## **PROJECT 3**

The project uses machine learning to detect the various types of breast cancer

## **Exploring the dataset**

```
df.info()
         <class 'pandas.core.frame.DataFrame'>
         RangeIndex: 569 entries, 0 to 568
         Data columns (total 33 columns):
         11 fractal_dimension_mean 569 non-null float64
12 radius_se 569 non-null float64
13 texture_se 569 non-null float64
14 perimeter_se 569 non-null float64
15 area_se 569 non-null float64
16 smoothness_se 569 non-null float64
17 compactness_se 569 non-null float64
18 concavity_se 569 non-null float64
19 concave points_se 569 non-null float64
20 symmetry_se 569 non-null float64
21 fractal_dimension_se 569 non-null float64
22 radius_worst 569 non-null float64
23 texture_worst 569 non-null float64
24 perimeter_worst 569 non-null float64
25 area_worst 569 non-null float64
26 smoothness_worst 569 non-null float64
27 compactness_worst 569 non-null float64
28 concavity_worst 569 non-null float64
29 concave points_worst 569 non-null float64
30 symmetry_worst 569 non-null float64
31 fractal_dimension_worst 569 non-null float64
31 fractal_dimension_worst 569 non-null float64
           11 fractal_dimension_mean 569 non-null float64
           31 fractal_dimension_worst 569 non-null float64
           32 Unnamed: 32
                                                 0 non-null float64
         dtypes: float64(31), int64(1), object(1)
         memory usage: 146.8+ KB
for column in df:
       if df[column].dtype == 'object':
               print(column)
         diagnosis
df.columns
         'concave points_mean', 'symmetry_mean', 'fractal_dimension_mean',
                       'radius_se', 'texture_se', 'perimeter_se', 'area_se', 'smoothness_se', 'compactness_se', 'concavity_se', 'concave points_se', 'symmetry_se',
                       'fractal_dimension_se', 'radius_worst', 'texture_worst',
                       'perimeter_worst', 'area_worst', 'smoothness_worst', 'compactness_worst', 'concavity_worst', 'concave points_worst',
                       'symmetry_worst', 'fractal_dimension_worst', 'Unnamed: 32'],
                     dtype='object')
```

## **Performing Exploratory Data Analysis on the dataset**

dtype: int64

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

# Load the dataset
df = pd.read_csv('/content/sample_data/data.csv')

# Display the first few rows of the dataset
print(df.head())

# Display the summary statistics of the dataset
print(df.describe())

# Display the correlation matrix
corr = df.corr()
sns.heatmap(corr)

# Display the distribution of the 'diagnosis' column
sns.countplot(df['diagnosis'])
```

	id diagnos	sis rac	lius mean	texture	e mean	nerimeter	mean	are		
0 8	42302	M	17.99		10.38		22.80	G., C		
	42517	М	20.57		17.77		32.90			
	00903	М	19.69		21.25		30.00			
	48301	М	11.42		20.38		77.58			
	58402	М	20.29		14.34		35.10			
7 075	30-02	11	20.23		17.57	1.	,,,,,			
smo	othness mean	compac	tness_mear	n conc	avitv me	an conca	ve noi	nts		
0	0.11840	compac	0.2776		0.30		ve poi	0.1		
1	0.08474		0.07864		0.08			0.0		
2	0.10960		0.15996		0.19			0.1		
3	0.14250		0.28396		0.24			0.1		
4	0.10030		0.13286		0.19			0.1		
	0,10000		0,1320		0 1 1 2			0.1		
	texture_wor	rst per	imeter wor	rst are	ea worst	smoothn	ess wo	rst		
0		.33	184		2019.0			.622		
1		.41	158	. 80	1956.6	)	0.1	.238		
2		. 53	152		1709.0			.444		
3	26	.50	98.	. 87	567.7	7	0.2	1098		
4		. 67	152		1575.6	)	0.1	.374		
com	pactness_wors	st conc	avity_wors	st con	cave poi	.nts worst	symm	etry		
0	0.665		0.71			0.2654				
1	0.186	56	0.243	16		0.1860				
2	0.424	45	0.450	94		0.2430				
3	0.866	53	0.686	59		0.2575				
4	0.20	50	0.400	30		0.1625				
fra	ctal_dimension	on_worst	Unnamed	: 32						
0		0.11890	)	NaN						
1		0.08902	2	NaN						
2		0.08758	3	NaN						
3		0.17300	)	NaN						
4		0.07678	3	NaN						
[5 row		[5 rows x 33 columns]								
	i		is_mean te			erimeter_m		are		
	5.690000e+02	2 569.	000000	569.000	9000	569.000	900	569.		
mean	5.690000e+02 3.037183e+02	2 569. 7 14.	000000 127292	569.000 19.289	9000 9649	569.000 91.969	900 933	569. 654.		
mean std	5.690000e+02 3.037183e+02 1.250206e+08	2 569. 7 14. 3 3.	000000 127292 524049	569.000 19.289 4.303	9000 9649 1036	569.0000 91.9690 24.2989	900 933 981	569. 654. 351.		
mean std min	5.690000e+02 3.037183e+02 1.250206e+08 8.670000e+03	2 569. 7 14. 3 3. 6.	000000 127292 524049 981000	569.000 19.289 4.303 9.710	9000 9649 1036 9000	569.000 91.969 24.298 43.790	900 933 981 900	569. 654. 351. 143.		
mean std min 25%	5.690000e+03 3.037183e+03 1.250206e+08 8.670000e+03 8.692180e+09	2 569. 7 14. 8 3. 6 11.	000000 127292 524049 981000 700000	569.000 19.289 4.303 9.710 16.170	3000 9649 1036 3000	569.000 91.969 24.298 43.790 75.170	900 933 981 900	569. 654. 351. 143. 420.		
mean std min 25% 50%	5.690000e+02 3.037183e+03 1.250206e+08 8.670000e+03 8.692180e+03 9.060240e+03	2 569. 7 14. 3 3. 3 6. 5 11.	000000 127292 524049 981000 700000 370000	569.000 19.289 4.303 9.710 16.170 18.840	3000 9649 1036 3000 3000	569.000 91.9690 24.2989 43.7900 75.1700 86.2400	000 033 981 000 000	569. 654. 351. 143. 420. 551.		
mean std min 25% 50% 75%	5.690000e+02 3.037183e+03 1.250206e+08 8.670000e+03 8.692180e+09 9.060240e+09 8.813129e+06	2 569. 7 14. 3 3. 6 11. 5 13.	000000 127292 524049 981000 700000 370000 780000	569.000 19.289 4.300 9.710 16.170 18.840 21.800	9649 1036 9000 9000 9000	569.000 91.969 24.298 43.790 75.170 86.240 104.100	000 033 981 000 000 000	569. 654. 351. 143. 420. 551. 782.		
mean std min 25% 50%	5.690000e+02 3.037183e+03 1.250206e+08 8.670000e+03 8.692180e+03 9.060240e+03	2 569. 7 14. 3 3. 6 11. 5 13.	000000 127292 524049 981000 700000 370000	569.000 19.289 4.303 9.710 16.170 18.840	9649 1036 9000 9000 9000	569.000 91.9690 24.2989 43.7900 75.1700 86.2400	000 033 981 000 000 000	569. 654. 351. 143. 420. 551.		
mean std min 25% 50% 75%	5.690000e+02 3.037183e+03 1.250206e+08 8.670000e+03 8.692180e+09 9.060240e+09 8.813129e+06 9.113205e+08	2 569. 7 14. 3 3. 6 11. 5 13. 15. 28.	000000 127292 524049 981000 700000 370000 780000 110000	569.000 19.289 4.300 9.710 16.170 18.840 21.800 39.280	9649 1036 9000 9000 9000 9000 9000	569.000 91.969 24.298 43.790 75.170 86.240 104.100 188.500	900 933 981 900 900 900 900 900 2	569. 654. 351. 143. 420. 551. 782.		
mean std min 25% 50% 75% max	5.690000e+02 3.037183e+03 1.250206e+03 8.670000e+03 8.692180e+03 9.060240e+03 8.813129e+04 9.113205e+04	2 569. 7 14. 8 3. 6. 11. 5 13. 5 15. 28.	000000 127292 524049 981000 700000 370000 780000 110000	569.000 19.289 4.300 9.710 16.170 18.840 21.800 39.280 mean	0000 0649 1036 0000 0000 0000 0000 concavit	569.000 91.969 24.298 43.790 75.170 86.240 104.100 188.500	000 033 981 000 000 000	569. 654. 351. 143. 420. 551. 782. 2501.		
mean std min 25% 50% 75% max	5.690000e+02 3.037183e+03 1.250206e+03 8.670000e+03 8.692180e+03 9.060240e+03 8.813129e+06 9.113205e+08 smoothness_r 569.006	2 569. 7 14. 8 3. 6. 5 11. 5 13. 65 28.	000000 127292 524049 981000 700000 370000 780000 110000 0mpactness_ 569.06	569.000 19.283 4.303 9.710 16.170 18.840 21.800 39.280 _mean	9000 9649 1036 9000 9000 9000 9000 concavit	569.000 91.969 24.298 43.790 75.170 86.240 104.100 188.500	900 933 981 900 900 900 900 900 2	569. 654. 351. 143. 420. 551. 782.		
mean std min 25% 50% 75% max	5.690000e+02 3.037183e+03 1.250206e+03 8.670000e+03 8.692180e+03 9.060240e+03 8.813129e+04 9.113205e+04	2 569. 7 14. 3 3. 6. 5 11. 5 15. 15. 28. mean cc 9000 5360	000000 127292 524049 981000 700000 370000 780000 110000 0mpactness 569.00 0.10	569.000 19.289 4.300 9.710 16.170 18.840 21.800 39.280 mean	3000 9649 1036 3000 3000 3000 3000 concavit 569.	569.000 91.969 24.298 43.790 75.170 86.240 104.100 188.500	900 933 981 900 900 900 900 200 2	569. 654. 351. 143. 420. 551. 782. 2501.		
mean std min 25% 50% 75% max count mean	5.690000e+0: 3.037183e+0: 1.250206e+0: 8.670000e+0: 8.692180e+0: 9.060240e+0: 8.813129e+0: 9.113205e+0: smoothness_r 569.00: 0.096	2 569. 7 14. 8 3. 6. 5 11. 5 15. 15. 28. mean cc 9000 5360 4064	000000 127292 524049 981000 700000 370000 780000 110000 0mpactness 569.00 0.10	569.000 19.283 4.303 9.710 16.170 18.840 21.800 39.280 _mean 00000 04341 52813	0000 0649 1036 0000 0000 0000 0000 concavit 569. 0.	569.000 91.969 24.298 43.790 75.170 86.240 104.100 188.500 Ey_mean co	900 933 981 900 900 900 900 200 2	569. 654. 351. 143. 420. 551. 782. 2501.		
mean std min 25% 50% 75% max  count mean std min	5.69000e+0: 3.037183e+0: 1.250206e+0: 8.670000e+0: 8.692180e+0: 9.060240e+0: 8.813129e+0: 9.113205e+0: smoothness_r 569.00: 0.09: 0.014 0.05:	2 569. 7 14. 3 3. 6 5. 5 11. 5 15. 15. 28. mean cc 2000 5360 4064 2630	000000 127292 524049 981000 700000 370000 780000 110000 mpactness 569.00 0.10 0.03	569.000 19.289 4.303 9.710 16.170 18.840 21.800 39.280 _mean 20000 24341 52813 19380	0000 0649 1036 0000 0000 0000 0000 concavit 569. 0.	569.0000 91.9690 24.2981 43.7900 75.1700 86.2400 104.1000 188.5000  Ey_mean co 000000 088799 079720	900 933 981 900 900 900 900 200 2	569. 654. 351. 143. 420. 551. 782. 2501.		
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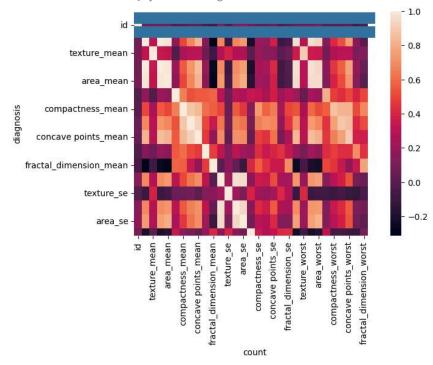
	concave points_worst	symmetry_worst	<pre>fractal_dimension_worst</pre>
count	569.000000	569.000000	569.000000
mean	0.114606	0.290076	0.083946
std	0.065732	0.061867	0.018061
min	0.000000	0.156500	0.055040
25%	0.064930	0.250400	0.071460
50%	0.099930	0.282200	0.080040
75%	0.161400	0.317900	0.092080
max	0.291000	0.663800	0.207500

Unnamed: 32 0.0 count mean NaN std NaN min NaN 25% NaN 50% NaN 75% NaN NaN max

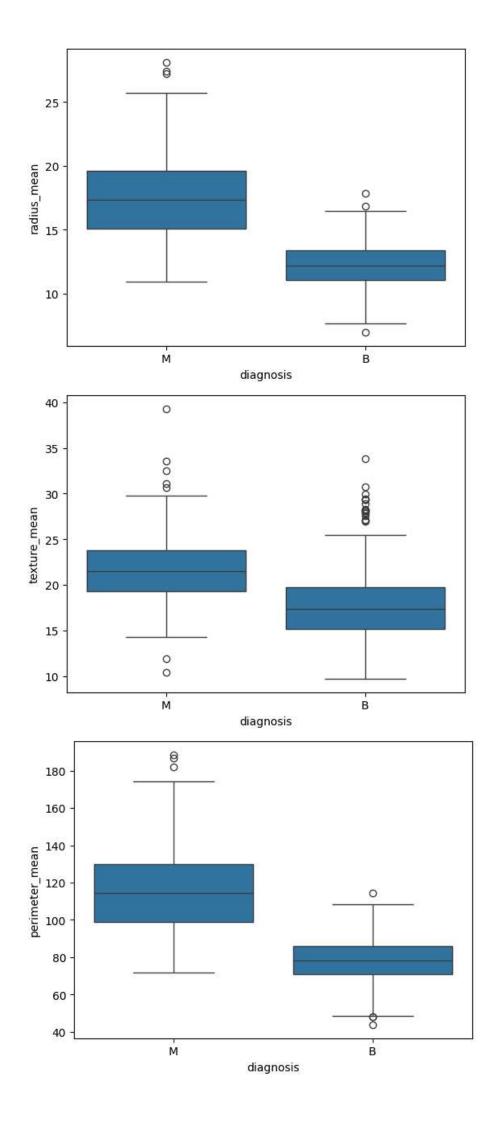
[8 rows x 32 columns]

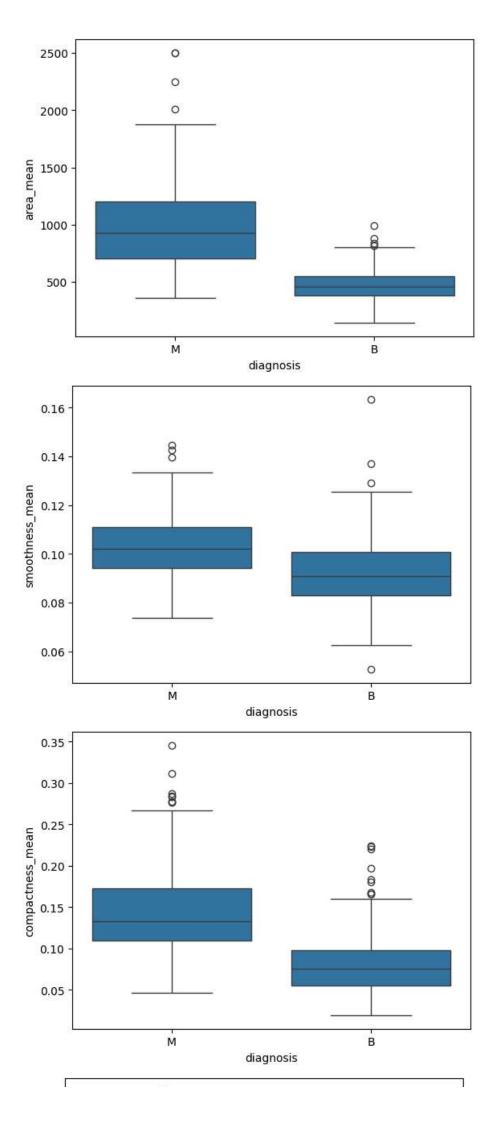
<ipython-input-16-f95bc6d7aa74>:15: FutureWarning: The default value
 corr = df.corr()

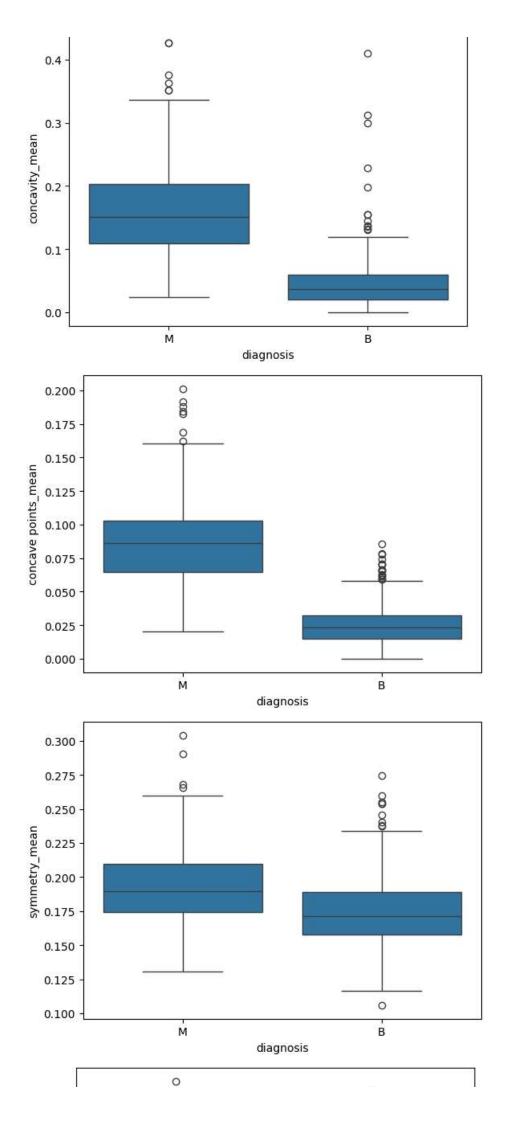
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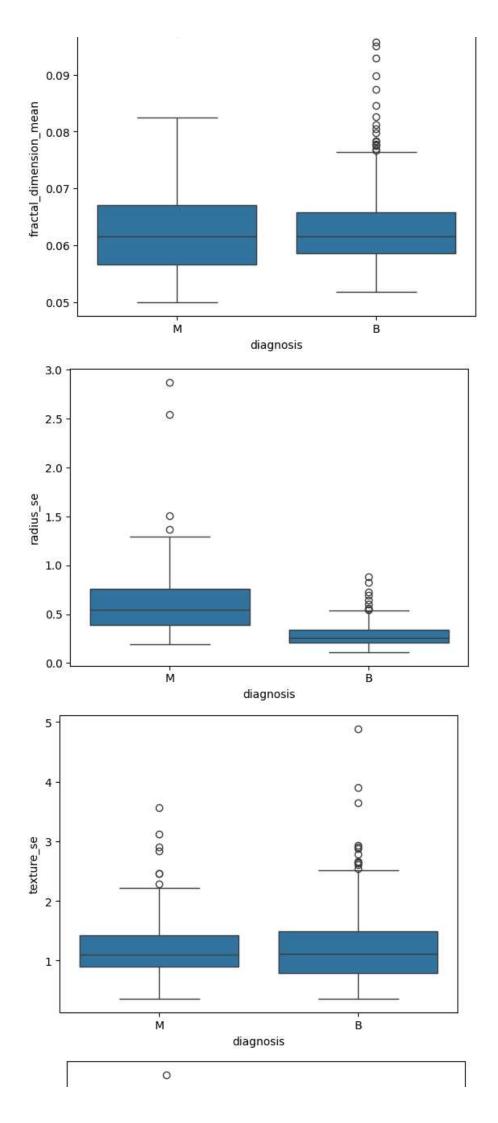


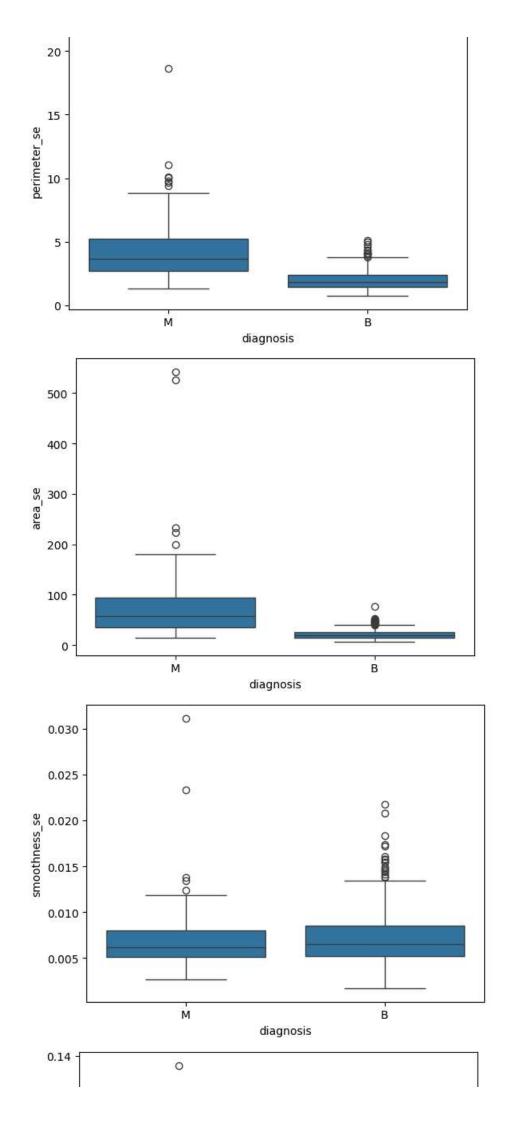
```
for column in df.columns:
   if column not in ['id', 'diagnosis', 'Unnamed: 32']:
        sns.boxplot(x='diagnosis', y=column, data=df)
        plt.show()
```

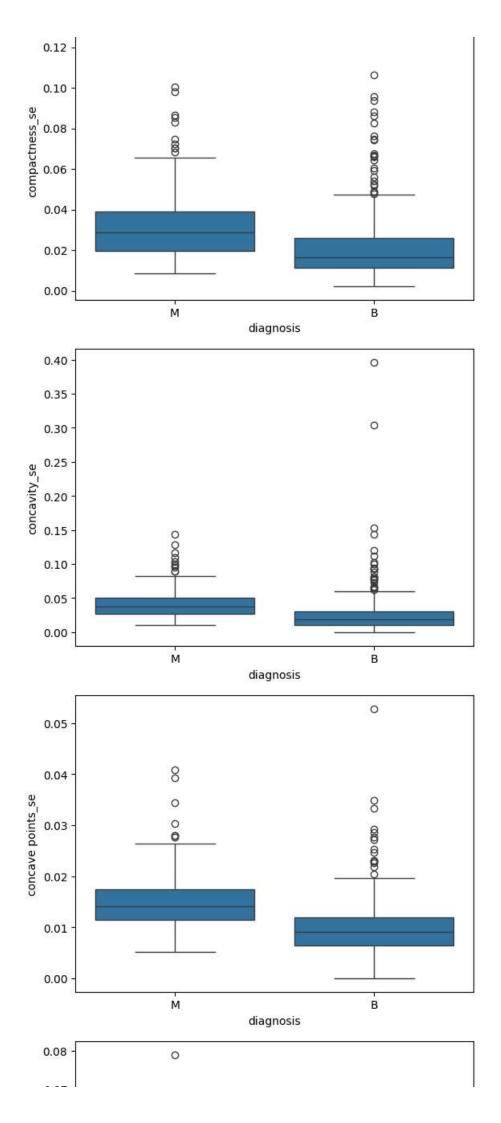


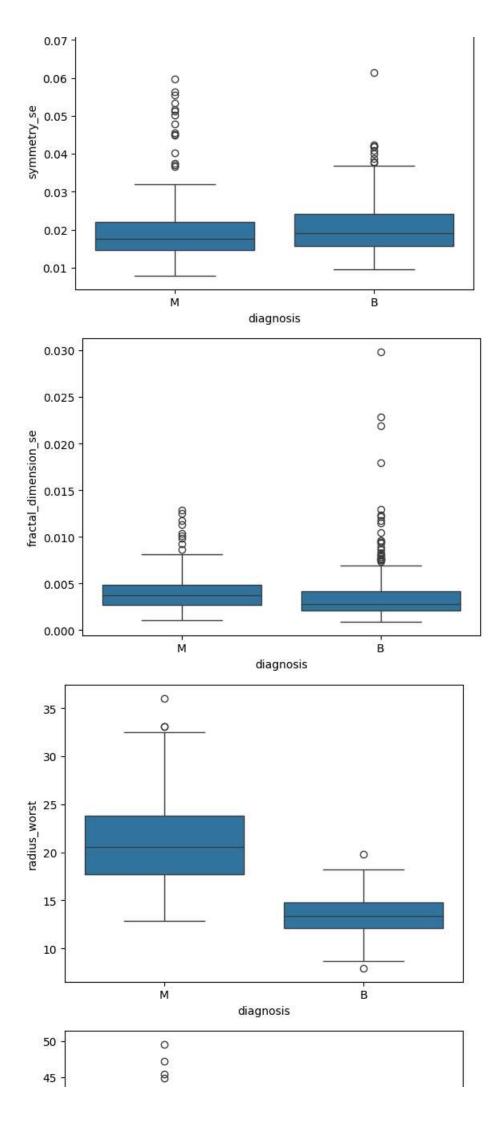


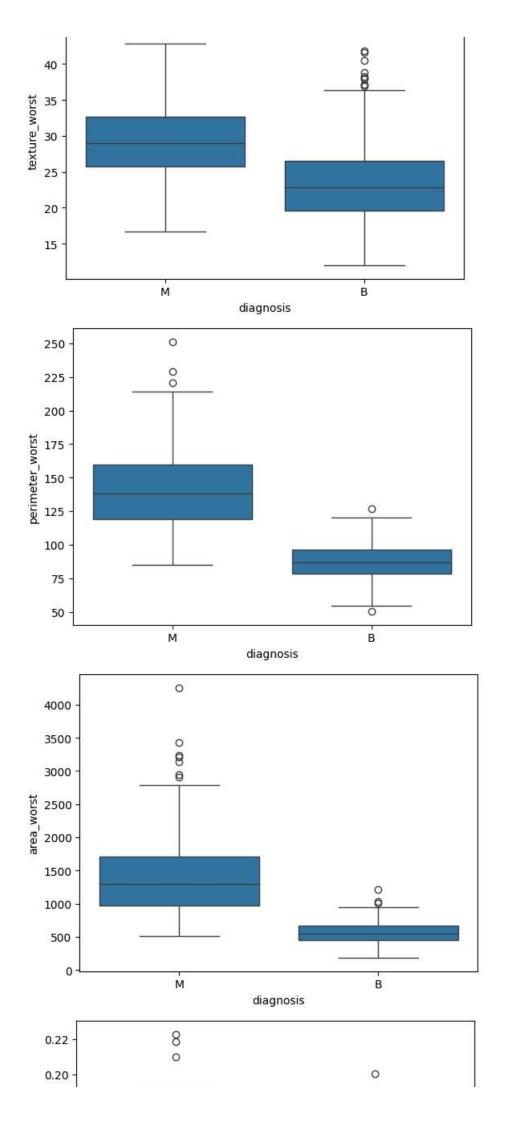


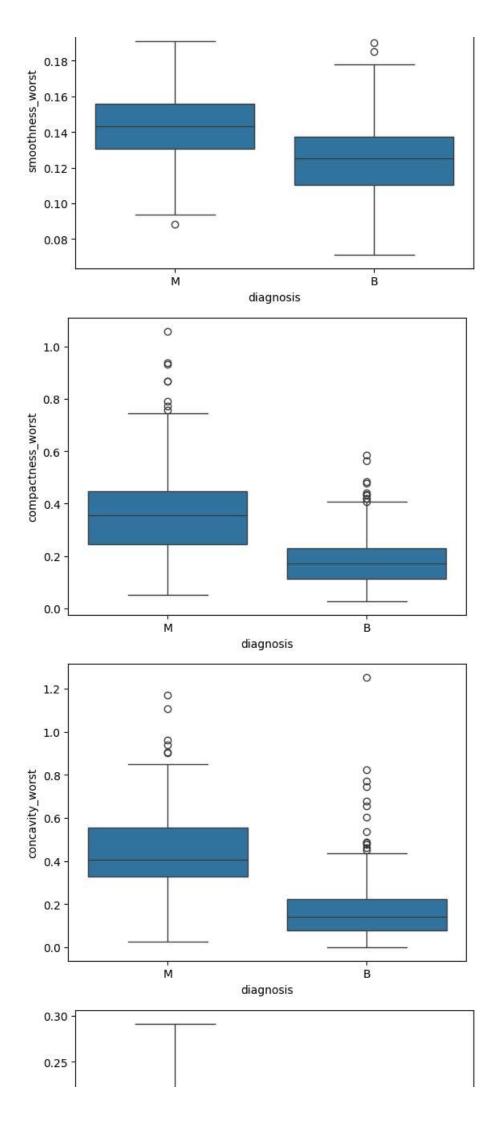


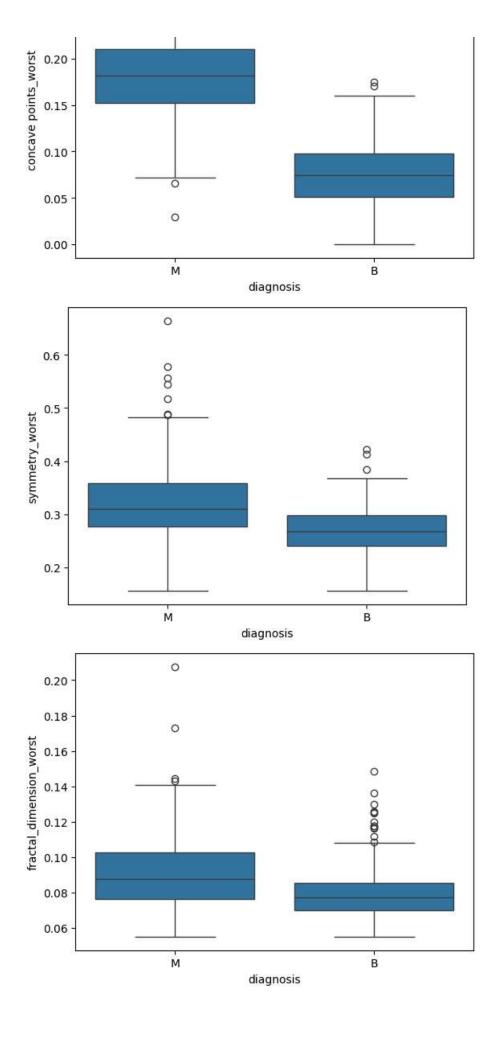










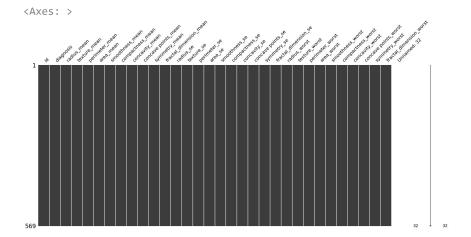


```
import pandas as pd
# Assuming 'df' is your DataFrame
df = pd.read_csv('/content/sample_data/data.csv')
# Check for missing values in the entire DataFrame
print(df.isnull().sum())
    id
                                0
    diagnosis
                                0
    radius_mean
                              0
    texture_mean
    perimeter_mean
    area mean
                              0
    smoothness_mean
    compactness_mean
    concavity_mean
    concave points_mean 0
    0
    texture_se
                              0
    perimeter_se
    area_se
                              0
    smoothness_se
    compactness se
    concavity_se
    concave points_se
    symmetry_se
    fractal_dimension_se 0
    radius_worst
                              0
    texture_worst
    perimeter_worst
    area worst
    smoothness_worst
    compactness_worst
                              0
    concavity_worst
    concave points_worst
symmetry_worst
                              0
    fractal_dimension_worst
                              0
                            569
    Unnamed: 32
    dtype: int64
import pandas as pd
# Assuming 'df' is your DataFrame
df = pd.read csv('/content/sample data/data.csv')
# Drop the rows where at least one element is missing
df = df.dropna()
# Now, 'df' is your DataFrame with rows containing null values dropped
!pip install missingno
import missingno as msno
    Requirement already satisfied: missingno in /usr/local/lib/python3.10/dist-packages (0.5.2)
    Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from missingno) (1.25.2)
    Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (from missingno) (3.7.1
     Requirement already satisfied: scipy in /usr/local/lib/python3.10/dist-packages (from missingno) (1.11.4)
    Requirement already satisfied: seaborn in /usr/local/lib/python3.10/dist-packages (from missingno) (0.13.1)
    Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib-
    Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib->mis
    Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib
    Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib
    Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->
    Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->mi
     Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib-
```

Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplot

Requirement already satisfied: pandas>=1.2 in /usr/local/lib/python3.10/dist-packages (from seaborn->missing Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.2->se Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.

msno.matrix(df)



```
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(strategy='mean')
X = imputer.fit_transform(X)
```

Training and testing the model

```
# Split the data into training and test sets
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Train the model
model.fit(X_train, y_train)

# Evaluate the model
y_pred = model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy*100:.2f}%")

Accuracy: 96.49%
```