Nadia Nasrin

Student ID: 171-35-1800

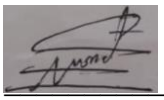
Batch: 22nd

Department of Software Engineering

Faculty of Science & Information Technology

Daffodil International University

Certified by:



Nusrat Jahan

Lecturer (Senior Scale)

Department of Software Engineering

Faculty of Science & Information Technology

Daffodil International University

ACKNOWLEDGEMENT

I would first like to thank the almighty Allah for allowing us to accomplish this B.SC study successfully. We are really thankful for the abundant blessings the Almighty Allah has bequeathed upon us, not only during our study life but in life long.

I would also like to express my sincere gratitude to my **Supervisor, Ms. Nusrat Jahan**, for the continuous support in my Undergraduate thesis research. Her guidance helped me throughout this research journey and also in writing the paper.

Besides my Supervisor, I would like to thank the rest of my thesis committee, Senior Lecturer, Afsana Begum, Associate Professor and Department head, Dr. Imran Mahmud.

I would like to thank my family: my parents for trusting in me and my decisions and supporting me spiritually throughout my life.

Last but definitely not least, I would also like to thank some of my friends, for their inspiration, motivation which encourages me a lot to finish this thesis.

TABLE OF CONTENT

TABLE OF FIGURE

TABLE OF LIST

ABSTRACT

Background: In this modern progressive world, everyone is suffering from some problem. Many people miss the track of solving their problems and are stuck in a maze. Then they get depressed or stressed over small things. Mostly, Students go through fluctuating moods a lot. In that critical time, everyone wants something that can comfort them. People prefer doing many things like eating, playing games, watching movies when they are not in a pleasurable emotional state. The connection between food and emotions are very intense. As these two things are interconnected, we explored the comfort foods of students in their different states of mind. The earlier researches are based on surveys and psychological questionnaires. In this paper, we proposed a machine learning model of Linear regression and Support Vector Machine with the aid of data science to find out the comfort foods of the students based on their emotional state. The dataset is collected from a publicly available source. The data was collected through a survey at Mercyhurst University. There were 126 students who participated in the survey and over 60 questions were asked. In this study, we tried to find out the comfort foods which students like to have in their different mental state. We performed 2 models, in a Linear regression model, we found 5% accuracy and in SVM we found 95% accuracy which is pretty good.

Keywords: Emotion, Comfort food, Machine learning, Linear regression.

CHAPTER 1

INTRODUCTION

1.1 Background

In this progressive world, every other person is struggling with their life. Someway or the other they are Shattered with depression. When people are under pressure they want to escape from life and take erroneous decisions. The tendency of depression has increased among the students. At the present time, teenagers give up life in very trivial matters. They try to part with everything easily because they think of it as a solution which is not. But those who can control themselves, try to calm down and fight back. People do various activities like watching movies, traveling, reading books, and so on when they are not in good mental condition.

The connection between food and emotions is from the starting of the universe. We consume food just not to satisfy our hunger but also for our mental satisfaction. The effect of food on humans is incomparable. For instance, if we know what is someone's comfort food when they are in stress, we can help that person to calm down and can prevent wrongdoing like suicide. So, it is necessary to know how to tackle these situations. In most cases, researchers use survey data to find out the comfort foods. So, in this study, we proposed a machine learning model Linear Regression and SVM to determine the comfort foods based on the person's mood, age, weight so that we can get accurate results and decide which model works better.

1.2 Motivation of the Research

Food and emotions are Interconnected, food can change the mood of a person. People sometimes overeat when they are upset which causes many health problems. So for example, if we know that someone is 180 pounds and he/she eats lots of fast food when he is in a stressful situation. His doctor can easily catch what is the reason behind his obesity. This research is helpful also in this way.

Researchers have been working on various sides of this topic like how food consumption can change a person's mood and so on. But the previous research relies on the survey and physiological terms. They have not gone so far with this topic and applied for any technical work in it. But it is a very important topic for this modern era where a lot of people are in depression, stressed. So, we need to know how to deal with it. All the previous papers are theoretical and the result is not accurate yet. It is quite difficult to understand the outputs as it's not visualized in plots or graphs. That's why I wanted to explore the topic and use a machine learning model to implement it. I have found a dataset in a public platform called Kaggle. There are 126 students who have participated in the survey and answered all the questions.

1.3 Problem Statement

The effect of food on human beings is incomparable. People sometimes overeat when they are upset which causes many health problems. Many pieces of research have been done on this topic previously. But all the works are basically theoretical. In those works, they have used various kinds of questionnaires like the TrierSocial stress test to find out the result. We can not expect a decent accuracy from these results because they are

not tested with any technical terms. So, we can not predict any results from surveys. If we predict then we must have to do the work with the help of technical terms like machine learning models. Machine learning can help us to demonstrate the correct result and show us the accuracy.

1.4 Research Questions

1. Question 1: The major question is what are the constituents to determine the comfort foods?
2. Question 2: Can Machine learning figure out the comfort foods accurately base on the emotional state?
3. Question 3: Which model of machine learning predicts better about comfort food?

1.5 Research Objectives

- The main objective of this study is to determine the comfort foods of the students based on their emotional state.
- The next objective is to perform different data pre-processing techniques and make the dataset workable.
- The last objective is to perform different machine learning models and identify which works better for this study.

1.6 Research Scope

Right now this topic has a huge research scope. Researchers are working on this topic but most of the studies are based on physiological questionnaires. As there has been no previous work done with the dataset so there are a lot of scopes to go further with it. We have tasted two machine learning models to determine which one is working better.

But there are other models as well. The main scope of this research is to implement different machine learning models to predict the comfort food of the students and also determine which model is doing better work. Also, in this dataset, there is a connection between food choice and weight. So, we can also predict that if he has the possibility to have diabetics or heart disease by analyzing his food preferences.

CHAPTER 2

LITERATURE REVIEW

Is comfort food actually comforting for emotional eaters? A(moderated) mediation analysis (Striena,b et al., 2019) in this paper states that strong emotional people eat more when they are stressed, and comfort foods can reduce their stress where less emotional people eat less. They have used the DEBQ for the survey and for observing the behavior, they used the Trier social stress test. This survey was held at the Universities of Valencia and Barcelona (Spain). The procedure of this study was, they have instructed the participants not to consume food for a minimum of 2 hours before arrival. In another study, they have proposed that males like to have warm foods as comfort food when they are not in a stable mental state where females preferred snacks kind of foods like chocolate, ice cream. The purpose was to simplify the concept of the difference in the types of comfort foods preferred by females and male. They did a survey with 1000 people and the postulate was the participants must be 18 or above. The key finding of this paper is that both age and gender create differences in preferences of comfort foods(Wansink* et al., 2003). One study age and gender about "chocolate addictions" track down that among 70 female out of 72 with is approximately 97.2% are obsessed with chocolate (Tuomisto et al., n.d.). In the paper titled "A sad mood increases attention to unhealthy food images in women with food addiction" (Frayn et al., 2016), 86 students were enrolled through a web base research participation system. They have used the YFAS questionnaire which consists of 27 questions. They have philosophized in the paper that the result is fuzzy because of the discrepancy of data, another back draw is in the YFAS measure of food addiction. These failings are for the non-

existence of any technical terms. Although sustainability between the need for food for hunger and the psychological value of food is difficult, sometimes this may proceed without interoceptive awareness and that turns out to be a habit of overeating (Ouwens et al., 2009). In another study, “Perceived stress and dietary choices: The moderating role of stress management”, they hypothesis that greater perceived stress would be associated with greater consumption of unhealthy foods and beverages and less consumption of healthy foods was partially supported (Vanessa L.Errisuriz, 2016).

CHAPTER 3

RESEARCH METHODOLOGY

The model which has been proposed for this study has several steps that include data collection for an accurate model. We needed to pre-process data after collecting it to make it workable in our model. Then we extract features from the data which are the key factors that are directly associated with our ultimate result which is Food preferences. Then we implemented 2 different types of supervised machine learning algorithms. One is regression and another is classification. For the regression we used Linear Regression (LR) model. For classification we used Support Vector Machine (SVM) model. But our data set works better in classification model. It predicts more accurate result than regression model. We feed data and train our selected algorithms. After that we make prediction and evaluate all the models in terms of evaluation matrix. After that we compare the coefficients, intercept, mean squared error, mean absolute error and r^2 of both models and select our best model from them.The workflow of the proposed model is given in **Figure 3.1.**

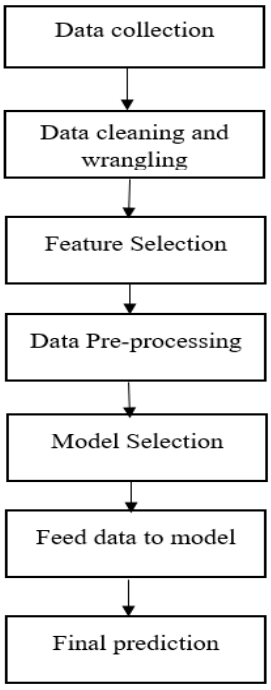


Figure 3.1: Workflow of the model

3.1 Dataset

The dataset used for this study was taken from a public source “Kaggle” (*Food choices, kaggle*). The dataset is collected from a survey which was held at Mercyhurst University. 126 students agreed to participate in the survey. The impetus behind collecting these data was to gain knowledge about the change of favoritism of food in different emotional states. This dataset entails information about food choice, preferences, gender, a childhood favorite, and much other information about the students. The information was given by the students themselves. The dataset was raw and fuzzy. This data has the formation of 5 rows including gender, calories, comfort_food, comfort_food_reasons, weight. Comfort food reason delivers information about in which emotional state a particular person yearns for that food. To erect the dataset well-groomed, we have converted some information into digits. To make the dataset doable we need to pre-process the data.

3.2 Dataset Pre-processing

The dataset was taken from a publicly available source under the section college student food choice and cooking preferences: Food choices. There has been no work done with this dataset. So, there was a lot of unnecessary and messy data which we have removed during pre-processing. Data preprocessing is the pivotal action of working with machine learning models. When we get any real-world dataset, it comes along with some noises, missing values. Data preprocessing boosts up the accuracy and productiveness of the model. In the dataset, there are 5 columns along with 6 comfort food reasons. The dataset was not cleaned so we needed to groom it before pre-

processing. There are several steps of data pre-processing that we need to follow. The steps of pre-processing of the dataset are given below in figure 3.2-

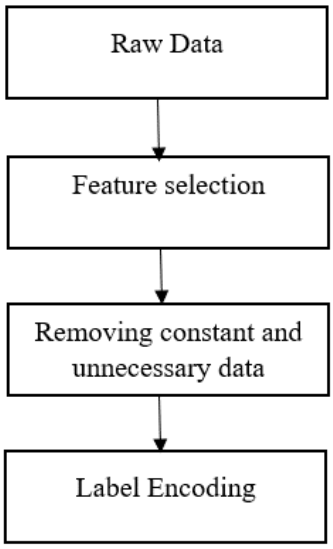


Figure 3.2: Steps of data pre-processing

3.2.1 Feature selection

Feature selection is one of the principal units of machine learning. Feature selection is primarily focused on removing non-informative or redundant predictors from the model (page 488, Applied predictive modeling, 2013). This is the process of selecting a subset of pertinent features/ attributes like a column in tabular data that are most episodic for the modeling and uprooting the impertinent features from the data set. There are some advantages of feature selection such as improving accuracy, reduce training time.

3.2.2 Removing constant and unnecessary data

A constant feature in machine learning doesn't help out with the result but it can generate errors in the prediction. It also does not assist in training the dataset. In our study, the initial column has some constant features (like GPA, diet_current, vitamins, on_off_camous, and so on) so considering the model, we removed the columns from the dataset.

3.2.3 Label Encoding

A Categorical Variable is one that has two or more Categorie. These variables are usually reposited as string values. For example activities like walking, reading, traveling. In our case, the categorical variables are gender, comfort_food_reasons. There are various paths to deal with categorical variables. In this study, we have used Label encoding to engage with categorical variables. For instance, we have two genders: male and female which we converted into female → 1, male → 2. Another feature is comfort_food_reasons, where we have 6 different values: stressed, boredom, sadness, anger, happiness, depressed. After applying label encoding, values will encode into digits like stressed → 1, boredom →2, sadness → 3, anger → 4, happiness →5, depressed → 6.

3.3 Model

There are several models like KNN, Naive Bayes, logistic regression, SVM in machine learning. In this research, we have used linear regression which in the short term is LR and we will also perform Support vector machine (SVM) to predict the comfort food of the students.

3.3.1 Linear Regression

Regression (Gandhi, 2018) is a process of modeling a target value based on independent predictors. This method is mainly used for finding out the cause and effect relationship between variables. We have two types of regression, one is univariate regression and the other is multivariate regression. If the number of feature variables is one then it is called univariate regression. We also know it as a simple regression. But if there is more than one feature variable then it is multivariate regression. The equation of simple linear regression is shown below,

$$\hat{Y} = \beta_0 + \beta_1 x + \epsilon$$

Where,

$\hat{Y}$ =Predicated Output

β =Coefficient

x = Input

ϵ = Error

3.3.2 SVM (Support Vector Machine)

We can use the SVM model both in classification and regression dataset. Support Vector Machines (SVM) were developed by Cortes & Vapnik (1995) for binary classification (Cortes & Vapnik). It is based on the concept of a hyper line that defines the decision boundaries. Hyper line segregation improves the robustness. SVMs treat

the classification task as one involving two classes where labeled training examples are represented using feature vectors. This model separates the data points by hyperplane that specify the decision boundaries but the types hyperplane is determined by kernel.

$$\|w\|2 \textit{ is minimum} \text{ and } yi *(w* xi-b)\geq 1$$

- Support Vectors are those data points that are near to the hyperplane and have an impact on the position and orientation of the hyperplane.
- The hyperplane is a decision line that creates a classification between two or more data points.
- Margin is the distance between two or more points. We determine margin by the distance between support vectors.

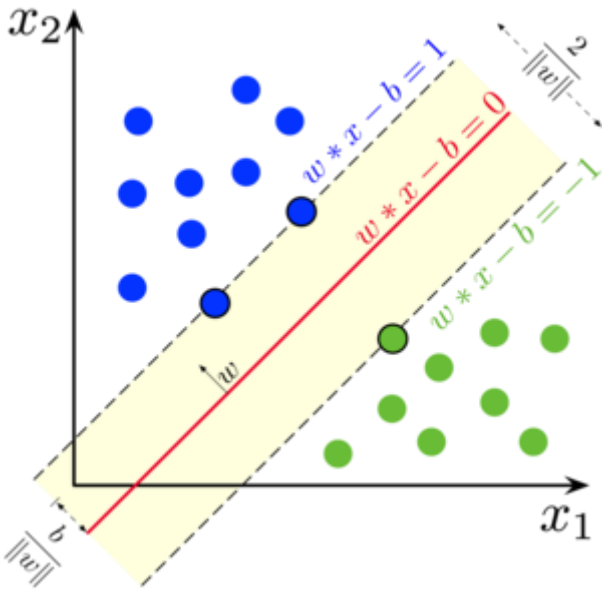


Figure 3.3: SVM Hyperplane

3.4 Performance Evaluation Metrics

After collecting data and performing data preprocessing, and implementing different models we get some outputs in form of a probability, the next step is to define out how feasible is the model based on some metrics using test datasets. Many types of performance metrics are conducted to evaluate the performance of Machine Learning models. In this study, we only focused on Regression evaluation metrics. For appraising our models we have chosen Coefficients, MAE, MSE, RMSE, Accuracy.

- Coefficients are the values that multiply the predictor values (Frost, coefficient).
- MAE is a simple regression error metric. It is the sum of absolute differences between our target and predicted variables
- MSE is the average of the square of the errors
- RMSE is the derivation of the root-square of the MSE.
- RES is an average deviation between the actual outcome and the true regression line.

$$MAE = \frac{1}{n}\sum_{j=1}^{n}|y_i - \hat{y}_j|$$

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{n}(y_j - \hat{y}_j)^2}$$

$$RAE = \frac{\sum_{j=1}^{n}|y_j - \hat{y}_j|}{\sum_{j=1}^{n}|y_i - \bar{y}|}$$

$$RSE = \frac{\sum_{j=1}^{n}(y_j - \hat{y}_j)^2}{\sum_{j=1}^{n}(y_j - \bar{y})^2}$$

$$\boxed{R^2 = 1 - RSE}$$

3.4 Accuracy

The fastest way to assess a set of predictions on a classification problem is by using an accuracy score. It is a matric of evaluating classification models. Classification accuracy score is a ratio of the number of correct predictions out of the total predictions that were made. The formula for calculating accuracy in binary classification problem given below:

$$Accuracy = \frac{True\ Positives + True\ Negatives}{Total\ Number\ of\ Examples}$$

CHAPTER 4

RESULTS AND DISCUSSION

In this study, we perform 2 machine learning models as experiments. In this section, we will describe these two models' results and discuss them elaborately. The first model we have performed is the LR and the second one is SVM.

4.1 Experiment 1

Experiment 1 is based on the Linear Regression model. After building those models we measure the performance through several evaluation metrics.

Table 4.1: Result of Linear Regression

Evaluation Metrics	Linear Regression
Coefficient	[-0.41282793, 0.00075782, -0.71960378, -0.00320168]
Intercept	9.4982
MAE	2.2623
MSE	7.0659
RMSE	2.6581
R2	0.0588
Accuracy	0.0588

In this experiment, we split our dataset into a test and train where we stored 70% data in the training dataset and 30% data in the testing dataset. We passed the dataset into LR and predicted accuracy. But for our dataset, LR does not work well. It results in low accuracy for both the training set and a test set. For the train set, it gives 12% accuracy

and for the test set, it gives only 5%. The ultimate accuracy it gives is 5.884% which is not acceptable. Reg plot is given below in **Figure 4.1**

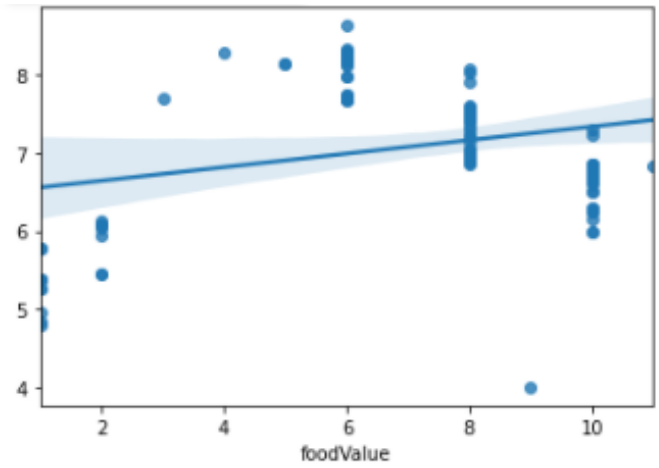


Figure 4.1: Reg Plot of Linear Regression

In the reg-plot we've seen most of the food name is out of the mainline so that's why it doesn't give proper accuracy.

4.2 Experiment 2

Experiment 1 is based on the SVM model. We use the same "food choice" data set to perform the SVM model. So that we can compare the results of these two models. The result we detect from this model is shown below :

Table 4.2: Result of SVM

Evaluation Metrics	Linear Regression
MAE	0.0666
MSE	0.1333
RMSE	0.3651
R2	0.9822
Accuracy	0.9583

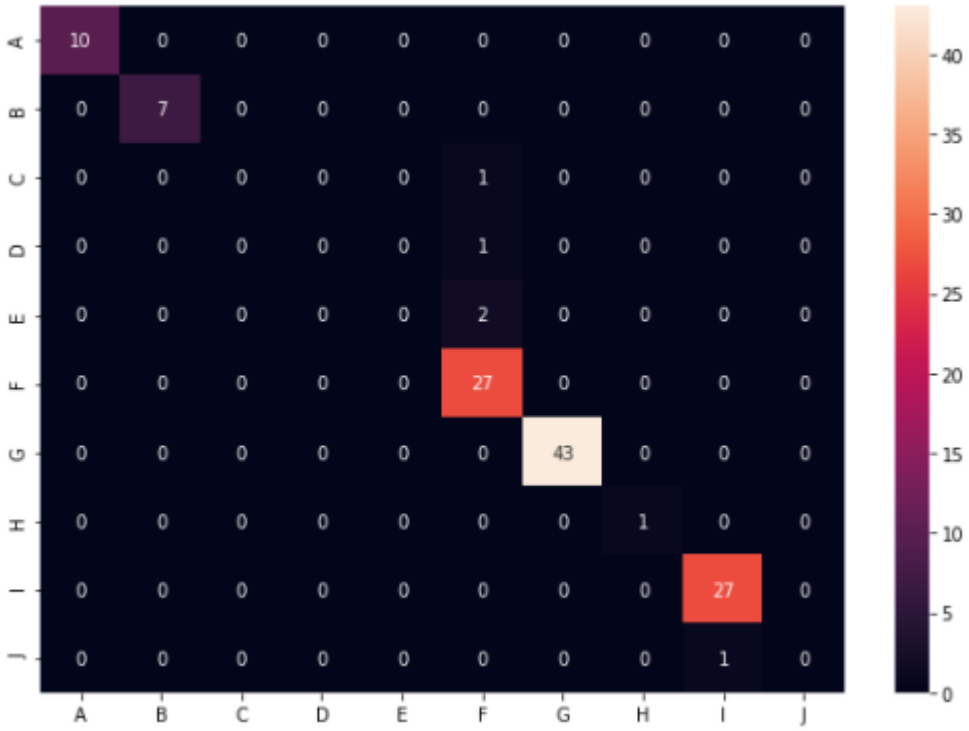


Figure 4.2: Confusion Matrix

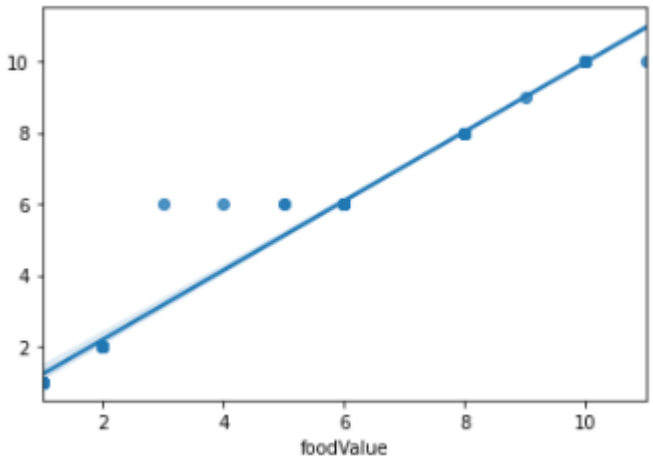


Figure 4.3: Reg Plot of SVM

In SVM we've seen that in the reg-plot most of the food name is around the Hyperplane. We also conducted confusion metrics where the value of G is the highest number of iterations.

Table 4.3: Table of Confusion Matrix

	A	B	C	D	E	F	G	H	I	J
A	10	0	0	0	0	0	0	0	0	0
B	0	7	0	0	0	0	0	0	0	0
C	0	0	0	0	0	1	0	0	0	0
D	0	0	0	0	0	1	0	0	0	0
E	0	0	0	0	0	2	0	0	0	0
F	0	0	0	0	0	27	0	0	0	0
G	0	0	0	0	0	0	43	0	0	0
H	0	0	0	0	0	0	0	1	0	0
I	0	0	0	0	0	0	0	0	27	0
J	0	0	0	0	0	0	0	0	1	0

4.3 Comparison between experiments

We've used Linear Regression and Support Vector Machine algorithms to predict the comfort food preferences of a student based on their emotional state. From the accuracy we get from both algorithms, we have come to the result that SVM works better than LR when we are working with multiple categorical values. Even in the plots, we can see that in SVM the data points are closer to the hyperplane wherein linear regression the data (comfort_foods) are not within the limit of the mainline. And we are aware of this, if the data points are not closer to the mainline it means there are errors and the model is not surviving well. That's why SVM gives us 95.833% accuracy where LR gives us 5.884% accuracy which is very low.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Findings and Contributions

In this study, we begin with a raw unclean dataset. We performed 4 different data pre-processing techniques to make the dataset scrubbed, optimum, well-ordered. We selected 5 key features to work on for this study. As there is no work done before with the dataset, and all the other work similar to this study was survey-based. There was no study where they used any machine learning model. We accomplished the LR model in this study along with data analysis so that we can predict the comfort food of the students when they are sad, stressed, happy, and so on. food and human emotions are interconnected. In our study, we have found the preferred food of a student in a particular emotional state. We performed two machine learning models. Between Experiment 1 and Experiment 2, we compared the result to determine which one is more efficient. In Experiment 1 we get only 5.88% accuracy where in Experiment 2 we get 95.83% accuracy.

5.2 Recommendations for Future Works

There are a few limitations of this study that should be considered when appraising our findings. One of them is that with the dataset as the dataset was raw and fuzzy. As this dataset is based on students so GPA may play an extensive role in a student's life. That's why in the future we will work on how low or good GPA affects a student's emotional state and what kind of food they prefer in that circumstance. We will also work with how this overeating habit can cause health issues like diabetics, heart disease, and many

more, and what kind of food is causing this problem. We will try to perform different models of machine learning so that we can decide which one works better in this study.

References

Bansal, A. (2019, April 28). *Need for Feature Engineering in Machine Learning.* Retrieved from towardsdatascience.com: https://towardsdatascience.com/need-for-feature-engineering-in-machine-learning-897df2ed00e6

Cortes, C., & Vapnik, V. (1995, February 20). Support-vector networks.*springer.com*.

Food choices. (2016). Retrieved from kaggle.com:https://www.kaggle.com/borapajo/food-choices

Frayn, M., Sears, C. R., & Ranson, ,. M. (2016, May 4). A sad mood increases attention to unhealthy food images in women with food addiction. *100*, 55-63.

Frost, J. (n.d.). *Regression coefficients.* Retrieved from statisticsbyjim.com: https://statisticsbyjim.com/glossary/regression-coefficient/

Gandhi, R. (2018, May 27). *Introduction to Machine Learning Algorithms: Linear Regression.* Retrieved from towards data science: https://towardsdatascience.com/introduction-to-machine-learning-algorithms-linear-regression-14c4e325882a

Kuhn, M., & Johnson, K. (2018). *Applied Predictive Modeling* (1st ed. 2013, Corr. 2nd printing 2018 ed.). Springer New York.

Ouwens, M. A., Strien, T. V., Leeuwe, J. V., & Staak, C. v. (2009). The dual pathway model of overeating. Replication and extension with actual food consumption. 234-237.

Striena,b, T. v., Gibsonc, E. L., Bañosd, R., Cebollad,e, A., & Winkensf, L. H. (2019, Augest 31). Is comfort food actually comforting for emotional eaters? A (moderated) mediation analysis. *211*. Retrieved from http://www.sciencedirect.com/science/article/pii/S0031938419301787

T. H., & Forestell, C. A. (2020, October 11). Mindfulness, Mood, and Food: The Mediating Role of Positive Affect. *158*. Retrieved from http://www.sciencedirect.com/science/article/pii/S0195666320316238

Tuomisto, T., Hetherington, M. M., Morris, M.-F., Tuomisto, M. T., Turjanmaa, V., & Lappalainen, R. (n.d.). Psychological and physiological characteristics of sweet food “addiction”. *25*(2), 169-175.

Understanding Regression Error Metrics in Python. (2016, September 26). Retrieved from dataquest.io: https://www.dataquest.io/blog/understanding-regression-error-metrics/

Vanessa, E. L., Keryn , P. E., & Cheryl , P. L. (2016). Perceived stress and dietary choices: The moderating role of stress management. *22*, 211-216. doi:https://doi.org/10.1016/j.eatbeh.2016.06.008

Wansink*, B., Cheney, M. M., & Chan, N. (2003, May 28). Exploring comfort food preferences across age and gender. *79*(4-5), 739-747. Retrieved from http://www.sciencedirect.com/science/article/pii/S0031938403002038

Appendix – A

Parameters of Food choices Data Set

Name	Description
Gender	Numerical Value, Gender of the Students (1 → Female, 2 → Male)
calories_scone	Numerical value, daily calorie count
comfort_food	Categorical Value (chips, chocolate, pizza, ice cream, pasta, fried chicken, cake, soup, cheese, burger, popcorn, wings, milkshake, nuggets, and so on)
comfort_food_reasons	Numerical value (stressed - 1, boredom - 2, sadness - 3, anger - 4, happiness - 5, depressed - 6)
weight	Numerical Value (weight of the students in pounds)

Appendix – B

List of Abbreviation

LR - Linear Regression

SVM - Support Machine Vector

MAE- mean absolute error

MSE- Mean Squared Error

RMSE - Root Mean Square Error

RAE - Relative Absolute Error

RSE - Relative Squared Error

Appendix – C

Plagiarism Report

Turnitin Originality Report

Processed on: 31-Jan-2021 13:51 +06
ID: 1498035622
Word Count: 4793
Submitted: 1

171-35-1800 By Nadia Nasrin

Similarity Index	Similarity by Source
17%	Internet Sources: 14% Publications: 6% Student Papers: 11%

3% match (student papers from 20-Jan-2021)
Submitted to Daffodil International University on 2021-01-20

3% match (Internet from 26-Aug-2020)
https://oregonsigmanu.com/online-watch-store/

1% match (Internet from 05-Jun-2020)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/3927/P148856%20%2828_%29.pdf?isAllowed=y&sequence=1

1% match (Internet from 23-Aug-2020)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/3557/P13665%20%2815%25%29.pdf?isAllowed=y&sequence=1

1% match (student papers from 22-May-2017)
Submitted to University College London on 2017-05-22

1% match ()
http://eprints.utem.edu.my/23394/

1% match (publications)
Vanessa L. Errisuriz, Keryn E. Pasch, Cheryl L. Perry. "Perceived stress and dietary choices: The moderating role of stress management", Eating Behaviors, 2016

1% match (Internet from 14-Nov-2020)
https://towardsdatascience.com/introduction-to-machine-learning-algorithms-linear-regression-14c4e325882a?gi=6a1830a7f820

< 1% match (Internet from 08-Dec-2020)
https://machinelearningmastery.com/feature-selection-with-real-and-categorical-data/

< 1% match (Internet from 13-Jul-2020)
https://github.com/ZihengZZH/data-science-IBM

< 1% match (Internet from 13-Nov-2020)
https://towardsdatascience.com/support-vector-machine-introduction-to-machine-learning-algorithms-934a444fca47?gi=2d866ec0dd33

< 1% match (Internet from 12-May-2014)
http://ebiquity.umbc.edu/_file_directory_/papers/213.pdf

< 1% match (publications)
"Recent Advances on Soft Computing and Data Mining", Springer Science and Business Media LLC, 2017

< 1% match (student papers from 08-Apr-2019)
Submitted to School of Economics and Management, Lisbon on 2019-04-08

< 1% match (student papers from 14-Dec-2020)
Submitted to University of Lincoln on 2020-12-14