Diabetes Risk Predictions

Data Understanding

Seif Kungulio

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Evaluating Dataset

Data Dictionary

Exploratory Data Analysis

Data Loading

Load the dataset and name it Diabetes.df

```
Diabetes.df <- read.csv("diabetes_health_indicators_BRFSS2015.csv", header = TRUE)
```

Examine the dimension of the data frame

```
dim(Diabetes.df)
```

```
## [1] 253680     22
```

Preview the data frame

```
glimpse(Diabetes.df)
```

```
## Rows: 253,680
## Columns: 22
## $ Diabetes_binary      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0~
## $ HighBP               <dbl> 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 1~
## $ HighChol             <dbl> 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1, 0, 1~
## $ CholCheck            <dbl> 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1~
## $ BMI                  <dbl> 40, 25, 28, 27, 24, 25, 30, 25, 30, 24, 25, 34, 2~
## $ Smoker               <dbl> 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0~
## $ Stroke               <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0~
## $ HeartDiseaseorAttack <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0~
## $ PhysActivity         <dbl> 0, 1, 0, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1, 1~
## $ Fruits               <dbl> 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1~
## $ Veggies              <dbl> 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1~
## $ HvyAlcoholConsump    <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
## $ AnyHealthcare        <dbl> 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1~
```

```
## $ NoDocbcCost          <dbl> 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0~
## $ GenHlth              <dbl> 5, 3, 5, 2, 2, 2, 3, 3, 5, 2, 3, 3, 3, 4, 4, 2, 3~
## $ MentHlth             <dbl> 18, 0, 30, 0, 3, 0, 0, 0, 30, 0, 0, 0, 0, 0, 30, ~
## $ PhysHlth             <dbl> 15, 0, 30, 0, 0, 2, 14, 0, 30, 0, 0, 30, 15, 0, 2~
## $ DiffWalk             <dbl> 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0~
## $ Sex                  <dbl> 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0~
## $ Age                  <dbl> 9, 7, 9, 11, 11, 10, 9, 11, 9, 8, 13, 10, 7, 11, ~
## $ Education            <dbl> 4, 6, 4, 3, 5, 6, 6, 4, 5, 4, 6, 5, 5, 4, 6, 6, 4~
## $ Income               <dbl> 3, 1, 8, 6, 4, 8, 7, 4, 1, 3, 8, 1, 7, 6, 2, 8, 3~
```

Display the first six rows of the data frame

```
head(Diabetes.df)
```

```
##   Diabetes_binary HighBP HighChol CholCheck BMI Smoker Stroke
## 1               0      1        1         1  40      1      0
## 2               0      0        0         0  25      1      0
## 3               0      1        1         1  28      0      0
## 4               0      1        0         1  27      0      0
## 5               0      1        1         1  24      0      0
## 6               0      1        1         1  25      1      0
##   HeartDiseaseorAttack PhysActivity Fruits Veggies HvyAlcoholConsump
## 1                    0            0      0       1                 0
## 2                    0            1      0       0                 0
## 3                    0            0      1       0                 0
## 4                    0            1      1       1                 0
## 5                    0            1      1       1                 0
## 6                    0            1      1       1                 0
##   AnyHealthcare NoDocbcCost GenHlth MentHlth PhysHlth DiffWalk Sex Age
## 1             1           0       5       18       15        1   0   9
## 2             0           1       3        0        0        0   0   7
## 3             1           1       5       30       30        1   0   9
## 4             1           0       2        0        0        0   0  11
## 5             1           0       2        3        0        0   0  11
## 6             1           0       2        0        2        0   1  10
##   Education Income
## 1         4      3
## 2         6      1
## 3         4      8
## 4         3      6
## 5         5      4
## 6         6      8
```

Display the last six rows of the data frame

```
tail(Diabetes.df)
```

```
##        Diabetes_binary HighBP HighChol CholCheck BMI Smoker Stroke
## 253675               0      0        0         1  27      0      0
## 253676               0      1        1         1  45      0      0
## 253677               1      1        1         1  18      0      0
## 253678               0      0        0         1  28      0      0
## 253679               0      1        0         1  23      0      0
```

```
## 253680               1      1        1         1  25      0      0
##        HeartDiseaseorAttack PhysActivity Fruits Veggies HvyAlcoholConsump
## 253675                    0            0      0       1                 0
## 253676                    0            0      1       1                 0
## 253677                    0            0      0       0                 0
## 253678                    0            1      1       0                 0
## 253679                    0            0      1       1                 0
## 253680                    1            1      1       0                 0
##        AnyHealthcare NoDocbcCost GenHlth MentHlth PhysHlth DiffWalk Sex Age
## 253675             1           0       1        0        0        0   0   3
## 253676             1           0       3        0        5        0   1   5
## 253677             1           0       4        0        0        1   0  11
## 253678             1           0       1        0        0        0   0   2
## 253679             1           0       3        0        0        0   1   7
## 253680             1           0       2        0        0        0   0   9
##        Education Income
## 253675         6      5
## 253676         6      7
## 253677         2      4
## 253678         5      2
## 253679         5      1
## 253680         6      2
```

Display the structure of the data frame

```
str(Diabetes.df)
```

```
## 'data.frame':    253680 obs. of  22 variables:
##  $ Diabetes_binary     : num  0 0 0 0 0 0 0 0 1 0 ...
##  $ HighBP              : num  1 0 1 1 1 1 1 1 1 0 ...
##  $ HighChol            : num  1 0 1 0 1 1 0 1 1 0 ...
##  $ CholCheck           : num  1 0 1 1 1 1 1 1 1 1 ...
##  $ BMI                 : num  40 25 28 27 24 25 30 25 30 24 ...
##  $ Smoker              : num  1 1 0 0 0 1 1 1 1 0 ...
##  $ Stroke              : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ HeartDiseaseorAttack: num  0 0 0 0 0 0 0 0 1 0 ...
##  $ PhysActivity        : num  0 1 0 1 1 1 0 1 0 0 ...
##  $ Fruits              : num  0 0 1 1 1 1 0 0 1 0 ...
##  $ Veggies             : num  1 0 0 1 1 1 0 1 1 1 ...
##  $ HvyAlcoholConsump   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ AnyHealthcare       : num  1 0 1 1 1 1 1 1 1 1 ...
##  $ NoDocbcCost         : num  0 1 1 0 0 0 0 0 0 0 ...
##  $ GenHlth             : num  5 3 5 2 2 2 3 3 5 2 ...
##  $ MentHlth            : num  18 0 30 0 3 0 0 0 30 0 ...
##  $ PhysHlth            : num  15 0 30 0 0 2 14 0 30 0 ...
##  $ DiffWalk            : num  1 0 1 0 0 0 0 1 1 0 ...
##  $ Sex                 : num  0 0 0 0 0 1 0 0 0 1 ...
##  $ Age                 : num  9 7 9 11 11 10 9 11 9 8 ...
##  $ Education           : num  4 6 4 3 5 6 6 4 5 4 ...
##  $ Income              : num  3 1 8 6 4 8 7 4 1 3 ...
```

Basic Summary and Structure

Summarize the dataset

```
summary(Diabetes.df)
```

```
##  Diabetes_binary      HighBP         HighChol        CholCheck
##  Min.   :0.0000   Min.   :0.000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.:0.000   1st Qu.:0.0000   1st Qu.:1.0000
##  Median :0.0000   Median :0.000   Median :0.0000   Median :1.0000
##  Mean   :0.1393   Mean   :0.429   Mean   :0.4241   Mean   :0.9627
##  3rd Qu.:0.0000   3rd Qu.:1.000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :1.0000   Max.   :1.000   Max.   :1.0000   Max.   :1.0000
##       BMI            Smoker           Stroke        HeartDiseaseorAttack
##  Min.   :12.00   Min.   :0.0000   Min.   :0.00000   Min.   :0.00000
##  1st Qu.:24.00   1st Qu.:0.0000   1st Qu.:0.00000   1st Qu.:0.00000
##  Median :27.00   Median :0.0000   Median :0.00000   Median :0.00000
##  Mean   :28.38   Mean   :0.4432   Mean   :0.04057   Mean   :0.09419
##  3rd Qu.:31.00   3rd Qu.:1.0000   3rd Qu.:0.00000   3rd Qu.:0.00000
##  Max.   :98.00   Max.   :1.0000   Max.   :1.00000   Max.   :1.00000
##   PhysActivity        Fruits          Veggies       HvyAlcoholConsump
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:1.0000   1st Qu.:0.0000   1st Qu.:1.0000   1st Qu.:0.0000
##  Median :1.0000   Median :1.0000   Median :1.0000   Median :0.0000
##  Mean   :0.7565   Mean   :0.6343   Mean   :0.8114   Mean   :0.0562
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:0.0000
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  AnyHealthcare     NoDocbcCost         GenHlth         MentHlth
##  Min.   :0.0000   Min.   :0.00000   Min.   :1.000   Min.   : 0.000
##  1st Qu.:1.0000   1st Qu.:0.00000   1st Qu.:2.000   1st Qu.: 0.000
##  Median :1.0000   Median :0.00000   Median :2.000   Median : 0.000
##  Mean   :0.9511   Mean   :0.08418   Mean   :2.511   Mean   : 3.185
##  3rd Qu.:1.0000   3rd Qu.:0.00000   3rd Qu.:3.000   3rd Qu.: 2.000
##  Max.   :1.0000   Max.   :1.00000   Max.   :5.000   Max.   :30.000
##     PhysHlth         DiffWalk           Sex              Age
##  Min.   : 0.000   Min.   :0.0000   Min.   :0.0000   Min.   : 1.000
##  1st Qu.: 0.000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.: 6.000
##  Median : 0.000   Median :0.0000   Median :0.0000   Median : 8.000
##  Mean   : 4.242   Mean   :0.1682   Mean   :0.4403   Mean   : 8.032
##  3rd Qu.: 3.000   3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:10.000
##  Max.   :30.000   Max.   :1.0000   Max.   :1.0000   Max.   :13.000
##    Education        Income
##  Min.   :1.00   Min.   :1.000
##  1st Qu.:4.00   1st Qu.:5.000
##  Median :5.00   Median :7.000
##  Mean   :5.05   Mean   :6.054
##  3rd Qu.:6.00   3rd Qu.:8.000
##  Max.   :6.00   Max.   :8.000
```

Skim for extended summary

```
#skim(Diabetes.df)
```

Data Cleaning

Check for Class Imbalance (target Variable)

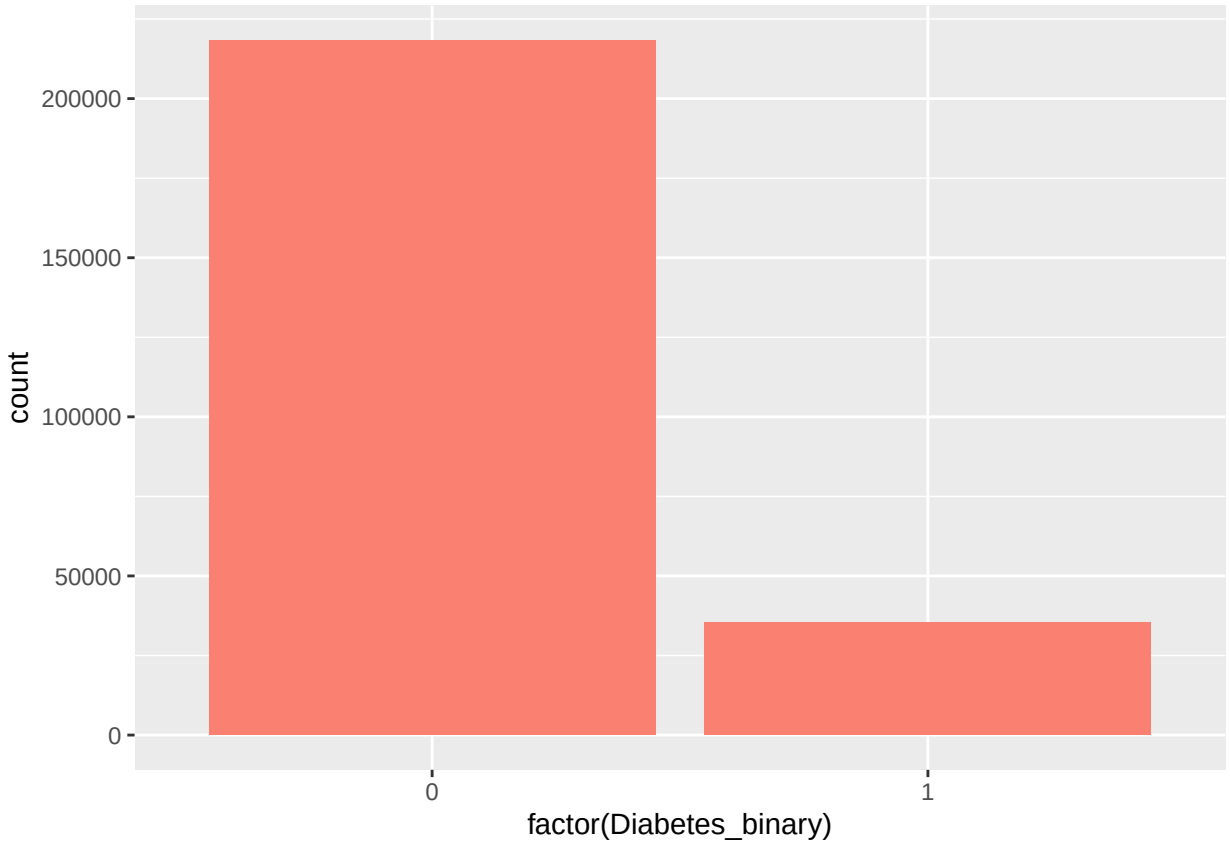
Distribution of diabetes classes

```
Diabetes.df %>%
  count(Diabetes_binary) %>%
  mutate(Percent = round(n / sum(n) * 100, 2))
```

```
##   Diabetes_binary      n Percent
## 1               0 218334   86.07
## 2               1  35346   13.93
```

Plot the distribution

```
ggplot(Diabetes.df,  aes(factor(Diabetes_binary))) +
  geom_bar(fill = "salmon") +
  labs()
```



Check for Missing Values and Data Quality

Check for missing values

```
colSums(is.na(Diabetes.df))
```

```
##      Diabetes_binary               HighBP             HighChol
##                    0                    0                    0
##            CholCheck                  BMI               Smoker
##                    0                    0                    0
##               Stroke HeartDiseaseorAttack         PhysActivity
##                    0                    0                    0
##               Fruits              Veggies    HvyAlcoholConsump
##                    0                    0                    0
##        AnyHealthcare          NoDocbcCost              GenHlth
##                    0                    0                    0
##             MentHlth             PhysHlth             DiffWalk
##                    0                    0                    0
##                  Sex                  Age            Education
##                    0                    0                    0
##               Income
##                    0
```

EDA: Visualizing Data

Univariate Analysis (Numeric Variables)

EDA: Determining Relationship