Untitled

December 25, 2019

[1]:
```python
from sklearn.datasets import  load_iris
iris = load_iris()

print(iris)
```

```
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```

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```

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```

```
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       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2]), 'target_names':
array(['setosa', 'versicolor', 'virginica'], dtype='<U10'), 'DESCR': '..
_iris_dataset:\n\nIris plants dataset\n--------------------\n\n**Data Set
Characteristics:**\n\n    :Number of Instances: 150 (50 in each of three
classes)\n    :Number of Attributes: 4 numeric, predictive attributes and the
class\n    :Attribute Information:\n        - sepal length in cm\n        -
sepal width in cm\n        - petal length in cm\n        - petal width in cm\n
- class:\n                - Iris-Setosa\n                - Iris-Versicolour\n
- Iris-Virginica\n                \n    :Summary Statistics:\n\n
============== ==== ==== ======= ===== ====================\n
Min  Max   Mean    SD   Class Correlation\n    ============== ==== ==== =======
===== ====================\n    sepal length:   4.3  7.9   5.84   0.83
0.7826\n    sepal width:    2.0  4.4   3.05   0.43   -0.4194\n    petal length:
1.0  6.9   3.76   1.76    0.9490  (high!)\n    petal width:    0.1  2.5   1.20
0.76    0.9565  (high!)\n    ============== ==== ==== ======= =====
====================\n\n    :Missing Attribute Values: None\n    :Class
Distribution: 33.3% for each of 3 classes.\n    :Creator: R.A. Fisher\n
:Donor: Michael Marshall (MARSHALL%PLU@io.arc.nasa.gov)\n    :Date: July,
1988\n\nThe famous Iris database, first used by Sir R.A. Fisher. The dataset is
taken\nfrom Fisher\'s paper. Note that it\'s the same as in R, but not as in the
UCI\nMachine Learning Repository, which has two wrong data points.\n\nThis is
```

```
perhaps the best known database to be found in the\npattern recognition
literature.  Fisher\'s paper is a classic in the field and\nis referenced
frequently to this day.  (See Duda & Hart, for example.)  The\ndata set contains
3 classes of 50 instances each, where each class refers to a\ntype of iris
plant.  One class is linearly separable from the other 2; the\nlatter are NOT
linearly separable from each other.\n\n.. topic:: References\n\n   - Fisher,
R.A. "The use of multiple measurements in taxonomic problems"\n     Annual
Eugenics, 7, Part II, 179-188 (1936); also in "Contributions to\n
Mathematical Statistics" (John Wiley, NY, 1950).\n   - Duda, R.O., & Hart, P.E.
(1973) Pattern Classification and Scene Analysis.\n     (Q327.D83) John Wiley &
Sons.  ISBN 0-471-22361-1.  See page 218.\n   - Dasarathy, B.V. (1980) "Nosing
Around the Neighborhood: A New System\n     Structure and Classification Rule
for Recognition in Partially Exposed\n     Environments".  IEEE Transactions on
Pattern Analysis and Machine\n     Intelligence, Vol. PAMI-2, No. 1, 67-71.\n
- Gates, G.W. (1972) "The Reduced Nearest Neighbor Rule".  IEEE Transactions\n
on Information Theory, May 1972, 431-433.\n   - See also: 1988 MLC Proceedings,
54-64.  Cheeseman et al"s AUTOCLASS II\n     conceptual clustering system finds
3 classes in the data.\n   - Many, many more …', 'feature_names': ['sepal
length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width (cm)'],
'filename': '/home/cesar/miniconda3/lib/python3.7/site-
packages/sklearn/datasets/data/iris.csv'}
```

[2]:
```
"""
en si el listado de iris es un diccionario

keys y elemento

el elemento en este caso es un arreglo de listas de listas
o sea un numpy array
"""
```

[2]:
```
'\nen si el listado de iris es un diccionario\n\nkeys y elemento\n\nel elemento
en este caso es un arreglo de listas de listas \no sea un numpy array \n'
```

[3]:
```
iris["target_names"]
```

[3]:
```
array(['setosa', 'versicolor', 'virginica'], dtype='<U10')
```

[4]:
```
iris["feature_names"]
```

[4]:
```
['sepal length (cm)',
 'sepal width (cm)',
 'petal length (cm)',
 'petal width (cm)']
```

[5]:
```
type(iris)
```

[5]: sklearn.utils.Bunch

[6]:
```
type(iris["data"])
```

[6]: numpy.ndarray

[7]:
```
iris["data"]
```

[7]:
```
array([[5.1, 3.5, 1.4, 0.2],
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[7.9, 3.8, 6.4, 2. ],
[6.4, 2.8, 5.6, 2.2],
```

```
        [6.3, 2.8, 5.1, 1.5],
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        [6.4, 3.1, 5.5, 1.8],
        [6. , 3. , 4.8, 1.8],
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        [6.3, 2.5, 5. , 1.9],
        [6.5, 3. , 5.2, 2. ],
        [6.2, 3.4, 5.4, 2.3],
        [5.9, 3. , 5.1, 1.8]])
```

[8]:
```
iris["data"].shape
```

[8]: (150, 4)

[9]:
```
#un total de 150 flores o muestras
#con 4 features
```

[10]:
```
type(iris["target"])
```

[10]: numpy.ndarray

[69]:
```
iris["target"]

type (iris["target"])
```

[69]: numpy.ndarray

[12]:
```
"""
target means flower species
0 setosa
1 versicolor
2 virginica

"""
```

[12]: '\ntarget means flower species\n0 setosa\n1 versicolor\n2 virginica\n\n'

1 Training and testing data

The part of the data is used to build our machine learning model, and is called the training data or trainning set.

The rest of the data will be used to access how well the model works and is called test data, test set or hold-out set.

Scikit-learn contains a functaion that shuffles the dataset and splits it for you, the function:

train_test_split

[13]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(iris["data"],iris["target"]
                                                    , random_state = 0)
```

[35]:
```
X_train.shape
#see the number of instances and attributes  of Train data
X_train
```

[35]:
```
array([[5.9, 3. , 4.2, 1.5],
       [5.8, 2.6, 4. , 1.2],
       [6.8, 3. , 5.5, 2.1],
       [4.7, 3.2, 1.3, 0.2],
       [6.9, 3.1, 5.1, 2.3],
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       [5. , 2. , 3.5, 1. ],
       [6.5, 3. , 5.5, 1.8],
       [6.7, 3.3, 5.7, 2.5],
       [6. , 2.2, 5. , 1.5],
       [6.7, 2.5, 5.8, 1.8],
       [5.6, 2.5, 3.9, 1.1],
       [7.7, 3. , 6.1, 2.3],
       [6.3, 3.3, 4.7, 1.6],
       [5.5, 2.4, 3.8, 1.1],
       [6.3, 2.7, 4.9, 1.8],
       [6.3, 2.8, 5.1, 1.5],
       [4.9, 2.5, 4.5, 1.7],
       [6.3, 2.5, 5. , 1.9],
       [7. , 3.2, 4.7, 1.4],
       [6.5, 3. , 5.2, 2. ],
       [6. , 3.4, 4.5, 1.6],
       [4.8, 3.1, 1.6, 0.2],
       [5.8, 2.7, 5.1, 1.9],
       [5.6, 2.7, 4.2, 1.3],
       [5.6, 2.9, 3.6, 1.3],
       [5.5, 2.5, 4. , 1.3],
       [6.1, 3. , 4.6, 1.4],
```

```
[7.2, 3.2, 6. , 1.8],
[5.3, 3.7, 1.5, 0.2],
[4.3, 3. , 1.1, 0.1],
[6.4, 2.7, 5.3, 1.9],
[5.7, 3. , 4.2, 1.2],
[5.4, 3.4, 1.7, 0.2],
[5.7, 4.4, 1.5, 0.4],
[6.9, 3.1, 4.9, 1.5],
[4.6, 3.1, 1.5, 0.2],
[5.9, 3. , 5.1, 1.8],
[5.1, 2.5, 3. , 1.1],
[4.6, 3.4, 1.4, 0.3],
[6.2, 2.2, 4.5, 1.5],
[7.2, 3.6, 6.1, 2.5],
[5.7, 2.9, 4.2, 1.3],
[4.8, 3. , 1.4, 0.1],
[7.1, 3. , 5.9, 2.1],
[6.9, 3.2, 5.7, 2.3],
[6.5, 3. , 5.8, 2.2],
[6.4, 2.8, 5.6, 2.1],
[5.1, 3.8, 1.6, 0.2],
[4.8, 3.4, 1.6, 0.2],
[6.5, 3.2, 5.1, 2. ],
[6.7, 3.3, 5.7, 2.1],
[4.5, 2.3, 1.3, 0.3],
[6.2, 3.4, 5.4, 2.3],
[4.9, 3. , 1.4, 0.2],
[5.7, 2.5, 5. , 2. ],
[6.9, 3.1, 5.4, 2.1],
[4.4, 3.2, 1.3, 0.2],
[5. , 3.6, 1.4, 0.2],
[7.2, 3. , 5.8, 1.6],
[5.1, 3.5, 1.4, 0.3],
[4.4, 3. , 1.3, 0.2],
[5.4, 3.9, 1.7, 0.4],
[5.5, 2.3, 4. , 1.3],
[6.8, 3.2, 5.9, 2.3],
[7.6, 3. , 6.6, 2.1],
[5.1, 3.5, 1.4, 0.2],
[4.9, 3.1, 1.5, 0.2],
[5.2, 3.4, 1.4, 0.2],
[5.7, 2.8, 4.5, 1.3],
[6.6, 3. , 4.4, 1.4],
[5. , 3.2, 1.2, 0.2],
[5.1, 3.3, 1.7, 0.5],
[6.4, 2.9, 4.3, 1.3],
[5.4, 3.4, 1.5, 0.4],
```

```
       [7.7, 2.6, 6.9, 2.3],
       [4.9, 2.4, 3.3, 1. ],
       [7.9, 3.8, 6.4, 2. ],
       [6.7, 3.1, 4.4, 1.4],
       [5.2, 4.1, 1.5, 0.1],
       [6. , 3. , 4.8, 1.8],
       [5.8, 4. , 1.2, 0.2],
       [7.7, 2.8, 6.7, 2. ],
       [5.1, 3.8, 1.5, 0.3],
       [4.7, 3.2, 1.6, 0.2],
       [7.4, 2.8, 6.1, 1.9],
       [5. , 3.3, 1.4, 0.2],
       [6.3, 3.4, 5.6, 2.4],
       [5.7, 2.8, 4.1, 1.3],
       [5.8, 2.7, 3.9, 1.2],
       [5.7, 2.6, 3.5, 1. ],
       [6.4, 3.2, 5.3, 2.3],
       [6.7, 3. , 5.2, 2.3],
       [6.3, 2.5, 4.9, 1.5],
       [6.7, 3. , 5. , 1.7],
       [5. , 3. , 1.6, 0.2],
       [5.5, 2.4, 3.7, 1. ],
       [6.7, 3.1, 5.6, 2.4],
       [5.8, 2.7, 5.1, 1.9],
       [5.1, 3.4, 1.5, 0.2],
       [6.6, 2.9, 4.6, 1.3],
       [5.6, 3. , 4.1, 1.3],
       [5.9, 3.2, 4.8, 1.8],
       [6.3, 2.3, 4.4, 1.3],
       [5.5, 3.5, 1.3, 0.2],
       [5.1, 3.7, 1.5, 0.4],
       [4.9, 3.1, 1.5, 0.1],
       [6.3, 2.9, 5.6, 1.8],
       [5.8, 2.7, 4.1, 1. ],
       [7.7, 3.8, 6.7, 2.2],
       [4.6, 3.2, 1.4, 0.2]])
```

[153]:
```
X_test.shape
#see the number of instances and attributes  of Test data

print(y_train)
print()
y_train
```

```
[1 1 2 0 2 0 0 1 2 2 2 2 1 2 1 1 2 2 2 2 1 2 1 0 2 1 1 1 1 2 0 0 2 1 0 0 1
 0 2 1 0 1 2 1 0 2 2 2 2 0 0 2 2 0 2 0 2 2 0 0 2 0 0 0 1 2 2 0 0 0 1 1 0 0
 1 0 2 1 2 1 0 2 0 2 0 0 2 0 2 1 1 1 2 2 1 1 0 1 2 2 0 1 1 1 1 0 0 0 2 1 2
```

0]

[153]:
```
array([1, 1, 2, 0, 2, 0, 0, 1, 2, 2, 2, 2, 1, 2, 1, 1, 2, 2, 2, 2, 1, 2,
       1, 0, 2, 1, 1, 1, 1, 2, 0, 0, 2, 1, 0, 0, 1, 0, 2, 1, 0, 1, 2, 1,
       0, 2, 2, 2, 2, 0, 0, 2, 2, 0, 2, 0, 2, 2, 0, 0, 2, 0, 0, 0, 1, 2,
       2, 0, 0, 0, 1, 1, 0, 0, 1, 0, 2, 1, 2, 1, 0, 2, 0, 2, 0, 0, 2, 0,
       2, 1, 1, 1, 2, 2, 1, 1, 0, 1, 2, 2, 0, 1, 1, 1, 1, 0, 0, 0, 2, 1,
       2, 0])
```

[164]:
```
import matplotlib.pyplot as plt

fig, ax = plt.subplots(3, 3, figsize=(15,15))
plt.suptitle("iris_pairplot")

for j in range(3):
    for i in range(3):

        print("i=",i,"j=",j,"i +1=",i+1)
        ax[i, j].scatter(X_train[:,j], X_train[:, i +1 ], c=y_train, s=70)

        ␣
 ↪print("------------------------------------------------------------------------------------
        print("X_train[:,j] =",X_train[:,j])
        print()
        print("X_train[:, i +1 ]=",X_train[:, i +1 ])
        ␣
 ↪print("------------------------------------------------------------------------------------
        ax[i, j].set_xticks(())
        ax[i, j].set_yticks(())
        if i == 2:
            ax[i, j].set_xlabel(iris["feature_names"][j])
        if j == 0:
            ax[i, j].set_ylabel(iris["feature_names"][i +1])
        if j > i:
            ax[i, j].set_visible(False)


print(y_train)
```

```
i= 0 j= 0 i +1= 1
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [5.9 5.8 6.8 4.7 6.9 5.  5.4 5.  6.5 6.7 6.  6.7 5.6 7.7 6.3 5.5
6.3 6.3
 4.9 6.3 7.  6.5 6.  4.8 5.8 5.6 5.6 5.5 6.1 7.2 5.3 4.3 6.4 5.7 5.4 5.7
 6.9 4.6 5.9 5.1 4.6 6.2 7.2 5.7 4.8 7.1 6.9 6.5 6.4 5.1 4.8 6.5 6.7 4.5
 6.2 4.9 5.7 6.9 4.4 5.  7.2 5.1 4.4 5.4 5.5 6.8 7.6 5.1 4.9 5.2 5.7 6.6
```

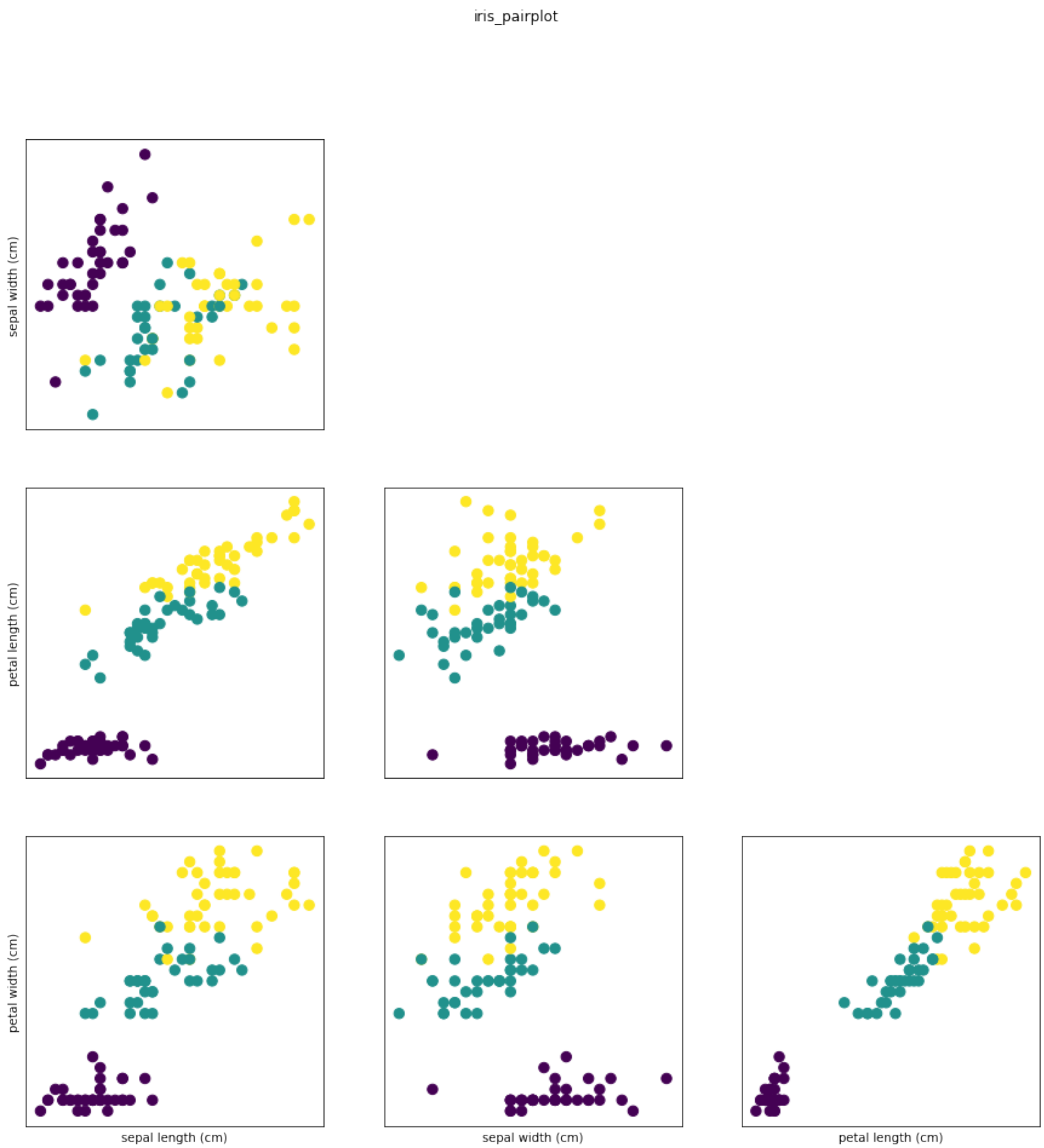
```
 5.  5.1 6.4 5.4 7.7 4.9 7.9 6.7 5.2 6.  5.8 7.7 5.1 4.7 7.4 5.  6.3 5.7
 5.8 5.7 6.4 6.7 6.3 6.7 5.  5.5 6.7 5.8 5.1 6.6 5.6 5.9 6.3 5.5 5.1 4.9
 6.3 5.8 7.7 4.6]

X_train[:, i +1 ]= [3.  2.6 3.  3.2 3.1 3.5 3.7 2.  3.  3.3 2.2 2.5 2.5 3.  3.3
2.4 2.7 2.8
 2.5 2.5 3.2 3.  3.4 3.1 2.7 2.7 2.9 2.5 3.  3.2 3.7 3.  2.7 3.  3.4 4.4
 3.1 3.1 3.  2.5 3.4 2.2 3.6 2.9 3.  3.  3.2 3.  2.8 3.8 3.4 3.2 3.3 2.3
 3.4 3.  2.5 3.1 3.2 3.6 3.  3.5 3.  3.9 2.3 3.2 3.  3.5 3.1 3.4 2.8 3.
 3.2 3.3 2.9 3.4 2.6 2.4 3.8 3.1 4.1 3.  4.  2.8 3.8 3.2 2.8 3.3 3.4 2.8
 2.7 2.6 3.2 3.  2.5 3.  3.  2.4 3.1 2.7 3.4 2.9 3.  3.2 2.3 3.5 3.7 3.1
 2.9 2.7 3.8 3.2]
--------------------------------------------------------------------------------
----------------
i= 1 j= 0 i +1= 2
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [5.9 5.8 6.8 4.7 6.9 5.  5.4 5.  6.5 6.7 6.  6.7 5.6 7.7 6.3 5.5
6.3 6.3
 4.9 6.3 7.  6.5 6.  4.8 5.8 5.6 5.6 5.5 6.1 7.2 5.3 4.3 6.4 5.7 5.4 5.7
 6.9 4.6 5.9 5.1 4.6 6.2 7.2 5.7 4.8 7.1 6.9 6.5 6.4 5.1 4.8 6.5 6.7 4.5
 6.2 4.9 5.7 6.9 4.4 5.  7.2 5.1 4.4 5.4 5.5 6.8 7.6 5.1 4.9 5.2 5.7 6.6
 5.  5.1 6.4 5.4 7.7 4.9 7.9 6.7 5.2 6.  5.8 7.7 5.1 4.7 7.4 5.  6.3 5.7
 5.8 5.7 6.4 6.7 6.3 6.7 5.  5.5 6.7 5.8 5.1 6.6 5.6 5.9 6.3 5.5 5.1 4.9
 6.3 5.8 7.7 4.6]

X_train[:, i +1 ]= [4.2 4.  5.5 1.3 5.1 1.6 1.5 3.5 5.5 5.7 5.  5.8 3.9 6.1 4.7
3.8 4.9 5.1
 4.5 5.  4.7 5.2 4.5 1.6 5.1 4.2 3.6 4.  4.6 6.  1.5 1.1 5.3 4.2 1.7 1.5
 4.9 1.5 5.1 3.  1.4 4.5 6.1 4.2 1.4 5.9 5.7 5.8 5.6 1.6 1.6 5.1 5.7 1.3
 5.4 1.4 5.  5.4 1.3 1.4 5.8 1.4 1.3 1.7 4.  5.9 6.6 1.4 1.5 1.4 4.5 4.4
 1.2 1.7 4.3 1.5 6.9 3.3 6.4 4.4 1.5 4.8 1.2 6.7 1.5 1.6 6.1 1.4 5.6 4.1
 3.9 3.5 5.3 5.2 4.9 5.  1.6 3.7 5.6 5.1 1.5 4.6 4.1 4.8 4.4 1.3 1.5 1.5
 5.6 4.1 6.7 1.4]
--------------------------------------------------------------------------------
----------------
i= 2 j= 0 i +1= 3
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [5.9 5.8 6.8 4.7 6.9 5.  5.4 5.  6.5 6.7 6.  6.7 5.6 7.7 6.3 5.5
6.3 6.3
 4.9 6.3 7.  6.5 6.  4.8 5.8 5.6 5.6 5.5 6.1 7.2 5.3 4.3 6.4 5.7 5.4 5.7
 6.9 4.6 5.9 5.1 4.6 6.2 7.2 5.7 4.8 7.1 6.9 6.5 6.4 5.1 4.8 6.5 6.7 4.5
 6.2 4.9 5.7 6.9 4.4 5.  7.2 5.1 4.4 5.4 5.5 6.8 7.6 5.1 4.9 5.2 5.7 6.6
 5.  5.1 6.4 5.4 7.7 4.9 7.9 6.7 5.2 6.  5.8 7.7 5.1 4.7 7.4 5.  6.3 5.7
 5.8 5.7 6.4 6.7 6.3 6.7 5.  5.5 6.7 5.8 5.1 6.6 5.6 5.9 6.3 5.5 5.1 4.9
 6.3 5.8 7.7 4.6]
```

```
X_train[:, i +1 ]= [1.5 1.2 2.1 0.2 2.3 0.6 0.2 1.  1.8 2.5 1.5 1.8 1.1 2.3 1.6
1.1 1.8 1.5
 1.7 1.9 1.4 2.  1.6 0.2 1.9 1.3 1.3 1.3 1.4 1.8 0.2 0.1 1.9 1.2 0.2 0.4
 1.5 0.2 1.8 1.1 0.3 1.5 2.5 1.3 0.1 2.1 2.3 2.2 2.1 0.2 0.2 2.  2.1 0.3
 2.3 0.2 2.  2.1 0.2 0.2 1.6 0.3 0.2 0.4 1.3 2.3 2.1 0.2 0.2 0.2 1.3 1.4
 0.2 0.5 1.3 0.4 2.3 1.  2.  1.4 0.1 1.8 0.2 2.  0.3 0.2 1.9 0.2 2.4 1.3
 1.2 1.  2.3 2.3 1.5 1.7 0.2 1.  2.4 1.9 0.2 1.3 1.3 1.8 1.3 0.2 0.4 0.1
 1.8 1.  2.2 0.2]
--------------------------------------------------------------------------------
----------------
i= 0 j= 1 i +1= 1
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [3.  2.6 3.  3.2 3.1 3.5 3.7 2.  3.  3.3 2.2 2.5 2.5 3.  3.3 2.4
2.7 2.8
 2.5 2.5 3.2 3.  3.4 3.1 2.7 2.7 2.9 2.5 3.  3.2 3.7 3.  2.7 3.  3.4 4.4
 3.1 3.1 3.  2.5 3.4 2.2 3.6 2.9 3.  3.  3.2 3.  2.8 3.8 3.4 3.2 3.3 2.3
 3.4 3.  2.5 3.1 3.2 3.6 3.  3.5 3.  3.9 2.3 3.2 3.  3.5 3.1 3.4 2.8 3.
 3.2 3.3 2.9 3.4 2.6 2.4 3.8 3.1 4.1 3.  4.  2.8 3.8 3.2 2.8 3.3 3.4 2.8
 2.7 2.6 3.2 3.  2.5 3.  3.  2.4 3.1 2.7 3.4 2.9 3.  3.2 2.3 3.5 3.7 3.1
 2.9 2.7 3.8 3.2]

X_train[:, i +1 ]= [3.  2.6 3.  3.2 3.1 3.5 3.7 2.  3.  3.3 2.2 2.5 2.5 3.  3.3
2.4 2.7 2.8
 2.5 2.5 3.2 3.  3.4 3.1 2.7 2.7 2.9 2.5 3.  3.2 3.7 3.  2.7 3.  3.4 4.4
 3.1 3.1 3.  2.5 3.4 2.2 3.6 2.9 3.  3.  3.2 3.  2.8 3.8 3.4 3.2 3.3 2.3
 3.4 3.  2.5 3.1 3.2 3.6 3.  3.5 3.  3.9 2.3 3.2 3.  3.5 3.1 3.4 2.8 3.
 3.2 3.3 2.9 3.4 2.6 2.4 3.8 3.1 4.1 3.  4.  2.8 3.8 3.2 2.8 3.3 3.4 2.8
 2.7 2.6 3.2 3.  2.5 3.  3.  2.4 3.1 2.7 3.4 2.9 3.  3.2 2.3 3.5 3.7 3.1
 2.9 2.7 3.8 3.2]
--------------------------------------------------------------------------------
----------------
i= 1 j= 1 i +1= 2
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [3.  2.6 3.  3.2 3.1 3.5 3.7 2.  3.  3.3 2.2 2.5 2.5 3.  3.3 2.4
2.7 2.8
 2.5 2.5 3.2 3.  3.4 3.1 2.7 2.7 2.9 2.5 3.  3.2 3.7 3.  2.7 3.  3.4 4.4
 3.1 3.1 3.  2.5 3.4 2.2 3.6 2.9 3.  3.  3.2 3.  2.8 3.8 3.4 3.2 3.3 2.3
 3.4 3.  2.5 3.1 3.2 3.6 3.  3.5 3.  3.9 2.3 3.2 3.  3.5 3.1 3.4 2.8 3.
 3.2 3.3 2.9 3.4 2.6 2.4 3.8 3.1 4.1 3.  4.  2.8 3.8 3.2 2.8 3.3 3.4 2.8
 2.7 2.6 3.2 3.  2.5 3.  3.  2.4 3.1 2.7 3.4 2.9 3.  3.2 2.3 3.5 3.7 3.1
 2.9 2.7 3.8 3.2]

X_train[:, i +1 ]= [4.2 4.  5.5 1.3 5.1 1.6 1.5 3.5 5.5 5.7 5.  5.8 3.9 6.1 4.7
3.8 4.9 5.1
 4.5 5.  4.7 5.2 4.5 1.6 5.1 4.2 3.6 4.  4.6 6.  1.5 1.1 5.3 4.2 1.7 1.5
 4.9 1.5 5.1 3.  1.4 4.5 6.1 4.2 1.4 5.9 5.7 5.8 5.6 1.6 1.6 5.1 5.7 1.3
```

```
 5.4 1.4 5.  5.4 1.3 1.4 5.8 1.4 1.3 1.7 4.  5.9 6.6 1.4 1.5 1.4 4.5 4.4
 1.2 1.7 4.3 1.5 6.9 3.3 6.4 4.4 1.5 4.8 1.2 6.7 1.5 1.6 6.1 1.4 5.6 4.1
 3.9 3.5 5.3 5.2 4.9 5.  1.6 3.7 5.6 5.1 1.5 4.6 4.1 4.8 4.4 1.3 1.5 1.5
 5.6 4.1 6.7 1.4]
--------------------------------------------------------------------------------
----------------
i= 2 j= 1 i +1= 3
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [3.  2.6 3.  3.2 3.1 3.5 3.7 2.  3.  3.3 2.2 2.5 2.5 3.  3.3 2.4
2.7 2.8
 2.5 2.5 3.2 3.  3.4 3.1 2.7 2.7 2.9 2.5 3.  3.2 3.7 3.  2.7 3.  3.4 4.4
 3.1 3.1 3.  2.5 3.4 2.2 3.6 2.9 3.  3.  3.2 3.  2.8 3.8 3.4 3.2 3.3 2.3
 3.4 3.  2.5 3.1 3.2 3.6 3.  3.5 3.  3.9 2.3 3.2 3.  3.5 3.1 3.4 2.8 3.
 3.2 3.3 2.9 3.4 2.6 2.4 3.8 3.1 4.1 3.  4.  2.8 3.8 3.2 2.8 3.3 3.4 2.8
 2.7 2.6 3.2 3.  2.5 3.  3.  2.4 3.1 2.7 3.4 2.9 3.  3.2 2.3 3.5 3.7 3.1
 2.9 2.7 3.8 3.2]

X_train[:, i +1 ]= [1.5 1.2 2.1 0.2 2.3 0.6 0.2 1.  1.8 2.5 1.5 1.8 1.1 2.3 1.6
1.1 1.8 1.5
 1.7 1.9 1.4 2.  1.6 0.2 1.9 1.3 1.3 1.3 1.4 1.8 0.2 0.1 1.9 1.2 0.2 0.4
 1.5 0.2 1.8 1.1 0.3 1.5 2.5 1.3 0.1 2.1 2.3 2.2 2.1 0.2 0.2 2.  2.1 0.3
 2.3 0.2 2.  2.1 0.2 0.2 1.6 0.3 0.2 0.4 1.3 2.3 2.1 0.2 0.2 0.2 1.3 1.4
 0.2 0.5 1.3 0.4 2.3 1.  2.  1.4 0.1 1.8 0.2 2.  0.3 0.2 1.9 0.2 2.4 1.3
 1.2 1.  2.3 2.3 1.5 1.7 0.2 1.  2.4 1.9 0.2 1.3 1.3 1.8 1.3 0.2 0.4 0.1
 1.8 1.  2.2 0.2]
--------------------------------------------------------------------------------
----------------
i= 0 j= 2 i +1= 1
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [4.2 4.  5.5 1.3 5.1 1.6 1.5 3.5 5.5 5.7 5.  5.8 3.9 6.1 4.7 3.8
4.9 5.1
 4.5 5.  4.7 5.2 4.5 1.6 5.1 4.2 3.6 4.  4.6 6.  1.5 1.1 5.3 4.2 1.7 1.5
 4.9 1.5 5.1 3.  1.4 4.5 6.1 4.2 1.4 5.9 5.7 5.8 5.6 1.6 1.6 5.1 5.7 1.3
 5.4 1.4 5.  5.4 1.3 1.4 5.8 1.4 1.3 1.7 4.  5.9 6.6 1.4 1.5 1.4 4.5 4.4
 1.2 1.7 4.3 1.5 6.9 3.3 6.4 4.4 1.5 4.8 1.2 6.7 1.5 1.6 6.1 1.4 5.6 4.1
 3.9 3.5 5.3 5.2 4.9 5.  1.6 3.7 5.6 5.1 1.5 4.6 4.1 4.8 4.4 1.3 1.5 1.5
 5.6 4.1 6.7 1.4]

X_train[:, i +1 ]= [3.  2.6 3.  3.2 3.1 3.5 3.7 2.  3.  3.3 2.2 2.5 2.5 3.  3.3
2.4 2.7 2.8
 2.5 2.5 3.2 3.  3.4 3.1 2.7 2.7 2.9 2.5 3.  3.2 3.7 3.  2.7 3.  3.4 4.4
 3.1 3.1 3.  2.5 3.4 2.2 3.6 2.9 3.  3.  3.2 3.  2.8 3.8 3.4 3.2 3.3 2.3
 3.4 3.  2.5 3.1 3.2 3.6 3.  3.5 3.  3.9 2.3 3.2 3.  3.5 3.1 3.4 2.8 3.
 3.2 3.3 2.9 3.4 2.6 2.4 3.8 3.1 4.1 3.  4.  2.8 3.8 3.2 2.8 3.3 3.4 2.8
 2.7 2.6 3.2 3.  2.5 3.  3.  2.4 3.1 2.7 3.4 2.9 3.  3.2 2.3 3.5 3.7 3.1
 2.9 2.7 3.8 3.2]
```

```
--------------------------------------------------------------------------------
----------------
i= 1 j= 2 i +1= 2
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [4.2 4.  5.5 1.3 5.1 1.6 1.5 3.5 5.5 5.7 5.  5.8 3.9 6.1 4.7 3.8
4.9 5.1
 4.5 5.  4.7 5.2 4.5 1.6 5.1 4.2 3.6 4.  4.6 6.  1.5 1.1 5.3 4.2 1.7 1.5
 4.9 1.5 5.1 3.  1.4 4.5 6.1 4.2 1.4 5.9 5.7 5.8 5.6 1.6 1.6 5.1 5.7 1.3
 5.4 1.4 5.  5.4 1.3 1.4 5.8 1.4 1.3 1.7 4.  5.9 6.6 1.4 1.5 1.4 4.5 4.4
 1.2 1.7 4.3 1.5 6.9 3.3 6.4 4.4 1.5 4.8 1.2 6.7 1.5 1.6 6.1 1.4 5.6 4.1
 3.9 3.5 5.3 5.2 4.9 5.  1.6 3.7 5.6 5.1 1.5 4.6 4.1 4.8 4.4 1.3 1.5 1.5
 5.6 4.1 6.7 1.4]

X_train[:, i +1 ]= [4.2 4.  5.5 1.3 5.1 1.6 1.5 3.5 5.5 5.7 5.  5.8 3.9 6.1 4.7
3.8 4.9 5.1
 4.5 5.  4.7 5.2 4.5 1.6 5.1 4.2 3.6 4.  4.6 6.  1.5 1.1 5.3 4.2 1.7 1.5
 4.9 1.5 5.1 3.  1.4 4.5 6.1 4.2 1.4 5.9 5.7 5.8 5.6 1.6 1.6 5.1 5.7 1.3
 5.4 1.4 5.  5.4 1.3 1.4 5.8 1.4 1.3 1.7 4.  5.9 6.6 1.4 1.5 1.4 4.5 4.4
 1.2 1.7 4.3 1.5 6.9 3.3 6.4 4.4 1.5 4.8 1.2 6.7 1.5 1.6 6.1 1.4 5.6 4.1
 3.9 3.5 5.3 5.2 4.9 5.  1.6 3.7 5.6 5.1 1.5 4.6 4.1 4.8 4.4 1.3 1.5 1.5
 5.6 4.1 6.7 1.4]
--------------------------------------------------------------------------------
----------------
i= 2 j= 2 i +1= 3
--------------------------------------------------------------------------------
----------------
X_train[:,j] = [4.2 4.  5.5 1.3 5.1 1.6 1.5 3.5 5.5 5.7 5.  5.8 3.9 6.1 4.7 3.8
4.9 5.1
 4.5 5.  4.7 5.2 4.5 1.6 5.1 4.2 3.6 4.  4.6 6.  1.5 1.1 5.3 4.2 1.7 1.5
 4.9 1.5 5.1 3.  1.4 4.5 6.1 4.2 1.4 5.9 5.7 5.8 5.6 1.6 1.6 5.1 5.7 1.3
 5.4 1.4 5.  5.4 1.3 1.4 5.8 1.4 1.3 1.7 4.  5.9 6.6 1.4 1.5 1.4 4.5 4.4
 1.2 1.7 4.3 1.5 6.9 3.3 6.4 4.4 1.5 4.8 1.2 6.7 1.5 1.6 6.1 1.4 5.6 4.1
 3.9 3.5 5.3 5.2 4.9 5.  1.6 3.7 5.6 5.1 1.5 4.6 4.1 4.8 4.4 1.3 1.5 1.5
 5.6 4.1 6.7 1.4]

X_train[:, i +1 ]= [1.5 1.2 2.1 0.2 2.3 0.6 0.2 1.  1.8 2.5 1.5 1.8 1.1 2.3 1.6
1.1 1.8 1.5
 1.7 1.9 1.4 2.  1.6 0.2 1.9 1.3 1.3 1.3 1.4 1.8 0.2 0.1 1.9 1.2 0.2 0.4
 1.5 0.2 1.8 1.1 0.3 1.5 2.5 1.3 0.1 2.1 2.3 2.2 2.1 0.2 0.2 2.  2.1 0.3
 2.3 0.2 2.  2.1 0.2 0.2 1.6 0.3 0.2 0.4 1.3 2.3 2.1 0.2 0.2 0.2 1.3 1.4
 0.2 0.5 1.3 0.4 2.3 1.  2.  1.4 0.1 1.8 0.2 2.  0.3 0.2 1.9 0.2 2.4 1.3
 1.2 1.  2.3 2.3 1.5 1.7 0.2 1.  2.4 1.9 0.2 1.3 1.3 1.8 1.3 0.2 0.4 0.1
 1.8 1.  2.2 0.2]
--------------------------------------------------------------------------------
----------------
[1 1 2 0 2 0 0 1 2 2 2 2 1 2 1 1 2 2 2 2 1 2 1 0 2 1 1 1 1 2 0 0 2 1 0 0 1
 0 2 1 0 1 2 1 0 2 2 2 2 0 0 2 2 0 2 0 2 2 0 0 2 0 0 0 1 2 2 0 0 0 1 1 0 0
```

```
1 0 2 1 2 1 0 2 0 2 0 0 2 0 2 1 1 1 2 2 1 1 0 1 2 2 0 1 1 1 1 0 0 0 2 1 2
0]
```



As you can see, without using a Machine Learning algorithm you determined that there are certain ways to determine if your data can be classified for example plotting the data first, you can that there are attributes that reflect very well iris' classifications

matplotlib.pyplot.subplots

matplotlib.pyplot.subplots(nrows=1, ncols=1, sharex=False, sharey=False, squeeze=True, subplot_kw=None, gridspec_kw=None, **fig_kw)

[152]:
```
y_train
```

[152]:
```
array([1, 1, 2, 0, 2, 0, 0, 1, 2, 2, 2, 2, 1, 2, 1, 1, 2, 2, 2, 2, 1, 2,
       1, 0, 2, 1, 1, 1, 1, 2, 0, 0, 2, 1, 0, 0, 1, 0, 2, 1, 0, 1, 2, 1,
       0, 2, 2, 2, 2, 0, 0, 2, 2, 0, 2, 0, 2, 2, 0, 0, 2, 0, 0, 0, 1, 2,
       2, 0, 0, 0, 1, 1, 0, 0, 1, 0, 2, 1, 2, 1, 0, 2, 0, 2, 0, 0, 2, 0,
       2, 1, 1, 1, 2, 2, 1, 1, 0, 1, 2, 2, 0, 1, 1, 1, 1, 0, 0, 0, 2, 1,
       2, 0])
```

[170]:
```
y_train.size
```

[170]:
```
112
```

[171]:
```
X_train.size
```

[171]:
```
448
```

[38]:
```
X_test
```

[38]:
```
array([[5.8, 2.8, 5.1, 2.4],
       [6. , 2.2, 4. , 1. ],
       [5.5, 4.2, 1.4, 0.2],
       [7.3, 2.9, 6.3, 1.8],
       [5. , 3.4, 1.5, 0.2],
       [6.3, 3.3, 6. , 2.5],
       [5. , 3.5, 1.3, 0.3],
       [6.7, 3.1, 4.7, 1.5],
       [6.8, 2.8, 4.8, 1.4],
       [6.1, 2.8, 4. , 1.3],
       [6.1, 2.6, 5.6, 1.4],
       [6.4, 3.2, 4.5, 1.5],
       [6.1, 2.8, 4.7, 1.2],
       [6.5, 2.8, 4.6, 1.5],
       [6.1, 2.9, 4.7, 1.4],
       [4.9, 3.6, 1.4, 0.1],
       [6. , 2.9, 4.5, 1.5],
       [5.5, 2.6, 4.4, 1.2],
       [4.8, 3. , 1.4, 0.3],
       [5.4, 3.9, 1.3, 0.4],
       [5.6, 2.8, 4.9, 2. ],
       [5.6, 3. , 4.5, 1.5],
       [4.8, 3.4, 1.9, 0.2],
       [4.4, 2.9, 1.4, 0.2],
       [6.2, 2.8, 4.8, 1.8],
       [4.6, 3.6, 1. , 0.2],
       [5.1, 3.8, 1.9, 0.4],
       [6.2, 2.9, 4.3, 1.3],
```

```
        [5. , 2.3, 3.3, 1. ],
        [5. , 3.4, 1.6, 0.4],
        [6.4, 3.1, 5.5, 1.8],
        [5.4, 3. , 4.5, 1.5],
        [5.2, 3.5, 1.5, 0.2],
        [6.1, 3. , 4.9, 1.8],
        [6.4, 2.8, 5.6, 2.2],
        [5.2, 2.7, 3.9, 1.4],
        [5.7, 3.8, 1.7, 0.3],
        [6. , 2.7, 5.1, 1.6]])
```

[52]:

```
{x= 0
for i in range(3):
    print("a")
    for j in range(3):
        print (i, j)
        x = x +1
```

```
a
0 0
0 1
0 2
a
1 0
1 1
1 2
a
2 0
2 1
2 2
```

[186]:

```
lol = np.array([[2,3,5,560] , [266,56,14,23], [22,35,14, 2],[2,33,18,56]])
print(lol)
maria = np.array([1, 2, 2, 0])
feature = np.array(["john", "luis", "2", "0"])
```

```
[[  2   3   5 560]
 [266  56  14  23]
 [ 22  35  14   2]
 [  2  33  18  56]]
```

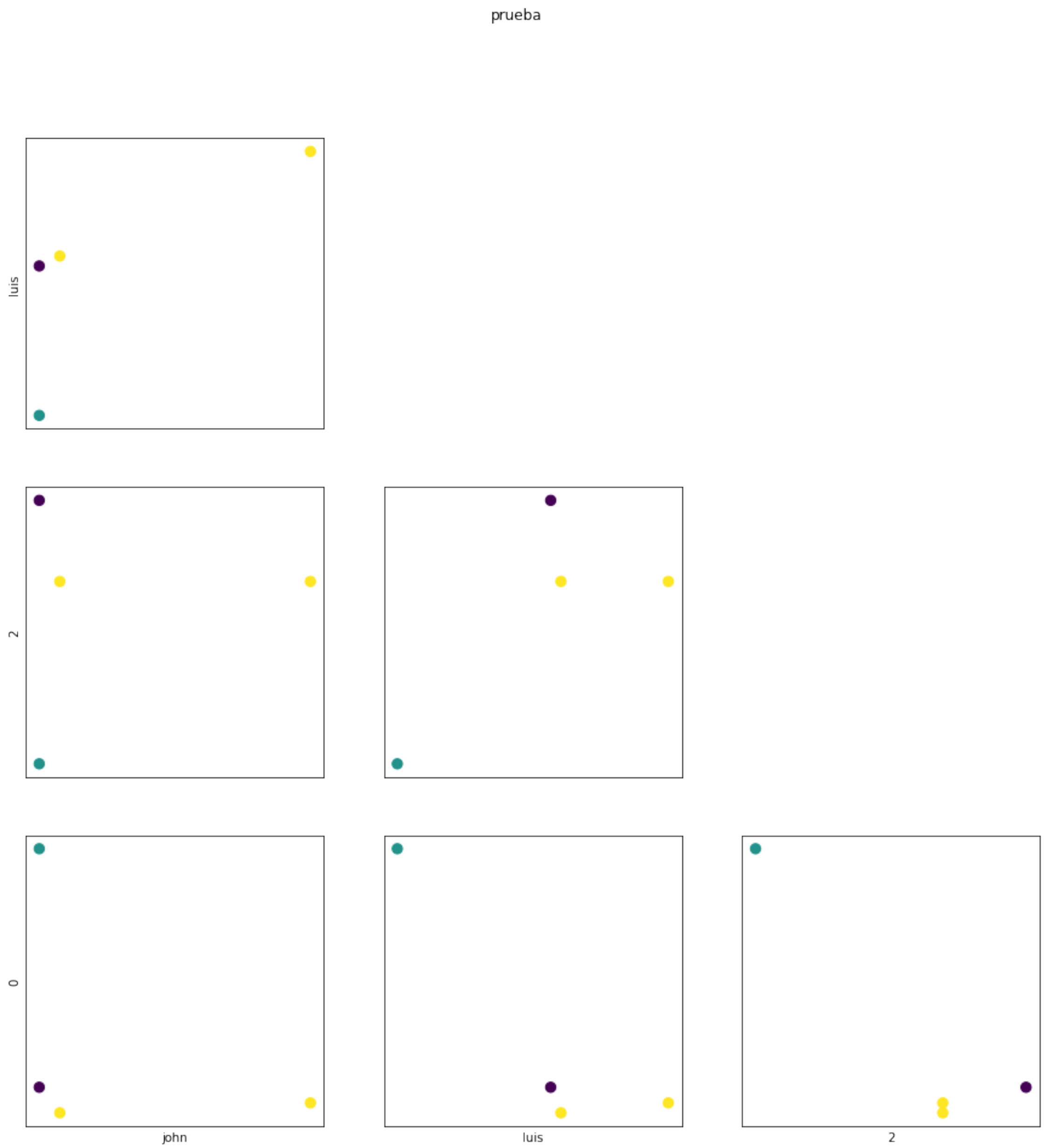
[187]:

```
import matplotlib.pyplot as plt

fig, ax = plt.subplots(3, 3, figsize=(15,15))
plt.suptitle("prueba")

for j in range(3):
```

```
    for i in range(3):
        ax[i, j].scatter(lol[:,j], lol[:, i +1 ], c=maria , s=70)
        print("i=",i,"j=",j,"  i+1=",i+1)
        print(lol[:,j])
        print(lol[:, i +1 ])
        print(".....")
        ax[i, j].set_xticks(())
        ax[i, j].set_yticks(())
        if i == 2:
            ax[i, j].set_xlabel(feature[j])
        if j == 0:
            ax[i, j].set_ylabel(feature[i +1])
        if j > i:
            ax[i, j].set_visible(False)
```

```
i= 0 j= 0   i+1= 1
[  2 266  22   2]
[ 3 56 35 33]
…
i= 1 j= 0   i+1= 2
[  2 266  22   2]
[ 5 14 14 18]
…
i= 2 j= 0   i+1= 3
[  2 266  22   2]
[560  23   2  56]
…
i= 0 j= 1   i+1= 1
[ 3 56 35 33]
[ 3 56 35 33]
…
i= 1 j= 1   i+1= 2
[ 3 56 35 33]
[ 5 14 14 18]
…
i= 2 j= 1   i+1= 3
[ 3 56 35 33]
[560  23   2  56]
…
i= 0 j= 2   i+1= 1
[ 5 14 14 18]
[ 3 56 35 33]
…
i= 1 j= 2   i+1= 2
[ 5 14 14 18]
[ 5 14 14 18]
```

```
…
i= 2 j= 2   i+1= 3
[ 5 14 14 18]
[560  23   2  56]
…
```




```
[ ]:
```

```
[ ]:
```