Assignment03

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0. Install the package

0.1 package for linear regression

```
!pip install tensorflow==1.12.0
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from google.colab import files
```

0.2 package for 3d plotting

```
from mpl_toolkits.mplot3d.axes3d import Axes3D
from matplotlib import cm
```

1. Input the data

1.1 Load the data

```
uploaded=files.upload()
path = "data.csv"

data = np.genfromtxt(path, delimiter=',')

x_data = data[:, 0]
y_data = data[:, 1]
num_data=len(x_data)
```

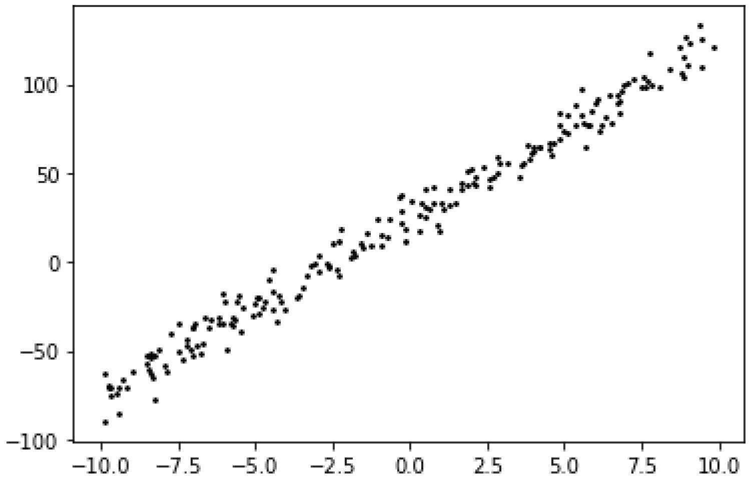
파일 선택 data.csv

- **data.csv**(text/csv) - 4186 bytes, last modified: 2020. 4. 10. - 100% done

```
Saving data.csv to data.csv
```

1.2 Plotting the input data

```
plt.scatter(x_data,y_data,c='k',s=3)
plt.show()
```



2. Relinear regression

2.1 Set the variables

```
theta1=tf.Variable(tf.random_normal([1],name='weight'))
theta0=tf.Variable(tf.random_normal([1],name='bias'))
#theta1=tf.Variable(-30.0)
#theta0=tf.Variable(-30.0)

X=tf.placeholder(tf.float32)
Y=tf.placeholder(tf.float32)


## hypothesis X*theta1+theta0
hypothesis= X*theta1+theta0
```

2.2 Cost function and Gradient descent

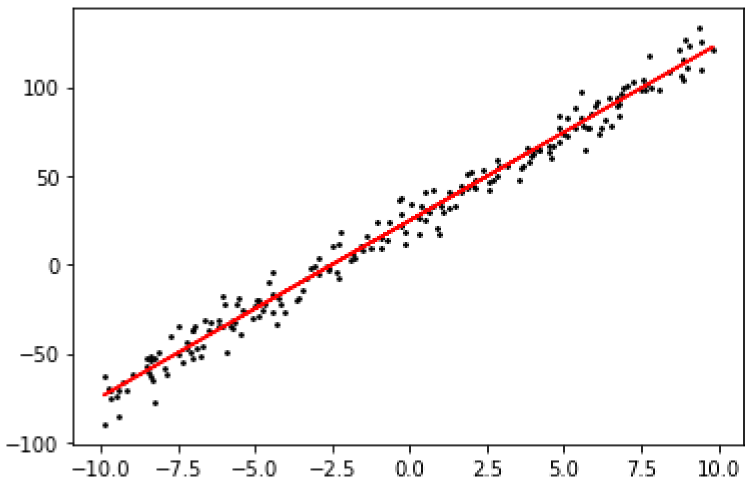
```
## Cost/loss function
cost= 0.5*tf.reduce_mean(tf.square(hypothesis-Y))

## Minimize
optimizer=tf.train.GradientDescentOptimizer(learning_rate=0.01)
train=optimizer.minimize(cost)
```

2.3 Fit the data

```
## Launch the graph in a session
sess=tf.Session()

## Initializes global variables in the graph
sess.run(tf.global_variables_initializer())

for step in range(3001):
    sess.run(train,feed_dict={X:x_data, Y:y_data})
    sess.run(train,feed_dict={X:x_data, Y:y_data})
```

2.4 Plotting the linear regression

```
def fun_H(x):
    f=sess.run(theta1)*x+sess.run(theta0)
    return f
Y_plot=fun_H(x_data)

plt.scatter(x_data,y_data,color='black',s=3)
plt.plot(x_data,Y_plot,color='red')
plt.show()
```



3. Energy surface

3.1 Define J function

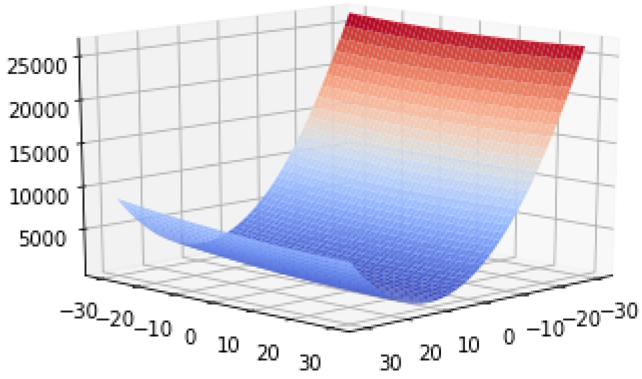
```
def J(W,b,x,y,m):
  r=0
  for i in range(m):
    r=r+(b+W*x[i]-y[i])**2
    ans=0.5*1/m*r
  return ans
```

3.2 Set variables for 3d plotting

```
x_cost=np.arange(-30,30,0.1)
y_cost=np.arange(-30,30,0.1)
XX, YY = np.meshgrid(x_cost,y_cost)
```

3.3 Plotting the energy surface

```
fig= plt.figure()
ax = fig.add_subplot(1,1,1,projection='3d')
ax.plot_surface(XX, YY,J(XX,YY,x_data,y_data,num_data),cmap=cm.coolwarm)
ax.view_init(15,45)
ax.view_init(15,45)
plt.show()
```

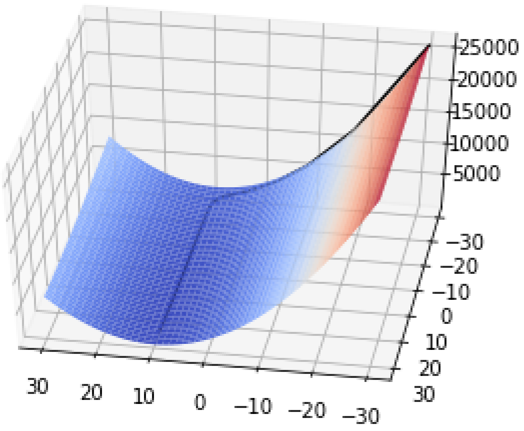


3.4 Find gradient decent (initial condition θ0=-30, θ1=-30)

```
## set variable theta1=-30, theta0=-30
theta1=tf.Variable(-30.0)
theta0=tf.Variable(-30.0)

theta1_history=[]
theta0_history=[]
cost_history=[]

## hypothesis X*theta1+theta0
hypothesis= x_data*theta1+theta0


## cost/loss function
cost=J(theta1,theta0,x_data,y_data,num_data)

## Minimize
optimizer=tf.train.GradientDescentOptimizer(learning_rate=0.01)
train=optimizer.minimize(cost)



##launch the graph in a session
sess=tf.Session()

##initializes global variables in the graph
sess.run(tf.global_variables_initializer())

for step in range(3001):
    theta1_history.append(sess.run(theta1))
    theta0_history.append(sess.run(theta0))
    cost_history.append(sess.run(cost))
    sess.run(train)
```

3.5 Plotting the optimization path

```
fig = plt.figure()
ax = fig.add_subplot(1,1,1,projection='3d')
ax.plot_surface(XX, YY,J(XX,YY,x_data,y_data,num_data),cmap=cm.coolwarm)
ax.plot(theta1_history,theta0_history,cost_history,color='black')
ax.view_init(45,100)
```


25000
20000
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5000
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