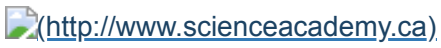


Project Solutions -- Logistic Regression

Breast Cancer Diagnostic

In this project, we are going to work with another very famous and real dataset on Breast Cancer Wisconsin (Diagnostic) (https://www.kaggle.com/uciml/breast-cancer-wisconsin-data/data). The dataset is available on kaggle and originally belong to UCI Machine Learning Repository (https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+%28Diagnostic%29).
This dataset was donated to UCI by Nick Street in 1995 for the public use. Relevant Papers (https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+%28Diagnostic%29) and detailed description (https://archive.ics.uci.edu/ml/machine-learning-databases/breast-cancer-wisconsin/wdbc.names) on the dataset is provided at UCI website.

Our target it to train a Logistic Regression model that can predict weather the cancer is benign (B) or malignant (M).
Let's start the project!

Let's import some libraries first!

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid') # just optional!
%matplotlib inline
```

Read the data into a dataframe `df`

In [2]:
```
df = pd.read_csv('Breast_Cancer_Diagnostic.csv')
```

We will only consider ten real-valued features in this project for diagnostic!
Let's separate the required features along with diagnosis column.

In [3]:
```
df = df[['radius_mean', 'texture_mean', 'perimeter_mean',
       'area_mean', 'smoothness_mean', 'compactness_mean', 'concavity_mean',
       'concave points_mean', 'symmetry_mean', 'fractal_dimension_mean','diagnosis']]
```

Check the head of your data

In [4]:
```
# code her please so than you don't lose the existing output
```

In [5]:
```
df.head()
```

Out[5]:

	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	concave points_mean	symmetry_mea
0	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	0.241
1	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	0.181
2	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	0.206
3	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	0.259
4	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	0.180

Can you tell how many entries you have in your data and is their any missing value?

In [6]:
```
# code her please so than you don't lose the existing output
```

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 11 columns):
radius_mean               569 non-null float64
texture_mean              569 non-null float64
perimeter_mean            569 non-null float64
area_mean                 569 non-null float64
smoothness_mean           569 non-null float64
compactness_mean          569 non-null float64
concavity_mean            569 non-null float64
concave points_mean       569 non-null float64
symmetry_mean             569 non-null float64
fractal_dimension_mean    569 non-null float64
diagnosis                 569 non-null object
dtypes: float64(10), object(1)
memory usage: 49.0+ KB
```

Get a summary on basic statistics for your data

In [8]:
```
# code her please so than you don't lose the existing output
```

In [9]:
```
df.describe()
```

Out[9]:

	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	concave points_mean	symmetry
count	569.000000	569.000000	569.000000	569.000000	569.000000	569.000000	569.000000	569.000000	569
mean	14.127292	19.289649	91.969033	654.889104	0.096360	0.104341	0.088799	0.048919	0
std	3.524049	4.301036	24.298981	351.914129	0.014064	0.052813	0.079720	0.038803	0
min	6.981000	9.710000	43.790000	143.500000	0.052630	0.019380	0.000000	0.000000	0
25%	11.700000	16.170000	75.170000	420.300000	0.086370	0.064920	0.029560	0.020310	0
50%	13.370000	18.840000	86.240000	551.100000	0.095870	0.092630	0.061540	0.033500	0
75%	15.780000	21.800000	104.100000	782.700000	0.105300	0.130400	0.130700	0.074000	0
max	28.110000	39.280000	188.500000	2501.000000	0.163400	0.345400	0.426800	0.201200	0

How many unique targets we have to predict?

In [10]:
```
# code her please so than you don't lose the existing output
```

In [11]:
```
df['diagnosis'].unique()
```

Out[11]:
```
array(['M', 'B'], dtype=object)
```

Which type of breast cancer is common? Hint: `value_counts()`

In [12]:
```
# code her please so than you don't lose the existing output
```

In [13]:
```
df['diagnosis'].value_counts()
```

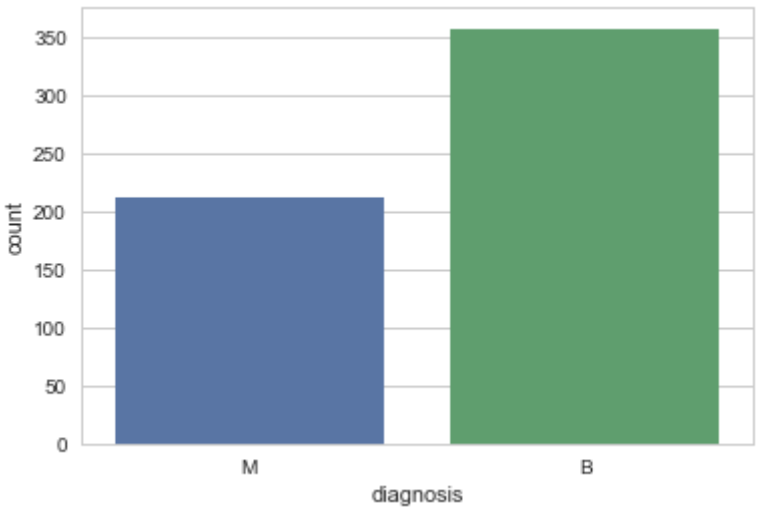
Out[13]:
```
B    357
M    212
Name: diagnosis, dtype: int64
```

Please, recreate the plot below

In [14]:
```
# code her please so than you don't lose the existing output
```

In [15]:
```
sns.countplot(df['diagnosis'])
```

Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x1129591d0>

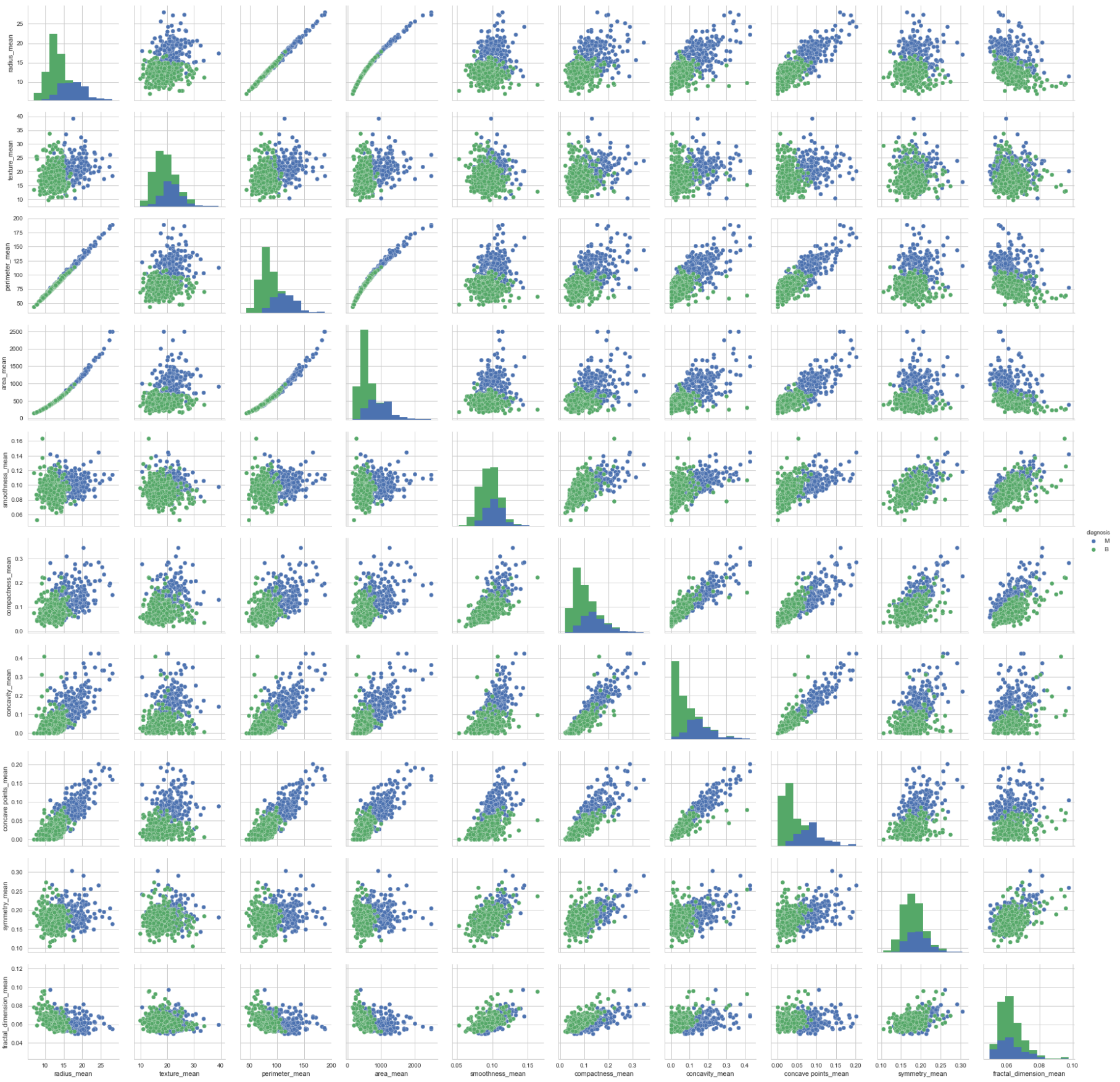


Recreate the plot below to overview your entire dataset

In [16]:
```
# code her please so than you don't lose the existing output
```

In [17]:
```
#plt.figure(figsize=(12,8))
#sns.heatmap(df.corr(), annot=True)
sns.pairplot(df, hue='diagnosis')
```

Out[17]: <seaborn.axisgrid.PairGrid at 0x1129b9a58>



Machine Learning

Please import `train_test_split()` method.

In [18]:
```
# code her please so than you don't lose the existing output
```

In [19]:
```
from sklearn.model_selection import train_test_split
```

Separate data into features and target datasets.

In [20]:
```
# code her please so than you don't lose the existing output
```

In [21]:
```
X = df.drop('diagnosis', axis = 1)
y = df['diagnosis']
```

Split the data into train test datasets

In [22]:
```
# code her please so than you don't lose the existing output
```

In [23]:
```
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.30, random_state=42)
```

Please import `LogisticRegression` and create its instance.

In [24]:
```
# code her please so than you don't lose the existing output
```

In [25]:
```
from sklearn.linear_model import LogisticRegression
logR = LogisticRegression()
```

How to fit a logistic regression model on the training dataset.

In [26]:
```
# code her please so than you don't lose the existing output
```

In [27]:
```
logR.fit(X_train,y_train)
```

Out[27]:
```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
          intercept_scaling=1, max_iter=100, multi_class='ovr', n_jobs=1,
          penalty='l2', random_state=None, solver='liblinear', tol=0.0001,
          verbose=0, warm_start=False)
```

Predict values for the testing data.

In [28]:
```
# code her please so than you don't lose the existing output
```

In [29]:
```
predictions = logR.predict(X_test)
```

Create a classification report for the model, also import the required module for this purpose.

In [30]:
```
# code her please so than you don't lose the existing output
```

In [31]:
```
from sklearn.metrics import classification_report
print(classification_report(y_test,predictions))
```

```
             precision    recall  f1-score   support

          B       0.94      0.95      0.95       108
          M       0.92      0.90      0.91        63

avg / total       0.94      0.94      0.94       171
```

Could you please display the confusion matrix?

In [32]:
```
# code her please so than you don't lose the existing output
```

In [33]:
```
from sklearn.metrics import confusion_matrix
```

In [34]:
```
print(confusion_matrix(y_test, predictions))
```

```
[[103   5]
 [  6  57]]
```

Excellent work!

We are done with Logistic Regression Section!