

**Classification of Health Awareness Level of Pregnant Women Using Machine
Learning Algorithm in Rural Area of Bangladesh**

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This Report Presented in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled “Classify Health Awareness Level of Pregnant Women Using Machine Learning Algorithm in Rural Area of Bangladesh”, submitted by **Salma Akter** and **Md Maruf Ahmed** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **13-09-2022**



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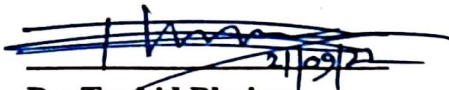
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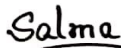
We hereby declare that this project has been done by us under the supervision of **Dr. Touhid Bhuiyan, Head, Department of CSE Daffodil International University**. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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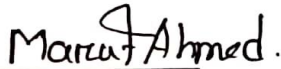


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ABSTRACT

This cross-section study was driven to notice the health awareness level from the nutritional level, hygiene level, and planning level of the pregnant woman in pekua, cox's Bazar in Bangladesh. Though mothers play a fundamental role in the health as well as the quality of life of their children and paying attention to maternal health during pregnancy is very important [1]; only 5% of rural pregnant women receive complete antenatal care and 25% of postnatal care in Bangladesh [2] which is not a good sign for a nation. The proposed model will be able to predict the health awareness level of pregnant women by analyzing their daily life data such as "eating habits", "food-list", "personal hygiene", and "planning knowledge about pre- and post-pregnancy" during their pregnancy. This study period was from June 2022 to July 2022(one month) and took these data from 297 pregnant women by applying some pre-recorded questionnaires. After predicting the level of nutrition, hygiene, and planning, the final health awareness level came out from these three levels. At the nutrition level, noticed their daily eating time with the food lists and supplements that they are taking during pregnancy; labeling each person's condition manually as "good", "average" and "bad" based on the ideal food list for pregnant women [3]. At the hygiene level, noticed whether these women are hygienic or not from some questionnaires like "handwashing before and after taking meal or toilet"; labeling each person's condition manually as "high", "medium" and "low" based on the ideal food list for pregnant women. Personal hygiene is essential during pregnancy. A pregnant woman needs to take care of herself as well as her unborn baby so that infections and illnesses cannot be passed on to the baby due to poor hygiene [4]. Since rural women are not enough educated and not financially strong to maintain all needed hygiene [4], primarily washing hands with soap has been selected to map their hygienic condition. At the planning level, determined that they have post-pre-pregnancy knowledge from some questionnaires "plan for baby feeding", and "plan for birth giving place". Finally, predicted the overall health awareness condition from the predicted levels of nutrition, hygiene, and planning by applying the Machine Learning algorithm (KNN).

Keywords: Pregnant woman, Nutrition Level, Hygiene Level, Planning Level, Health Awareness Level, Machine Learning, Classification, KNN

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CHAPTER 1

Introduction

1.1 Introduction

Nutrition is a necessary and essential thing that plays a vital role in physical and mental health and the pregnant state requires more nutrition than a normal condition [5]. It helps to be stronger, and healthy, repair damaged cells, and improve the immune system and the baby [5]. Taken food is converted into vitamins and nutrition [6]. This research developed a model where “Nutrition level” is predicted by considering the necessary foods they are taking during their pregnancy such as *Grains, nuts-Seed, milk, fish, meat, egg, vegetables, color-vegetable, and iron tablets* that are ideal foods for maintaining the healthy lifestyle during pregnancy [3].

Hygiene is another essential thing for pregnant women. If they cannot maintain hygiene, they will suffer from diseases that are very bad for pregnant women and their babies [4]. Since rural women are not enough educated and not financially strong to maintain all needed hygiene [4], primarily washing hands with soap has been selected to map their hygienic condition. So, washing hands before and after taking a meal, washing hands before eating anything, and washing hands after the toilet are the key points to predicting their “Hygiene level”.

The “Planning level” consists of pre- and post-information about pregnancy. In most developing countries like Bangladesh, most women do not know about this thing and many superstitions about newborn babies and pregnant women [7]. Sometimes unconscious rural women feed newborn babies honey and mustard oil which is very dangerous [8]. Even they do not know what eats a pregnant mother and her baby. At this level, considered some key attributes that are the *newborn feeding plan, after six-month feeding plan, and the plan for birth giving place*.

Why did consider Grains, nuts-Seed, milk, fish, meat, egg, vegetable, color-vegetable, and iron tablets to train the dataset to predict the “Nutrition Level”? These are how very essential sources of nutrition and important for pregnant women, as mentioned in table 1.1 [5]

Table 1.1: List of foods with nutrition

Name of food	Importance of food
Grains	To make body heat
Nut-seed	A great resource of protein, vitamin b, b-complex
milk	A great source of protein, fat, vitamin, mineral, etc.
Fish	A great resource of protein
vegetable	Contains vitamin
Egg	A great resource of protein
Meat	A great resource of protein
Color-vegetable	
Iron-tablet	A great source of iron

1.2 Motivation

Every year many pregnant women have miscarriages and suffer from many types of diseases because of proper nutrition levels, hygiene levels, and planning levels [9]. Even a newborn healthy baby died because of the baby's mother's lack of knowledge about pregnancy [10]. Many mothers in our country die while giving birth to children. One of the reasons behind this is not being aware of their health while they were pregnant [11]. But a pregnant state requires more nutrition and more awareness than a normal condition. If the mother is healthy, the child will be healthy. Moreover, a healthy mother will not be easily affected by various diseases which are more common during pregnancy. That is why this study was driven to develop a model by which a pregnant woman can easily predict her level of awareness and encourage her to be more aware.

1.3 Objective

- Determine the levels of Nutrition, Personal hygiene, and Planning, and thus the scaling of the level of Health awareness of a pregnant woman.
- Developing a standard model for use in various kinds of apps to determine the health conditions of a pregnant woman.

1.4 Research Questions

1. What is the purpose of this research?
2. How were all the data collected?
3. Which algorithm works for this perfectly?
4. How is the accuracy?
5. Does it predict an actual output by given sample data with the system?

The main purpose of this research is to aware people of the importance of maintaining health during the time of pregnancy. This model will help them to check their present

condition. These collected raw data from some NGOs who are working in rural areas in Bangladesh. At first, collected the assessments(hardcopy) from them and then entered the needed data in the CSV file manually. This research has been working on a small area's [Pekua, Cox's Bazar] data for now. Applied the "Decision Tree" algorithm for this model, and it is working perfectly.

Accuracy in Decision Tree algorithm-

- Nutrition Level: 85%
- Hygiene Level: 100%
- Planning Level: 99%
- Health Awareness Level: 80%

Accuracy in KNN-

- Nutrition Level: 93%
- Hygiene Level: 100%
- Planning Level: 99%
- Health Awareness Level: 99%

This model can predict an actual output by giving sample data to the system.

1.5 Expected Outcome

This research developed a model that could classify the Health Awareness Level of pregnant women. For this classification, K nearest Neighbor Algorithm gives a better result than the Decision Tree.

In this model, 80% training data and 20% testing data will give accuracy for-

- Decision Tree: 80%
- KNN: 99%

1.6 Report Layout

Chapter 01: Discussed the inspiration of the study for this model, targets, and what it will produce.

Chapter 02: Presented the foundation of this research and reviewed related works, similar investigations, and the extent of the issues with difficulties.

Chapter 03: Discussed the subject of the study, used instruments, Data organizing procedure, model implementation, and statistical analysis.

Chapter 04: Presented the experimental result, analysis, and find-out summary.

Chapter 05: Discussed the impact of this research on society, ethics, and its suitability.

Chapter 06: Discussed the summary of the output, conclusion, and further study process.

CHAPTER 2

Background

2.1 Introduction

Foods are very important for all. Because it provides nutrition that makes healthy, strong, and energetic. But in a developing country like Bangladesh, most people do not know the right diet plan. To a report on ADB in 2019 in Bangladesh, 20.5% of the population lived below the poverty level. Now this rate is decreased to 18.54% [12]. Another report from UNICEF 22.6% of girls is malnourished [13]. It is a very bad sign for women who give birth to newborn babies. The mother and the baby suffer from nutrition. To provide a balanced diet pregnant women become healthy and stronger, and it is also good for their babies.

On the other hand, Hygiene is also important for pregnant women. Because if pregnant women are ok, so babies are ok. maintain hygiene levels pregnant women should wash hands after and before eating and after to the toilet.

Planning level, most women are not properly educated. Worldwide adolescents lower than 20 years are riskier and die during pregnancy more than twice. Under 15 years die during pregnancy 5 times [14].

2.2 Related Works

There is much research that has been done on pregnant women's health. Some are worldwide, some are selected areas. Fallah and F. studied the effects of nutrition education on levels of nutritional awareness of pregnant women in Western Iran [15]. Gaszyńska and E. studied the oral health of pregnant women in Poland [16].

Chowdhury, H. A., Ahmed found the Factors among pregnant women's maternal anemia in Dhaka city [17].

Their practices, and beliefs during pregnancy in the slums of Dhaka city Bangladesh. Some research was on what makes pregnant women sick in a garment factory in Bangladesh, education knowledge, and the evolution of pregnancy of women in an urban community in rangpur. Pregnancy-related health status and their factors in rural pregnant women in Bangladesh. Women and children's nutrition in Bangladesh.

This study proposed a model by which a pregnant woman could check her primary condition of awareness level about her own health despite her little education skill.

2.3 Research Summary

Determining the awareness of pregnant women is the focus of this survey. Found that we use some key points nutrition level, hygiene level, and planning level. The nutrition, level finds the nutrition of foods like grains, dal, meat, and fish that the pregnant women are eating. Also, iron tablet which is more necessary for pregnant women.

In hygiene level finding the washing hand after eating a meal and after toilet. Having a healthy hygiene level is very important.

At the planning level finding what they must eat for their babies after birth, and what they have to eat after 6 months of the baby and giving birthplace.

Here from the dataset, found these class levels using SVL (supervised machine learning).

Decision tree: - Decision tree flowchart-like structure where each internal node Show the test on the feature and the leaf node shows the class level and branches show conjunctions of the feature.

KNN: -nearest neighbor is an algorithm which use to determine what group the data point is in by checking the data points around it. In the KNN algorithm at first, we must select the value of K and then short down the value in ascending order using Euclidian distance. After that select the same number of values of K and compare the value with each other if any value has the largest count, then it is the predicted value.

Naïve Bayes: The probability of the first event based on the other event is equal to the second event given by the first event multiplied by the first event.

2.4 Scope of the Problem

The main reason for our project is to determine the nutrition level of different food like grains, meat, nut-seed, and so on so that all the women can know what they must eat during a certain period. most women do not the nutrition level of this food. So, from this, they can know about the proper nutrition diet. Women can also understand by taking this food makes them stronger, and healthy.

Women can also know hygiene things. if they lead their life with hygiene, they can protect the self from many diseases that are bad for the babies.

Not only hygiene level but also planning level. women can make decisions about their children's birthplace, after birth feeding, and after six-month latter feeding.

2.5 Challenges

It is very tough for us to collect the data set. if the data set is not collected properly the predicted results will not be in work properly. Because prediction depends on the dataset. to collect this data we must go outside of Dhaka and stay there for one day. after that, we must set the data in the dataset approximately.

The aim of this project is to determine the awareness level of pregnant women through nutrition, hygiene, and planning level. to make the dataset we are facing some problems. how to set this huge data to the data set from start to. which things and key points we need to find out the proper output.

Another challenge is to predict this dataset using a different type of algorithm.

Which algorithm is used to get the proper result? to collect the code for the algorithm. find the problem and solve the problem. we are facing a big problem in training and tasting the data and converting the data from string to number.

CHAPTER 3

Materials and Methodology

3.1 Introduction

Research methodology refers to the way of explaining how the researchers intend to carry out their research which is a logical and systematic plan to resolve the research problem. It ensures reliable, valid results that address their aims and objectives [18].

This study period was from June 2022 to July 2022(one month) and took these data from 297 pregnant women by applying some pre-recorded questionnaires. After predicting the level of nutrition, hygiene, and planning, the final health awareness level came out from these three levels. At the nutrition level, noticed their daily eating time with the food lists and supplements that they are taking during pregnancy; labeling each person's condition manually as "good", "average" and "bad" based on the ideal food list for pregnant women [3]. At the hygiene level, noticed whether these women are hygienic or not from some questionnaires like "handwashing before and after taking meal or toilet"; labeling each person's condition manually as "high", "medium" and "low" based on the ideal food list for pregnant women. Personal hygiene is essential during pregnancy. A pregnant woman needs to take care of herself as well as her unborn baby so that infections and illnesses cannot be passed on to the baby due to poor hygiene [4]. Since rural women are not enough educated and not financially strong to maintain all needed hygiene [4], primarily washing hands with soap has been selected to map their hygienic condition. At the planning level, determined that they have post-pre-pregnancy knowledge from some questionnaires "plan for baby feeding", and "plan for birth giving place". Finally, predicted the overall health awareness condition from the predicted levels of nutrition, hygiene, and planning by applying the Machine Learning algorithm Decision Tree Algorithm and KNN.

Data collection procedure to algorithms implementation described in detail including needed instruments, all the phases, and statistical analysis. The whole methodology is shown in figure 3.1

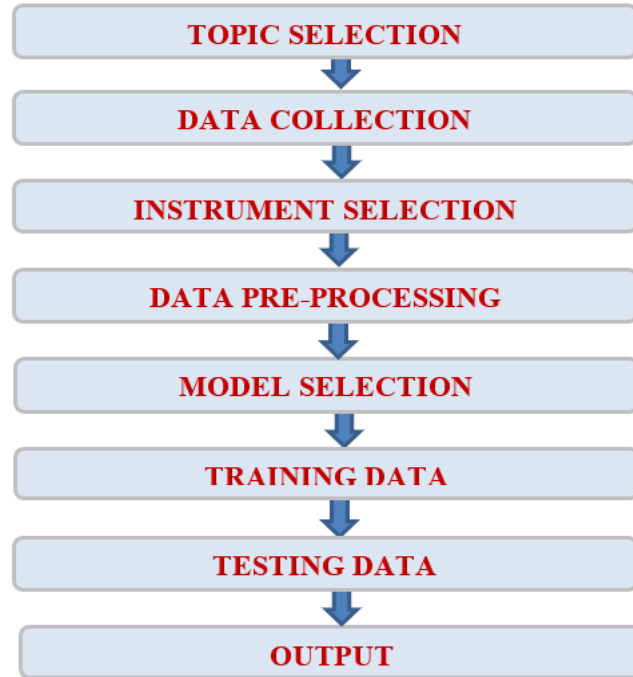


Figure 3.1: Methodology diagram

3.2 Research Subject and Instrumentation

The goal of this thesis is to see an efficient method that would be able to classify the level of health awareness of Pregnant women with better precision and less mistake rate. Classify Health Awareness Level of Pregnant Women is classification-based research with survey data where data is implemented in a machine learning algorithm to predict the class.

This thesis needed some tools that are-

- Microsoft Excel
- Google Collaboratory
- Python v-3.10

➤ ML Algorithm

3.3 Dataset Details

In this thesis, the Total number of collected raw data is 297 and the number of total attributes is 29 where total feature attributes are 25 and class attributes are 4.

From these total attributes, some are used to analyze the percentage or condition, some are used to detect the “Nutrition Level”, some are used to “Hygiene Level”, some are used for “Planning Level” and finally, the health awareness level is detected from these three levels. Selected data samples for “general analysis” are given in Table 3.1 and Selected data samples for “Nutrition Level” are given in Table 3.2 and Selected data samples for “Hygiene Level” are given in Table 3.3 and Selected data samples for “Planning Level” are given in Table 3.4 and Selected data samples for “Health Awareness Level” are given in Table 3.5

Table 3.1: Sample data for general analysis

Attributes	Person1	Person2	Person 55	Person 87
Age	20	26	35	28
The current month of Pregnancy	7	3	4	8
Less Than 2 Years old Child	1	0	0	0
Miss/Abor/Dead/Imma ture	none	Miss	Dead	none
Danger Sign	no	no	yes	no
Mental State	good	bad	average	good
Daily Rest Hour	2	1	2	0.5
Change Eating Habit	stable	decrease	decrease	stable

Table 3.2: Sample data for “Nutrition Level”

Attributes	Person1	Person2	Person 55	Person 87
Daily Eating Time	3	3	2	4
Grains	yes	yes	yes	yes
Dal	yes	yes	no	yes
Nuts and Seed	no	yes	no	no
Milk	yes	yes	yes	no
Fish and Meat	yes	no	no	yes
Egg	yes	yes	no	yes
Green and Vegetables	yes	yes	no	yes
Color Vegetables or Fruit	yes	yes	no	no
IFA tablet	yes	yes	no	no
Nutrition Level	good	good	bad	average

Table 3.3: Sample data for “Hygiene Level”

Attributes	Person1	Person 2	Person 55	Person 87
Handwash Before Prepare Food	yes	yes	yes	no
Handwash After Toilet	yes	no	yes	no
Handwash After Taking Food	yes	yes	yes	no
Hygiene Level	high	medium	high	low

Table 3.4: Sample data for “Planning Level”

Attributes	person1	person 2	person 55	person 87
Newborn Feeding Plan	breast feeding	Don't Know	Honey	mustard Oil

6month Feeding Plan	breast feeding	Don't Know	breast feeding	breast feeding
Birth Giving Place Plan	home	home	home	hospital
Planning Level	good	bad	bad	bad

Table 3.5: Sample data for “Health Awareness Level”

Attributes	person 1	person 2	person 55	person 87
Nutrition Level	good	good	bad	average
Hygiene Level	high	medium	high	low
Planning Level	good	bad	bad	bad
Health Awareness Level	good	medium	low	low

3.4 Data Collection

This thesis worked on primary data that are collected from the local NGO(SARPV) office at Pekua, Cox’s Bazar, Bangladesh. At first, collected the assessments(hardcopy) from them and then entered the needed data in the CSV file manually. This research has been working on a small area’s [Pekua, Cox’s Bazar] data for now. A sample assessment copy is given in figure 3.2.

From figure 3.2, collected primary data in an excel sheet. Then it has been converted to a CSV file and prepared for data preprocessing.

- The null value has been handled as replaced by zero.

3.6 Phase I

The initial stage predicted the “Nutrition level” from selected attributes. Figure 3.5 shows how the dataset has been selected for the Nutrition level. Figure 3.6 shows how the “features” and the “class label” has been selected for the Nutrition level. Figure 3.7 shows how the feature data has been encoded. Figure 3.8 shows how the “NULL VALUE” has been handled for the feature data.

```
# Selecting columns for NutritionLevel
selected_for_nutritionLevel = data_set[['DailyEatingTime', 'Grains', 'Dal', 'NutsSeed',
    'Milk', 'Fish_Meat', 'Egg', 'GreenVgtbles', 'ColourVgtbles_Fruit',
    'IFA_tablet', 'NutritionLevel']]
```

Figure 3.3: Select the dataset for “Nutrition Level”

```
# Extracting features for independent columns and output column
features_name_for_nutritionLevel = ['DailyEatingTime', 'Grains', 'Dal', 'NutsSeed',
    'Milk', 'Fish_Meat', 'Egg', 'GreenVgtbles', 'ColourVgtbles_Fruit',
    'IFA_tablet']
Xn = selected_for_nutritionLevel.iloc[:, 0:10]
yn = selected_for_nutritionLevel.iloc[:, 10:11]
```

Figure 3.4: Select the features and class label for “Nutrition Level”

```

# Label Encoding for categorical data
for col in Xn:
    le = LabelEncoder()
    Xn[col] =le.fit_transform(Xn[col])

Xn = pd.DataFrame(Xn)

```

Figure 3.5: Label Encoding the categorical data of “Nutrition Level”

```

Xn = Xn.fillna(0)

```

Figure 3.6: Handling the NULL value for “Nutrition Level”

3.6.1 Classification using Decision Tree

Figure 3.9 shows how the data has been selected for train and testing. There are 80% is for train and 20% is for testing. After classification, the accuracy and the confusion matrix of this level are shown in Table 3.6

Table 3.6: Confusion Matrix for “Nutrition Level”

Accuracy	85%																
Confusion Matrix	<table border="1"> <thead> <tr> <th>True label \ Predicted label</th> <th>average</th> <th>bad</th> <th>good</th> </tr> </thead> <tbody> <tr> <th>average</th> <td>90</td> <td>2</td> <td>14</td> </tr> <tr> <th>bad</th> <td>10</td> <td>42</td> <td>0</td> </tr> <tr> <th>good</th> <td>5</td> <td>0</td> <td>41</td> </tr> </tbody> </table>	True label \ Predicted label	average	bad	good	average	90	2	14	bad	10	42	0	good	5	0	41
True label \ Predicted label	average	bad	good														
average	90	2	14														
bad	10	42	0														
good	5	0	41														

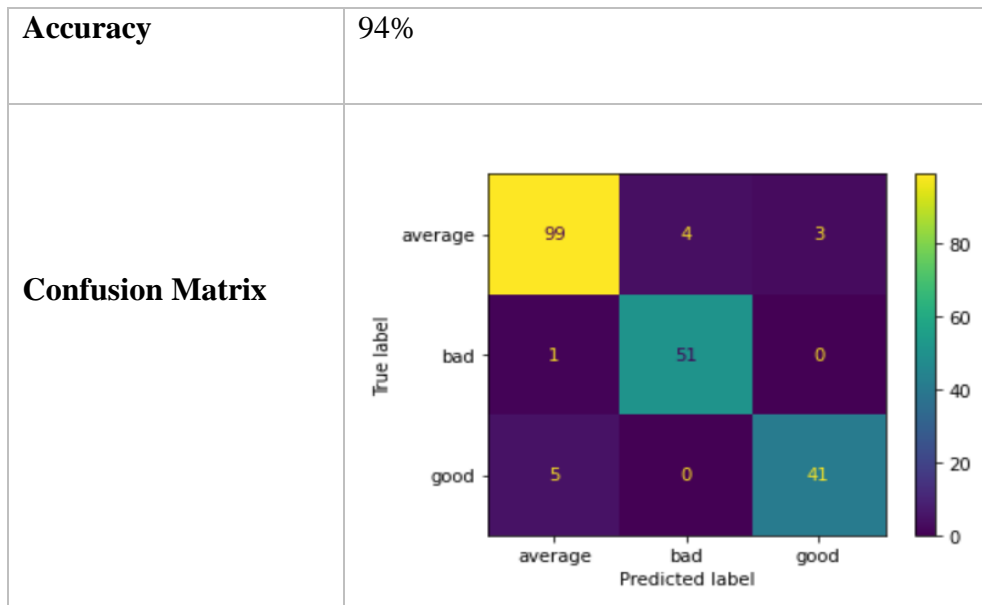
3.6.2 Classification using KNN

KNN requires data normalization, and Figure 3.10 shows how it changed data after normalization. After classification, the accuracy and the confusion matrix of this level are shown in Table 3.7

	0	1	2	3	4	5	6	7	8	9
0	0.666667	0.0	1.0	1.0	0.0	1.0	1.0	1.0	0.0	0.0
1	0.666667	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	1.0
2	0.666667	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	1.0
3	0.666667	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	0.333333	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	0.0
...

Figure 3.7: Normalized data for “Nutrition Level”

Table 3.7: Confusion Matrix for “Nutrition Level”



3.7 Phase II

The second stage predicted the “Hygiene level” from selected attributes. Figure 3.11 shows how the dataset has been selected for the Hygiene level. Figure 3.3.5.2 shows how the “features” and the “class label” has been selected for the Hygiene level. Figure 3.12 shows how the feature data has been encoded. Figure 3.13 shows how the “NULL VALUE” has been handled for the feature data.

```
# Selecting columns for NutritionLevel
selected_for_hygeineLevel = data_set[['HandwashBefore_PrepareFood',
                                       'HandwashAfter_toilet',
                                       'HandwashAfter_TakingFood',
                                       'HygieneLevel']]
```

Figure 3.8: Select the dataset for “Hygiene Level”

```
# Extracting features for independent columns and output column
features_name_for_hygeineLevel = ['HandwashBefore_PrepareFood',
                                   'HandwashAfter_toilet',
                                   'HandwashAfter_TakingFood']
Xh = selected_for_hygeineLevel.iloc[:, 0:3]
yh = selected_for_hygeineLevel.iloc[:, 3:4]
```

Figure 3.9: Select the features and class label for “Hygiene Level”

```

# Label Encoding for categorical data
for col in Xh:
    le = LabelEncoder()
    Xh[col] =le.fit_transform(Xh[col])

Xh = pd.DataFrame(Xh)

```

Figure 3.10: Label Encoding the categorical data of “Hygiene Level”

```

Xn = Xh.fillna(0)

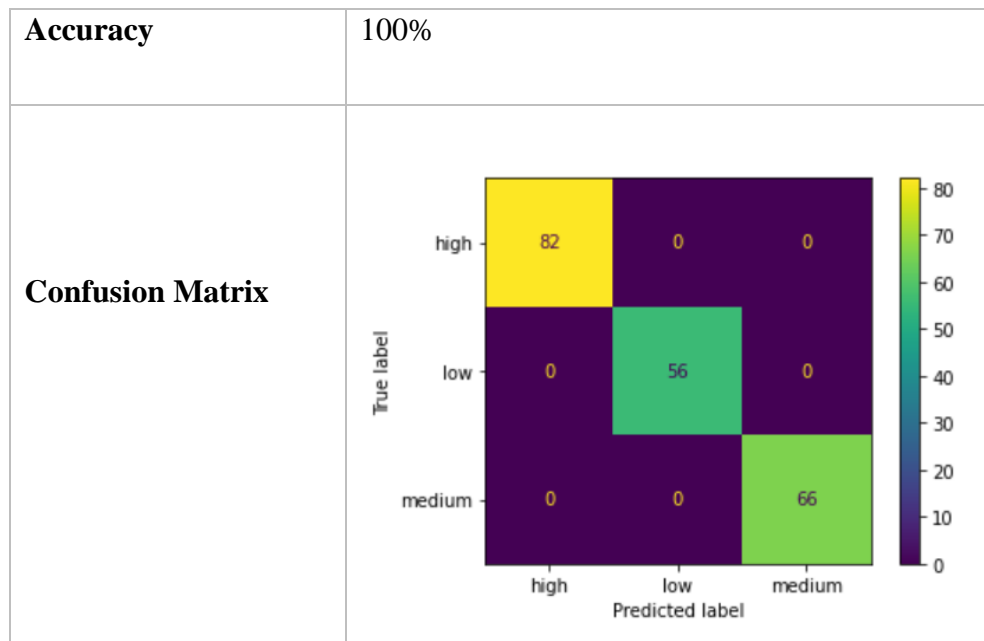
```

Figure 3.11: Handling the NULL value for “Hygiene Level”

3.7.1 Classification using Decision Tree

Figure 3.14 shows how the data has been selected for train and testing. There are 80% is for train and 20% is for testing. After classification, the accuracy and the confusion matrix of this level are shown in Table 3. 8.

Table 3.8: Confusion Matrix for “Hygiene Level”



3.7.2 Classification using KNN

KNN requires data normalization, and Figure 3.15 shows how it changed data after normalization. After classification, the accuracy and the confusion matrix of this level are shown in Table 3.9

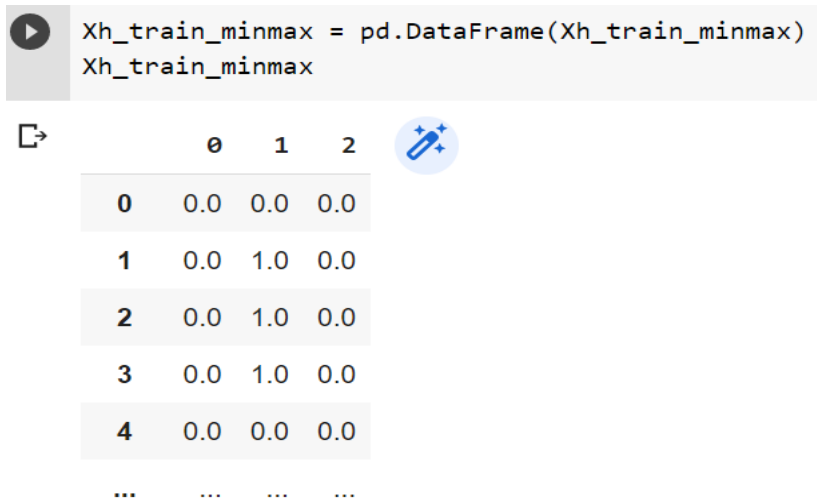
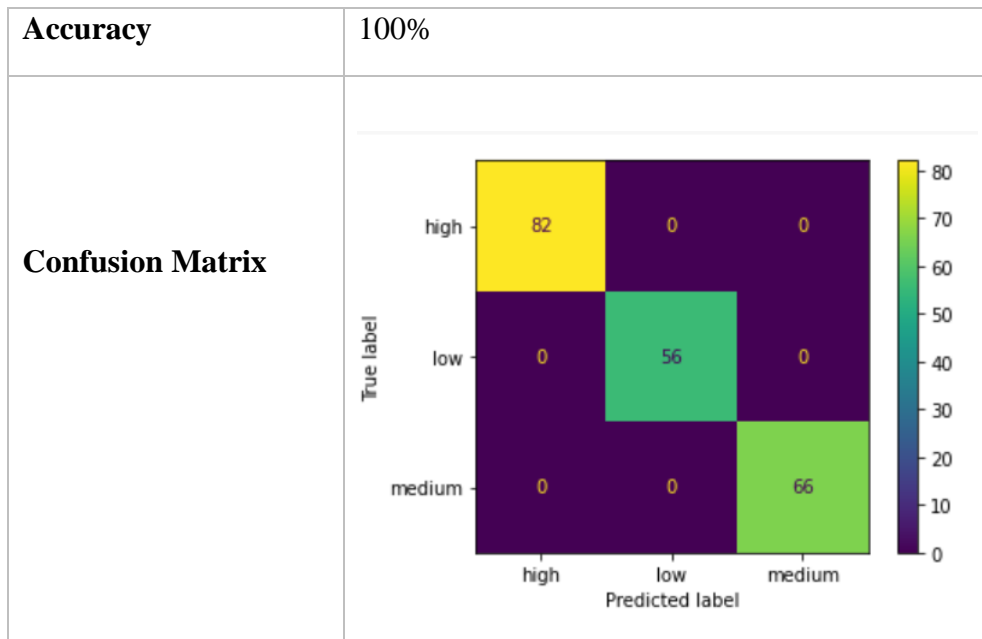


Figure 3.12: Normalized data for “Hygiene Level”

Table 3.9: Confusion Matrix for “Hygiene Level”



3.8 Phase III

The third stage predicted the “Planning level” from selected attributes. Figure 3.16 shows how the dataset has been selected for the Planning level. Figure 3.17 shows how the “features” and the “class label” has been selected for the Planning level. Figure 3.18 shows how the feature data has been encoded. Figure 3.19 shows how the “NULL VALUE” has been handled for the feature data.

```
# Selecting columns for NutritionLevel
selected_for_planningLevel = data_set[['Newborn_FeedingPlan',
                                       '6month_FeedingPlan',
                                       'BirthGiving_PlacePlan',
                                       'PlanningLevel']]
```

Figure 3.13: Select the dataset for “Planning Level”

```
# Extracting features for independent columns and output column
features_name_for_planningLevel = ['Newborn_FeedingPlan',
                                   '6month_FeedingPlan',
                                   'BirthGiving_PlacePlan']
Xp = selected_for_planningLevel.iloc[:, 0:3]
yp = selected_for_planningLevel.iloc[:, 3:4]
```

Figure 3.14: Select the features and class label for “Planning Level”

```

# Label Encoding for categorical data
for col in Xp:
    le = LabelEncoder()
    Xp[col] =le.fit_transform(Xp[col])

Xp = pd.DataFrame(Xp)
# Xp.to_numpy()

```

Figure 3.15: Label Encoding the categorical data of “Planning Level”

```

Xn = Xn.fillna(0)

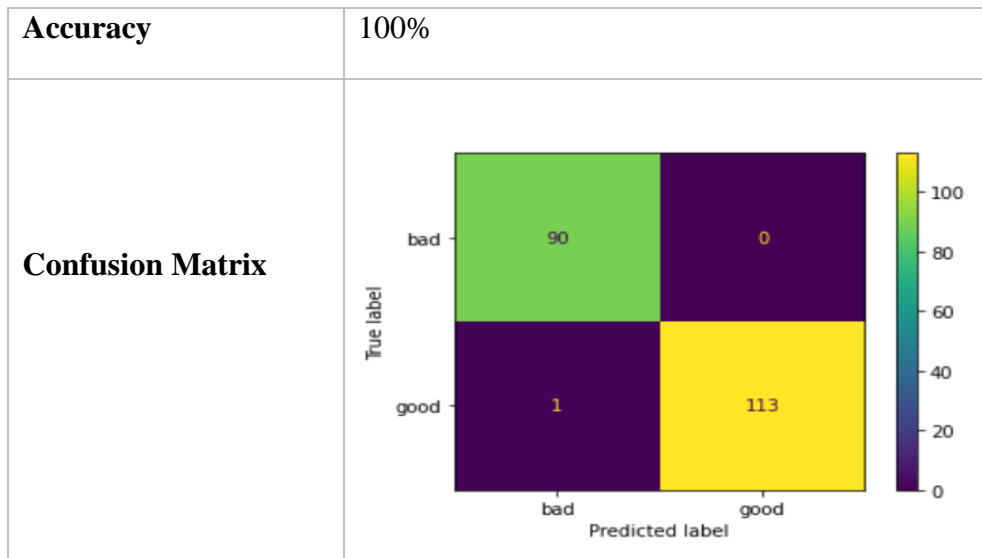
```

Figure 3.16: Handling the NULL value for “Planning Level”

3.8.1 Classification using Decision Tree

Figure 3.20 shows how the data has been selected for train and testing. There are 80% is for train and 20% is for testing. After classification, the accuracy and the confusion matrix of this level are shown in Table 3.10

Table 3.10: Confusion Matrix for “Planning Level”



3.8.2 Classification using KNN

KNN requires data normalization, and Figure 3.21 shows how it changed data after normalization. After classification, the accuracy and the confusion matrix of this level are shown in Table 3.11

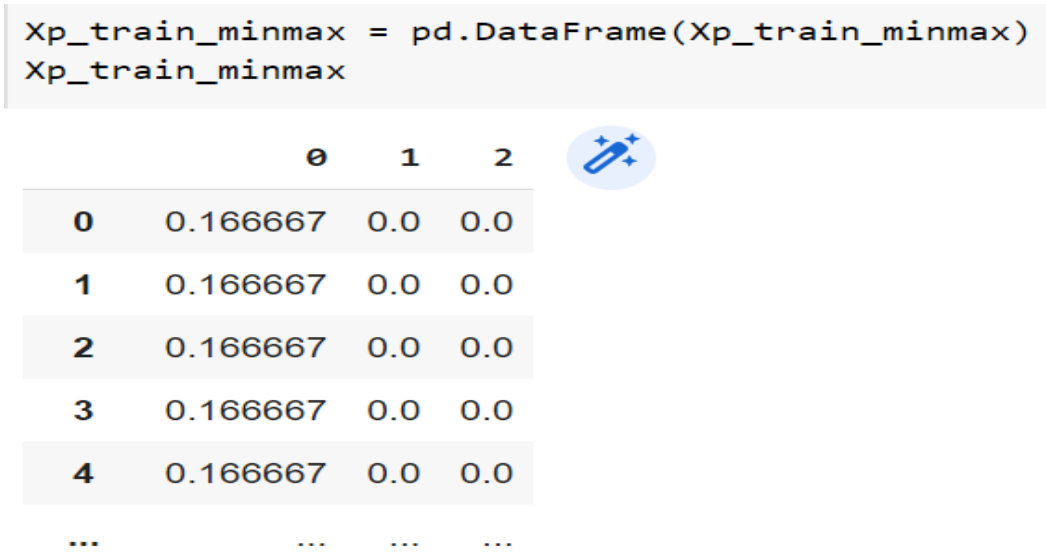
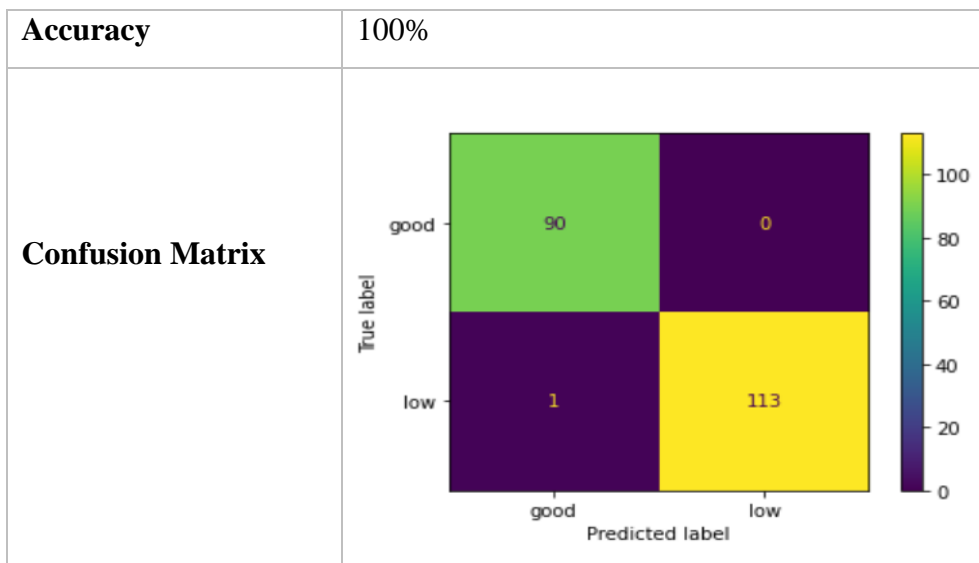


Figure 3.17: Normalized data for “Planning Level”

Table 3.11: Confusion Matrix for “Planning Level”



3.9 Phase IV

The final stage predicted the “Health Awareness level” from selected attributes. Figure 3.22 shows how the dataset has been selected for the Planning level. Figure 3.23 shows how the “features” and the “class label” has been selected for the Health Awareness level. Figure 3.24 shows how the feature data has been encoded. Figure 3.25 shows how the “NULL VALUE” has been handled for the feature data.

```
# Selecting columns for HealthAwarenessLevel
selected_for_healthAwarenessLevel = data_set[[ 'NutritionLevel',
                                               'HygieneLevel',
                                               'PlanningLevel',
                                               'HealthAwarenessLevel']]
```

Figure 3.18: Select the dataset for “Health Awareness Level”

```
# Extracting features for independent columns and output column
features_name_for_healthAwarenessLevel = ['NutritionLevel',
                                           'HygieneLevel',
                                           'PlanningLevel']
X = selected_for_healthAwarenessLevel.iloc[:, 0:3]
y = selected_for_healthAwarenessLevel.iloc[:, 3:4]
```

Figure 3.19: Select the features and class label for “Health Awareness Level”

```

# Label Encoding for categorical data
for col in X:
    le = LabelEncoder()
    X[col] =le.fit_transform(X[col])

X = pd.DataFrame(X)

```

Figure 3.20: Label Encoding the categorical data of “Health Awareness Level”

```

X = X.fillna(0)

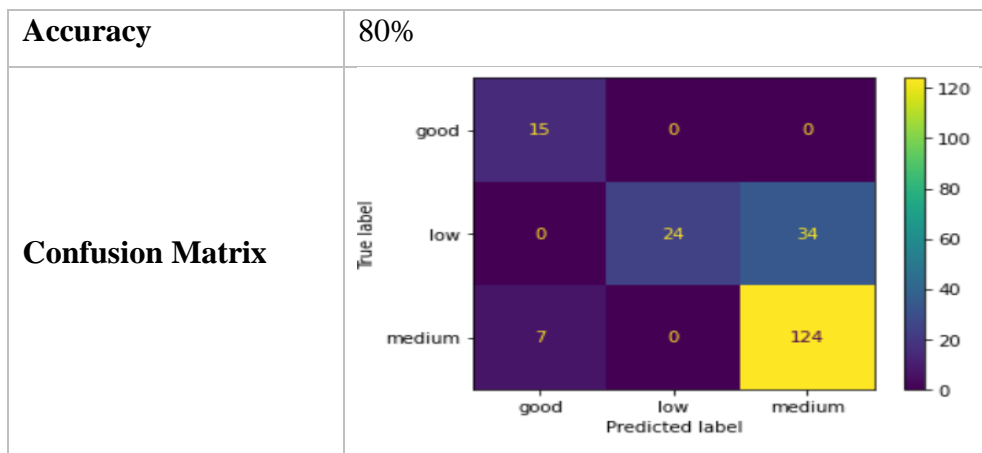
```

Figure 3.21: Handling the NULL value for “Health Awareness Level”

3.9.1 Classification using Decision Tree

Table 3.12 shows how the data has been selected for train and testing. There are 80% is for train and 20% is for testing. After classification, the accuracy and the confusion matrix of this level are shown in Figure 3.26

Table 3.12: Confusion Matrix for “Health Awareness Level



3.9.2 Classification using KNN

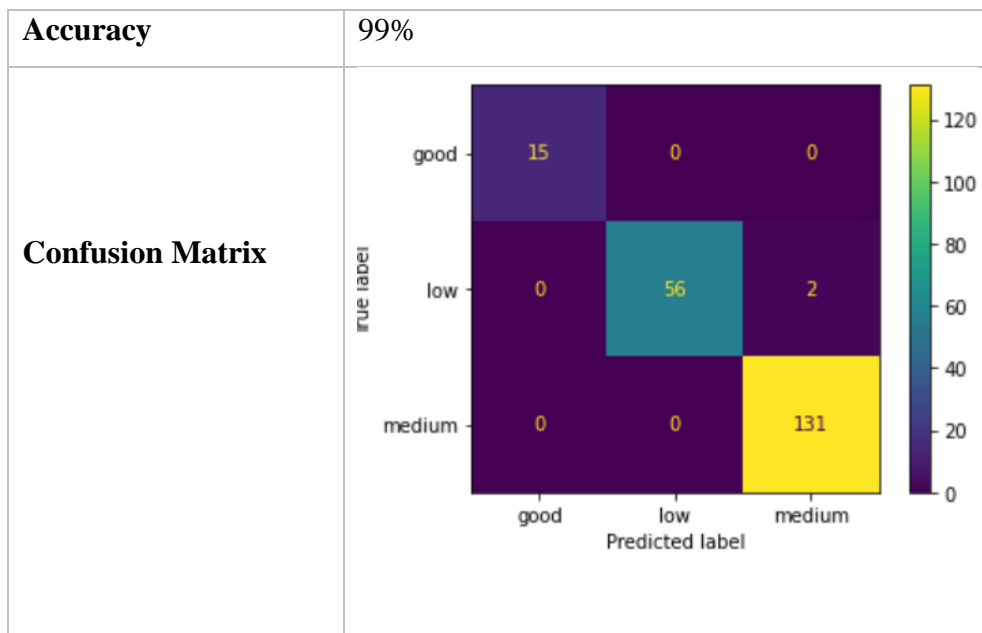
KNN requires data normalization, and Figure 3.22 shows how it changed data after normalization. After classification, the accuracy and the confusion matrix of this level are shown in Table 3.13

```
X_train_minmax = pd.DataFrame(X_train_minmax)
X_train_minmax
```

	0	1	2
0	0.5	0.5	1.0
1	0.0	1.0	1.0
2	0.0	1.0	1.0
3	1.0	1.0	1.0
4	0.0	0.5	1.0
...

Figure 3.22: Normalized data for “Health Awareness Level”

Table 3.13: Confusion Matrix for “Health Awareness Level”



3.10 Visualizing the graph:

Figure 3.23, Figure 3.24, Figure 3.25, and Figure 3.26 show the visual results for the Decision Tree. Figure 3.23, Figure 3.24, Figure 3.25, and Figure 3.26 show the visual results for the KNN.

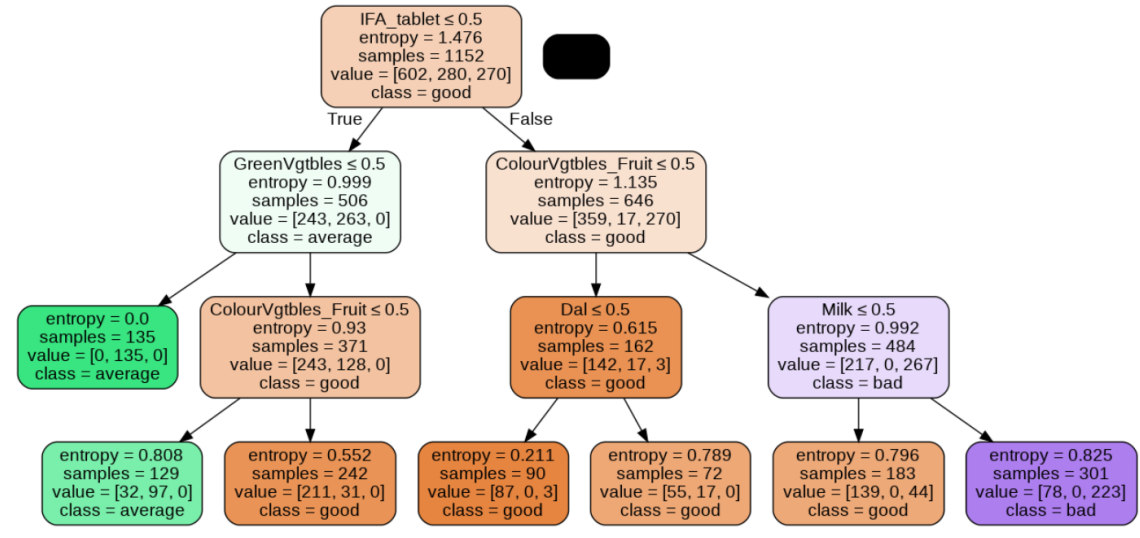


Figure 3.23: Decision Tree visualization for “Nutrition Level”

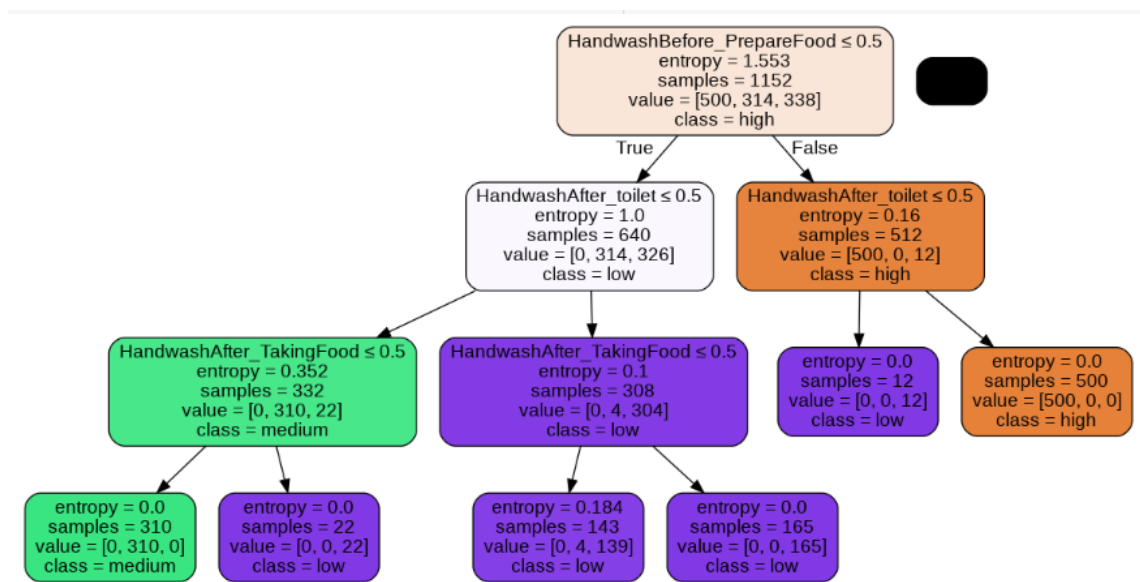


Figure 3.24: Decision Tree visualization for “Hygiene Level”

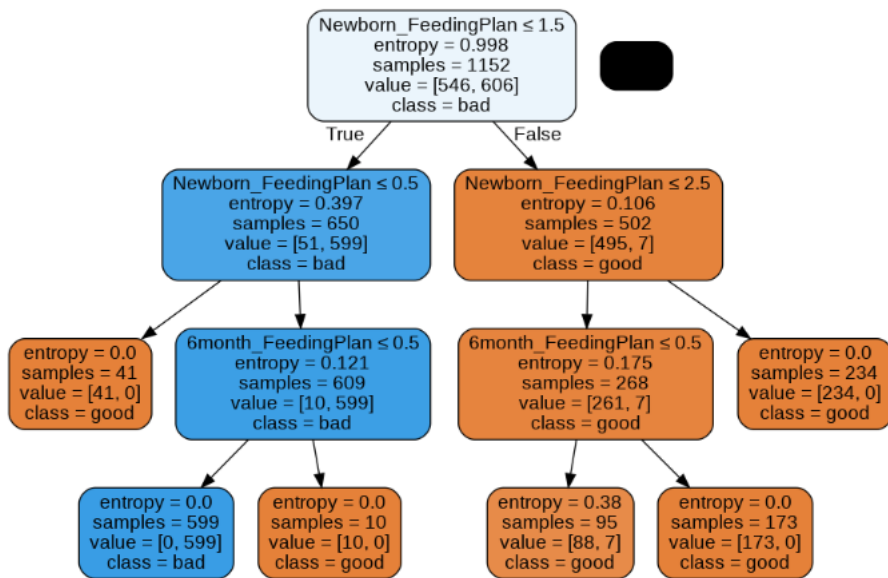


Figure 3.25: Decision Tree visualization for “Planning Level”

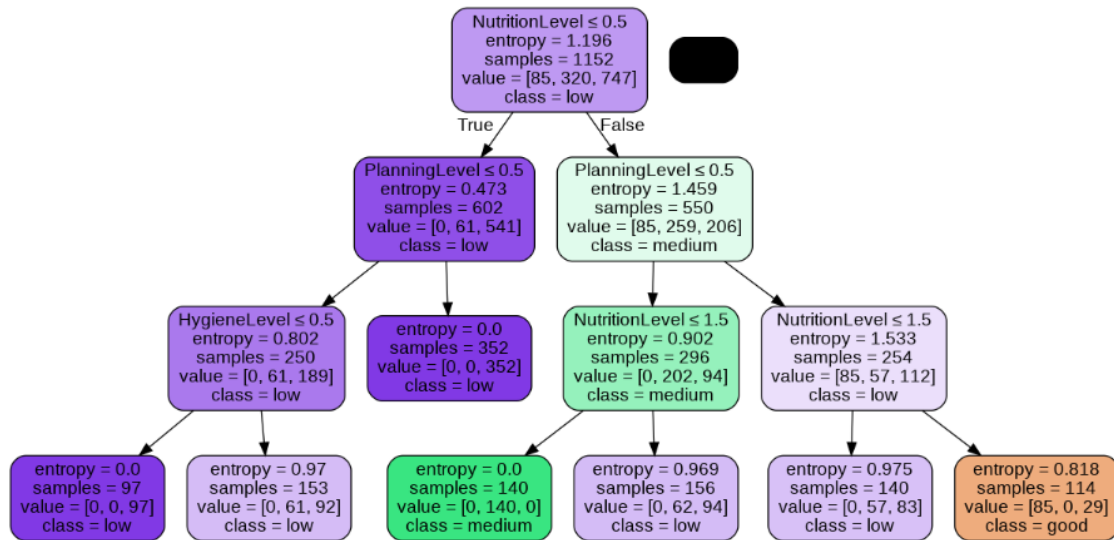
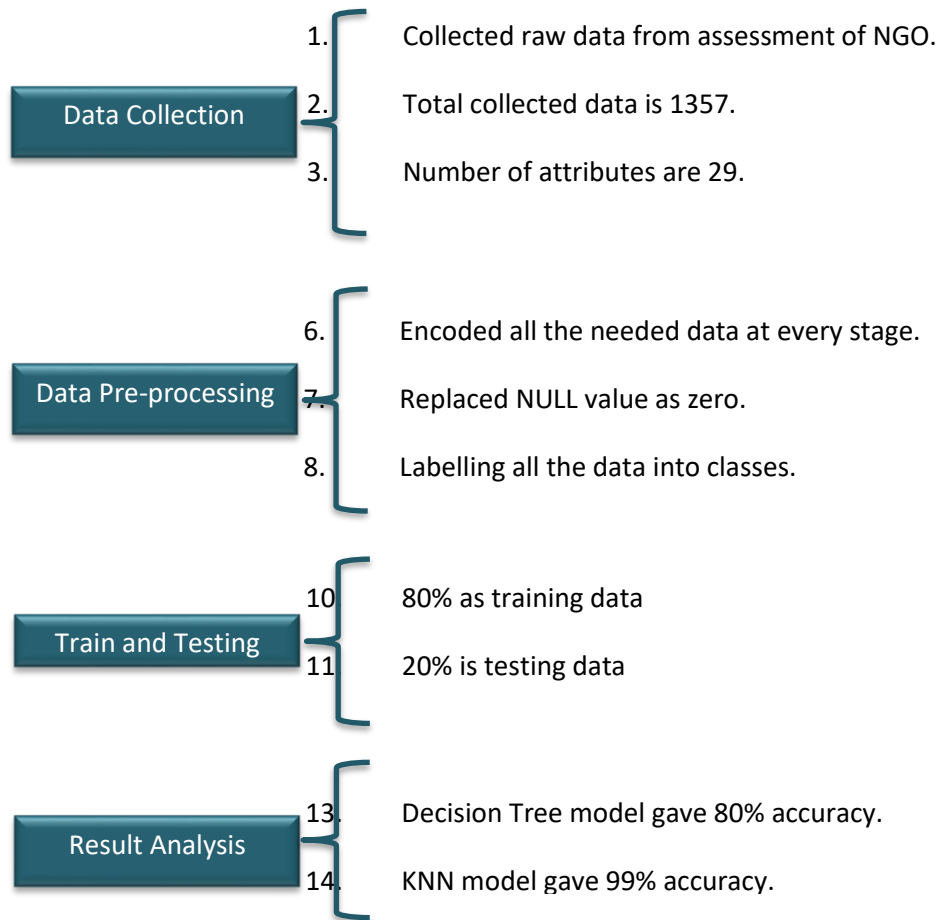


Figure 3.26: Decision Tree visualization for “Health Awareness Level”

3.12 Statistical Analysis

Figure 3.27 shows the overall methods.



CHAPTER 4

Experimental result and discussion

4.1 Experiment Setup

Prepared a model to experiment with the predictions to get the desired result. Figure 4.1 is showing the prediction of the result from the models.

4.2 Experimental Result and Analysis

Table 4.1 shows the experimental results where the result of the four levels for two applied algorithms are different for different accuracy.

Table 4.1: Experimental result analysis

Algorithm Name	Nutrition Level	Hygiene Level	Planning Level	Health Awareness Level	Accuracy
Decision Tree	Input = [[0,1,1,0,1,0,1,0,1,1]] Result = "good"	Input = [[1,0,1]] Result = "medium"	Input = [[1,1,0]] Result = "bad"	Input = [[1,1,1]] Result = "good"	80%
KNN	Input = [[0,1,0,1,1,1,1,0,1,0]] Result = "average"	Input = [[1,1,1]] Result = "high"	Input = [[0,0,0]] Result = "bad"	Input = [[1,1,0]] Result = " average "	99%

4.3 Model Summary

Figure 4.2 shows the working flowchart of this model.

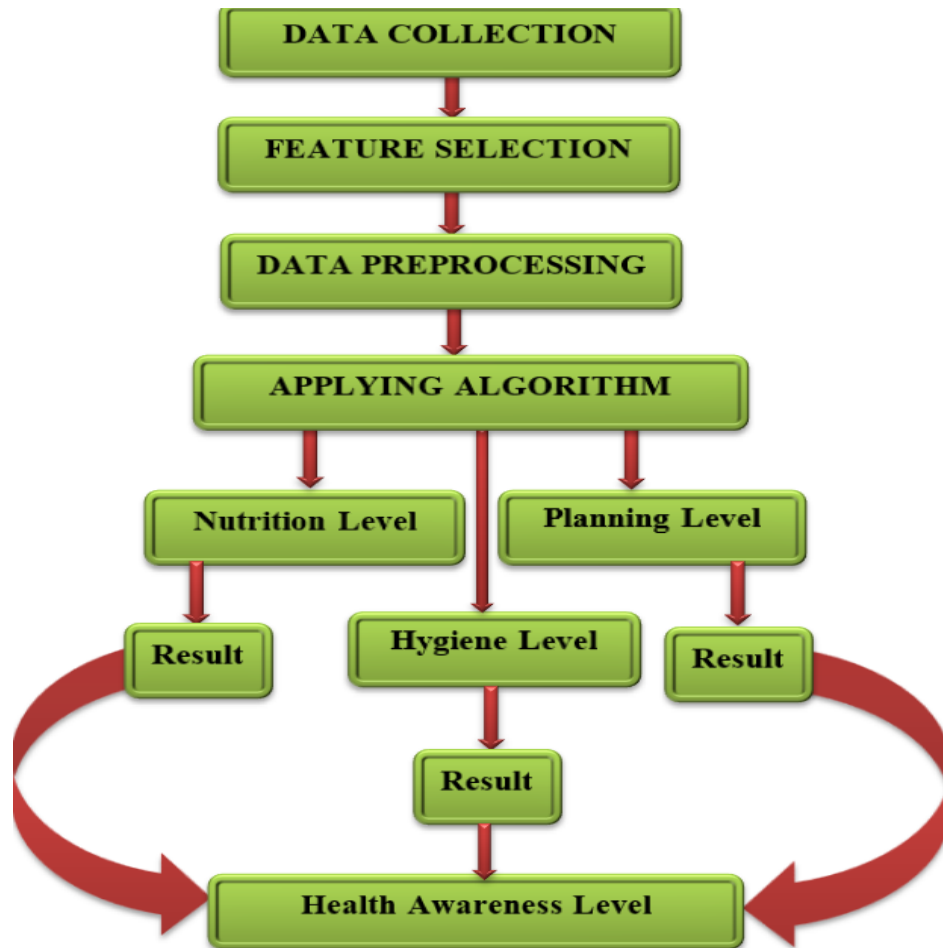


Figure 4.2: Proposed Model Structure

CHAPTER 5

Impact on Society, Environment, and Sustainability

1.1 Impacts on society

This project is to determine awareness level from three key points: nutrition level, hygiene level, and planning level. Pregnancy is a very crucial time for pregnant women and for their children. One of the biggest problems is that malnutrition for pregnant women. Mostly seen in slums in city areas. In this project, there is a nutrition level that shows the proper nutrition level for women. So, it will help these women to maintain the proper diet that is good for their children and for them.

The second one is the hygiene level. Hygiene is necessary for maintaining good health. because to maintain hygiene, it'll batter for pregnant women. In this project, there is a hygiene level that shows how to maintain hygiene during the pregnancy period. The third one is the planning level. Many women in this country do not maintain proper planning. some of them do not know to feed their children after birth and six months after birth. Sometimes it is seen that they give a birth child in slums in unhygienic areas besides medical.

Finally, the awareness level. From these three levels, the awareness level is constructed. If women maintain these levels, women will be safe. So, this project is very impactful for society in many areas and reasons.

1.2 Impacts on the environment

This project has also impacted the environment. it shows the awareness level of pregnant women. Everything in society is an element of the environment. So, women are also an essential element of this environment. Because women give birth the children. Which keeps going this generation. if women are not possible to birth healthy children this has become an environmental Disaster.

Through this project, women will know about their awareness level from a nutrition level, hygiene level, and planning level. From one woman it'll spread to other women. for this project positive intent for women will increase and they will play a vital role in this society. Because a healthy child is a golden child for the future. It is the main plan of our

project to spread women's awareness level by knowing them about the dangerous situation of pregnancy and the helpful effect of nutrition, hygiene, and planning during the pregnancy period.

1.3 Ethical aspects

Ethics are a very important thing in human life. Ethical things increase the beauty of the thing. Otherwise, its own beauty fades into blame or disappears. The ethical aspect of this project is that It spread awareness among women. This project discusses nutrition levels, awareness levels, and hygiene levels. which is very important for pregnant women. The nutrition level, of this project, shows the nutrition elements that are very important for pregnant women .it is making the women healthy, strong, and positive as also the child.

Moreover, in the hygiene section, the project shows how to lead a healthy life during pregnancy. It is very important. Because if women lead a healthy life, it ll better for them. unless they will suffer from many diseases which are bad for the child and for pregnant mothers. Again, the planning level shows how to feed the child, and what thing to feed the child after birth and six months after birth. Also, discuss where women want to birth the baby. So, the main ethic is that make women aware during pregnancy.

1.4 Sustainability plans

Bangladesh is a poor country. The economy of our country is not good, so it is tough to get facilities for all the people in the country. The main reason for the project is to know the situation of pregnancy of Bangladeshi women. Their nutrition level, hygiene level, and planning level. Women can be known about various things during pregnancy. To inform them about this thing they'll take proper care of themselves and their child. The main plan of this project is to make the women aware.

CHAPTER 6

Conclusion and Future Scope

6.1 discussion and conclusion:

The pregnancy period is a sensitive period for a woman. Because in this time, women needed to maintain a proper routine and balanced diet to give birth to a healthy child. This project is to provide pregnant women with health awareness. In this project, from a nutrition level, hygiene level, and planning level finding awareness level. At the nutrition level, discuss what is important for this certain period. At the hygiene, level discussion about the hygiene

The thing that is necessary for women. At the last planning level, discuss women's post and pre-planning during pregnancy. From these levels finding the awareness level of a woman. that if the woman is aware or not.

It is necessary to maintain a good diet, keep healthy, keep awful, have proper exercise, and awareness. That is important for women and society.

6.2 Future Scope

Pregnancy is a very crucial time for a woman. So, it is very necessary to take some proper steps for better health solutions. There are some key points:

1. Appropriate weight gain.
2. Balanced diet
3. Regular exercise
4. Appropriate and timely vitamin and mineral supplementation

Appropriate weight gain: It is very important to maintain a proper weight. If a women's weight is too much it is bad for her children and her. On the other hand, if a woman's weight is very low it is also bad for her children. Because of these two situations, it will be dangerous to give birth to a child.

Balanced diet: All of the above key steps it is also very important to maintain. To maintain a healthy diet humans will be healthy. it is very dangerous if a women take too many calories, her weight will grow soon

And that is a bad sign for pregnant women to gain too much weight. On the other hands if women do not take a minimal diet, their weight will be lost soon. Which is also bad for a woman.

Regular Exercise: Regular exercise keeps a woman healthy both mentally and physically. It makes the women strong to give a healthy child. Again women also prevent many diseases.

Appropriate and timely vitamin and mineral supplementation: Women are facing many vitamin storages during the pregnancy period .so it is very important to take some supplements and vitamins during the pregnancy period. It is very important for a pregnant woman.

APPENDIX

PANDAS: Pandas refers to an open-source library of python that provides high-performance data manipulation and analysis tools. Pandas provided some key features are-

- Data Frame object.
- Data Alignment.
- Integrated handling of missing data.
- Label-based slicing.
- Indexing
- Subsetting of large data sets.

NUMPY: It is also a python library that provides multidimensional array objects.

GOOGLE COLLABORATORY: It allows to use as IDE in the browser where-

- No configuration is required to write and execute the code.
- GPU access is free of charge.
- The sharing process is very easy.

PYTHON V-3.10: Python is an object-oriented high-level programming language for general purposes, and it is an interpreted language.

DECISION TREE: - Decision tree flowchart-like structure where each internal node show the test on feature and leaf node shows the class level and branches show conjunctions of the feature.

KNN: -nearest neighbor is an algorithm which use to determine what group the data point is in by checking the data points around it. In the KNN algorithm at first, we must select the value of K and then short down the value in ascending order using Euclidian distance. after that select the same number of values of K and compare the value with each other if any value has the largest count, then it is the predicted value.

Naïve Bayes: The probability of the first event based on the other event is equal to the second event given by the first event multiplied by the first event.

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