MLFA_ASSGN_2

January 30, 2022

[ ]:

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# MLFA Assignment 2

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[1]:

```
# import commands
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
```

[2]:

```
# installing wget on Colab then downloading dataset
!pip install wget
import wget
url = 'https://archive.ics.uci.edu/ml/machine-learning-databases/00537/sobar-72.
 ↪csv'
filename = wget.download(url)
```

```
Requirement already satisfied: wget in
/home/tfjuror/anaconda3/lib/python3.7/site-packages (3.2)
```

[3]:

```
# setting a seed for repeatability
np.random.seed(42)
```

[4]:

```
# adding a bias column to imported dataframe so that b can be simulated with a␣
 ↪theta parameter later
df = pd.read_csv("sobar-72.csv")
df.insert(0, "bias", np.ones((72)), False)
```

[5]:
```
df.shape
```

[5]:
```
(72, 21)
```

[6]:
```
df.head()
```

[6]:
```
   bias  behavior_sexualRisk  behavior_eating  behavior_personalHygine  \
0   1.0                   10               13                       12   
1   1.0                   10               11                       11   
2   1.0                   10               15                        3   
3   1.0                   10               11                       10   
4   1.0                    8               11                        7   

   intention_aggregation  intention_commitment  attitude_consistency  \
0                      4                     7                     9   
1                     10                    14                     7   
2                      2                    14                     8   
3                     10                    15                     7   
4                      8                    10                     7   

   attitude_spontaneity  norm_significantPerson  norm_fulfillment  ...  \
0                    10                       1                 8  ...   
1                     7                       5                 5  ...   
2                    10                       1                 4  ...   
3                     7                       1                 5  ...   
4                     8                       1                 5  ...   

   perception_severity  motivation_strength  motivation_willingness  \
0                    3                   14                       8   
1                    2                   15                      13   
2                    2                    7                       3   
3                    2                   15                      13   
4                    2                   15                       5   

   socialSupport_emotionality  socialSupport_appreciation  \
0                           5                           7   
1                           7                           6   
2                           3                           6   
3                           7                           4   
4                           3                           6   

   socialSupport_instrumental  empowerment_knowledge  empowerment_abilities  \
0                          12                     12                     11   
1                           5                      5                      4   
2                          11                      3                      3   
3                           4                      4                      4   
4                          12                      5                      4   
```

```
   empowerment_desires  ca_cervix
0                    8          1
1                    4          1
2                   15          1
3                    4          1
4                    7          1

[5 rows x 21 columns]
```

[7]:

```
X = df.iloc[:,:-1]
y = df.iloc[:,-1]
```

[8]:

```
# splitting train and test sets using specified instructions
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.1,␣
 ↪random_state=42)
```

[9]:

```
# specified hyperparameters used
learning_rate = 0.001
iterations = 1000
loss_array =[]
```

[10]:

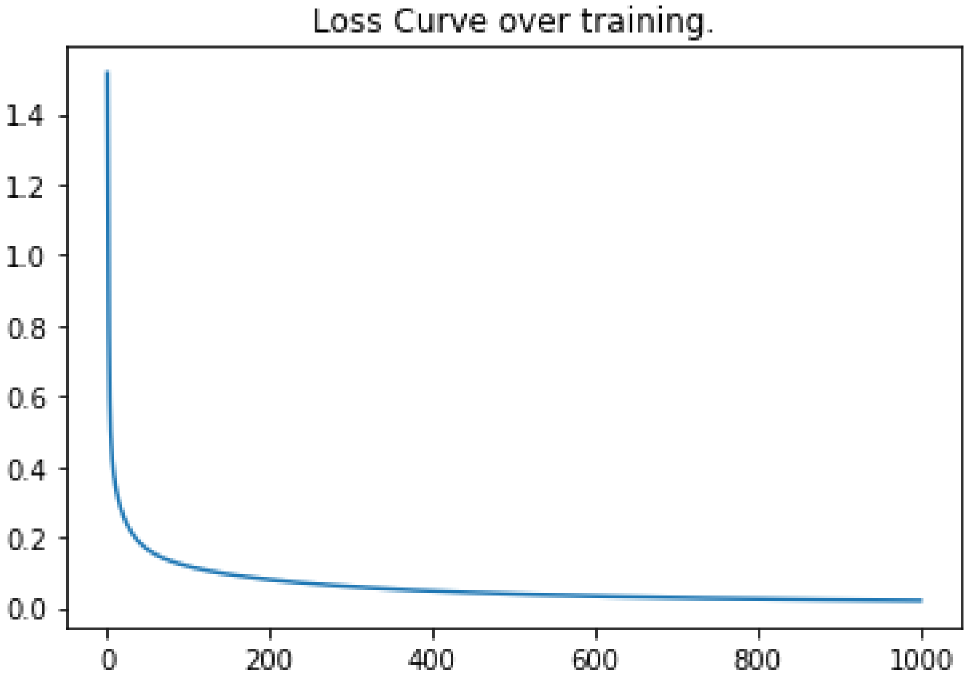
```
# random initialisation of the parameters of the model
params = np.random.rand(20,1)
```

[11]:

```
# the learning loop is run for specified number of interations
for iter in range(iterations):
    avg_loss = 0

    # each data row is seen during each epoch
    for curr_index in range(X_train.shape[0]):

        # extracting a row from train set
        test_row = X_train.iloc[curr_index]
        test_row = np.array(test_row)
        test_row = np.reshape(test_row,(-1,1))

        # label is the ground truth
        label = y_train.iloc[curr_index]

        # calculating Z, the linear function of features
        Z = np.matmul(np.transpose(params),test_row)
        Z = Z[0,0]

        # logistic function applied
        LR = np.exp(Z)/(1+np.exp(Z))
        # calculating the loss
        loss = label*np.log(LR) + (1-label)*np.log(1-LR)
        avg_loss = avg_loss+loss

        # updating param values
        for i in range(20):
            params[i] = params[i] + learning_rate*((label - LR)*test_row[i])

    avg_loss = avg_loss/X_train.shape[0]
    # appending avg loss per epoch at to an array
    loss_array.append(np.abs(avg_loss))
```

```
/home/tfjuror/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:24:
RuntimeWarning: divide by zero encountered in log
/home/tfjuror/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:24:
RuntimeWarning: invalid value encountered in multiply
```

[12]:
```
# decreasing loss is seen
plt.plot(loss_array)
plt.title("Loss Curve over training.")
plt.show()
```



[13]:
```
# utility function that prints the accuracy on a dataset (X,y)
# params is the array with trained parameter values
def accuracy_ours(X,y,params):
    correct=0
    for i in range(X.shape[0]):
        test_row = X.iloc[i]
        test_row = np.array(test_row)
        test_row = np.reshape(test_row,(-1,1))
        Z = np.matmul(np.transpose(params),test_row)
        Z = Z[0,0]

        LR = np.exp(Z)/(1+np.exp(Z))
        pred=0
        if(LR>0.5):
            pred = 1

        if(pred == y.iloc[i]):
            correct= correct+1

    print(correct/X.shape[0])
```

[14]:

```
# final accuracy on the train set
accuracy_ours(X_train,y_train,params)
```

```
1.0
```

[15]:

```
# accuracy(OURS) on the test dataset
accuracy_ours(X_test,y_test,params)
```

```
1.0
```

[16]:

```
# Now we train the LogisticRegression object from SKLEARN on the same train␣
 ↪dataset with same hyperparameters
clf = LogisticRegression(random_state=42,max_iter=1000,).fit(X_train, y_train)

# predictions are generated on the test dataset
pred = clf.predict(X_test)
```

[17]:

```
# utility function that prints accuracy on a dataset(X,y)
# clf is the trained classifier model that needs to be passed
def accuracy_sklearn(X,y,clf):
    correct=0

    # predictions are generated on the test dataset
    pred = clf.predict(X)

    for i in range(X.shape[0]):
        if(pred[i] == y.iloc[i]):
            correct= correct+1
    print(correct/X.shape[0])
```

[18]:

```
# accuracy of the SKLEARN model trained on same train set on the same test set
accuracy_sklearn(X_test,y_test,clf)
```

```
1.0
```