PyTorch

Machine Learning & Deep Learning
(Barcha uchun)

<02> Chiziqli model
(Linear model)

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Machine Learning

Agar 1 kunda 4 soat o'qisam nechchi baho olaman?

4 soat

Ma'lumot
(Information)

?
Baho

Bashorat
(Prediction)

Soat (x)	Baho(y)
1	2
2	4
3	6
4	?

O'rgatish ma'lumotlar to'plami
(Training dataset)

Supervised learning

Test ma'lumotlar to'plami
(Test dataset)

Model dizayni

Ushbu ma'lumotlar uchun qaysi model to'g'ri keladi? Chiziqli?

Soat (x)	Baho(y)
1	2
2	4
3	6
4	?

$$\hat{y} = x * w$$

$$\hat{y} = x * w + b$$

$$x \rightarrow \boxed{\text{Linear}} \rightarrow \hat{y}$$
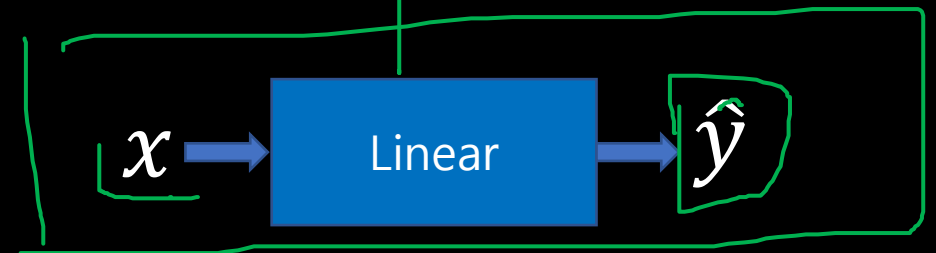
Chiziqli Regressiya

$$\hat{y} = x * w$$

$w=4 \cdot (\hat{y} - y)^2 = error \ loss$

Soat (x)	Baho(y)
1	2
2	4
3	6

Asl chiziq

$w=1$
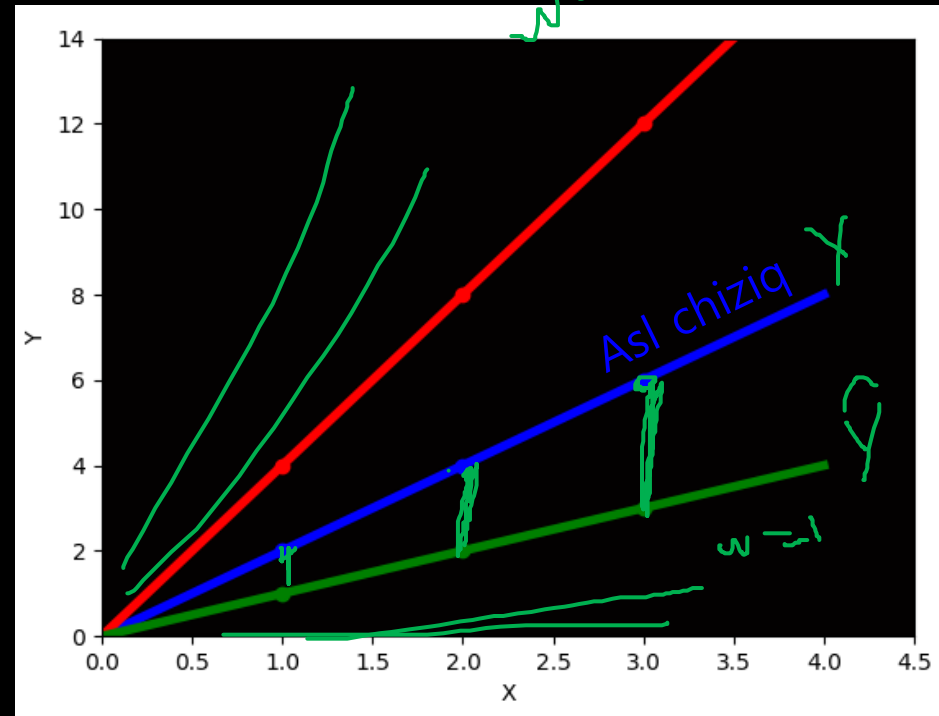
* w=taxminiy qiymatlar orqali o'rgatish.

O'rgatishdagi xatolik (Training Loss) (Error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

Soat (x)	Baho (y)	Bashorat(predict) $\hat{y}(w=3)$	Xatolik (loss) $(w=3)$
1	2	3	1
2	4	6	4
3	6	9	9
			O'rtacha(mean)= 14/3

O'rgatishdagi xatolik (Training Loss) (Error)

$$loss = \ (\hat{y} - y)^2 = (x * \overset{4}{w} - y)^2$$

Soat (x)	Baho (y)	Bashorat(predict) $\hat{y}(w=\textbf{4})$	Xatolik (loss) $(w=\textbf{4})$
1	2	4	4
2	4	8	16
3	6	12	36
			O'rtacha(mean)= 56/3

O'rgatishdagi xatolik (Training Loss) (Error)

$$loss = \ (\hat{y}-y)^2 = (x*w-y)^2$$

Soat (x)	Baho (y)	Bashorat(predict) $\hat{y}(w=0)$	Xatolik (loss) $(w=0)$
1	2	0	4
2	4	0	16
3	6	0	36
			O'rtacha(mean)= 56/3

O'rgatishdagi xatolik (Training Loss) (Error)

$$loss = \ (\hat{y}-y)^2 = (x*w-y)^2$$

Soat (x)	Baho (y)	Bashorat(predict) $\hat{y}(w=1)$	Xatolik (loss) $(w=0)$
1	2	1	1
2	4	2	4
3	6	3	9
			O'rtacha(mean)= 14/3

O'rgatishdagi xatolik (Training Loss) (Error)

$$loss = \ (\hat{y} - y)^2 = (x * w - y)^2$$

Soat (x)	Baho (y)	Bashorat(predict) $\hat{y}(w=2)$	Xatolik (loss) $(w=2)$
1	2	2	0
2	4	4	0
3	6	6	0
			O'rtacha(mean)= 0

O'rgatishdagi xatolik (Training Loss) (Error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

$$loss = \frac{1}{N} \sum_{n=1}^{N} (\hat{y}_n - y_n)^2$$

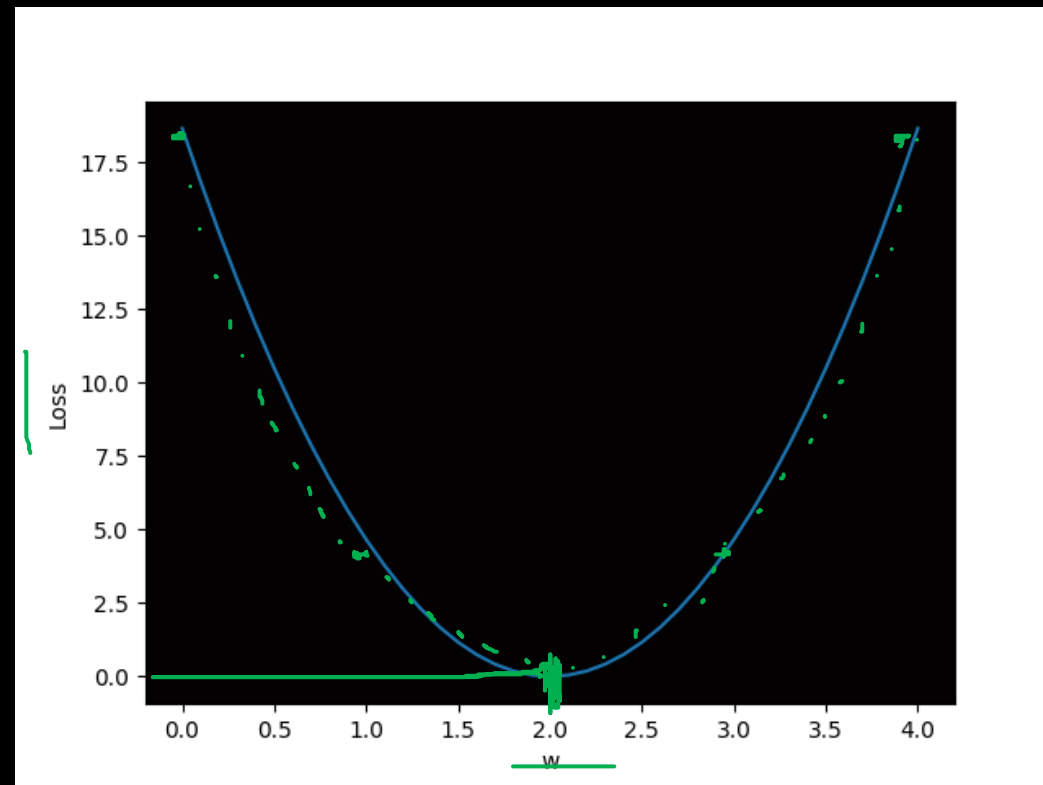❖ O'rtacha kvadratik xatolik (Mean Square Error)

Soat (x)	Loss(w=0)	Loss(w=1)	Loss(w=2)	Loss(w=3)	Loss(w=4)
1	4	1	0	1	4
2	16	4	0	4	16
3	36	9	0	9	36
	MSE=56/3=18.7	MSE=14/3=4.7	MSE=0	MSE=14/3=4.7	MSE=56/3=18.7

O'rgatishdagi xatolik(Loss) grafigi.

❖ O'rtacha kvadratik xatolik (Mean Square Error)

$$loss = \frac{1}{N} \sum_{n=1}^{N} (\hat{y}_n - y_n)^2$$

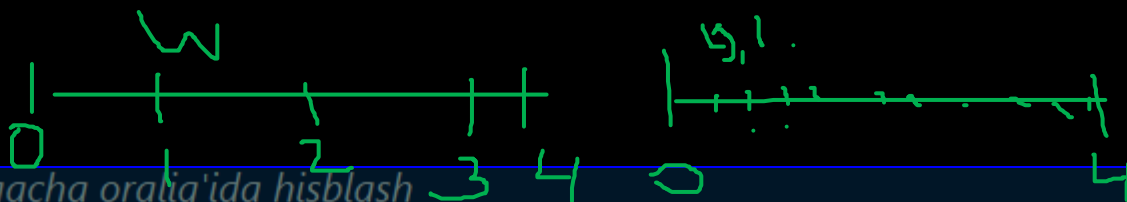| Loss(w=0)	Loss(w=1)	Loss(w=2)	Loss(w=3)	Loss(w=4)
MSE=56/3=18.7	MSE=14/3=4.7	MSE=0	MSE=14/3=4.7	MSE=56/3=18.7

Model&Loss.

$$\hat{y} = x * w$$

```python
#To'g'ri hisoblash uchun funksiya
def forward(x):
    return x*w
```

$$loss = (\hat{y} - y)^2$$

```python
#Xatolik (Loss) ning funksiyasi
def loss(x,y):
    y_pred = forward(x)
    return (y_pred-y)**2
```

w ning xatolik (loss) qiymatini hisoblash.

```python
#w ni 0 dan 4 gacha oralig'ida hisblash
for w in np.arange(0.0,4.1,0.1):
    print("w={:.3f}".format(w))
    L_umum=0

    for x_hb_qiym, y_hb_qiym in zip(x_soat, y_baho):
        y_hb_bash = forward(x_hb_qiym)
        L_hb_qiym = loss(x_hb_qiym, y_hb_qiym)
        L_umum += L_hb_qiym
        print("\t", "{:.2f}, {:.2f}, {:.2f}, {:.2f}".format(x_hb_qiym, y_hb_qiym, y_hb_bash, L_hb_qiym))

    # Har bir ma'lumot uchun MSE ni hisoblaymiz
    print("MSE=", L_umum / len(x_soat))  #len(x_soat)--> N
```

```
w=0.000
        1.00, 2.00, 0.00, 4.00
        2.00, 4.00, 0.00, 16.00
        3.00, 6.00, 0.00, 36.00
MSE= 18.666666666666668
w=0.100
        1.00, 2.00, 0.10, 3.61
        2.00, 4.00, 0.20, 14.44
        3.00, 6.00, 0.30, 32.49
MSE= 16.846666666666668
w=0.200
        1.00, 2.00, 0.20, 3.24
        2.00, 4.00, 0.40, 12.96
        3.00, 6.00, 0.60, 29.16
MSE= 15.120000000000003
w=0.300
        1.00, 2.00, 0.30, 2.89
        2.00, 4.00, 0.60, 11.56
        3.00, 6.00, 0.90, 26.01
MSE= 13.486666666666665
w=0.400
        1.00, 2.00, 0.40, 2.56
        2.00, 4.00, 0.80, 10.24
        3.00, 6.00, 1.20, 23.04
MSE= 11.946666666666667
```
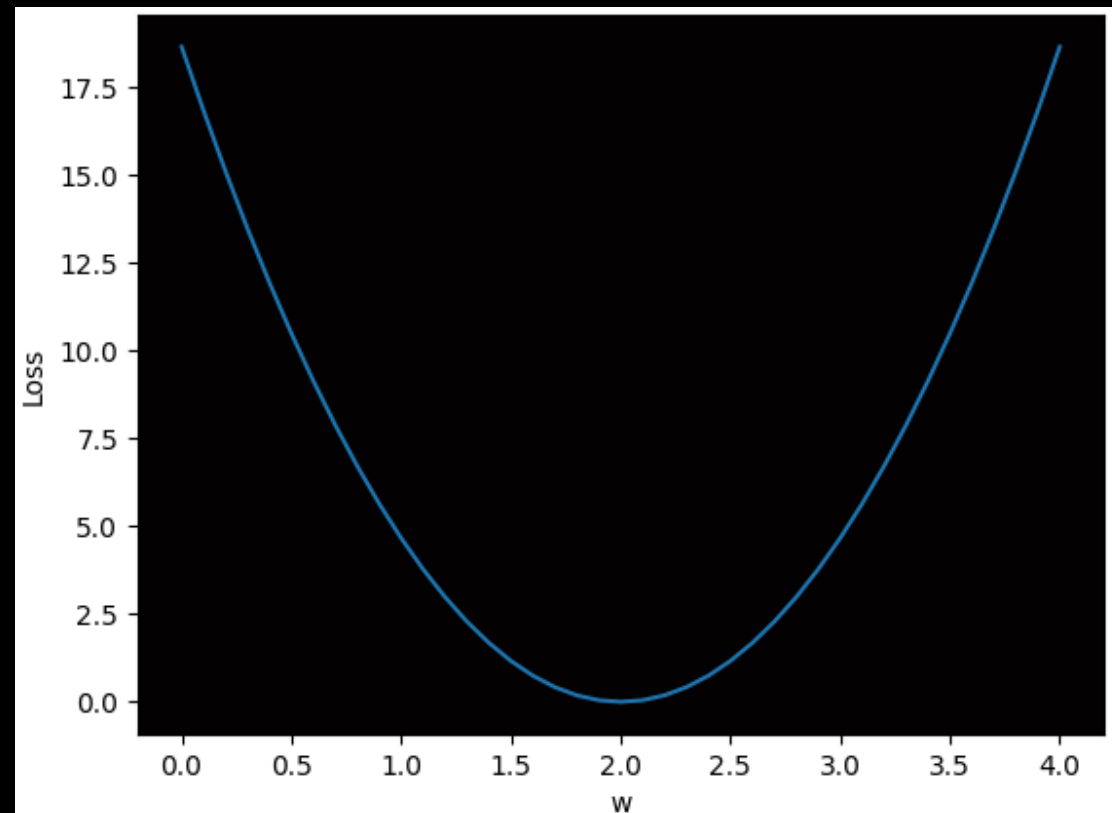
Xatolik (loss) grafigini olish.

```python
#Grafikni yaratib olishimiz uchun kontaynerlar
w_list=[]
mse_list=[]
#w ni 0 dan 4 gacha oralig'ida hisblash
for w in np.arange(0.0,4.1,0.1):
    print("w={:.3f}".format(w))
    L_umum=0

    for x_hb_qiym, y_hb_qiym in zip(x_soat, y_baho):
        y_hb_bash = forward(x_hb_qiym)
        L_hb_qiym = loss(x_hb_qiym, y_hb_qiym)
        L_umum += L_hb_qiym
        print("\t", "{:.2f}, {:.2f}, {:.2f}, {:.2f}".format(x_hb_qiym, y_hb_qiym, y_hb_bash, L_hb_qiym))

    # Har bir ma'lumot uchun MSE ni hisoblaymiz
    print("MSE=", L_umum / len(x_soat))  #len(x_soat)--> N
    w_list.append(w)
    mse_list.append(L_umum / len(x_soat))


#Grafik natija
plt.plot(w_list, mse_list)
plt.ylabel('Loss')
plt.xlabel('w')
ax= plt.axes()
ax.set_facecolor('#030101')
plt.show()
```

To'liq kodimiz

```python
import matplotlib.pyplot as plt
import numpy as np
x_soat = np.array([1.0, 2.0, 3.0])
y_baho = np.array([2.0, 4.0, 6.0 ])
#To'g'ri hisoblash uchun funksiya
def forward(x):
    return x*w
#Xatolik (Loss) ning funksiyasi
def loss(x,y):
    y_pred = forward(x)
    return (y_pred-y)**2
#Grafikni yaratib olishimiz uchun kontaynerlar
w_list=[]
mse_list=[]
#w ni 0 dan 4 gacha oralig'ida hisblash
for w in np.arange(0.0,4.1,0.1):
    print("w={:.3f}".format(w))
    L_umum=0
    for x_hb_qiym, y_hb_qiym in zip(x_soat, y_baho):
        y_hb_bash = forward(x_hb_qiym)
        L_hb_qiym = loss(x_hb_qiym, y_hb_qiym)
        L_umum += L_hb_qiym
        print("\t", "{:.2f}, {:.2f}, {:.2f}, {:.2f}".format(x_hb_qiym, y_hb_qiym, y_hb_bash, L_hb_qiym))
    # Har bir ma'lumot uchun MSE ni hisoblaymiz
    print("MSE=", L_umum / len(x_soat))  #len(x_soat)--> N
    w_list.append(w)
    mse_list.append(L_umum / len(x_soat))
#Grafik natija
plt.plot(w_list, mse_list)
plt.ylabel('Loss')
plt.xlabel('w')
ax= plt.axes()
ax.set_facecolor('#030101')
plt.show()
```

x → Linear → $\hat{y}$

Vazifa - 2

- O'zingiz biror qiziq chiziqli modelni qurib ko'ring

- Biror qizi chiziqli ma'lumot qidirib toping va uni modellashtiring.
  - -Grafik ko'rinishida w va xatolkning (loss) ning natijasini oling.

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Keyingi darsligimiz

<03>Dars
Gradient pastlash (Gradient Descent)