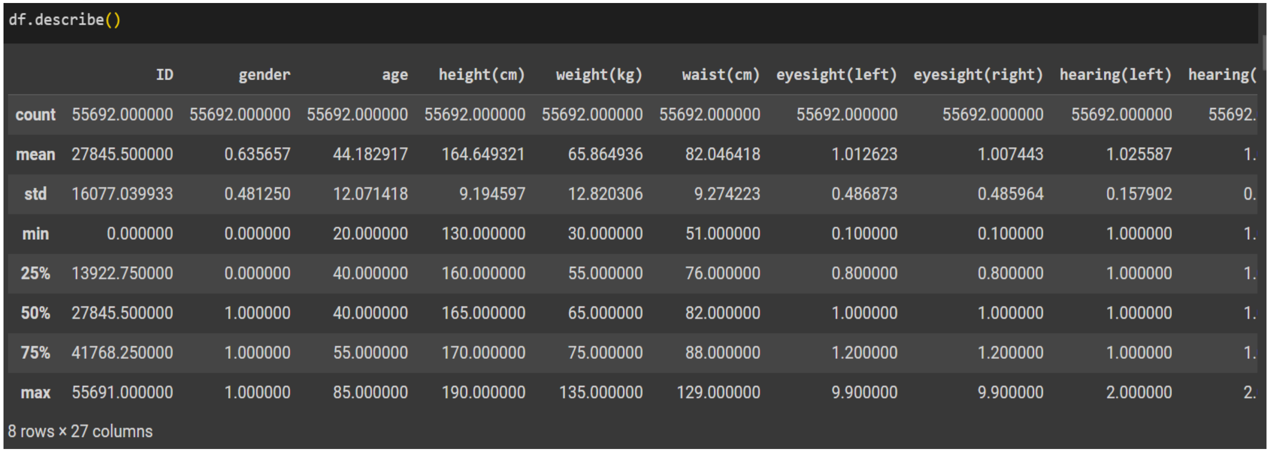
Data Collection and Preprocessing Phase

Date	21 June 2024
Team ID	739680
Project Title	Estimating Presence or Absence of smoking Through Bio Signals
Maximum Marks	6 Marks

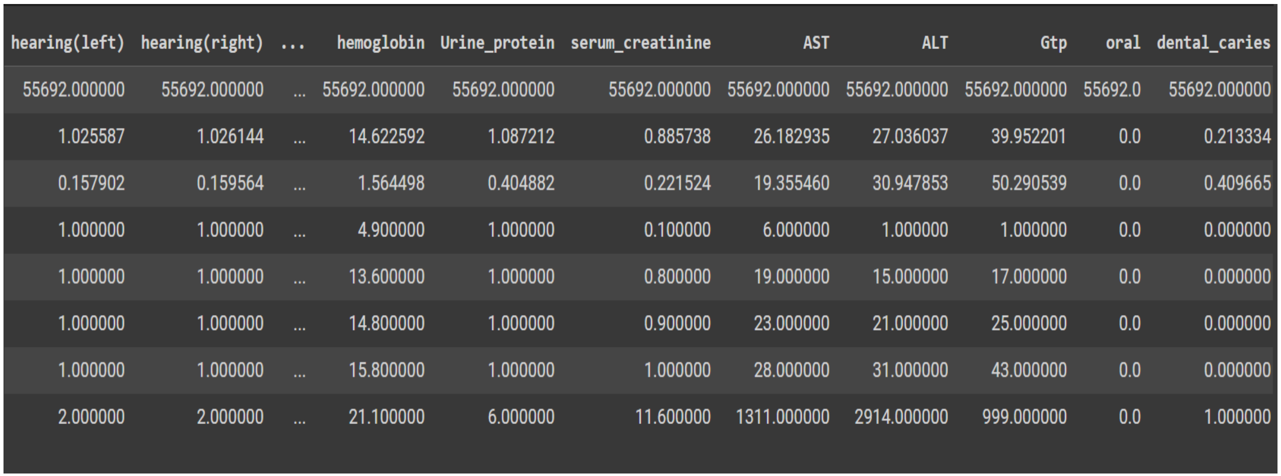
Data Exploration and Preprocessing Report

Effective data exploration and preprocessing are foundational steps in developing a reliable system for estimating smoking behavior using biosignals. By understanding the characteristics of the data, addressing noise and outliers, and extracting meaningful features, the processed data is now ready for further analysis and model development.

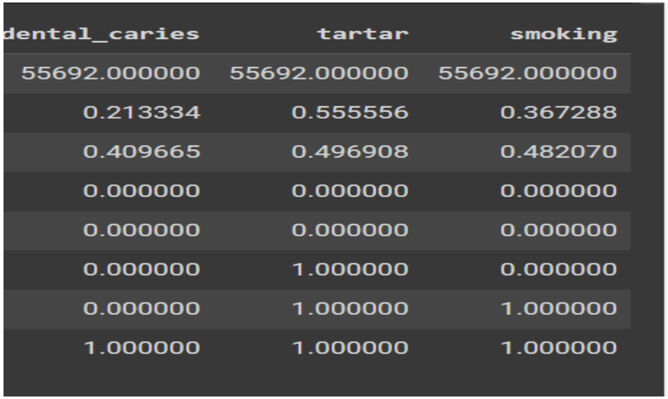
Section	Description
Data Overview	Descriptive statistics: 

```
df.describe()

                 ID        gender           age    height(cm)    weight(kg)     waist(cm)  eyesight(left)  eyesight(right)  hearing(left)  hearing(
count  55692.000000  55692.000000  55692.000000  55692.000000  55692.000000  55692.000000    55692.000000     55692.000000   55692.000000    55692.
mean   27845.500000      0.635657     44.182917    164.649321     65.864936     82.046418        1.012623         1.007443       1.025587        1.
std    16077.039933      0.481250     12.071418      9.194597     12.820306      9.274223        0.486873         0.485964       0.157902        0.
min        0.000000      0.000000     20.000000    130.000000     30.000000     51.000000        0.100000         0.100000       1.000000        1.
25%    13922.750000      0.000000     40.000000    160.000000     55.000000     76.000000        0.800000         0.800000       1.000000        1.
50%    27845.500000      1.000000     40.000000    165.000000     65.000000     82.000000        1.000000         1.000000       1.000000        1.
75%    41768.250000      1.000000     55.000000    170.000000     75.000000     88.000000        1.200000         1.200000       1.000000        1.
max    55691.000000      1.000000     85.000000    190.000000    135.000000    129.000000        9.900000         9.900000       2.000000        2.
8 rows × 27 columns
```

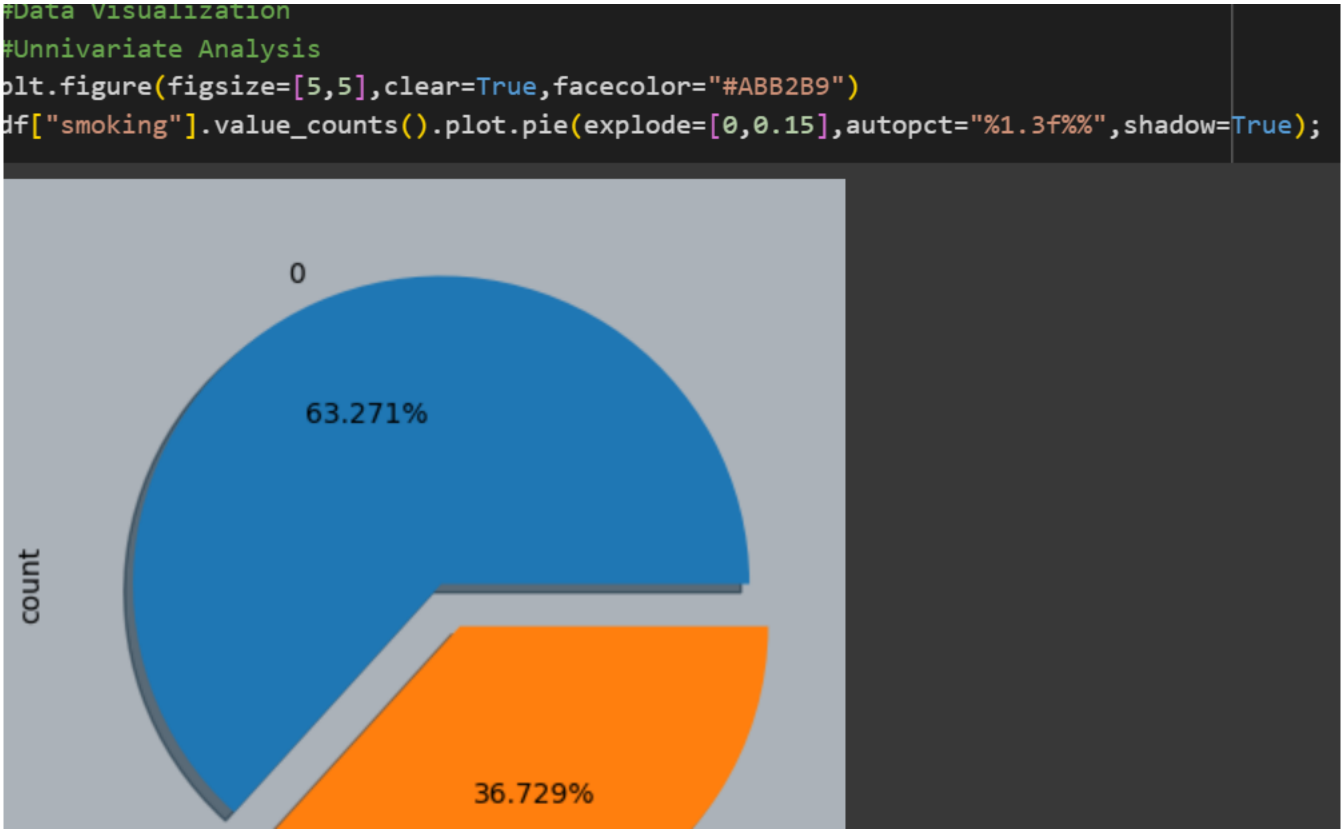


```
hearing(left)  hearing(right)  ...  hemoglobin  Urine_protein  serum_creatinine          AST          ALT          Gtp     oral  dental_caries
 55692.000000    55692.000000  ...  55692.000000  55692.000000     55692.000000  55692.000000  55692.000000  55692.000000  55692.0   55692.000000
     1.025587        1.026144  ...     14.622592      1.087212         0.885738     26.182935     27.036037     39.952201      0.0       0.213334
     0.157902        0.159564  ...      1.564498      0.404882         0.221524     19.355460     30.947853     50.290539      0.0       0.409665
     1.000000        1.000000  ...      4.900000      1.000000         0.100000      6.000000      1.000000      1.000000      0.0       0.000000
     1.000000        1.000000  ...     13.600000      1.000000         0.800000     19.000000     15.000000     17.000000      0.0       0.000000
     1.000000        1.000000  ...     14.800000      1.000000         0.900000     23.000000     21.000000     25.000000      0.0       0.000000
     1.000000        1.000000  ...     15.800000      1.000000         1.000000     28.000000     31.000000     43.000000      0.0       0.000000
     2.000000        2.000000  ...     21.100000      6.000000        11.600000   1311.000000   2914.000000    999.000000      0.0       1.000000
```



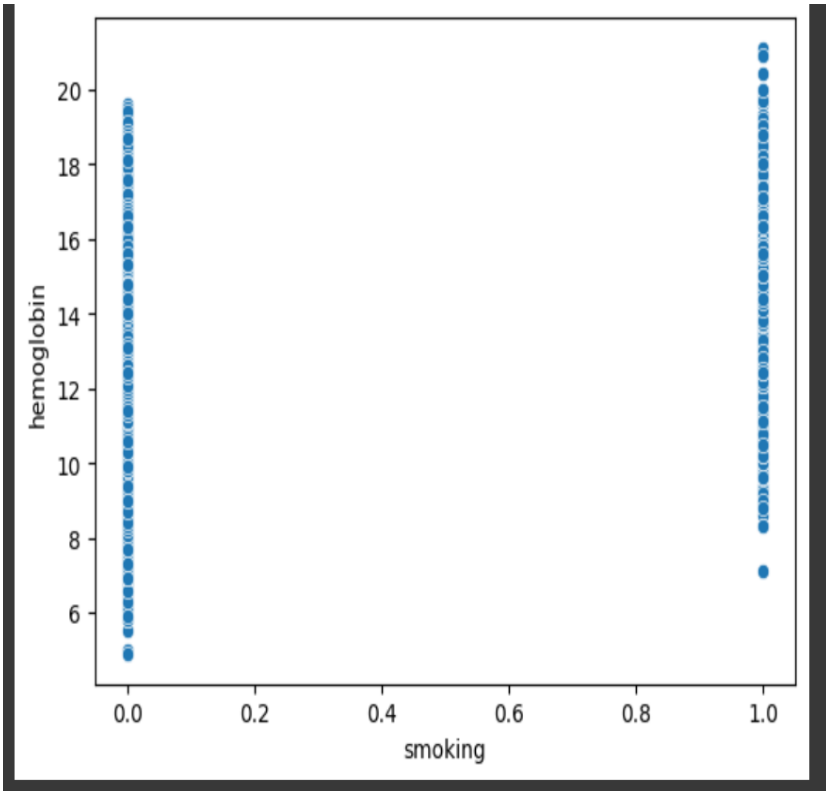
```
dental_caries        tartar       smoking
 55692.000000  55692.000000  55692.000000
     0.213334      0.555556      0.367288
     0.409665      0.496908      0.482070
     0.000000      0.000000      0.000000
     0.000000      0.000000      0.000000
     0.000000      1.000000      0.000000
     0.000000      1.000000      1.000000
     1.000000      1.000000      1.000000
```

<table>
<tr>
<td>Univariate Analysis</td>
<td>



```
#Data Visualization
#Unnivariate Analysis
plt.figure(figsize=[5,5],clear=True,facecolor="#ABB2B9")
df["smoking"].value_counts().plot.pie(explode=[0,0.15],autopct="%1.3f%%",shadow=True);
```

</td>
</tr>
</table>

Bivariate Analysis	
Multivariate Analysis	-

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<td>Outliers and Anomalies</td>
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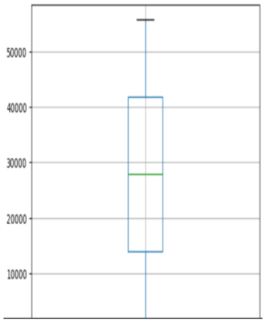

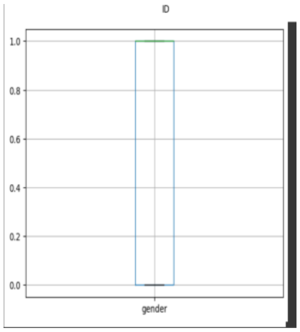

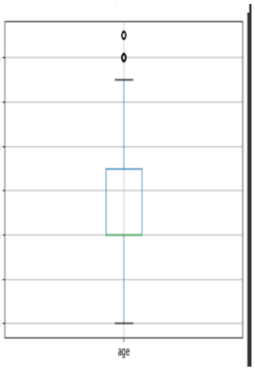

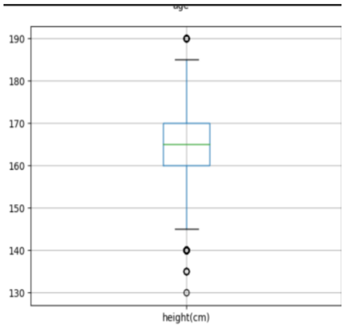

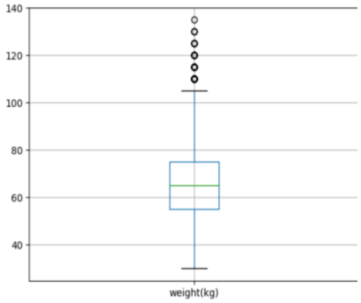

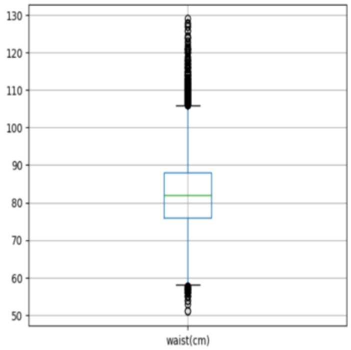

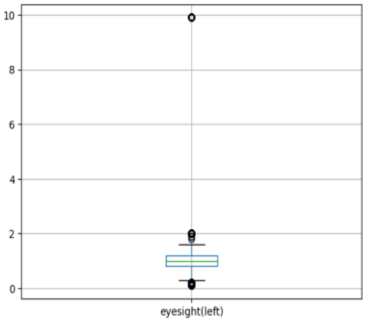

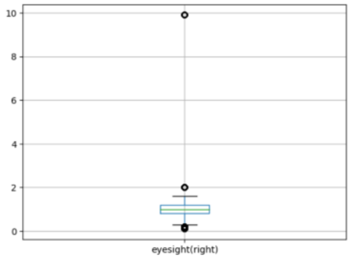

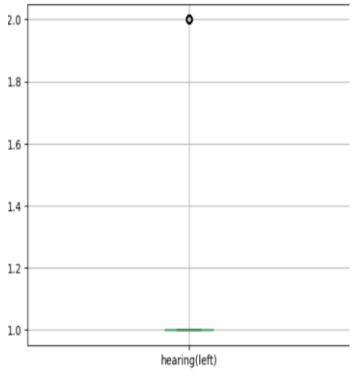

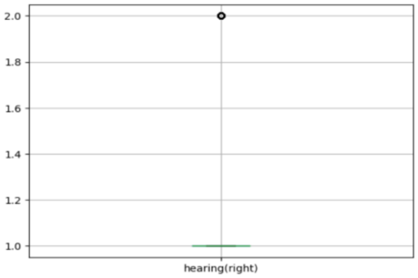

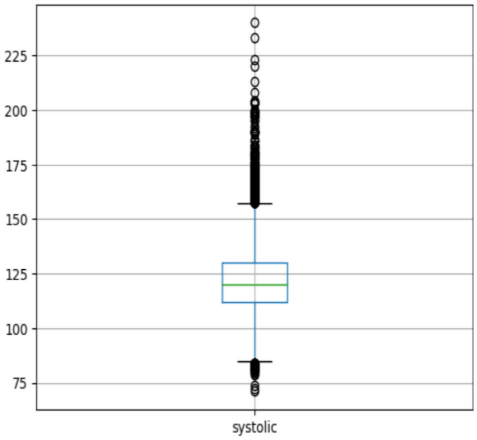

</td>
</tr>
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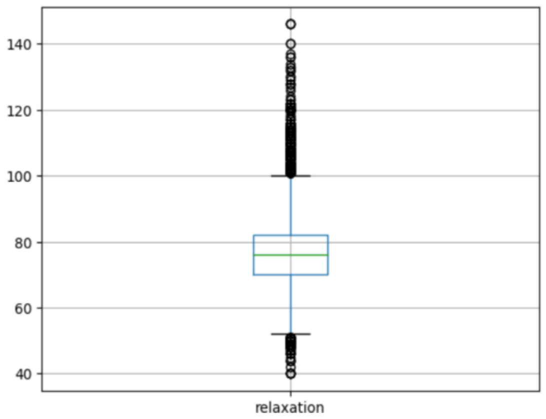
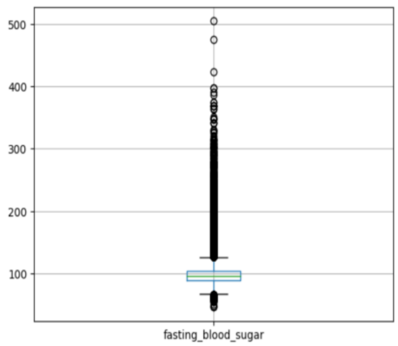
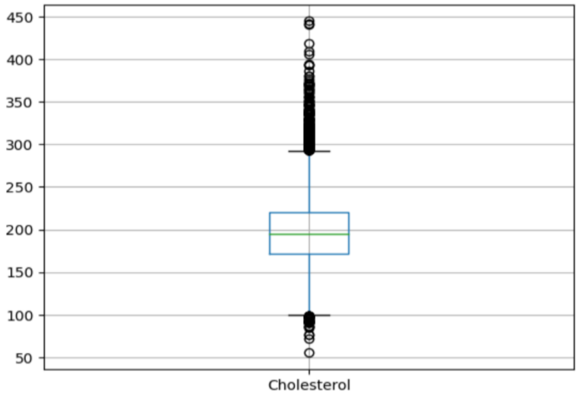
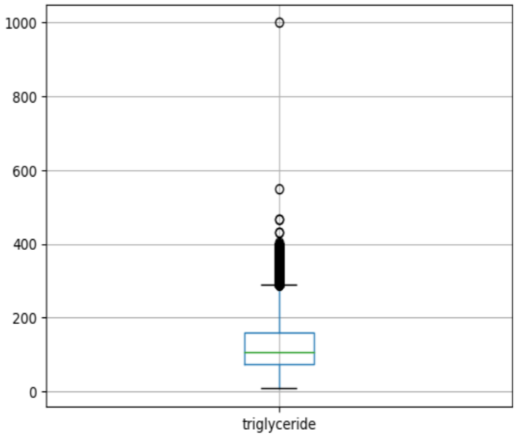
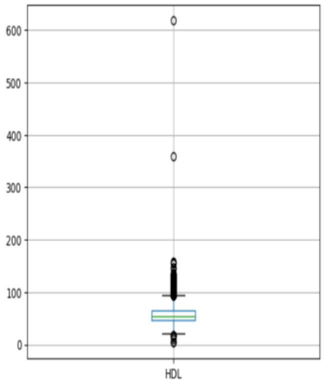
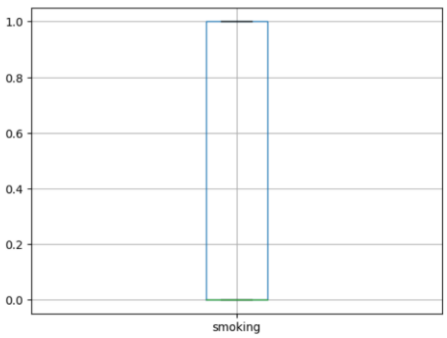

140
120
100
80
60
40
relaxation


500
400
300
200
100
fasting_blood_sugar


450
400
350
300
250
200
150
100
50
Cholesterol

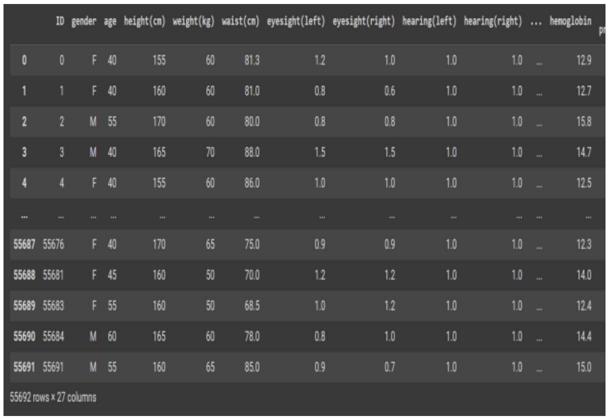

1000
800
600
400
200
0
triglyceride


600
500
400
300
200
100
0
HDL


1.0
0.8
0.6
0.4
0.2
0.0
smoking

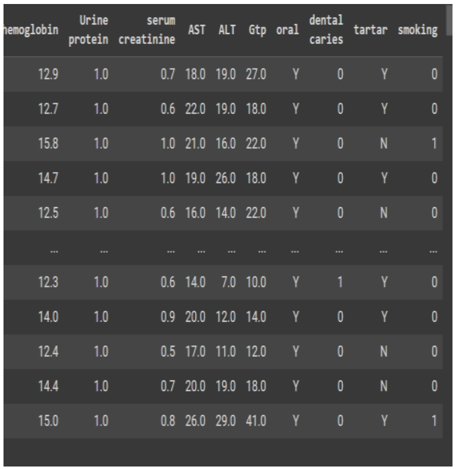
Data Preprocessing Code Screenshots

Loading Data



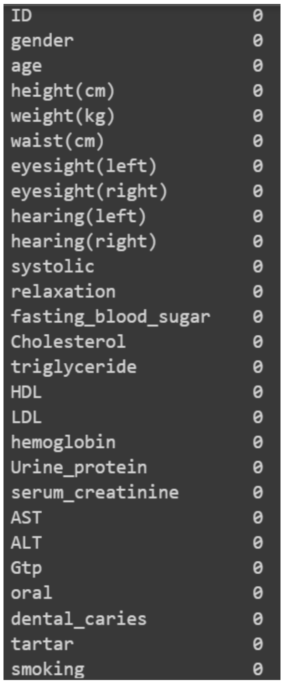
	ID	gender	age	height(cm)	weight(kg)	waist(cm)	eyesight(left)	eyesight(right)	hearing(left)	hearing(right)	...	hemoglobin	pr
0	0	F	40	155	60	81.3	1.2	1.0	1.0	1.0	...	12.9	
1	1	F	40	160	60	81.0	0.8	0.6	1.0	1.0	...	12.7	
2	2	M	55	170	60	80.0	0.8	0.8	1.0	1.0	...	15.8	
3	3	M	40	165	70	88.0	1.5	1.5	1.0	1.0	...	14.7	
4	4	F	40	155	60	86.0	1.0	1.0	1.0	1.0	...	12.5	
...	...	...	...	...	...	...	...	...	...	...	...	...	
55687	55676	F	40	170	65	75.0	0.9	0.9	1.0	1.0	...	12.3	
55688	55681	F	45	160	50	70.0	1.2	1.2	1.0	1.0	...	14.0	
55689	55683	F	55	160	50	68.5	1.0	1.2	1.0	1.0	...	12.4	
55690	55684	M	60	165	60	78.0	0.8	1.0	1.0	1.0	...	14.4	
55691	55691	M	55	160	65	85.0	0.9	0.7	1.0	1.0	...	15.0	

55692 rows × 27 columns



hemoglobin	Urine protein	serum creatinine	AST	ALT	Gtp	oral	dental caries	tartar	smoking
12.9	1.0	0.7	18.0	19.0	27.0	Y	0	Y	0
12.7	1.0	0.6	22.0	19.0	18.0	Y	0	Y	0
15.8	1.0	1.0	21.0	16.0	22.0	Y	0	N	1
14.7	1.0	1.0	19.0	26.0	18.0	Y	0	Y	0
12.5	1.0	0.6	16.0	14.0	22.0	Y	0	N	0
...	...	...	...	...	...	...	...	...	...
12.3	1.0	0.6	14.0	7.0	10.0	Y	1	Y	0
14.0	1.0	0.9	20.0	12.0	14.0	Y	0	Y	0
12.4	1.0	0.5	17.0	11.0	12.0	Y	0	N	0
14.4	1.0	0.7	20.0	19.0	18.0	Y	0	N	0
15.0	1.0	0.8	26.0	29.0	41.0	Y	0	Y	1

Handling Missing Data



```
ID                     0
gender                 0
age                    0
height(cm)             0
weight(kg)             0
waist(cm)              0
eyesight(left)         0
eyesight(right)        0
hearing(left)          0
hearing(right)         0
systolic               0
relaxation             0
fasting_blood_sugar    0
Cholesterol            0
triglyceride           0
HDL                    0
LDL                    0
hemoglobin             0
Urine_protein          0
serum_creatinine       0
AST                    0
ALT                    0
Gtp                    0
oral                   0
dental_caries          0
tartar                 0
smoking                0
```

```
dtype: int64
```

Data Transformation

-

Feature Engineering

Attached the codes in final submission.

Save Processed Data	-