Machine_learning_lab_report_1

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Machine learning Lab report

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List of Lab-Programme

1. Using Linear Regression fit The data points
2. Using some random data point find out the the maximum likelihood using the concept of prior and posterior probability and plot it.
3. Using Naive Bayes find out the Giveing sms/email content it belongs ham or spam.
4. using the logistic regression find out the weight
5. using the concept of SVM make simple digit classifier of mnist dataset
6. Using KNN classifier concept make a digit recognize classifier.
7. Solve XOR problem Using Single perceptron
8. Make a simple forward and backward perceptron
9. using gauusian classifer find out the maximum likelihood and find out the bias and variance
10. using basis concept find out the different

Fit line and curve of the Given Dataset using linear regression method

1(a). Line

```
In [2]: #import the necessary package
        import matplotlib.pyplot as plt
        import numpy as np
        from numpy.linalg import inv
        from sklearn.metrics import mean_squared_error
```

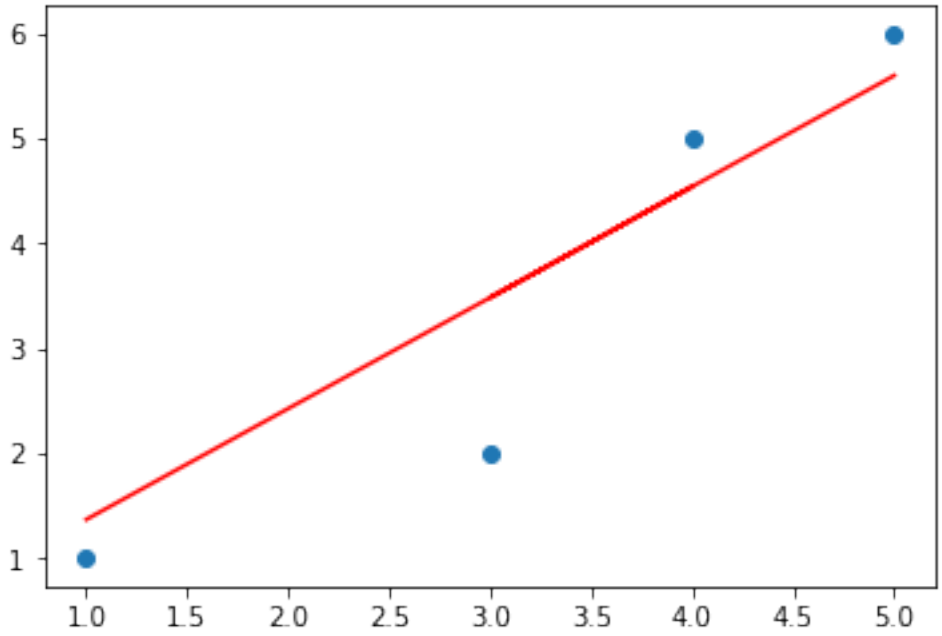
```
a1=np.array([1,4,3,5])
b1=np.array([1,5,2,6])
a=np.array([[1,1],[1,4],[1,3],[1,5]] )
b=a.transpose()
c=np.matmul(b,a)
d=inv(c)
e=np.matmul(d,b)
y=np.array([[2],[5],[2],[6]])
f=np.matmul(e,y)
print("the inetercept= %f and weight= %f :" %(f[0],f[1]))

c=f[0]
m=f[1]

plt.scatter(a1,b1)
plt.plot(a1,a1*m+c,'r')
plt.show()

# find the accuracy using rmse value
acc=mean_squared_error(b1,a1*m+c)
print("The Rmse value is:%f" %(acc))
```

```
the inetercept= 0.314286 and weight= 1.057143 :
```




```
The Rmse value is:0.678571
```

1(b). Fit Curve

In [3]:
```
import matplotlib.pyplot as plt
import numpy as np
from sklearn import datasets, linear_model
from numpy.linalg import inv

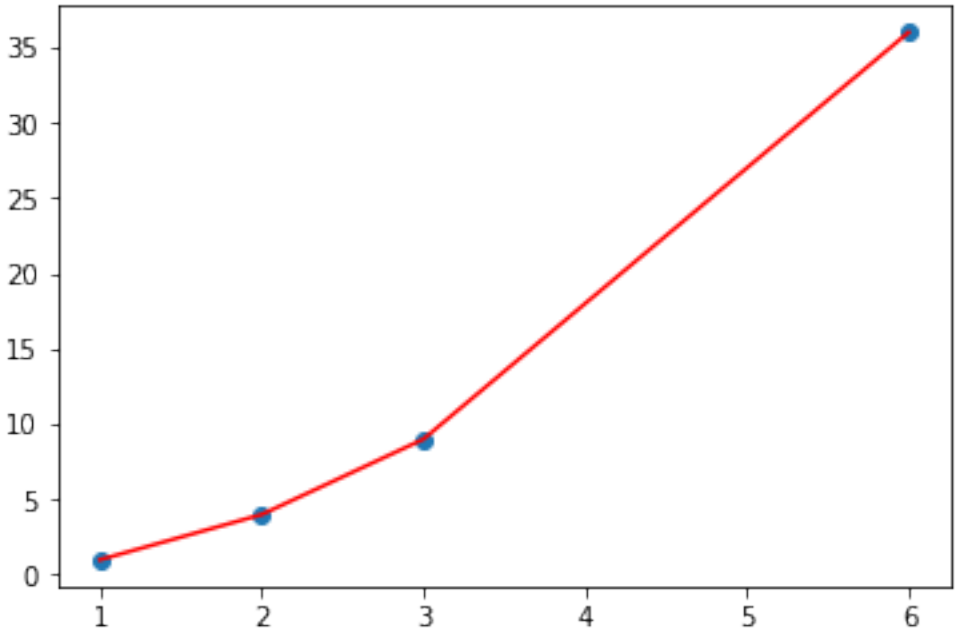

x1=np.array([1,2,3,6])
y1=np.array([1,4,9,36])

a=np.array([[1,1,1],[1,2,4],[1,3,9],[1,6,36]])
b=a.transpose()
c=np.matmul(b,a)
d=inv(c)
e=np.matmul(d,b)
y=np.array([[1],[4],[9],[36]])
f=np.matmul(e,y)
print("The Intercept is: %f and weights are:(%f,%f):" %(f[0],f[1],f[2]))
c=f[0]
b=f[1]
a3=f[2]
plt.scatter(x1,y1)
plt.plot(x1,x1*x1*a3+x1*b+c,'r')
plt.show()

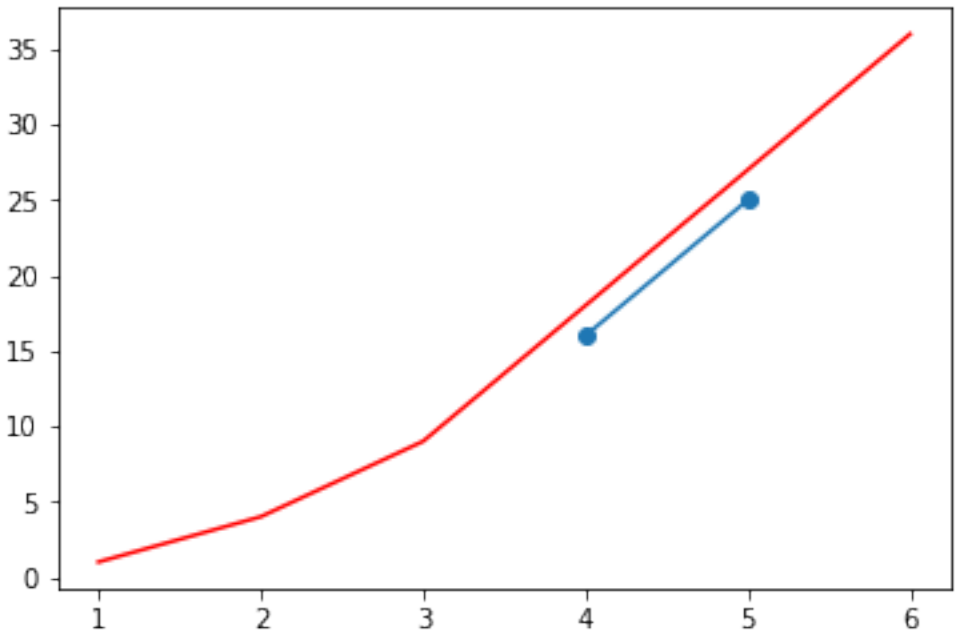
##tesing data
x_test1=np.array([4,5])
y_test=x_test1*x_test1*a3+x_test1*b+c
print("X value is" )
print(x_test1)
print("The Y predicted corresponding to X is" )
print(y_test)

#plot
plt.scatter(x_test1,y_test)
plt.plot(x1,x1*x1*a3+x1*b+c,'r',x_test1,y_test)
plt.show()
```

```
The Intercept is: -0.000000 and weights are:(-0.000000,1.000000):
```




```
X value is
[4 5]
The Y predicted corresponding to X is
[ 16.  25.]
```



As above graph shown in fig has red and blue color line red color is shown for training data and blue will be for testing data

2 Using some random data point find out the the maximum likelihood using the concept of prior and posterior probability and plot it.

```
In [4]: import numpy as np
        import matplotlib.pyplot as plt

        x=np.array([0.0,0.25,0.5,0.75,1.0])
        y=np.array([0.2,0.2,0.2,0.2,0.2])
        prior_matrix=np.array([[0.0,0.2],[0.25,0.2],[0.5,0.2],[0.75,0.2],[1.0,0.2]])

        print("The probability at intital will be same ")
        print(y)

        Total_Heads=5
        Total_Tails=5

        #using binomial distribution find out the likelihood
        likelihood=pow(x,Total_Heads)*pow(1-x,Total_Tails)

        sbplot, (first_axes, sec_axes, third_axes) = plt.subplots(3, 1, sharex=True)

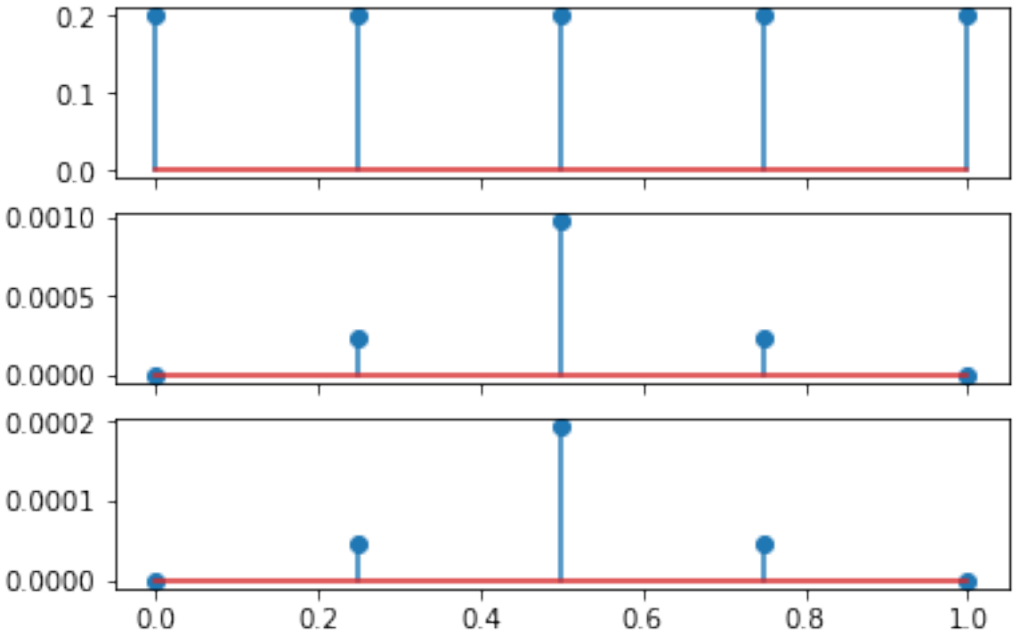
        #plot value and their equal probablity (initial probabilty)
        first_axes.stem(x, y)

        #plot x and  maximum likelihood of that x after binomial distribution
        sec_axes.stem(x,likelihood)

        ##posterior probability will be the likelihood * the prior probablity
        posterior_probability=likelihood*y

        #plot the posterior probablity using above equation
        third_axes.stem(x,posterior_probability)
        plt.show()
```

```
The probability at intital will be same
[ 0.2  0.2  0.2  0.2  0.2]
```



(3) Using Navie bayes Classifier find the given sms/email content weather it is spam or ham

```
In [5]: import csv
        with open("/home/iiitd032/Music/abhay/code/Machine-Learning-master/SMSSpamCollection","r
            data = csv.reader(f)
            data_n = list(data)
        spam_train = {}
        ham_train = {}
        hamcount=0
        spamcount=0
        ham_sum = 0
        spam_sum = 0
        ham_prob = {}
        spam_prob = {}

        spam_test = {}
        ham_test = {}
        test_prob_spam = 1
        test_prob_ham = 1

            #l = list(map(tuple, reader))
        for i in range(1,len(data_n)):
            for word in data_n[i][0].split():
                if word == "ham":
                    hamcount=hamcount+1
                else:
```

```
            spamcount+=1

for i in range(1,len(data_n)):
    for word in data_n[i][0].split():
        if word=="ham":

            for word in data_n[i][1].split():
                if word in ham_train:
                    ham_train[word] +=1
                    ham_sum = ham_sum+ham_train[word]
                    ham_prob[word] = ham_train[word]/ham_sum
                else:
                    ham_train[word] = 1
                    ham_sum = ham_sum+ham_train[word]
                    ham_prob[word] = ham_train[word]/ham_sum



        else:
            for word in data_n[i][1].split():
                if word in spam_train:
                    spam_train[word] +=1
                    spam_sum = spam_sum+spam_train[word]
                    spam_prob[word] = spam_train[word]/spam_sum
                else:
                    spam_train[word] = 1
                    spam_sum = spam_sum+spam_train[word]
                    spam_prob[word] = spam_train[word]/spam_sum

print("=========================================test sms content weather it is spam or


wish = "free free you can win 1000 rupees"

for word in wish.split():
    if word in ham_train:
        continue
    else:
        ham_train[word] = 1
        ham_sum = ham_sum+ham_train[word]
        ham_prob[word] = ham_train[word]/ham_sum
        hamcount = hamcount+1
for word in wish.split():
    if word in spam_train:
        continue
    else:
        spam_train[word] = 1
        spam_sum = spam_sum+spam_train[word]
```

```
                spam_prob[word] = spam_train[word]/spam_sum
                spamcount+=1


        spam_prob_new = spamcount/(spamcount+hamcount)
        ham_prob_new = 1-spam_prob_new

        for word in wish.split():
                test_prob_spam = test_prob_spam*spam_prob[word]

                test_prob_ham = test_prob_ham*ham_prob[word]



        test_prob_spam = test_prob_spam*spam_prob_new
        test_prob_ham = test_prob_ham*ham_prob_new

        if test_prob_spam>test_prob_ham:
            print(" spam")
        else:
            print("ham")


==========================================test sms content weather it is spam or not==========
 spam
```

(4) Logistic regression

```
In [6]: from math import exp


        def predict(row, coefficients):
            yhat = coefficients[0]
            for i in range(len(row)-1):
                yhat += coefficients[i + 1] * row[i]
            return 1.0 / (1.0 + exp(-yhat))


        def coefficients_sgd(train, learning_rate, no_of_loops):
            coef = [0.0 for i in range(len(train[0]))]
            for n_loop in range(no_of_loops):
                sum_error = 0
                for row in train:
                    yhat = predict(row, coef)
                    error = row[-1] - yhat
                    sum_error += error**2
                    coef[0] = coef[0] + learning_rate * error * yhat * (1.0 - yhat)
```

```
                for i in range(len(row)-1):
                    coef[i + 1] = coef[i + 1] + learning_rate * error * yhat * (1.0 - yhat)
                print('no_of_loops=%d, learning_rate=%f, error_in the iteration=%f' % (no_of
        return coef


dataset = [[2.7810836,2.550537003,0],
           [1.465489372,2.362125076,0],
           [3.396561688,4.400293529,0],
           [1.38807019,1.850220317,0],
           [3.06407232,3.005305973,0],
           [7.627531214,2.759262235,1],
           [5.332441248,2.088626775,1],
           [6.922596716,1.77106367,1],
           [8.675418651,-0.242068655,1],
           [7.673756466,3.508563011,1]]

learning_rate = 0.3
no_of_loops = 100
coef = coefficients_sgd(dataset, learning_rate, no_of_loops)
print("The final coefficient after %d loops"%(no_of_loops))
print(coef)
```

```
no_of_loops=100, learning_rate=0.300000, error_in the iteration=0.250000
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```

```
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The final coefficient after 100 loops
[-0.8596443546618897, 1.5223825112460005, -2.218700210565016]
```

6 Using KNN classifier concept make a digit recognize classifier.

```
In [7]: from sklearn import datasets
        import numpy as np
        import matplotlib.pyplot as plt

        dataset = datasets.load_digits()

        train_set = dataset.images[0:1400]
        test_set = dataset.images[1400:1797]
        test1=1451
        test = dataset.images[test1]
        #
        imgc = np.zeros((64,1400))


        n_sample = len(train_set)
        data = train_set.reshape(n_sample,-1)

        dist = np.zeros(n_sample)
        darray= np.zeros(n_sample)
        sa = np.zeros(n_sample)

        #finding Eculidean distance
        for i in range(0,n_sample):
            dist[i] = np.sqrt(np.sum((test- train_set[i]) ** 2))


        darray = np.array(dist)
```

```
        sa = sorted(darray)
        #select the no of nearest neighbour
        k=10
        print("accuracy for image test for k=10 for image no",test1)

        sum=0

        for i in range(1,k):
            for j in range(0,n_sample):
                if(sa[i] == dist[j]):
                    if(dataset.target[j]==dataset.target[test1]):
                        sum=sum+1

        print(sum/k)
        print("the label of the test images is:",dataset.target[test1])
```

```
accuracy for image test for k=10 for image no 1451
0.9
the label of the test images is: 0
```

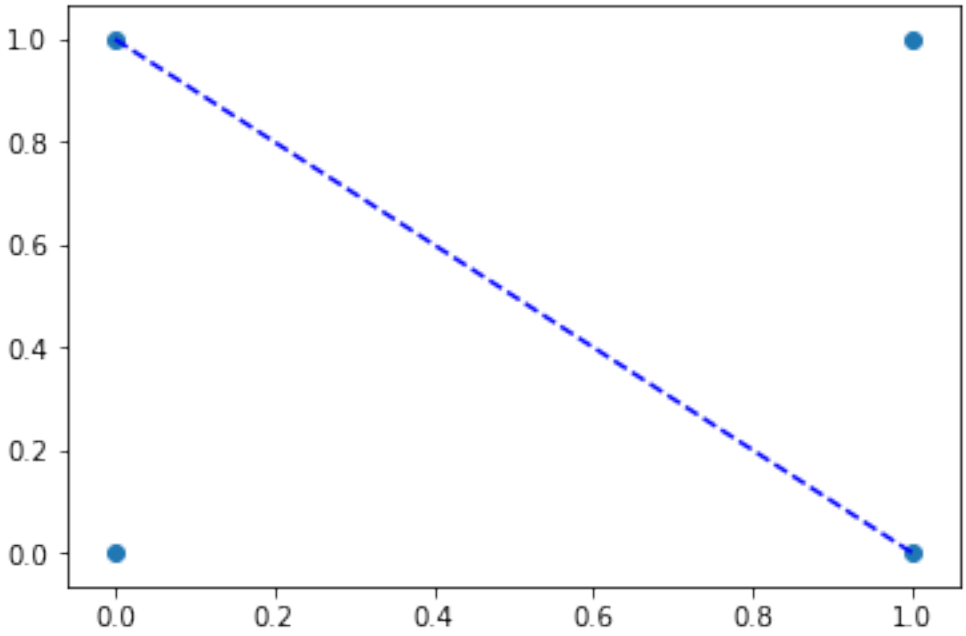
(7) Solve XOR with single layer perceptron

```
In [10]: import numpy as np
         import matplotlib.pyplot as plt
         dataset=np.array([[0,0,0],[0,1,1],[1,0,1],[1,1,1]])
         x1=dataset[:,[0]]
         x2=dataset[:,[1]]

         print("")
         plt.scatter(x1,x2)
         plt.plot(x1,line,'b--')
         plt.show()


         print(len(dataset[0]))
         weights=[0.0 for i in range(len(dataset[0]))]
         print(len(dataset))
         learning=1
         epochs=100
         for i in range(epochs):
             for row in dataset:
                 expected=row[-1]
                 activation=weights[0]
                 for i in range(len(row)-1):
                     activation+= weights[i+1]*row[i]
                 if(activation>=0):
```

```
                prediction=1
            else:
                prediction=0;
            print("prediction=%d,Expected=%d,error=%d"%(prediction,expected,expected-predic
            weights[0]+=learning*(expected-prediction)
            for i in range(len(row)-1):
                print("%d"%(i+1))
                weights[i+1]+=learning*(expected-prediction)*row[i]
    print(weights)
    line=-(weights[0]/weights[2])-(weights[1]/weights[2])*x1
```

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[-1.0, 1.0, 1.0]
```

(8) **Make a simple forward and backward perceptron**

```
In [11]: import numpy as np
         #input value
         input_data=np.array([[0.05],[0.10]])

         #weight of the first layer
```

```
weight_input=np.array([[0.15,0.20],[0.20,0.30]])
#weight for the hidden and output layer
weight_hidden=np.array([[0.40,0.45],[0.50,0.55]])

#bias value for each layer
bias_1=0.35
bias_2=0.60
learning_rate=0.5

target_value=np.array([[0.01,0.99]])

net_at_h=bias_1+np.matmul(weight_input,input_data)
out_at_h=1/(1+np.exp(-net_at_h))
net_at_o=bias_2+np.matmul(weight_hidden,out_at_h)
out_at_o=1/(1+np.exp(-net_at_o))

error=(target_value.transpose()-out_at_o)**2/2

total_error=error[0]+error[1]

deouto=-(target_value.transpose()-out_at_o)

doutoneto=(out_at_o)*(1-out_at_o)

dew=deouto*doutoneto*out_at_h

dnetouth1=np.array([weight_hidden[:,0]])

dnetouth1_tran=dnetouth1.transpose()
deouth1=deouto*doutoneto*dnetouth1_tran
douthneth=(out_at_h)*(1-out_at_h)
dnethw=i
dnetouth2=np.array([weight_hidden[:,1]])
dnetouth2_tran=dnetouth1.transpose()
deouth2=deouto*doutoneto*dnetouth2_tran
detouth1=deouth1[0]+deouth1[1]
detouth2=deouth2[0]+deouth2[1]
detw13=detouth1*douthneth*dnethw

print("""====================""")
print(detw13)
print("==========================")
detw24=detouth2*douthneth*dnethw
detw=np.concatenate((detw13,detw24),axis=1)
print(detw)
weight_input=weight_input-learning_rate*detw
print("================================")
print(weight_input)
```

```
====================
[[ 0.0087702 ]
 [ 0.00874945]]
============================
[[ 0.0087702   0.0087702 ]
 [ 0.00874945  0.00874945]]
==============================
[[ 0.1456149   0.1956149 ]
 [ 0.19562528  0.29562528]]
```

(9) using gauusian classifer find out the maximum likelihood and find out the bias and variance

```
In [1]: import numpy as np
        import math
        import matplotlib.pyplot as plt

        x=np.linspace(-3.14,3.14,100)
        y=np.sin(x)
        plt.plot(x,y)



        x=np.linspace(-3.14,3.14,100)
        y=np.sin(x)
        plt.plot(x,y)

        hypo1=[]
        for i in range(0,99):
            h1=(y[i] + y[i+1])/2
            hypo1.append(h1)
            plt.axhline(y=h1, color='r', linestyle='-',alpha=0.2)

        avg=np.mean(hypo1)
        plt.axhline(y=avg, color='b', linestyle='-', alpha=0.2)

        hypo1_var=np.var(hypo1)

        var_max=hypo1_var + avg
        var_min = avg - hypo1_var

        plt.axhspan(var_max, var_min, color='g', alpha=0.2)

        plt.show()

        #plot the variance for the
        print("=======================================")
```

```
print("for the variance of the plot")
plt.plot(x,y)
plt.axhline(y=avg, color='b', linestyle='-', alpha=0.3)

plt.axhspan(var_max, var_min, color='g', alpha=0.4)
plt.show()

print("bias for hypo_0=",avg)
print("var for hypo_0=",hypo1_var)

print("========================hypothesis 1=====================")
hypo_1=np.zeros((100,100))

for i in range(0,100):
        rand_num=np.random.randint(100,size=2)
        x1=x[rand_num[0]]
        x2=x[rand_num[1]]
        y1=y[rand_num[0]]
        y2=y[rand_num[1]]
        diff=x1-x2
        if(diff==0):
            diff = 0.1**10
        m=(y1-y2)/diff
        c=y1-m*x1
        hypo_1[:,i]=m*x+c


avg_h1=np.zeros((100,1))
bias_h1=np.zeros((100,1))
var_h1=np.zeros((100,1))
var_up_h1=np.zeros((100,1))
var_down_h1=np.zeros((100,1))



for i in range (0,100):
    avg_h1[i]=sum(hypo_1[i,:])
avg_h1=avg_h1/100

for i in range(0,100):
    bias_h1[i]=(avg_h1[i]-y[i])**2
    bias12=sum(bias_h1)/100



for i in range(0,100):
    for j in range(0,100):
        var_h1[i]=var_h1[i]+(hypo_1[i,j]-avg_h1[i])**2
```

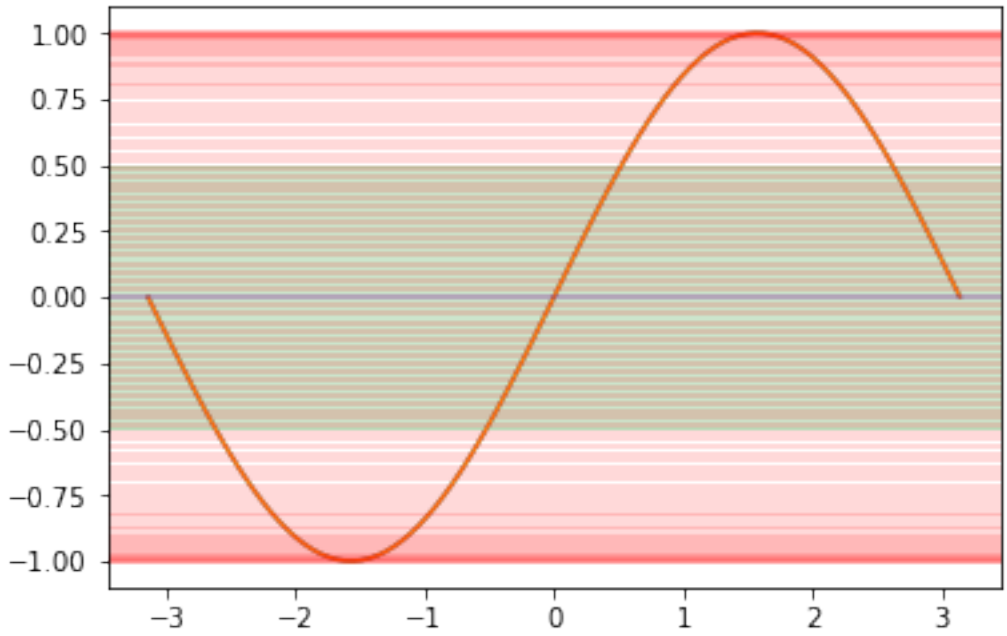
```
    var_h1[i]=var_h1[i]/100

var12=sum(var_h1)/100

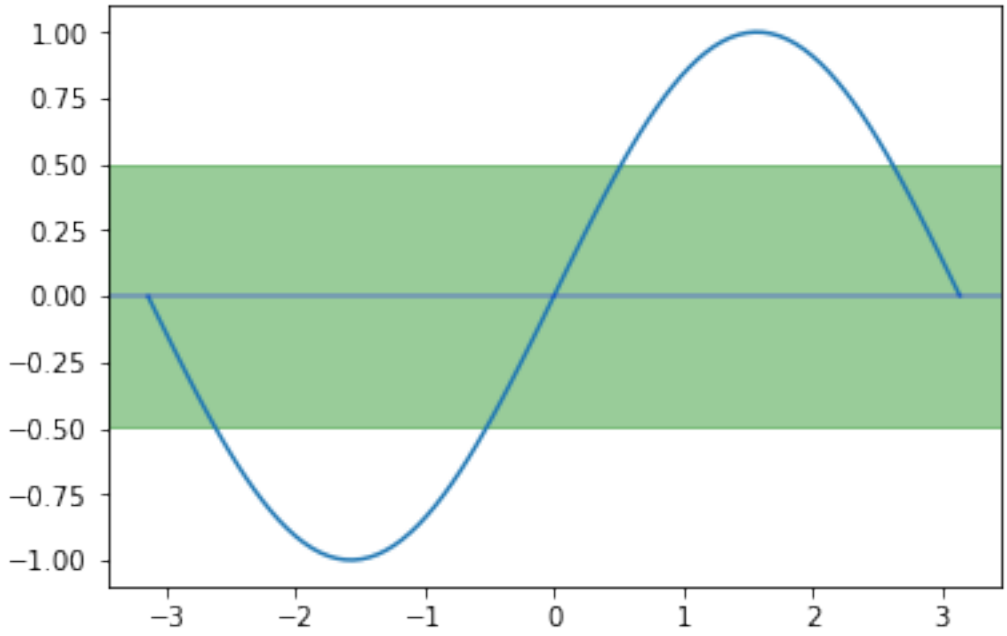

for i in range (0,100):
    var_up_h1[i]=avg_h1[i]+math.sqrt(var_h1[i])
    var_down_h1[i]=avg_h1[i]-math.sqrt(var_h1[i])

plt.figure(2)
plt.plot(x,y)
plt.plot(x,avg_h1,'yellow')
plt.scatter(x,var_up_h1,color='green')
plt.scatter(x,var_down_h1,color='green')
plt.show()

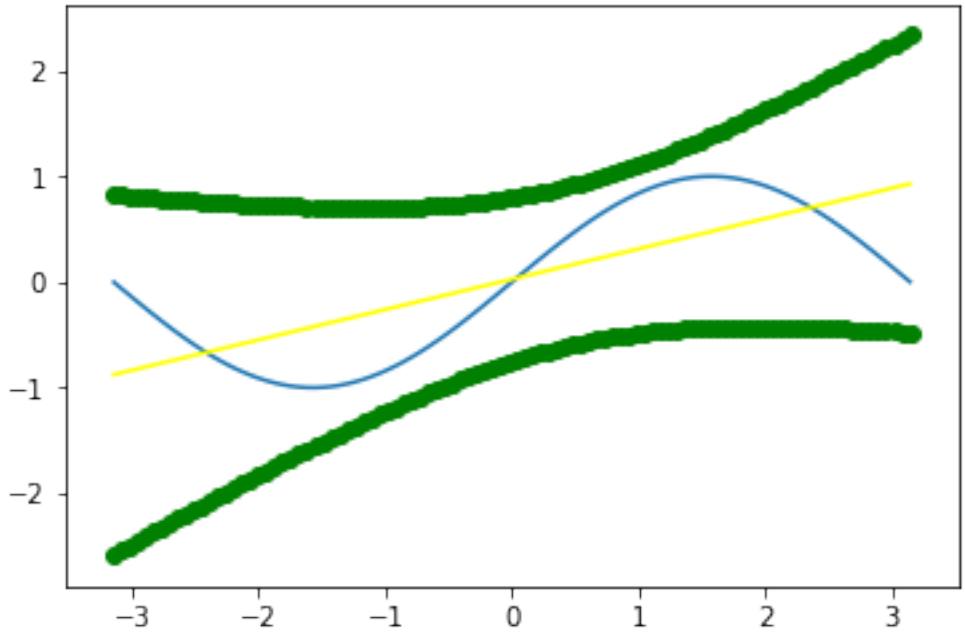
print("bias_for hypo_1 =",bias12)
print("varience for hypo_1 =",var12)
```




```
========================================
for the variance of the plot
```




```
bias for hypo_0= -9.39203821337e-18
var for hypo_0= 0.499750700936
=========================hypothesis 1=====================
```



```
bias_for hypo_1 = [ 0.20372861]
varience for hypo_1 = [ 1.22722345]
```

(10) **using basis concept find out the different**

```
In [13]: import numpy as np
         import matplotlib.pyplot as plt
         x=np.linspace(-10,10,100)

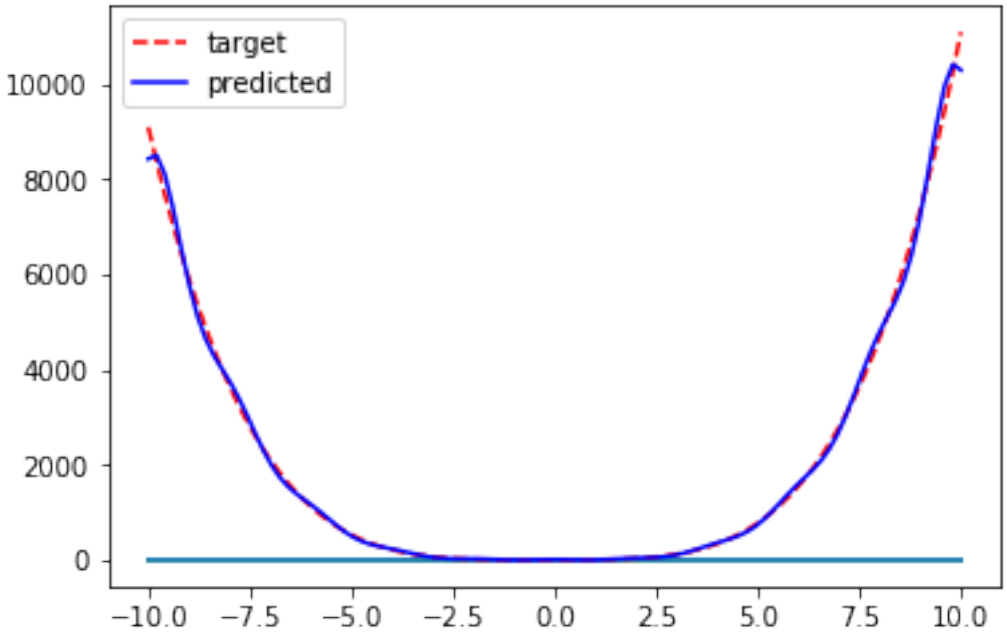
         t=1+(x**2)+(x**3)+(x**4)
         basis_function=np.zeros((21,100),dtype=float)

         for i in range(-10,11):
             basis_function[i]=2*(np.exp(-((x+(i))**2)))


         plt.plot(x,basis_function.T)
         weight=np.dot(np.dot((np.linalg.inv(np.dot(basis_function,basis_function.T))),basis_fun

         print("the value of weight is:",weight)
         predicted_y=np.dot(weight.T,basis_function)
         plt.plot(x,t,'r--',label="target")
         plt.plot(x,predicted_y,'b',label="predicted")
         plt.legend(loc='upper left')
         plt.show()
```

```
the value of weight is: [  1.17317884e+01  -1.20826987e+01   1.75482462e+01  -1.28079994e+01
   8.63124279e+01   6.55867334e+01   3.92755973e+02   3.78908144e+02
   1.28747945e+03   1.01744273e+03   3.81903007e+03   4.64089542e+03
   1.30417852e+03   1.63112475e+03   5.31212183e+02   5.30469100e+02
   1.19339245e+02   1.26530904e+02  -4.50956231e+00   2.27944194e+01
  -1.34400138e+01]
```


target
predicted
10000
8000
6000
4000
2000
0
−10.0
−7.5
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0

----------The End ----------