Day8Logistic_Regression

笔记本:	100days
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Logistic_Regression

In [10]:

9

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
import sklearn
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score
```

. . .

In [11]:

1

```
df = pd.read_csv('iris-data.csv')
```

. . .

In [12]:

1

```
df.head()
```

Out[12]:

	SEPAL_LENGTH_CM	SEPAL_WIDTH_CM	PETAL_LENGTH_CM	PETAL_WIDTH_CM	CLASS
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa

SEPAL_LENGTH_CM	SEPAL_WIDTH_CM	PETAL_LENGTH_CM	PETAL_WIDTH_CM	CLASS	
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

. . .

In [13]:

1

```
df.describe()
```

Out[13]:

SEPAL_LENGTH_CM	SEPAL_WIDTH_CM	PETAL_LENGTH_CM	PETAL_WIDTH_CM	
count	150.000000	150.000000	150.000000	145.000000
mean	5.644627	3.054667	3.758667	1.236552
std	1.312781	0.433123	1.764420	0.755058
min	0.055000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.400000
50%	5.700000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

. . .

In [5]:

1

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
sepal_length_cm    150 non-null float64
sepal_width_cm     150 non-null float64
petal_length_cm    150 non-null float64
petal_width_cm     145 non-null float64
class              150 non-null object
dtypes: float64(4), object(1)
memory usage: 5.9+ KB
```

. . .

In [6]:

3

```
#Removing all null values row
```

```
df = df.dropna(subset=['petal_width_cm'])
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 145 entries, 0 to 149
Data columns (total 5 columns):
sepal_length_cm    145 non-null float64
sepal_width_cm     145 non-null float64
petal_length_cm    145 non-null float64
petal_width_cm     145 non-null float64
class              145 non-null object
dtypes: float64(4), object(1)
memory usage: 6.8+ KB
```

. . .

In [8]:

1

```
#Plot
```

. . .

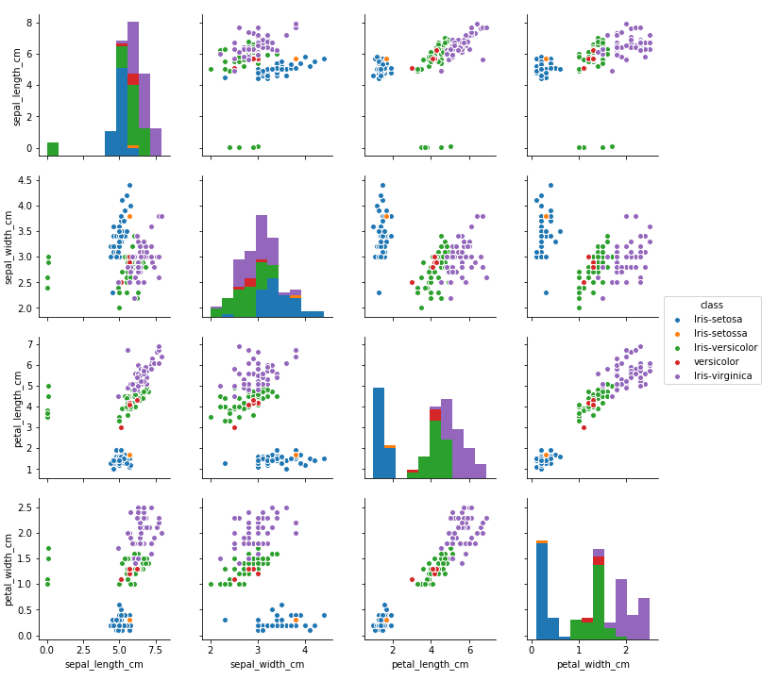
In [8]:

1

```
sns.pairplot(df, hue='class', size=2.5)
```

Out[8]:

```
<seaborn.axisgrid.PairGrid at 0x1afc795f048>
```



. . .

From the plots it can be observed that there is some abnormality in the class name. Let's explore further

In [9]:

1

```
df['class'].value_counts()
```

Out[9]:

```
Iris-virginica     50
Iris-versicolor    45
Iris-setosa        44
versicolor          5
Iris-setossa        1
Name: class, dtype: int64
```

. . .

Two observations can be made from the above results

- For 5 data points 'Iris-versicolor' has been specified as 'versicolor'
- For 1 data points, 'Iris-setosa' has been specified as 'Iris-setossa'

In [10]:

1

```
df['class'].replace(["Iris-setossa","versicolor"], ["Iris-setosa","Iris-versicolor"], inplace=True)
```

```
df['class'].value_counts()
```

Out[10]:

```
Iris-virginica     50
Iris-versicolor    50
Iris-setosa        45
Name: class, dtype: int64
```

. . .

Simple Logistic Regression¶

Consider only two class 'Iris-setosa' and 'Iris-versicolor'. Dropping all other class

In [11]:

1

```
final_df = df[df['class'] != 'Iris-virginica']
```

. . .

In [12]:

1

```
final_df.head()
```

Out[12]:

	SEPAL_LENGTH_CM	SEPAL_WIDTH_CM	PETAL_LENGTH_CM	PETAL_WIDTH_CM	CLASS
0	5.1	3.5	1.4	0.2	Iris-setosa

	SEPAL_LENGTH_CM	SEPAL_WIDTH_CM	PETAL_LENGTH_CM	PETAL_WIDTH_CM	CLASS
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

. . .

Outlier Check¶

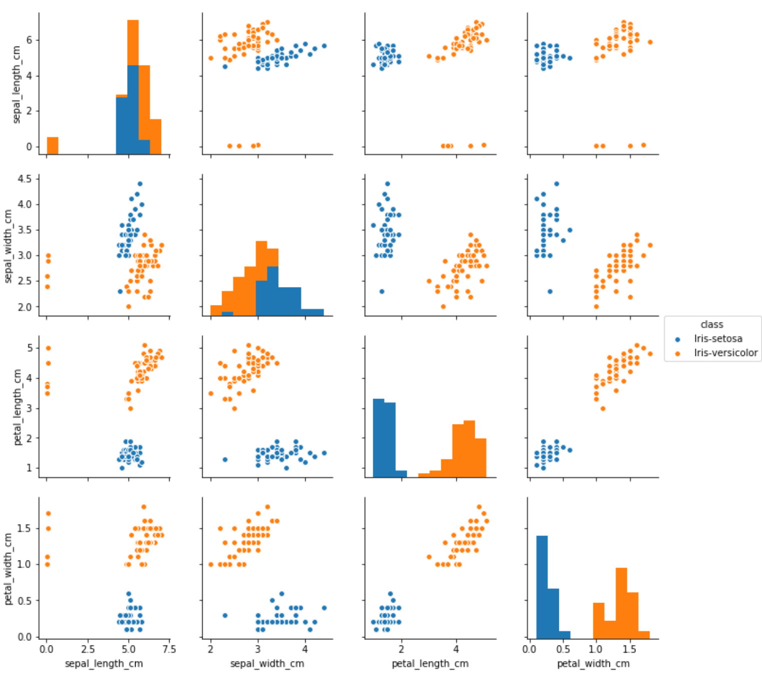
In [13]:

```
1
```

```
sns.pairplot(final_df, hue='class', size=2.5)
```

Out[13]:

```
<seaborn.axisgrid.PairGrid at 0x1afc9d13ba8>
```



. . .

From the above plot, sepal_width and sepal_length seems to have outliers. To confirm let's plot them seperately

SEPAL LENGTH

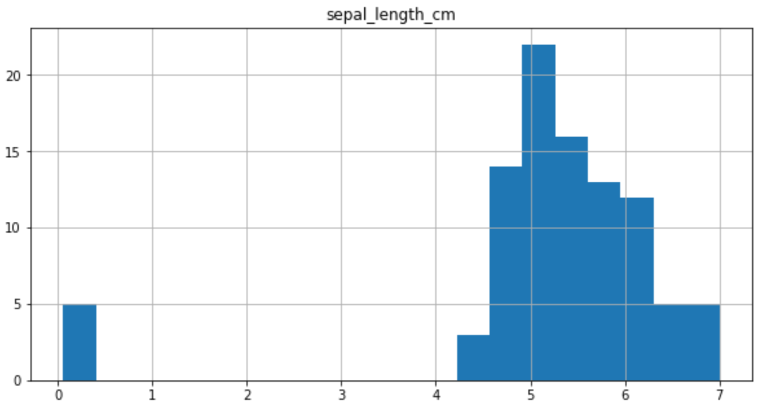
In [14]:

```
1
```

```
final_df.hist(column = 'sepal_length_cm',bins=20, figsize=(10,5))
```

Out[14]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001AFCA702128>]], dtype=object)
```



. . .

It can be observed from the plot, that for 5 data points values are below 1 and they seem to be outliers. So, these data points are considered to be in 'm' and are converted to 'cm'.

In [15]:

1

```
final_df.loc[final_df.sepal_length_cm < 1, ['sepal_length_cm']] = final_df['sepal_length_cm']*100
```

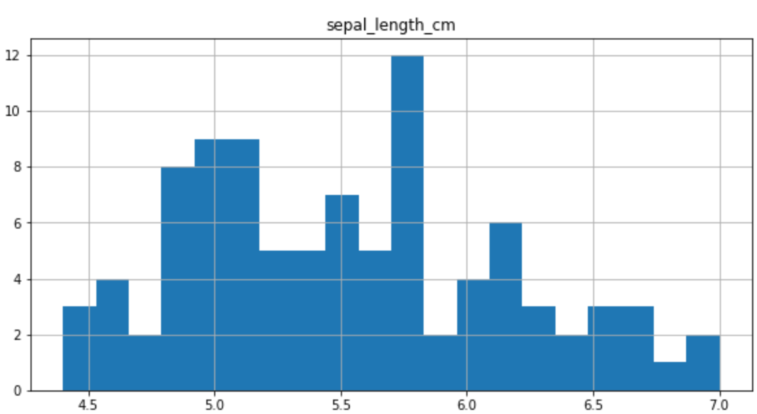
```
final_df.hist(column = 'sepal_length_cm',bins=20, figsize=(10,5))
```

```
C:\Users\saish\Anaconda2\envs\tensorflow\lib\site-packages\pandas\core\indexing.py:517: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#indexing-view-versus-copy
  self.obj[item] = s
```

Out[15]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001AFCA731D68>]], dtype=object)
```



. . .

SEPAL WIDTH

In [16]:

1

```
final_df = final_df.drop(final_df[(final_df['class'] == "Iris-setosa") & (final_df['sepal_width_cm'] < 2.5)].index)
```

. . .

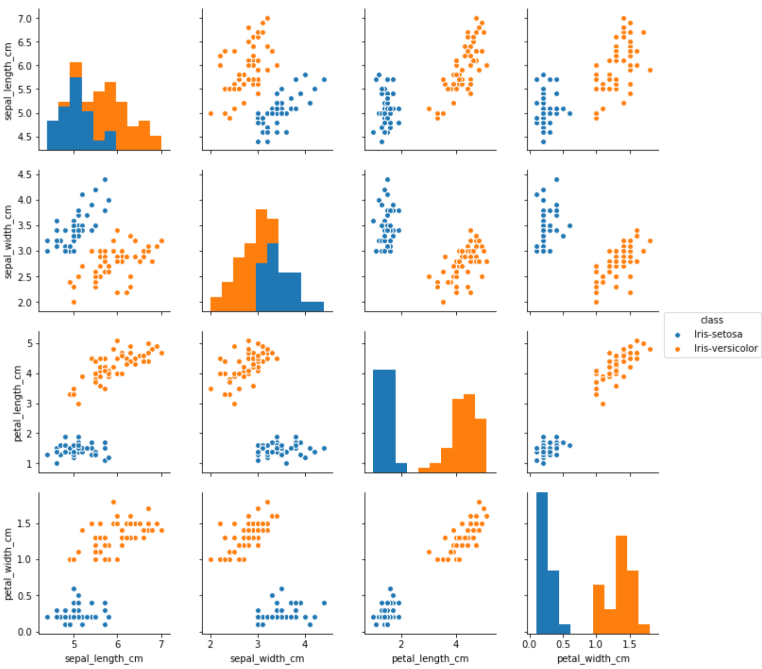
In [17]:

1

```
sns.pairplot(final_df, hue='class', size=2.5)
```

Out[17]:

```
<seaborn.axisgrid.PairGrid at 0x1afcaeef2b0>
```



. . .

Successfully removed outliers!!

Label Encoding¶

In [18]:

1

```
final_df['class'].replace(["Iris-setosa","Iris-versicolor"], [1,0], inplace=True)
```

. . .

In [19]:

1

```
final_df.head()
```

Out[19]:

	SEPAL_LENGTH_CM	SEPAL_WIDTH_CM	PETAL_LENGTH_CM	PETAL_WIDTH_CM	CLASS
0	5.1	3.5	1.4	0.2	1
1	4.9	3.0	1.4	0.2	1
2	4.7	3.2	1.3	0.2	1
3	4.6	3.1	1.5	0.2	1
4	5.0	3.6	1.4	0.2	1

. . .

Model Construction¶

In [20]:

1

```
inp_df = final_df.drop(final_df.columns[[4]], axis=1)

out_df = final_df.drop(final_df.columns[[0,1,2,3]], axis=1)

#

scaler = StandardScaler()

inp_df = scaler.fit_transform(inp_df)

#

X_train, X_test, y_train, y_test = train_test_split(inp_df, out_df, test_size=0.2, random_state=42)
```

. . .

In [21]:

1

```
X_tr_arr = X_train

X_ts_arr = X_test

y_tr_arr = y_train.as_matrix()

y_ts_arr = y_test.as_matrix()
```

. . .

In [22]:

1

```
print('Input Shape', (X_tr_arr.shape))

print('Output Shape', X_test.shape)
```

```
Input Shape (75, 4)
Output Shape (19, 4)
```

. . .

In [23]:

```
def weightInitialization(n_features):
    w = np.zeros((1,n_features))
    b = 0
    return w,b
```

. . .

In [24]:

```
def sigmoid_activation(result):
    final_result = 1/(1+np.exp(-result))
    return final_result
```

. . .

In [25]:

```
def model_optimize(w, b, X, Y):
    m = X.shape[0]
    #Prediction
    final_result = sigmoid_activation(np.dot(w,X.T)+b)
    Y_T = Y.T
    cost = (-1/m)*(np.sum((Y_T*np.log(final_result)) + ((1-Y_T)*(np.log(1-final_result)))))
    #
    #Gradient calculation
    dw = (1/m)*(np.dot(X.T, (final_result-Y.T).T))
    db = (1/m)*(np.sum(final_result-Y.T))
    grads = {"dw": dw, "db": db}
    return grads, cost
```

. . .

In [26]:

```
def model_predict(w, b, X, Y, learning_rate, no_iterations):
    costs = []
    for i in range(no_iterations):
        #
        grads, cost = model_optimize(w,b,X,Y)
        #
        dw = grads["dw"]
        db = grads["db"]
        #weight update
        w = w - (learning_rate * (dw.T))
        b = b - (learning_rate * db)
        #
        if (i % 100 == 0):
            costs.append(cost)
            #print("Cost after %i iteration is %f" %(i, cost))
    #final parameters
    coeff = {"w": w, "b": b}
    gradient = {"dw": dw, "db": db}
    return coeff, gradient, costs
```

. . .

In [27]:

1

```
def predict(final_pred, m):
    y_pred = np.zeros((1,m))
    for i in range(final_pred.shape[1]):
        if final_pred[0][i] > 0.5:
            y_pred[0][i] = 1
    return y_pred
```

. . .

In [28]:

1

23

```
#Get number of features

n_features = X_tr_arr.shape[1]

print('Number of Features', n_features)

w, b = weightInitialization(n_features)

#Gradient Descent

coeff, gradient, costs = model_predict(w, b, X_tr_arr, y_tr_arr, learning_rate=0.0001,no_iterations=4500)

#Final prediction

w = coeff["w"]

b = coeff["b"]

print('Optimized weights', w)

print('Optimized intercept',b)

#

final_train_pred = sigmoid_activation(np.dot(w,X_tr_arr.T)+b)

final_test_pred = sigmoid_activation(np.dot(w,X_ts_arr.T)+b)

#

m_tr =  X_tr_arr.shape[0]

m_ts =  X_ts_arr.shape[0]

#

y_tr_pred = predict(final_train_pred, m_tr)

print('Training Accuracy',accuracy_score(y_tr_pred.T, y_tr_arr))

#

y_ts_pred = predict(final_test_pred, m_ts)

print('Test Accuracy',accuracy_score(y_ts_pred.T, y_ts_arr))
```

```
Number of Features 4
Optimized weights [[-0.13397714  0.13130132 -0.18248682 -0.18319564]]
Optimized intercept -0.0241346319213
Training Accuracy 1.0
Test Accuracy 1.0
```

. . .

In [29]:

1

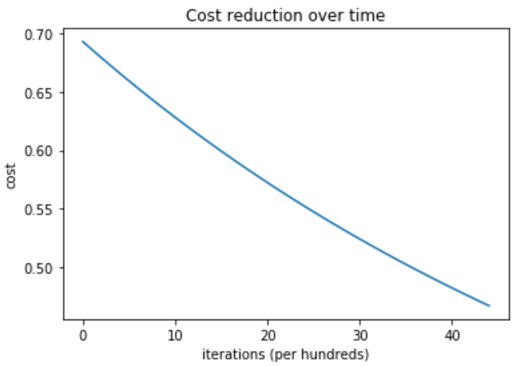
```
plt.plot(costs)
```

```
plt.ylabel('cost')
```

```
plt.xlabel('iterations (per hundreds)')
```

```
plt.title('Cost reduction over time')
```

```
plt.show()
```



. . .

In [30]:

1

```
from sklearn.linear_model import LogisticRegression
```

. . .

In [31]:

1

```
clf = LogisticRegression()
```

. . .

In [32]:

1

```
clf.fit(X_tr_arr, y_tr_arr)
```

```
C:\Users\saish\Anaconda2\envs\tensorflow\lib\site-packages\sklearn\utils\validation.py:547: DataConversionWarning: A column-vector y was passed when a 1d array v
  y = column_or_1d(y, warn=True)
```

Out[32]:

```
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)
```

. . .

In [33]:

1

```
print (clf.intercept_, clf.coef_)
```

```
[-0.32958987] [[-0.65118738  1.21001434 -1.38924001 -1.46364162]]
```

. . .

In [34]:

1

```
pred = clf.predict(X_ts_arr)
```

. . .

In [35]:

1

```
print ('Accuracy from sk-learn: {0}'.format(clf.score(X_ts_arr, y_ts_arr)))
```

```
Accuracy from sk-learn: 1.0
```

. . .

In [ ]:

1

```

```

. . .