In [ ]:

```
#************************************************************************************************************************
#                                                Breast_Cancer_Prediction_Project
#************************************************************************************************************************
```

In [ ]:

```
#This project is made using CSV File called Data
#This CSV file is downloaded from https://www.kaggle.com/uciml/breast-cancer-wisconsin-data
#Project by:Anubha Sharma-Data Science
#Submitted to:Jyotika
```

In [2]:

```
#1.Import Libraries
import numpy
import pandas as pd
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
```

```
Matplotlib is building the font cache; this may take a moment.
```

In [4]:

```
df=pd.read_csv("data.csv")
df.head()
print(df)
```

```
           id diagnosis  radius_mean  texture_mean  perimeter_mean  area_mean  \
0      842302         M        17.99         10.38          122.80     1001.0   
1      842517         M        20.57         17.77          132.90     1326.0   
2    84300903         M        19.69         21.25          130.00     1203.0   
3    84348301         M        11.42         20.38           77.58      386.1   
4    84358402         M        20.29         14.34          135.10     1297.0   
..        ...       ...          ...           ...             ...        ...   
564    926424         M        21.56         22.39          142.00     1479.0   
565    926682         M        20.13         28.25          131.20     1261.0   
566    926954         M        16.60         28.08          108.30      858.1   
567    927241         M        20.60         29.33          140.10     1265.0   
568     92751         B         7.76         24.54           47.92      181.0   

     smoothness_mean  compactness_mean  concavity_mean  concave points_mean  \
0            0.11840           0.27760         0.30010              0.14710   
1            0.08474           0.07864         0.08690              0.07017   
2            0.10960           0.15990         0.19740              0.12790   
3            0.14250           0.28390         0.24140              0.10520   
4            0.10030           0.13280         0.19800              0.10430   
```

```
..               ...               ...              ...                  ...
564          0.11100           0.11590         0.24390              0.13890
565          0.09780           0.10340         0.14400              0.09791
566          0.08455           0.10230         0.09251              0.05302
567          0.11780           0.27700         0.35140              0.15200
568          0.05263           0.04362         0.00000              0.00000

     ...  texture_worst  perimeter_worst  area_worst  smoothness_worst  \
0    ...          17.33           184.60      2019.0           0.16220
1    ...          23.41           158.80      1956.0           0.12380
2    ...          25.53           152.50      1709.0           0.14440
3    ...          26.50            98.87       567.7           0.20980
4    ...          16.67           152.20      1575.0           0.13740
..   ...            ...              ...         ...               ...
564  ...          26.40           166.10      2027.0           0.14100
565  ...          38.25           155.00      1731.0           0.11660
566  ...          34.12           126.70      1124.0           0.11390
567  ...          39.42           184.60      1821.0           0.16500
568  ...          30.37            59.16       268.6           0.08996

     compactness_worst  concavity_worst  concave points_worst  symmetry_worst  \
0              0.66560           0.7119                0.2654          0.4601
1              0.18660           0.2416                0.1860          0.2750
2              0.42450           0.4504                0.2430          0.3613
3              0.86630           0.6869                0.2575          0.6638
4              0.20500           0.4000                0.1625          0.2364
..                 ...              ...                   ...             ...
564            0.21130           0.4107                0.2216          0.2060
565            0.19220           0.3215                0.1628          0.2572
566            0.30940           0.3403                0.1418          0.2218
567            0.86810           0.9387                0.2650          0.4087
568            0.06444           0.0000                0.0000          0.2871

     fractal_dimension_worst  Unnamed: 32
0                    0.11890          NaN
1                    0.08902          NaN
2                    0.08758          NaN
3                    0.17300          NaN
4                    0.07678          NaN
..                       ...          ...
564                  0.07115          NaN
565                  0.06637          NaN
566                  0.07820          NaN
567                  0.12400          NaN
568                  0.07039          NaN

[569 rows x 33 columns]
```

In [32]:

```
df.describe()
```

Out[32]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_m
count	5.690000e+02	569.000000	569.000000	569.000000	569.000000	569.000000	569.000000	569.000000	569.000
mean	3.037183e+07	0.372583	14.127292	19.289649	91.969033	654.889104	0.096360	0.104341	0.088
std	1.250206e+08	0.483918	3.524049	4.301036	24.298981	351.914129	0.014064	0.052813	0.079
min	8.670000e+03	0.000000	6.981000	9.710000	43.790000	143.500000	0.052630	0.019380	0.000
25%	8.692180e+05	0.000000	11.700000	16.170000	75.170000	420.300000	0.086370	0.064920	0.029
50%	9.060240e+05	0.000000	13.370000	18.840000	86.240000	551.100000	0.095870	0.092630	0.061
75%	8.813129e+06	1.000000	15.780000	21.800000	104.100000	782.700000	0.105300	0.130400	0.130
max	9.113205e+08	1.000000	28.110000	39.280000	188.500000	2501.000000	0.163400	0.345400	0.426

8 rows × 33 columns

In [34]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 33 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   id                       569 non-null    int64  
 1   diagnosis                569 non-null    int64  
 2   radius_mean              569 non-null    float64
 3   texture_mean             569 non-null    float64
 4   perimeter_mean           569 non-null    float64
 5   area_mean                569 non-null    float64
 6   smoothness_mean          569 non-null    float64
 7   compactness_mean         569 non-null    float64
 8   concavity_mean           569 non-null    float64
 9   concave points_mean      569 non-null    float64
 10  symmetry_mean            569 non-null    float64
 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
 32  Unnamed: 32              0 non-null      float64
dtypes: float64(31), int64(2)
memory usage: 146.8 KB
```

In [31]:

```
#**************************
#1.Training Model
#Here 1 stands for M
#Here 2 stands for B
#*************************

from sklearn.preprocessing import LabelEncoder
labelencoder_Y = LabelEncoder()
df.iloc[:,1]=labelencoder_Y.fit_transform(df.iloc[:,1].values)
df.head()
```

Out[31]:

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	c point
0	842302	1	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	
1	842517	1	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	
2	84300903	1	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	
3	84348301	1	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	
4	84358402	1	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	

5 rows × 33 columns

In [15]:

```
#************************
# Models/ Algorithms
#************************
def models(X_train,Y_train):

        #**********************
        #logistic regression
        #***********************
        from sklearn.linear_model import LogisticRegression
        log=LogisticRegression(random_state=0)
        log.fit(X_train,Y_train)


        #************************
        #Decision Tree
        #*************************
        from sklearn.tree import DecisionTreeClassifier
        tree=DecisionTreeClassifier(random_state=0,criterion="entropy")
        tree.fit(X_train,Y_train)

        #*********************
        #Random Forest
        #*********************
        from sklearn.ensemble import RandomForestClassifier
        forest=RandomForestClassifier(random_state=0,criterion="entropy",n_estimators=10)
        forest.fit(X_train,Y_train)

        print('[0]logistic regression accuracy:',log.score(X_train,Y_train))
        print('[1]Decision tree accuracy:',tree.score(X_train,Y_train))
        print('[2]Random forest accuracy:',forest.score(X_train,Y_train))

        return log,tree,forest
```

In [21]:

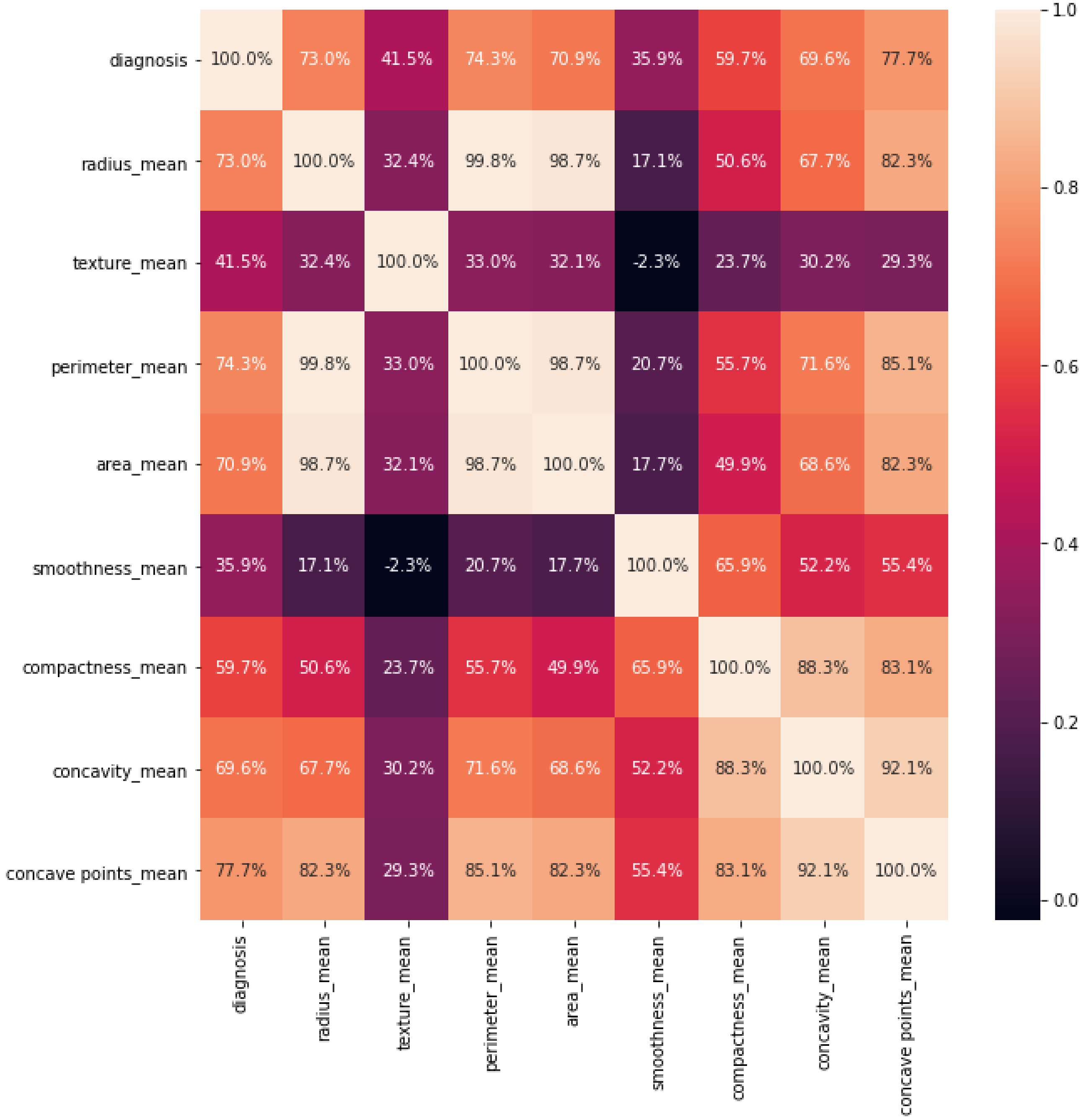
```
model=models(X_train,Y_train)
```

```
[0]logistic regression accuracy: 0.9912087912087912
[1]Decision tree accuracy: 1.0
[2]Random forest accuracy: 0.9978021978021978
```

In [20]:

```
plt.figure(figsize=(10,10))
sns.heatmap(df.iloc[:,1:10].corr(),annot=True,fmt=".01%")
```

```
Out[20]: <AxesSubplot:>
```

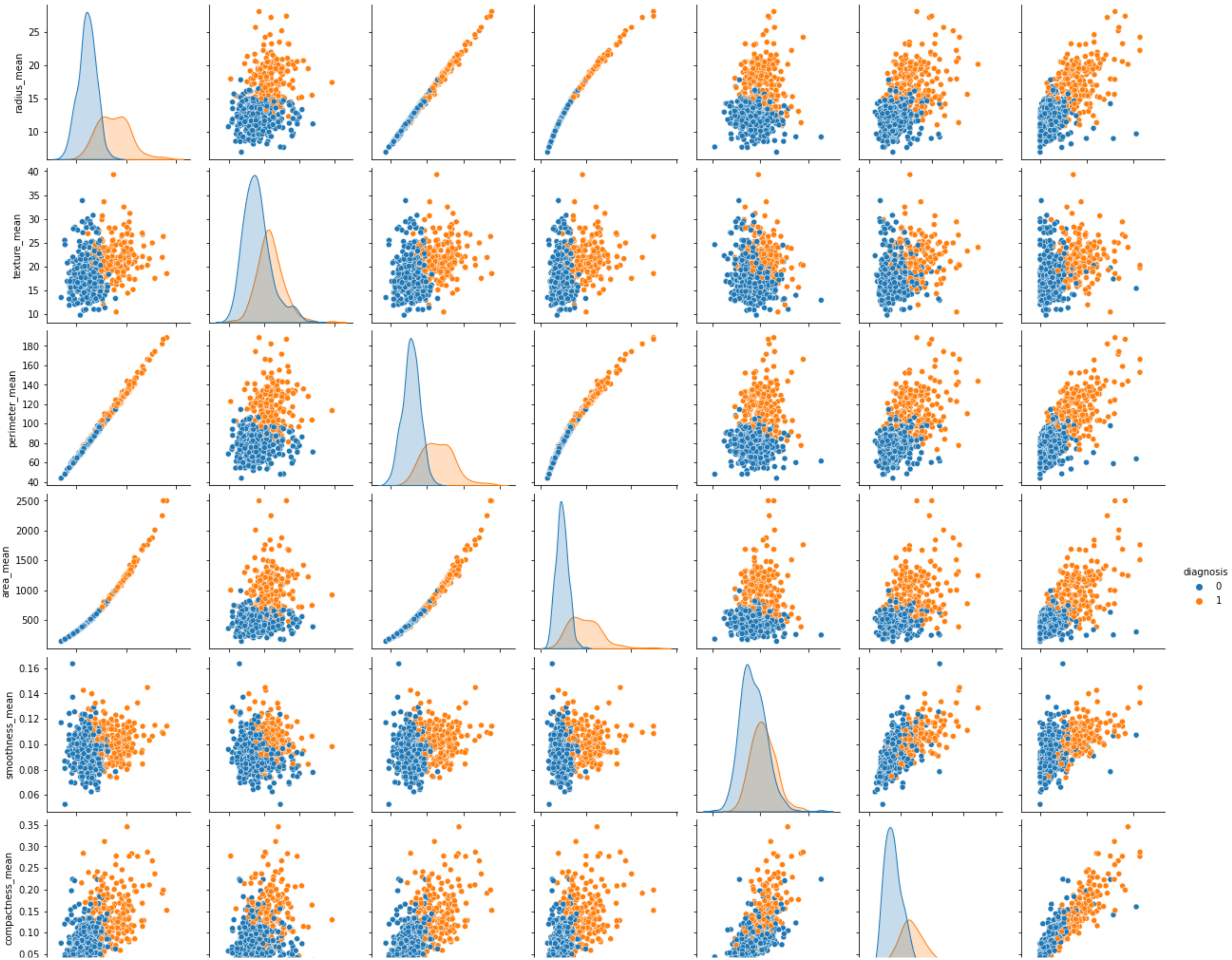

diagnosis
radius_mean
texture_mean
perimeter_mean
area_mean
smoothness_mean
compactness_mean
concavity_mean
concave points_mean
100.0% 73.0% 41.5% 74.3% 70.9% 35.9% 59.7% 69.6% 77.7%
73.0% 100.0% 32.4% 99.8% 98.7% 17.1% 50.6% 67.7% 82.3%
41.5% 32.4% 100.0% 33.0% 32.1% -2.3% 23.7% 30.2% 29.3%
74.3% 99.8% 33.0% 100.0% 98.7% 20.7% 55.7% 71.6% 85.1%
70.9% 98.7% 32.1% 98.7% 100.0% 17.7% 49.9% 68.6% 82.3%
35.9% 17.1% -2.3% 20.7% 17.7% 100.0% 65.9% 52.2% 55.4%
59.7% 50.6% 23.7% 55.7% 49.9% 65.9% 100.0% 88.3% 83.1%
69.6% 67.7% 30.2% 71.6% 68.6% 52.2% 88.3% 100.0% 92.1%
77.7% 82.3% 29.3% 85.1% 82.3% 55.4% 83.1% 92.1% 100.0%
1.0
0.8
0.6
0.4
0.2
0.0

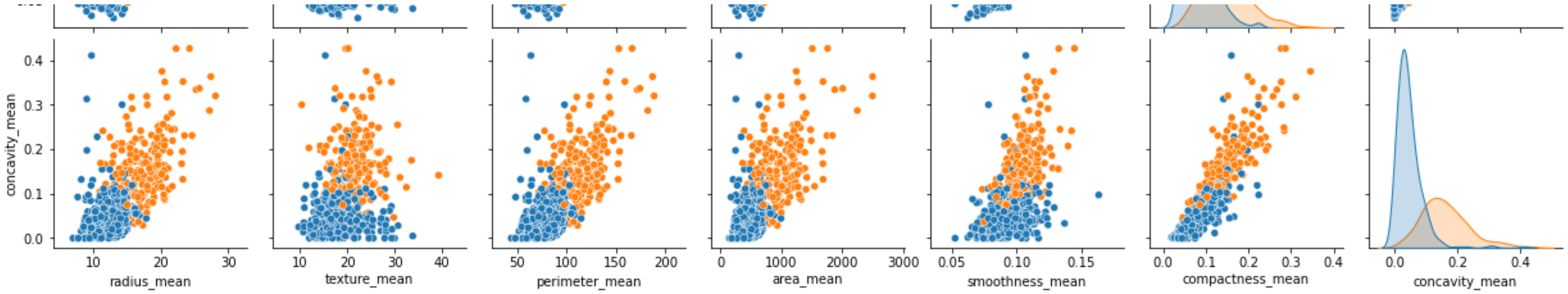
In [33]:

```
sns.pairplot(df.iloc[:,1:9],hue="diagnosis")
```

Out[33]:

```
<seaborn.axisgrid.PairGrid at 0x29bf4a19280>
```



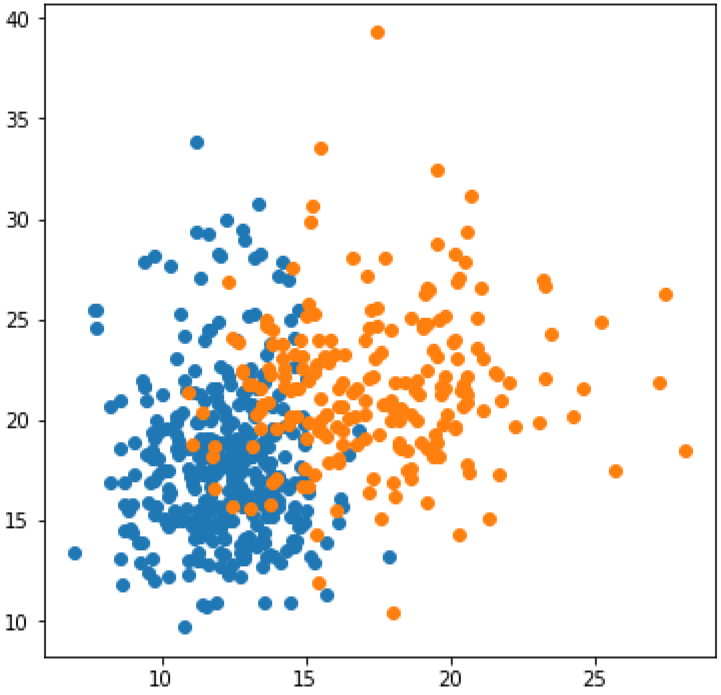


In [39]:

```
plt.figure(figsize=(6,6))
plt.scatter(X[Y == 0][:, 0], X[Y == 0][:, 1],  label = '0')
plt.scatter(X[Y == 1][:, 0], X[Y == 1][:, 1],  label = '1')
```

Out[39]:

```
<matplotlib.collections.PathCollection at 0x29bf7330490>
```



In [23]:

```
#****************************************
# Testing the models
#****************************************
```

```
from sklearn.metrics import accuracy_score
from sklearn.metrics import classification_report

for i in range(len(model)):
    print("Model",i)
    print(classification_report(Y_test,model[i].predict(X_test)))
    print('Accuracy : ',accuracy_score(Y_test,model[i].predict(X_test)))
```

```
Model 0
              precision    recall  f1-score   support

           0       0.96      0.99      0.97        67
           1       0.98      0.94      0.96        47

    accuracy                           0.96       114
   macro avg       0.97      0.96      0.96       114
weighted avg       0.97      0.96      0.96       114

Accuracy :  0.9649122807017544
Model 1
              precision    recall  f1-score   support

           0       0.94      0.96      0.95        67
           1       0.93      0.91      0.92        47

    accuracy                           0.94       114
   macro avg       0.94      0.94      0.94       114
weighted avg       0.94      0.94      0.94       114

Accuracy :  0.9385964912280702
Model 2
              precision    recall  f1-score   support

           0       0.96      1.00      0.98        67
           1       1.00      0.94      0.97        47

    accuracy                           0.97       114
   macro avg       0.98      0.97      0.97       114
weighted avg       0.97      0.97      0.97       114

Accuracy :  0.9736842105263158
```

In [18]:

```
#*********************************************
#Accuracy
#*********************************************
pred=model[2].predict(X_test)
print('Predicted values:')
print(pred)
print('Actual values:')
print(Y_test)
```

```
Predicted values:
[1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 1 1 0 0 1 0 0 1 0 1 0 1 0 1 0 1 0
 1 0 1 0 0 0 0 0 1 0 0 0 1 1 1 1 0 0 0 0 0 0 1 1 1 0 0 1 0 1 1 1 0 0 1 0 0
 1 0 0 0 0 0 1 1 1 0 1 0 0 0 1 1 0 1 0 1 0 0 1 0 0 0 0 0 0 0 1 0 1 0 1 1 0
 1 1 0]
Actual values:
[1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 1 1 0 0 1 0 0 1 0 1 0 1 0 1 0 1 0
 1 0 1 1 0 1 0 0 1 0 0 0 1 1 1 1 0 0 0 0 0 0 1 1 1 0 0 1 0 1 1 1 0 0 1 0 1
 1 0 0 0 0 0 1 1 1 0 1 0 0 0 1 1 0 1 0 1 0 0 1 0 0 0 0 0 0 0 1 0 1 0 1 1 0
 1 1 0]
```

In [ ]:

```
#************************************************************************************************************************
#                                                  End of the Project
#************************************************************************************************************************
```