HW1-1 Regression-1106

November 7, 2019

[2]:

```
#author = 0712238@NCTU, Maxwill Lin, YT Lin
#last update = 2019.11.07
#usage = HW1 of Deep Learning 2019 fall @ NCTU
#regression part
#preprocess with normaliztion and one-hot vectorization
#NN architectur = NN([17, 10, 5, 1],activations=['sigmoid', 'sigmoid', 'relu'],␣
 ↪usage = 'regression')
#train and test with split data set
#learning curve + train/test RMS
#save files

#2019.11.06-07 some bug fixed, improvement on weight init, experiments
```

[3]:

```
import numpy as np
import math
import pandas as pd
from model import *
import csv
import matplotlib.pyplot as plt
import pickle
```

[4]:

```
#preprocessing
df = pd.read_csv("EnergyEfficiency_data.csv")
df
```

[4]:

```
     Relative Compactness  Surface Area  Wall Area  Roof Area  Overall Height  \
0                    0.98         514.5      294.0     110.25             7.0
1                    0.98         514.5      294.0     110.25             7.0
2                    0.98         514.5      294.0     110.25             7.0
3                    0.98         514.5      294.0     110.25             7.0
4                    0.90         563.5      318.5     122.50             7.0
..                    …           …          …         …               …
763                  0.64         784.0      343.0     220.50             3.5
764                  0.62         808.5      367.5     220.50             3.5
765                  0.62         808.5      367.5     220.50             3.5
766                  0.62         808.5      367.5     220.50             3.5
767                  0.62         808.5      367.5     220.50             3.5
```

```
     Orientation  Glazing Area  Glazing Area Distribution  Heating Load  \
0              2           0.0                          0         15.55
1              3           0.0                          0         15.55
2              4           0.0                          0         15.55
3              5           0.0                          0         15.55
4              2           0.0                          0         20.84
..           …            …                        …           …
763            5           0.4                          5         17.88
764            2           0.4                          5         16.54
765            3           0.4                          5         16.44
766            4           0.4                          5         16.48
767            5           0.4                          5         16.64

     Cooling Load
0           21.33
1           21.33
2           21.33
3           21.33
4           28.28
..             …
763         21.40
764         16.88
765         17.11
766         16.61
767         16.03

[768 rows x 10 columns]
```

[5]:

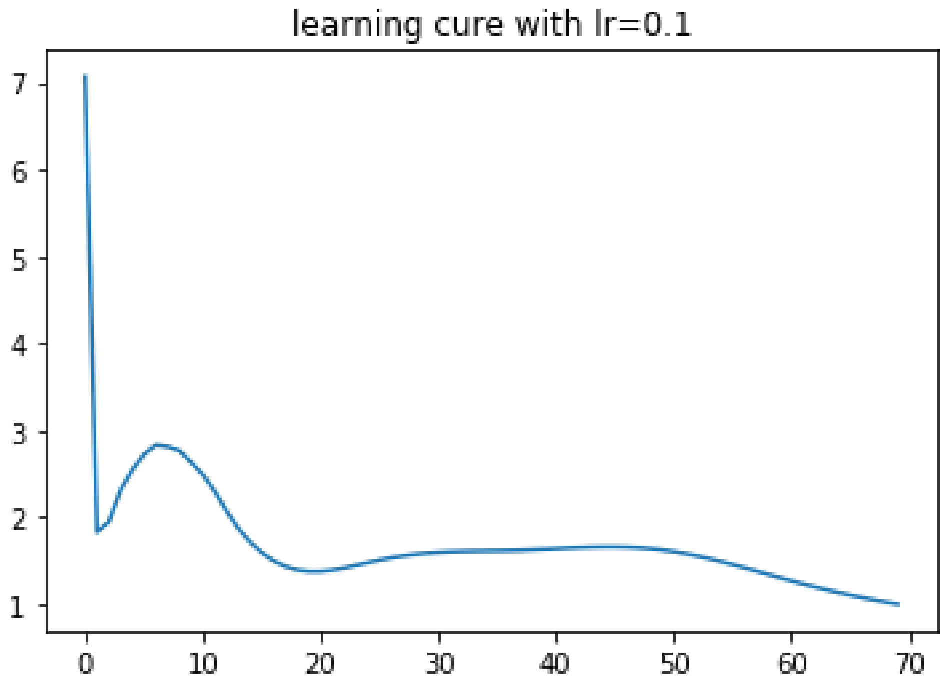
```
def get_onehot(df, name):
    A = df[name].values
    n = A.shape[0]
    onehot_A = np.zeros((n,max(A)-min(A)+1))
    onehot_A[np.arange(n), A-min(A)] = 1
    return onehot_A

def normalize(X):
    s = [ np.mean(dim) for dim in X.T]
    X = np.asarray([np.divide(x, s) for x in X])
    return X

O = get_onehot(df, "Orientation")
G = get_onehot(df, "Glazing Area Distribution")
y = df["Heating Load"].values.reshape((-1,1))
y.shape
Other = df.drop(['Orientation', 'Glazing Area Distribution', "Heating Load"],␣
 ↪axis=1).values
```

```
X = np.c_[normalize(Other), O, G]
assert(X.shape[1] == O.shape[1]+G.shape[1]+Other.shape[1])

def partition(X, y, ratio=0.75):
    n = X.shape[0]
    indices = np.arange(n)
    np.random.shuffle(indices)
    X = X[indices]
    y = y[indices]
    p = int(n*ratio)
    train_X = X[:p]
    test_X = X[p:]
    train_y = y[:p]
    test_y = y[p:]
    return train_X, train_y, test_X, test_y

train_X, train_y, test_X, test_y = partition(X, y, ratio=0.75)
```

[6]:

```
nn = NN([train_X.shape[1], 10, 5,  1],activations=['sigmoid', 'sigmoid',␣
 ↪'relu'], usage = 'regression')
#the network architecture is as the constructer

lr = .1
learning_curve = nn.train(train_X, train_y, epochs=70, batch_size=10, lr = lr)
#lr = 0.5 => too large, 0.1 => ok, 0.01 =>  smooth and as good as 0.1

train_RMS = nn.calc_error(train_X, train_y)
test_RMS = nn.calc_error(test_X, test_y)

plt.title("learning cure with lr={}".format(lr))
plt.plot(np.arange(len(learning_curve)), learning_curve, label='lr={}'.
 ↪format(lr))
print('train_RMS = ', train_RMS, '\n', 'test_RMS = ', test_RMS)

#improve weight initialization by Xavier/HE Init
#i.e. self.weights.append(np.random.randn(layers[i+1], layers[i])*np.
 ↪sqrt(layers[i])/2.)
#train_RMS =  24.520031677634964 (0 grad(<0.001) verified by assert(assert(np.
 ↪linalg.norm(dw[i]) > eps)) )
```

```
train_RMS =  1.4740087997456948
 test_RMS =  1.6367335249675623
```



```
[14]: def save_res(name):
          pathcsv = "./predictions/"
          reg_train_csv = pathcsv + "reg_train_pred_"+name+".csv"
          reg_test_csv = pathcsv + "reg_test_pred_"+name+".csv"
          with open(reg_train_csv, 'w', newline='') as csvFile:
              writer = csv.writer(csvFile)
              writer.writerow(['prediction', 'label'])
              for i in range(train_X.shape[0]):
                  writer.writerow([nn.prediction(np.asarray([train_X[i]]))[0][0],␣
       ↪train_y[i][0]])
          with open(reg_test_csv, 'w', newline='') as csvFile:
              writer = csv.writer(csvFile)
              writer.writerow(['prediction', 'label'])
              for i in range(test_X.shape[0]):
                  writer.writerow([nn.prediction(np.asarray([test_X[i]]))[0][0],␣
       ↪test_y[i][0]])

          pathnn = "./savedmodels/"
          savefilename = pathnn +"reg_nn_"+name
          with open(savefilename, 'wb') as fo:
              pickle.dump(nn, fo)

      save_res("1107-1")
```

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