In [3]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sbn
```

In [4]:
```
dataFrame = pd.read_excel("mercedes.xlsx")
```

In [5]:
```
dataFrame
```

Out[5]:

	year	price	transmission	mileage	tax	mpg	engineSize
0	2005	5200	Automatic	63000	325	32.1	1.8
1	2017	34948	Automatic	27000	20	61.4	2.1
2	2016	49948	Automatic	6200	555	28.0	5.5
3	2016	61948	Automatic	16000	325	30.4	4.0
4	2016	73948	Automatic	4000	325	30.1	4.0
...	...	...	...	...	...	...	...
13114	2020	35999	Automatic	500	145	55.4	2.0
13115	2020	24699	Automatic	2500	145	55.4	2.0
13116	2019	30999	Automatic	11612	145	41.5	2.1
13117	2019	37990	Automatic	2426	145	45.6	2.0
13118	2019	54999	Automatic	2075	145	52.3	2.9

13119 rows × 7 columns

In [6]:
```
dataFrame.describe()
```

Out[6]:

	year	price	mileage	tax	mpg	engineSize
count	13119.000000	13119.000000	13119.000000	13119.000000	13119.000000	13119.000000
mean	2017.296288	24698.596920	21949.559037	129.972178	55.155843	2.071530
std	2.224709	11842.675542	21176.512267	65.260286	15.220082	0.572426
min	1970.000000	650.000000	1.000000	0.000000	1.100000	0.000000
25%	2016.000000	17450.000000	6097.500000	125.000000	45.600000	1.800000
50%	2018.000000	22480.000000	15189.000000	145.000000	56.500000	2.000000
75%	2019.000000	28980.000000	31779.500000	145.000000	64.200000	2.100000
max	2020.000000	159999.000000	259000.000000	580.000000	217.300000	6.200000

In [7]:
```
#null değerleri temizleme
dataFrame = dataFrame.dropna(axis=0) #null içeren satırları sil
dataFrame
```

Out[7]:

	year	price	transmission	mileage	tax	mpg	engineSize
0	2005	5200	Automatic	63000	325	32.1	1.8
1	2017	34948	Automatic	27000	20	61.4	2.1
2	2016	49948	Automatic	6200	555	28.0	5.5
3	2016	61948	Automatic	16000	325	30.4	4.0
4	2016	73948	Automatic	4000	325	30.1	4.0
...	...	...	...	...	...	...	...
13114	2020	35999	Automatic	500	145	55.4	2.0
13115	2020	24699	Automatic	2500	145	55.4	2.0
13116	2019	30999	Automatic	11612	145	41.5	2.1
13117	2019	37990	Automatic	2426	145	45.6	2.0
13118	2019	54999	Automatic	2075	145	52.3	2.9

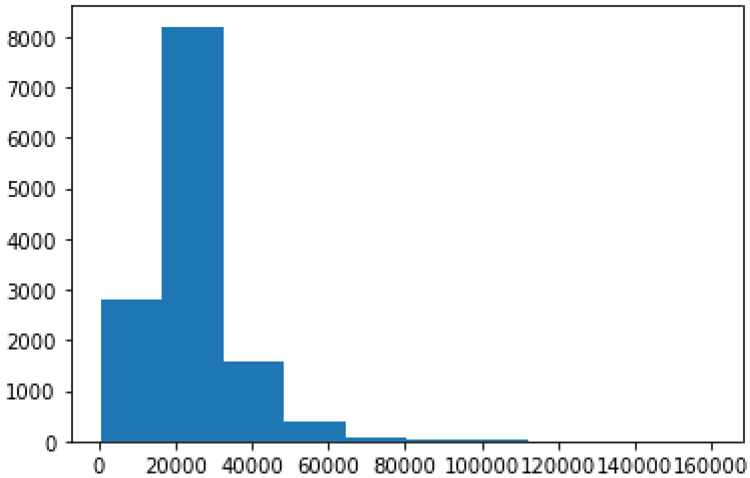
13119 rows × 7 columns

In [8]:

```
# veri dağılımını kontrol etme (histogram)
plt.hist(dataFrame["price"])
```

Out[8]:

```
(array([2.792e+03, 8.199e+03, 1.594e+03, 3.930e+02, 9.100e+01, 1.800e+01,
        1.300e+01, 7.000e+00, 9.000e+00, 3.000e+00]),
 array([   650. ,  16584.9,  32519.8,  48454.7,  64389.6,  80324.5,
         96259.4, 112194.3, 128129.2, 144064.1, 159999. ]),
 <BarContainer object of 10 artists>)
```



In [9]:

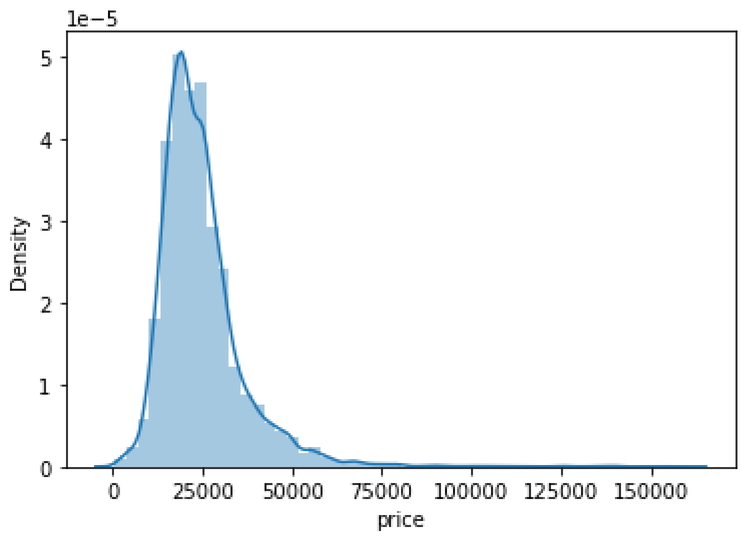
```
# veri dağılımını kontrol etme (distribution)
sbn.distplot(dataFrame["price"])

# çok pahalı arabalar azınlıkta, modelimizi olumsuz etkileyebilir
# fiyatı 75 bin'den pahalıları silsek iyi olur
# zira onlar için ayrı bir model oluşturulabilir
```

```
C:\Users\Mehmet KAHRAMAN\.conda\envs\tensorflow\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

```
<AxesSubplot:xlabel='price', ylabel='Density'>
```

Out[9]:



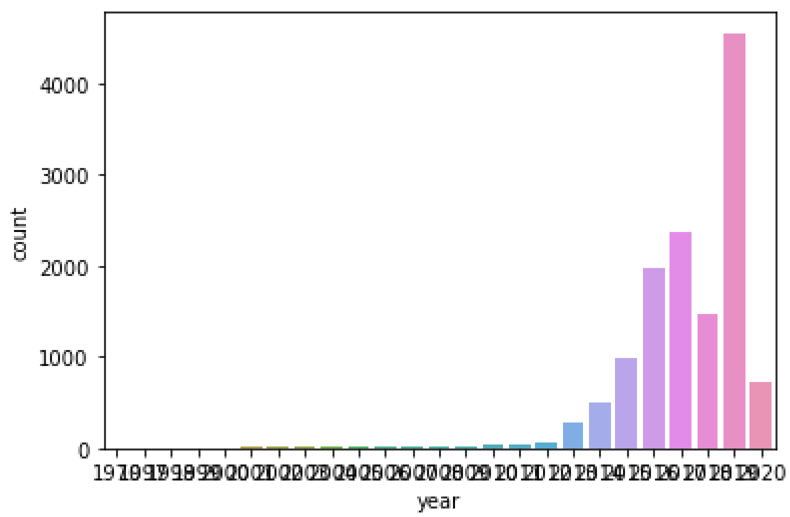
In [10]:

```
sbn.countplot(dataFrame["year"])
```

```
C:\Users\Mehmet KAHRAMAN\.conda\envs\tensorflow\lib\site-packages\seaborn\_decorator
s.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From versio
n 0.12, the only valid positional argument will be `data`, and passing other argumen
ts without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[10]:

```
<AxesSubplot:xlabel='year', ylabel='count'>
```



In [11]:

```
# Korelasyon analizi
# veri özellikleri arasında doğrusal bir ilişki olup olmadığını,
# varsa bu ilişkinin katsayısını veren matematiksel yöntemdir.
# örneğin araba yılı ile araba fiyatı arasında pozitif korelasyon vardır
# az da olsa hata oranı barındırır

dataFrame.corr()["price"].sort_values()   #fiyatı etkileyen korelasyonlar
```

Out[11]:

```
mileage      -0.537214
mpg          -0.438445
tax           0.268717
engineSize    0.516126
year          0.520712
price         1.000000
Name: price, dtype: float64
```

In [12]:

```
# String Sütununu silme (Transmission sütunu)
```

```
dataFrame = dataFrame.drop("transmission", axis=1)
dataFrame
```

Out[12]:

	year	price	mileage	tax	mpg	engineSize
0	2005	5200	63000	325	32.1	1.8
1	2017	34948	27000	20	61.4	2.1
2	2016	49948	6200	555	28.0	5.5
3	2016	61948	16000	325	30.4	4.0
4	2016	73948	4000	325	30.1	4.0
...	...	...	...	...	...	...
13114	2020	35999	500	145	55.4	2.0
13115	2020	24699	2500	145	55.4	2.0
13116	2019	30999	11612	145	41.5	2.1
13117	2019	37990	2426	145	45.6	2.0
13118	2019	54999	2075	145	52.3	2.9

13119 rows × 6 columns

In [13]:

```
# en pahalı arabaları listele
dataFrame.sort_values("price",ascending=False).head(50)
```

Out[13]:

	year	price	mileage	tax	mpg	engineSize
6199	2020	159999	1350	145	21.4	4.0
10044	2020	154998	3000	150	21.4	4.0
5	2011	149948	3000	570	21.4	6.2
8737	2019	140319	785	150	22.1	4.0
6386	2018	139995	13046	145	21.4	4.0
8	2019	139948	12000	145	21.4	4.0
9133	2019	139559	1000	145	22.1	4.0
8821	2020	138439	1000	145	22.1	4.0
5902	2018	135771	19000	145	21.4	4.0
7864	2018	135124	18234	150	21.4	4.0
8673	2019	134219	1000	145	24.8	4.0
6210	2019	129990	1000	145	24.8	4.0
4759	2019	126000	250	145	24.6	4.0
2647	2019	125796	637	145	24.8	4.0
6223	2019	124999	1500	145	31.7	4.0
4094	2019	124366	880	145	24.8	4.0
2629	2019	123846	2951	145	22.1	4.0
7134	2019	115359	1000	145	30.1	4.0

	year	price	mileage	tax	mpg	engineSize
9159	2019	114199	891	145	22.6	4.0
1980	2019	109995	4688	150	31.7	4.0
8745	2018	109989	2122	145	24.8	4.0
13060	2017	109495	1755	145	24.8	4.0
7828	2019	109445	195	145	22.6	4.0
5311	2019	105000	6807	150	22.6	4.0
1011	2019	104999	5822	150	22.6	4.0
4087	2019	104590	3671	145	31.7	4.0
4209	2018	104400	3796	145	31.7	4.0
3978	2019	102502	8691	150	11.0	3.0
9241	2017	100124	439	145	24.8	4.0
686	2019	99950	2013	145	22.6	4.0
5662	2015	99850	10000	570	20.5	5.5
10281	2019	97900	163	145	30.1	4.0
7128	2019	95099	1022	145	34.0	4.0
4779	2018	94522	1736	145	24.8	4.0
8672	2019	93499	1000	145	34.0	4.0
10807	2018	90900	9141	145	24.8	4.0
7312	2019	90759	1000	145	34.0	4.0
965	2019	89999	1400	145	34.0	4.0
3597	2018	89995	2928	145	31.7	4.0
11940	2018	89990	6800	145	24.8	4.0
4053	2019	89880	50	145	28.0	5.5
9275	2019	88995	200	145	28.0	4.0
8671	2019	87478	1257	145	34.0	4.0
8670	2019	87459	1493	145	23.7	5.5
7135	2019	86699	1314	145	34.0	4.0
8750	2019	86399	1912	145	34.0	4.0
11700	2018	84500	3695	145	24.8	4.0
8682	2018	82099	1952	145	34.0	4.0
10566	2019	81900	21442	145	32.1	4.0
3858	2019	80650	221	145	28.0	5.5

In [14]:

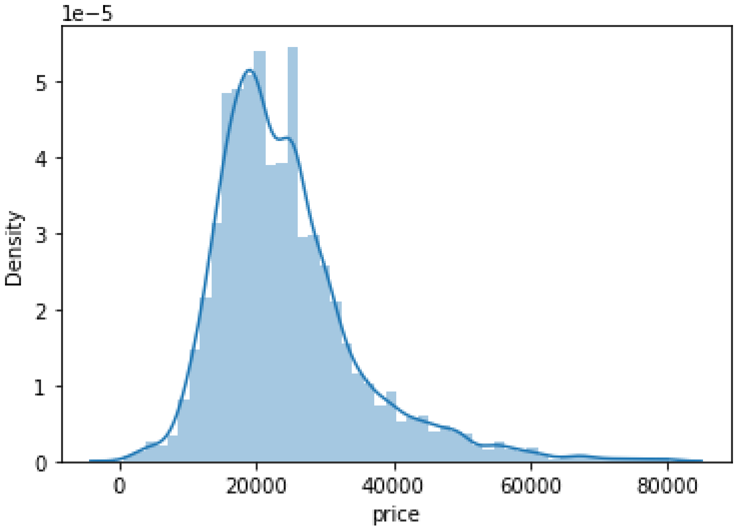
```
# fiyatı yüksek olanlara göre sıralanmış dataframe üzerinde,
# ilk 50 tanesini bırak 50.sıradan sonuna kadar dataFrame'i güncelle

dataFrame = dataFrame.sort_values("price",ascending=False).iloc[50:]
sbn.distplot(dataFrame["price"])
```

```
C:\Users\Mehmet KAHRAMAN\.conda\envs\tensorflow\lib\site-packages\seaborn\distributi
ons.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed
in a future version. Please adapt your code to use either `displot` (a figure-level
function with similar flexibility) or `histplot` (an axes-level function for histogr
ams).
  warnings.warn(msg, FutureWarning)
```

Out[14]:

```
<AxesSubplot:xlabel='price', ylabel='Density'>
```



In [15]:

```python
# araba yılına göre ortalama fiyatlar
dataFrame.groupby("year").mean()["price"]

# 1970 model arabaların ort fiyatı uyumsuz
```

Out[15]:

```
year
1970    24999.000000
1997     9995.000000
1998     8605.000000
1999     5995.000000
2000     5743.333333
2001     4957.900000
2002     5820.444444
2003     4878.000000
2004     4727.615385
2005     4426.111111
2006     4036.875000
2007     5136.045455
2008     6967.437500
2009     6166.764706
2010     8308.473684
2011     8913.459459
2012    10845.140351
2013    11939.842466
2014    14042.936864
2015    16647.822222
2016    19307.892948
2017    21444.282472
2018    25119.638736
2019    30752.414952
2020    34948.455307
Name: price, dtype: float64
```

In [16]:

```python
# bozuk veriyi sorgulayarak silme
dataFrame = dataFrame.query("year != 1970")
dataFrame.groupby("year").mean()["price"]
```

Out[16]:

```
year
```

```
1997     9995.000000
1998     8605.000000
1999     5995.000000
2000     5743.333333
2001     4957.900000
2002     5820.444444
2003     4878.000000
2004     4727.615385
2005     4426.111111
2006     4036.875000
2007     5136.045455
2008     6967.437500
2009     6166.764706
2010     8308.473684
2011     8913.459459
2012    10845.140351
2013    11939.842466
2014    14042.936864
2015    16647.822222
2016    19307.892948
2017    21444.282472
2018    25119.638736
2019    30752.414952
2020    34948.455307
Name: price, dtype: float64
```

In [17]:

```
# x (özellikler) ve y (label hedefi) değerlerini oluşturma

y = dataFrame["price"].values
x = dataFrame.drop("price",axis=1).values
```

In [18]:

```
# veri setinin test-train oranına ayrılması

from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.3)
```

In [19]:

```
# veri ölçeklendirme

from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()

x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)
```

In [20]:

```
# modeli oluşturma

import tensorflow as tf
from tensorflow.keras import models
from tensorflow.keras import layers

model = models.Sequential()
# 5 araba özelliği olduğundan bir katmanda en az 5 nöron olmalı

model.add(layers.Dense(12, activation="relu"))
model.add(layers.Dense(12, activation="relu"))
model.add(layers.Dense(12, activation="relu"))
model.add(layers.Dense(12, activation="relu"))
model.add(layers.Dense(1))

model.compile(optimizer="adam",loss="mse")
```

In [21]:
```
# modeli eğitme

#validation --> ek olarak test verilerine göre de loss oranını çıkar
model.fit(x_train,y_train, validation_data=(x_test,y_test), batch_size=500, epochs=4
```

```
Epoch 1/400
19/19 [==============================] - 0s 16ms/step - loss: 711546240.0000 - val_l
oss: 689768064.0000
Epoch 2/400
19/19 [==============================] - 0s 4ms/step - loss: 711519552.0000 - val_lo
ss: 689735552.0000
Epoch 3/400
19/19 [==============================] - 0s 4ms/step - loss: 711475328.0000 - val_lo
ss: 689674048.0000
Epoch 4/400
19/19 [==============================] - 0s 4ms/step - loss: 711389760.0000 - val_lo
ss: 689553152.0000
Epoch 5/400
19/19 [==============================] - 0s 4ms/step - loss: 711220096.0000 - val_lo
ss: 689312256.0000
Epoch 6/400
19/19 [==============================] - 0s 4ms/step - loss: 710876736.0000 - val_lo
ss: 688829632.0000
Epoch 7/400
19/19 [==============================] - 0s 4ms/step - loss: 710216512.0000 - val_lo
ss: 687935104.0000
Epoch 8/400
19/19 [==============================] - 0s 3ms/step - loss: 709013056.0000 - val_lo
ss: 686328320.0000
Epoch 9/400
19/19 [==============================] - 0s 4ms/step - loss: 706915072.0000 - val_lo
ss: 683609024.0000
Epoch 10/400
19/19 [==============================] - 0s 4ms/step - loss: 703473088.0000 - val_lo
ss: 679264512.0000
Epoch 11/400
19/19 [==============================] - 0s 4ms/step - loss: 698102080.0000 - val_lo
ss: 672653568.0000
Epoch 12/400
19/19 [==============================] - 0s 4ms/step - loss: 690064320.0000 - val_lo
ss: 662955840.0000
Epoch 13/400
19/19 [==============================] - 0s 4ms/step - loss: 678504128.0000 - val_lo
ss: 649249344.0000
Epoch 14/400
19/19 [==============================] - 0s 4ms/step - loss: 662423616.0000 - val_lo
ss: 630543872.0000
Epoch 15/400
19/19 [==============================] - 0s 4ms/step - loss: 640841088.0000 - val_lo
ss: 605852608.0000
Epoch 16/400
19/19 [==============================] - 0s 5ms/step - loss: 612612992.0000 - val_lo
ss: 574076416.0000
Epoch 17/400
19/19 [==============================] - 0s 5ms/step - loss: 576892544.0000 - val_lo
ss: 534337440.0000
Epoch 18/400
19/19 [==============================] - 0s 4ms/step - loss: 532852704.0000 - val_lo
ss: 486737152.0000
Epoch 19/400
19/19 [==============================] - 0s 4ms/step - loss: 481137888.0000 - val_lo
ss: 431883264.0000
Epoch 20/400
19/19 [==============================] - 0s 4ms/step - loss: 422672960.0000 - val_lo
ss: 371522560.0000
Epoch 21/400
19/19 [==============================] - 0s 4ms/step - loss: 359987616.0000 - val_lo
ss: 308631712.0000
Epoch 22/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 296549536.0000 - val_lo
ss: 248069760.0000
Epoch 23/400
19/19 [==============================] - 0s 4ms/step - loss: 237285504.0000 - val_lo
ss: 194182576.0000
Epoch 24/400
19/19 [==============================] - 0s 4ms/step - loss: 186865536.0000 - val_lo
ss: 151519088.0000
Epoch 25/400
19/19 [==============================] - 0s 4ms/step - loss: 148828224.0000 - val_lo
ss: 122170080.0000
Epoch 26/400
19/19 [==============================] - 0s 5ms/step - loss: 124123624.0000 - val_lo
ss: 105267128.0000
Epoch 27/400
19/19 [==============================] - 0s 5ms/step - loss: 110723744.0000 - val_lo
ss: 97153784.0000
Epoch 28/400
19/19 [==============================] - 0s 4ms/step - loss: 104426888.0000 - val_lo
ss: 94142008.0000
Epoch 29/400
19/19 [==============================] - 0s 5ms/step - loss: 102055320.0000 - val_lo
ss: 93056952.0000
Epoch 30/400
19/19 [==============================] - 0s 4ms/step - loss: 101045656.0000 - val_lo
ss: 92569176.0000
Epoch 31/400
19/19 [==============================] - 0s 4ms/step - loss: 100467096.0000 - val_lo
ss: 92191552.0000
Epoch 32/400
19/19 [==============================] - 0s 4ms/step - loss: 100011352.0000 - val_lo
ss: 91833752.0000
Epoch 33/400
19/19 [==============================] - 0s 4ms/step - loss: 99597376.0000 - val_los
s: 91475304.0000
Epoch 34/400
19/19 [==============================] - 0s 4ms/step - loss: 99196432.0000 - val_los
s: 91113872.0000
Epoch 35/400
19/19 [==============================] - 0s 4ms/step - loss: 98814048.0000 - val_los
s: 90761992.0000
Epoch 36/400
19/19 [==============================] - 0s 4ms/step - loss: 98440264.0000 - val_los
s: 90430240.0000
Epoch 37/400
19/19 [==============================] - 0s 5ms/step - loss: 98073960.0000 - val_los
s: 90085072.0000
Epoch 38/400
19/19 [==============================] - 0s 4ms/step - loss: 97712576.0000 - val_los
s: 89770888.0000
Epoch 39/400
19/19 [==============================] - 0s 5ms/step - loss: 97358936.0000 - val_los
s: 89439680.0000
Epoch 40/400
19/19 [==============================] - 0s 5ms/step - loss: 97015640.0000 - val_los
s: 89106016.0000
Epoch 41/400
19/19 [==============================] - 0s 5ms/step - loss: 96668528.0000 - val_los
s: 88811792.0000
Epoch 42/400
19/19 [==============================] - 0s 4ms/step - loss: 96325848.0000 - val_los
s: 88495016.0000
Epoch 43/400
19/19 [==============================] - 0s 4ms/step - loss: 95989608.0000 - val_los
s: 88184704.0000
Epoch 44/400
19/19 [==============================] - 0s 4ms/step - loss: 95664360.0000 - val_los
s: 87863120.0000
Epoch 45/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 95327280.0000 - val_los
s: 87568224.0000
Epoch 46/400
19/19 [==============================] - 0s 5ms/step - loss: 95003984.0000 - val_los
s: 87280696.0000
Epoch 47/400
19/19 [==============================] - 0s 5ms/step - loss: 94666736.0000 - val_los
s: 86964896.0000
Epoch 48/400
19/19 [==============================] - 0s 5ms/step - loss: 94340416.0000 - val_los
s: 86680672.0000
Epoch 49/400
19/19 [==============================] - 0s 5ms/step - loss: 94012832.0000 - val_los
s: 86371432.0000
Epoch 50/400
19/19 [==============================] - 0s 4ms/step - loss: 93700152.0000 - val_los
s: 86083032.0000
Epoch 51/400
19/19 [==============================] - 0s 4ms/step - loss: 93368312.0000 - val_los
s: 85791240.0000
Epoch 52/400
19/19 [==============================] - 0s 4ms/step - loss: 93048824.0000 - val_los
s: 85471328.0000
Epoch 53/400
19/19 [==============================] - 0s 5ms/step - loss: 92721944.0000 - val_los
s: 85196872.0000
Epoch 54/400
19/19 [==============================] - 0s 5ms/step - loss: 92402024.0000 - val_los
s: 84914232.0000
Epoch 55/400
19/19 [==============================] - 0s 5ms/step - loss: 92093664.0000 - val_los
s: 84650520.0000
Epoch 56/400
19/19 [==============================] - 0s 4ms/step - loss: 91768856.0000 - val_los
s: 84297400.0000
Epoch 57/400
19/19 [==============================] - 0s 4ms/step - loss: 91453112.0000 - val_los
s: 84013056.0000
Epoch 58/400
19/19 [==============================] - 0s 4ms/step - loss: 91128168.0000 - val_los
s: 83730408.0000
Epoch 59/400
19/19 [==============================] - 0s 4ms/step - loss: 90807112.0000 - val_los
s: 83416592.0000
Epoch 60/400
19/19 [==============================] - 0s 5ms/step - loss: 90488024.0000 - val_los
s: 83142152.0000
Epoch 61/400
19/19 [==============================] - 0s 4ms/step - loss: 90168832.0000 - val_los
s: 82861488.0000
Epoch 62/400
19/19 [==============================] - 0s 4ms/step - loss: 89847968.0000 - val_los
s: 82562632.0000
Epoch 63/400
19/19 [==============================] - 0s 4ms/step - loss: 89532600.0000 - val_los
s: 82273232.0000
Epoch 64/400
19/19 [==============================] - 0s 4ms/step - loss: 89216488.0000 - val_los
s: 81943112.0000
Epoch 65/400
19/19 [==============================] - 0s 5ms/step - loss: 88887392.0000 - val_los
s: 81672304.0000
Epoch 66/400
19/19 [==============================] - 0s 4ms/step - loss: 88565856.0000 - val_los
s: 81390616.0000
Epoch 67/400
19/19 [==============================] - 0s 3ms/step - loss: 88246872.0000 - val_los
s: 81104280.0000
Epoch 68/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 87928792.0000 - val_los
s: 80796728.0000
Epoch 69/400
19/19 [==============================] - 0s 4ms/step - loss: 87604576.0000 - val_los
s: 80531712.0000
Epoch 70/400
19/19 [==============================] - 0s 5ms/step - loss: 87282248.0000 - val_los
s: 80210640.0000
Epoch 71/400
19/19 [==============================] - 0s 4ms/step - loss: 86959784.0000 - val_los
s: 79922472.0000
Epoch 72/400
19/19 [==============================] - 0s 4ms/step - loss: 86632896.0000 - val_los
s: 79619840.0000
Epoch 73/400
19/19 [==============================] - 0s 4ms/step - loss: 86302872.0000 - val_los
s: 79292640.0000
Epoch 74/400
19/19 [==============================] - 0s 4ms/step - loss: 85977032.0000 - val_los
s: 79020632.0000
Epoch 75/400
19/19 [==============================] - 0s 4ms/step - loss: 85647616.0000 - val_los
s: 78734776.0000
Epoch 76/400
19/19 [==============================] - 0s 4ms/step - loss: 85323720.0000 - val_los
s: 78418160.0000
Epoch 77/400
19/19 [==============================] - 0s 3ms/step - loss: 84991848.0000 - val_los
s: 78103232.0000
Epoch 78/400
19/19 [==============================] - 0s 4ms/step - loss: 84659360.0000 - val_los
s: 77809632.0000
Epoch 79/400
19/19 [==============================] - 0s 4ms/step - loss: 84337184.0000 - val_los
s: 77518848.0000
Epoch 80/400
19/19 [==============================] - 0s 4ms/step - loss: 83997216.0000 - val_los
s: 77208144.0000
Epoch 81/400
19/19 [==============================] - 0s 4ms/step - loss: 83663128.0000 - val_los
s: 76898264.0000
Epoch 82/400
19/19 [==============================] - 0s 4ms/step - loss: 83329312.0000 - val_los
s: 76621432.0000
Epoch 83/400
19/19 [==============================] - 0s 4ms/step - loss: 82990088.0000 - val_los
s: 76302192.0000
Epoch 84/400
19/19 [==============================] - 0s 4ms/step - loss: 82651832.0000 - val_los
s: 75986656.0000
Epoch 85/400
19/19 [==============================] - 0s 4ms/step - loss: 82312520.0000 - val_los
s: 75691672.0000
Epoch 86/400
19/19 [==============================] - 0s 5ms/step - loss: 81967928.0000 - val_los
s: 75379328.0000
Epoch 87/400
19/19 [==============================] - 0s 4ms/step - loss: 81625400.0000 - val_los
s: 75053216.0000
Epoch 88/400
19/19 [==============================] - 0s 3ms/step - loss: 81287680.0000 - val_los
s: 74750368.0000
Epoch 89/400
19/19 [==============================] - 0s 4ms/step - loss: 80929664.0000 - val_los
s: 74412448.0000
Epoch 90/400
19/19 [==============================] - 0s 4ms/step - loss: 80578744.0000 - val_los
s: 74087576.0000
Epoch 91/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 80227432.0000 - val_los
s: 73763688.0000
Epoch 92/400
19/19 [==============================] - 0s 3ms/step - loss: 79876704.0000 - val_los
s: 73454520.0000
Epoch 93/400
19/19 [==============================] - 0s 3ms/step - loss: 79520080.0000 - val_los
s: 73147496.0000
Epoch 94/400
19/19 [==============================] - 0s 4ms/step - loss: 79161096.0000 - val_los
s: 72785208.0000
Epoch 95/400
19/19 [==============================] - 0s 4ms/step - loss: 78789224.0000 - val_los
s: 72496472.0000
Epoch 96/400
19/19 [==============================] - 0s 5ms/step - loss: 78430328.0000 - val_los
s: 72163768.0000
Epoch 97/400
19/19 [==============================] - 0s 4ms/step - loss: 78060432.0000 - val_los
s: 71828688.0000
Epoch 98/400
19/19 [==============================] - 0s 5ms/step - loss: 77689912.0000 - val_los
s: 71459160.0000
Epoch 99/400
19/19 [==============================] - 0s 4ms/step - loss: 77321336.0000 - val_los
s: 71133120.0000
Epoch 100/400
19/19 [==============================] - 0s 4ms/step - loss: 76935832.0000 - val_los
s: 70782016.0000
Epoch 101/400
19/19 [==============================] - 0s 4ms/step - loss: 76563488.0000 - val_los
s: 70450584.0000
Epoch 102/400
19/19 [==============================] - 0s 4ms/step - loss: 76173792.0000 - val_los
s: 70078016.0000
Epoch 103/400
19/19 [==============================] - 0s 4ms/step - loss: 75790896.0000 - val_los
s: 69745368.0000
Epoch 104/400
19/19 [==============================] - 0s 4ms/step - loss: 75398408.0000 - val_los
s: 69406472.0000
Epoch 105/400
19/19 [==============================] - 0s 4ms/step - loss: 75008088.0000 - val_los
s: 69049448.0000
Epoch 106/400
19/19 [==============================] - 0s 4ms/step - loss: 74621184.0000 - val_los
s: 68699600.0000
Epoch 107/400
19/19 [==============================] - 0s 4ms/step - loss: 74214992.0000 - val_los
s: 68331928.0000
Epoch 108/400
19/19 [==============================] - 0s 5ms/step - loss: 73805352.0000 - val_los
s: 67936960.0000
Epoch 109/400
19/19 [==============================] - 0s 4ms/step - loss: 73417984.0000 - val_los
s: 67554152.0000
Epoch 110/400
19/19 [==============================] - 0s 4ms/step - loss: 73008536.0000 - val_los
s: 67265168.0000
Epoch 111/400
19/19 [==============================] - 0s 4ms/step - loss: 72585304.0000 - val_los
s: 66841400.0000
Epoch 112/400
19/19 [==============================] - 0s 4ms/step - loss: 72161536.0000 - val_los
s: 66454800.0000
Epoch 113/400
19/19 [==============================] - 0s 4ms/step - loss: 71735048.0000 - val_los
s: 66070152.0000
Epoch 114/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 71302056.0000 - val_los
s: 65667164.0000
Epoch 115/400
19/19 [==============================] - 0s 5ms/step - loss: 70878960.0000 - val_los
s: 65292684.0000
Epoch 116/400
19/19 [==============================] - 0s 5ms/step - loss: 70432296.0000 - val_los
s: 64881680.0000
Epoch 117/400
19/19 [==============================] - 0s 4ms/step - loss: 70009016.0000 - val_los
s: 64487468.0000
Epoch 118/400
19/19 [==============================] - 0s 4ms/step - loss: 69552248.0000 - val_los
s: 64116228.0000
Epoch 119/400
19/19 [==============================] - 0s 4ms/step - loss: 69102384.0000 - val_los
s: 63683864.0000
Epoch 120/400
19/19 [==============================] - 0s 5ms/step - loss: 68643792.0000 - val_los
s: 63296244.0000
Epoch 121/400
19/19 [==============================] - 0s 4ms/step - loss: 68179912.0000 - val_los
s: 62832108.0000
Epoch 122/400
19/19 [==============================] - 0s 5ms/step - loss: 67717480.0000 - val_los
s: 62436296.0000
Epoch 123/400
19/19 [==============================] - 0s 4ms/step - loss: 67229768.0000 - val_los
s: 61966028.0000
Epoch 124/400
19/19 [==============================] - 0s 4ms/step - loss: 66746684.0000 - val_los
s: 61564632.0000
Epoch 125/400
19/19 [==============================] - 0s 5ms/step - loss: 66263644.0000 - val_los
s: 61164104.0000
Epoch 126/400
19/19 [==============================] - 0s 5ms/step - loss: 65767896.0000 - val_los
s: 60683316.0000
Epoch 127/400
19/19 [==============================] - 0s 4ms/step - loss: 65262872.0000 - val_los
s: 60210948.0000
Epoch 128/400
19/19 [==============================] - 0s 5ms/step - loss: 64750628.0000 - val_los
s: 59748892.0000
Epoch 129/400
19/19 [==============================] - 0s 5ms/step - loss: 64239224.0000 - val_los
s: 59287016.0000
Epoch 130/400
19/19 [==============================] - 0s 4ms/step - loss: 63718532.0000 - val_los
s: 58818076.0000
Epoch 131/400
19/19 [==============================] - 0s 4ms/step - loss: 63185172.0000 - val_los
s: 58343520.0000
Epoch 132/400
19/19 [==============================] - 0s 5ms/step - loss: 62648932.0000 - val_los
s: 57844976.0000
Epoch 133/400
19/19 [==============================] - 0s 5ms/step - loss: 62113140.0000 - val_los
s: 57398904.0000
Epoch 134/400
19/19 [==============================] - 0s 4ms/step - loss: 61562148.0000 - val_los
s: 56856768.0000
Epoch 135/400
19/19 [==============================] - 0s 4ms/step - loss: 61020164.0000 - val_los
s: 56420224.0000
Epoch 136/400
19/19 [==============================] - 0s 4ms/step - loss: 60447728.0000 - val_los
s: 55835944.0000
Epoch 137/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 59844492.0000 - val_los
s: 55384476.0000
Epoch 138/400
19/19 [==============================] - 0s 4ms/step - loss: 59285360.0000 - val_los
s: 54852124.0000
Epoch 139/400
19/19 [==============================] - 0s 4ms/step - loss: 58685688.0000 - val_los
s: 54272580.0000
Epoch 140/400
19/19 [==============================] - 0s 4ms/step - loss: 58080252.0000 - val_los
s: 53767196.0000
Epoch 141/400
19/19 [==============================] - 0s 4ms/step - loss: 57480272.0000 - val_los
s: 53254540.0000
Epoch 142/400
19/19 [==============================] - 0s 4ms/step - loss: 56872008.0000 - val_los
s: 52627904.0000
Epoch 143/400
19/19 [==============================] - 0s 4ms/step - loss: 56258608.0000 - val_los
s: 52114484.0000
Epoch 144/400
19/19 [==============================] - 0s 4ms/step - loss: 55627760.0000 - val_los
s: 51506916.0000
Epoch 145/400
19/19 [==============================] - 0s 4ms/step - loss: 54978596.0000 - val_los
s: 50994308.0000
Epoch 146/400
19/19 [==============================] - 0s 5ms/step - loss: 54350988.0000 - val_los
s: 50433036.0000
Epoch 147/400
19/19 [==============================] - 0s 5ms/step - loss: 53697012.0000 - val_los
s: 49803232.0000
Epoch 148/400
19/19 [==============================] - 0s 5ms/step - loss: 53045784.0000 - val_los
s: 49269028.0000
Epoch 149/400
19/19 [==============================] - 0s 5ms/step - loss: 52393576.0000 - val_los
s: 48649252.0000
Epoch 150/400
19/19 [==============================] - 0s 5ms/step - loss: 51737804.0000 - val_los
s: 48076232.0000
Epoch 151/400
19/19 [==============================] - 0s 4ms/step - loss: 51069344.0000 - val_los
s: 47466652.0000
Epoch 152/400
19/19 [==============================] - 0s 4ms/step - loss: 50398632.0000 - val_los
s: 46884732.0000
Epoch 153/400
19/19 [==============================] - 0s 4ms/step - loss: 49735880.0000 - val_los
s: 46279272.0000
Epoch 154/400
19/19 [==============================] - 0s 5ms/step - loss: 49066780.0000 - val_los
s: 45688464.0000
Epoch 155/400
19/19 [==============================] - 0s 4ms/step - loss: 48387412.0000 - val_los
s: 45133132.0000
Epoch 156/400
19/19 [==============================] - 0s 4ms/step - loss: 47731072.0000 - val_los
s: 44528364.0000
Epoch 157/400
19/19 [==============================] - 0s 5ms/step - loss: 47057208.0000 - val_los
s: 43928444.0000
Epoch 158/400
19/19 [==============================] - 0s 4ms/step - loss: 46395924.0000 - val_los
s: 43353128.0000
Epoch 159/400
19/19 [==============================] - 0s 5ms/step - loss: 45745000.0000 - val_los
s: 42777200.0000
Epoch 160/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 45112884.0000 - val_los
s: 42212156.0000
Epoch 161/400
19/19 [==============================] - 0s 4ms/step - loss: 44469184.0000 - val_los
s: 41669808.0000
Epoch 162/400
19/19 [==============================] - 0s 4ms/step - loss: 43829792.0000 - val_los
s: 41101612.0000
Epoch 163/400
19/19 [==============================] - 0s 4ms/step - loss: 43221900.0000 - val_los
s: 40585396.0000
Epoch 164/400
19/19 [==============================] - 0s 3ms/step - loss: 42602332.0000 - val_los
s: 40057384.0000
Epoch 165/400
19/19 [==============================] - 0s 4ms/step - loss: 42003860.0000 - val_los
s: 39497032.0000
Epoch 166/400
19/19 [==============================] - 0s 3ms/step - loss: 41426688.0000 - val_los
s: 39000920.0000
Epoch 167/400
19/19 [==============================] - 0s 3ms/step - loss: 40858796.0000 - val_los
s: 38507456.0000
Epoch 168/400
19/19 [==============================] - 0s 4ms/step - loss: 40299612.0000 - val_los
s: 38078044.0000
Epoch 169/400
19/19 [==============================] - 0s 4ms/step - loss: 39767240.0000 - val_los
s: 37570764.0000
Epoch 170/400
19/19 [==============================] - 0s 4ms/step - loss: 39250700.0000 - val_los
s: 37114596.0000
Epoch 171/400
19/19 [==============================] - 0s 5ms/step - loss: 38769936.0000 - val_los
s: 36706824.0000
Epoch 172/400
19/19 [==============================] - 0s 5ms/step - loss: 38264632.0000 - val_los
s: 36268020.0000
Epoch 173/400
19/19 [==============================] - 0s 5ms/step - loss: 37802384.0000 - val_los
s: 35876680.0000
Epoch 174/400
19/19 [==============================] - 0s 4ms/step - loss: 37358968.0000 - val_los
s: 35473736.0000
Epoch 175/400
19/19 [==============================] - 0s 5ms/step - loss: 36899492.0000 - val_los
s: 35086868.0000
Epoch 176/400
19/19 [==============================] - 0s 5ms/step - loss: 36465064.0000 - val_los
s: 34720084.0000
Epoch 177/400
19/19 [==============================] - 0s 4ms/step - loss: 36049004.0000 - val_los
s: 34378760.0000
Epoch 178/400
19/19 [==============================] - 0s 4ms/step - loss: 35655720.0000 - val_los
s: 34021672.0000
Epoch 179/400
19/19 [==============================] - 0s 4ms/step - loss: 35280860.0000 - val_los
s: 33682480.0000
Epoch 180/400
19/19 [==============================] - 0s 4ms/step - loss: 34897764.0000 - val_los
s: 33373276.0000
Epoch 181/400
19/19 [==============================] - 0s 4ms/step - loss: 34512544.0000 - val_los
s: 33039512.0000
Epoch 182/400
19/19 [==============================] - 0s 5ms/step - loss: 34155980.0000 - val_los
s: 32717992.0000
Epoch 183/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 33821232.0000 - val_los
s: 32405742.0000
Epoch 184/400
19/19 [==============================] - 0s 4ms/step - loss: 33468254.0000 - val_los
s: 32103590.0000
Epoch 185/400
19/19 [==============================] - 0s 4ms/step - loss: 33136004.0000 - val_los
s: 31805816.0000
Epoch 186/400
19/19 [==============================] - 0s 4ms/step - loss: 32816678.0000 - val_los
s: 31537150.0000
Epoch 187/400
19/19 [==============================] - 0s 4ms/step - loss: 32517792.0000 - val_los
s: 31256974.0000
Epoch 188/400
19/19 [==============================] - 0s 4ms/step - loss: 32229242.0000 - val_los
s: 31002942.0000
Epoch 189/400
19/19 [==============================] - 0s 4ms/step - loss: 31959482.0000 - val_los
s: 30780078.0000
Epoch 190/400
19/19 [==============================] - 0s 4ms/step - loss: 31728570.0000 - val_los
s: 30555026.0000
Epoch 191/400
19/19 [==============================] - 0s 4ms/step - loss: 31501328.0000 - val_los
s: 30363384.0000
Epoch 192/400
19/19 [==============================] - 0s 5ms/step - loss: 31286186.0000 - val_los
s: 30194994.0000
Epoch 193/400
19/19 [==============================] - 0s 4ms/step - loss: 31079200.0000 - val_los
s: 29974000.0000
Epoch 194/400
19/19 [==============================] - 0s 4ms/step - loss: 30901606.0000 - val_los
s: 29845434.0000
Epoch 195/400
19/19 [==============================] - 0s 4ms/step - loss: 30725200.0000 - val_los
s: 29643014.0000
Epoch 196/400
19/19 [==============================] - 0s 3ms/step - loss: 30545636.0000 - val_los
s: 29492774.0000
Epoch 197/400
19/19 [==============================] - 0s 4ms/step - loss: 30341222.0000 - val_los
s: 29320302.0000
Epoch 198/400
19/19 [==============================] - 0s 5ms/step - loss: 30155850.0000 - val_los
s: 29123866.0000
Epoch 199/400
19/19 [==============================] - 0s 4ms/step - loss: 29945106.0000 - val_los
s: 28945522.0000
Epoch 200/400
19/19 [==============================] - 0s 3ms/step - loss: 29742744.0000 - val_los
s: 28750252.0000
Epoch 201/400
19/19 [==============================] - 0s 3ms/step - loss: 29552542.0000 - val_los
s: 28519992.0000
Epoch 202/400
19/19 [==============================] - 0s 4ms/step - loss: 29294860.0000 - val_los
s: 28327936.0000
Epoch 203/400
19/19 [==============================] - 0s 3ms/step - loss: 29055134.0000 - val_los
s: 28092254.0000
Epoch 204/400
19/19 [==============================] - 0s 4ms/step - loss: 28816720.0000 - val_los
s: 27875982.0000
Epoch 205/400
19/19 [==============================] - 0s 4ms/step - loss: 28580170.0000 - val_los
s: 27656126.0000
Epoch 206/400
```

```
19/19 [==============================] - 0s 5ms/step - loss: 28343068.0000 - val_los
s: 27460786.0000
Epoch 207/400
19/19 [==============================] - 0s 4ms/step - loss: 28130546.0000 - val_los
s: 27273124.0000
Epoch 208/400
19/19 [==============================] - 0s 4ms/step - loss: 27928666.0000 - val_los
s: 27075898.0000
Epoch 209/400
19/19 [==============================] - 0s 4ms/step - loss: 27760622.0000 - val_los
s: 26943164.0000
Epoch 210/400
19/19 [==============================] - 0s 4ms/step - loss: 27584386.0000 - val_los
s: 26779368.0000
Epoch 211/400
19/19 [==============================] - 0s 5ms/step - loss: 27445150.0000 - val_los
s: 26680052.0000
Epoch 212/400
19/19 [==============================] - 0s 4ms/step - loss: 27328778.0000 - val_los
s: 26576720.0000
Epoch 213/400
19/19 [==============================] - 0s 4ms/step - loss: 27234840.0000 - val_los
s: 26451416.0000
Epoch 214/400
19/19 [==============================] - 0s 5ms/step - loss: 27128276.0000 - val_los
s: 26398282.0000
Epoch 215/400
19/19 [==============================] - 0s 4ms/step - loss: 27057606.0000 - val_los
s: 26286396.0000
Epoch 216/400
19/19 [==============================] - 0s 4ms/step - loss: 26971074.0000 - val_los
s: 26222506.0000
Epoch 217/400
19/19 [==============================] - 0s 5ms/step - loss: 26887640.0000 - val_los
s: 26154602.0000
Epoch 218/400
19/19 [==============================] - 0s 5ms/step - loss: 26809960.0000 - val_los
s: 26071912.0000
Epoch 219/400
19/19 [==============================] - 0s 4ms/step - loss: 26742270.0000 - val_los
s: 25971998.0000
Epoch 220/400
19/19 [==============================] - 0s 3ms/step - loss: 26655166.0000 - val_los
s: 25934498.0000
Epoch 221/400
19/19 [==============================] - 0s 4ms/step - loss: 26585890.0000 - val_los
s: 25862704.0000
Epoch 222/400
19/19 [==============================] - 0s 3ms/step - loss: 26511270.0000 - val_los
s: 25746908.0000
Epoch 223/400
19/19 [==============================] - 0s 4ms/step - loss: 26438210.0000 - val_los
s: 25678226.0000
Epoch 224/400
19/19 [==============================] - 0s 3ms/step - loss: 26343526.0000 - val_los
s: 25581384.0000
Epoch 225/400
19/19 [==============================] - 0s 4ms/step - loss: 26268366.0000 - val_los
s: 25512208.0000
Epoch 226/400
19/19 [==============================] - 0s 5ms/step - loss: 26156460.0000 - val_los
s: 25394866.0000
Epoch 227/400
19/19 [==============================] - 0s 4ms/step - loss: 26046528.0000 - val_los
s: 25283528.0000
Epoch 228/400
19/19 [==============================] - 0s 5ms/step - loss: 25922568.0000 - val_los
s: 25151326.0000
Epoch 229/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 25759744.0000 - val_los
s: 25035928.0000
Epoch 230/400
19/19 [==============================] - 0s 4ms/step - loss: 25612400.0000 - val_los
s: 24873640.0000
Epoch 231/400
19/19 [==============================] - 0s 4ms/step - loss: 25462100.0000 - val_los
s: 24742474.0000
Epoch 232/400
19/19 [==============================] - 0s 5ms/step - loss: 25304788.0000 - val_los
s: 24598374.0000
Epoch 233/400
19/19 [==============================] - 0s 5ms/step - loss: 25166310.0000 - val_los
s: 24433192.0000
Epoch 234/400
19/19 [==============================] - 0s 5ms/step - loss: 24977592.0000 - val_los
s: 24282426.0000
Epoch 235/400
19/19 [==============================] - 0s 5ms/step - loss: 24838272.0000 - val_los
s: 24164914.0000
Epoch 236/400
19/19 [==============================] - 0s 3ms/step - loss: 24678284.0000 - val_los
s: 24009708.0000
Epoch 237/400
19/19 [==============================] - 0s 4ms/step - loss: 24527308.0000 - val_los
s: 23870982.0000
Epoch 238/400
19/19 [==============================] - 0s 4ms/step - loss: 24403244.0000 - val_los
s: 23766318.0000
Epoch 239/400
19/19 [==============================] - 0s 4ms/step - loss: 24286090.0000 - val_los
s: 23648582.0000
Epoch 240/400
19/19 [==============================] - 0s 3ms/step - loss: 24191102.0000 - val_los
s: 23559410.0000
Epoch 241/400
19/19 [==============================] - 0s 4ms/step - loss: 24096772.0000 - val_los
s: 23489414.0000
Epoch 242/400
19/19 [==============================] - 0s 4ms/step - loss: 24023278.0000 - val_los
s: 23417486.0000
Epoch 243/400
19/19 [==============================] - 0s 3ms/step - loss: 23955420.0000 - val_los
s: 23371306.0000
Epoch 244/400
19/19 [==============================] - 0s 3ms/step - loss: 23890282.0000 - val_los
s: 23285160.0000
Epoch 245/400
19/19 [==============================] - 0s 3ms/step - loss: 23825018.0000 - val_los
s: 23228910.0000
Epoch 246/400
19/19 [==============================] - 0s 3ms/step - loss: 23763262.0000 - val_los
s: 23161776.0000
Epoch 247/400
19/19 [==============================] - 0s 3ms/step - loss: 23713730.0000 - val_los
s: 23107118.0000
Epoch 248/400
19/19 [==============================] - 0s 3ms/step - loss: 23660854.0000 - val_los
s: 23079056.0000
Epoch 249/400
19/19 [==============================] - 0s 3ms/step - loss: 23615662.0000 - val_los
s: 22996402.0000
Epoch 250/400
19/19 [==============================] - 0s 3ms/step - loss: 23539720.0000 - val_los
s: 22950212.0000
Epoch 251/400
19/19 [==============================] - 0s 3ms/step - loss: 23487750.0000 - val_los
s: 22894598.0000
Epoch 252/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 23429202.0000 - val_los
s: 22839268.0000
Epoch 253/400
19/19 [==============================] - 0s 4ms/step - loss: 23376594.0000 - val_los
s: 22780850.0000
Epoch 254/400
19/19 [==============================] - 0s 4ms/step - loss: 23337980.0000 - val_los
s: 22757458.0000
Epoch 255/400
19/19 [==============================] - 0s 4ms/step - loss: 23275562.0000 - val_los
s: 22673478.0000
Epoch 256/400
19/19 [==============================] - 0s 4ms/step - loss: 23219842.0000 - val_los
s: 22627148.0000
Epoch 257/400
19/19 [==============================] - 0s 4ms/step - loss: 23176564.0000 - val_los
s: 22583302.0000
Epoch 258/400
19/19 [==============================] - 0s 4ms/step - loss: 23126686.0000 - val_los
s: 22524072.0000
Epoch 259/400
19/19 [==============================] - 0s 3ms/step - loss: 23090234.0000 - val_los
s: 22506252.0000
Epoch 260/400
19/19 [==============================] - 0s 2ms/step - loss: 23033926.0000 - val_los
s: 22433468.0000
Epoch 261/400
19/19 [==============================] - 0s 3ms/step - loss: 23024006.0000 - val_los
s: 22409592.0000
Epoch 262/400
19/19 [==============================] - 0s 3ms/step - loss: 22954146.0000 - val_los
s: 22383046.0000
Epoch 263/400
19/19 [==============================] - 0s 4ms/step - loss: 22907596.0000 - val_los
s: 22310760.0000
Epoch 264/400
19/19 [==============================] - 0s 4ms/step - loss: 22884282.0000 - val_los
s: 22284574.0000
Epoch 265/400
19/19 [==============================] - 0s 4ms/step - loss: 22840078.0000 - val_los
s: 22236190.0000
Epoch 266/400
19/19 [==============================] - 0s 4ms/step - loss: 22810088.0000 - val_los
s: 22205382.0000
Epoch 267/400
19/19 [==============================] - 0s 4ms/step - loss: 22774170.0000 - val_los
s: 22191640.0000
Epoch 268/400
19/19 [==============================] - 0s 4ms/step - loss: 22736076.0000 - val_los
s: 22132906.0000
Epoch 269/400
19/19 [==============================] - 0s 4ms/step - loss: 22713252.0000 - val_los
s: 22096568.0000
Epoch 270/400
19/19 [==============================] - 0s 4ms/step - loss: 22672894.0000 - val_los
s: 22059444.0000
Epoch 271/400
19/19 [==============================] - 0s 4ms/step - loss: 22646228.0000 - val_los
s: 22032202.0000
Epoch 272/400
19/19 [==============================] - 0s 4ms/step - loss: 22617850.0000 - val_los
s: 22021722.0000
Epoch 273/400
19/19 [==============================] - 0s 4ms/step - loss: 22586572.0000 - val_los
s: 21959436.0000
Epoch 274/400
19/19 [==============================] - 0s 4ms/step - loss: 22582158.0000 - val_los
s: 21988040.0000
Epoch 275/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 22521242.0000 - val_los
s: 21894696.0000
Epoch 276/400
19/19 [==============================] - 0s 4ms/step - loss: 22505952.0000 - val_los
s: 21870532.0000
Epoch 277/400
19/19 [==============================] - 0s 3ms/step - loss: 22494472.0000 - val_los
s: 21842086.0000
Epoch 278/400
19/19 [==============================] - 0s 4ms/step - loss: 22447674.0000 - val_los
s: 21833332.0000
Epoch 279/400
19/19 [==============================] - 0s 4ms/step - loss: 22423048.0000 - val_los
s: 21796320.0000
Epoch 280/400
19/19 [==============================] - 0s 4ms/step - loss: 22475540.0000 - val_los
s: 21777220.0000
Epoch 281/400
19/19 [==============================] - 0s 4ms/step - loss: 22372288.0000 - val_los
s: 21733482.0000
Epoch 282/400
19/19 [==============================] - 0s 5ms/step - loss: 22346518.0000 - val_los
s: 21720682.0000
Epoch 283/400
19/19 [==============================] - 0s 5ms/step - loss: 22331876.0000 - val_los
s: 21682700.0000
Epoch 284/400
19/19 [==============================] - 0s 5ms/step - loss: 22314380.0000 - val_los
s: 21653042.0000
Epoch 285/400
19/19 [==============================] - 0s 4ms/step - loss: 22281810.0000 - val_los
s: 21638220.0000
Epoch 286/400
19/19 [==============================] - 0s 4ms/step - loss: 22261930.0000 - val_los
s: 21604638.0000
Epoch 287/400
19/19 [==============================] - 0s 4ms/step - loss: 22248402.0000 - val_los
s: 21582144.0000
Epoch 288/400
19/19 [==============================] - 0s 3ms/step - loss: 22222140.0000 - val_los
s: 21572888.0000
Epoch 289/400
19/19 [==============================] - 0s 4ms/step - loss: 22226302.0000 - val_los
s: 21537596.0000
Epoch 290/400
19/19 [==============================] - 0s 4ms/step - loss: 22185500.0000 - val_los
s: 21514622.0000
Epoch 291/400
19/19 [==============================] - 0s 4ms/step - loss: 22177076.0000 - val_los
s: 21492294.0000
Epoch 292/400
19/19 [==============================] - 0s 4ms/step - loss: 22141004.0000 - val_los
s: 21495308.0000
Epoch 293/400
19/19 [==============================] - 0s 4ms/step - loss: 22127312.0000 - val_los
s: 21454266.0000
Epoch 294/400
19/19 [==============================] - 0s 4ms/step - loss: 22118288.0000 - val_los
s: 21487388.0000
Epoch 295/400
19/19 [==============================] - 0s 5ms/step - loss: 22127356.0000 - val_los
s: 21422674.0000
Epoch 296/400
19/19 [==============================] - 0s 4ms/step - loss: 22073024.0000 - val_los
s: 21426532.0000
Epoch 297/400
19/19 [==============================] - 0s 4ms/step - loss: 22091616.0000 - val_los
s: 21385172.0000
Epoch 298/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 22050486.0000 - val_los
s: 21359130.0000
Epoch 299/400
19/19 [==============================] - 0s 4ms/step - loss: 22032946.0000 - val_los
s: 21339794.0000
Epoch 300/400
19/19 [==============================] - 0s 4ms/step - loss: 22023914.0000 - val_los
s: 21396072.0000
Epoch 301/400
19/19 [==============================] - 0s 4ms/step - loss: 22014328.0000 - val_los
s: 21325986.0000
Epoch 302/400
19/19 [==============================] - 0s 4ms/step - loss: 21987202.0000 - val_los
s: 21355522.0000
Epoch 303/400
19/19 [==============================] - 0s 4ms/step - loss: 22022320.0000 - val_los
s: 21322682.0000
Epoch 304/400
19/19 [==============================] - 0s 4ms/step - loss: 21961238.0000 - val_los
s: 21305434.0000
Epoch 305/400
19/19 [==============================] - 0s 4ms/step - loss: 21949904.0000 - val_los
s: 21236952.0000
Epoch 306/400
19/19 [==============================] - 0s 4ms/step - loss: 21909518.0000 - val_los
s: 21278836.0000
Epoch 307/400
19/19 [==============================] - 0s 4ms/step - loss: 21953540.0000 - val_los
s: 21256350.0000
Epoch 308/400
19/19 [==============================] - 0s 4ms/step - loss: 21938194.0000 - val_los
s: 21214274.0000
Epoch 309/400
19/19 [==============================] - 0s 4ms/step - loss: 21894186.0000 - val_los
s: 21183250.0000
Epoch 310/400
19/19 [==============================] - 0s 5ms/step - loss: 21871726.0000 - val_los
s: 21157584.0000
Epoch 311/400
19/19 [==============================] - 0s 5ms/step - loss: 21852516.0000 - val_los
s: 21139926.0000
Epoch 312/400
19/19 [==============================] - 0s 4ms/step - loss: 21826586.0000 - val_los
s: 21120048.0000
Epoch 313/400
19/19 [==============================] - 0s 3ms/step - loss: 21819246.0000 - val_los
s: 21100934.0000
Epoch 314/400
19/19 [==============================] - 0s 5ms/step - loss: 21810178.0000 - val_los
s: 21088162.0000
Epoch 315/400
19/19 [==============================] - 0s 4ms/step - loss: 21785092.0000 - val_los
s: 21085980.0000
Epoch 316/400
19/19 [==============================] - 0s 4ms/step - loss: 21760800.0000 - val_los
s: 21053954.0000
Epoch 317/400
19/19 [==============================] - 0s 4ms/step - loss: 21764272.0000 - val_los
s: 21063328.0000
Epoch 318/400
19/19 [==============================] - 0s 5ms/step - loss: 21746090.0000 - val_los
s: 21023210.0000
Epoch 319/400
19/19 [==============================] - 0s 5ms/step - loss: 21727356.0000 - val_los
s: 21030894.0000
Epoch 320/400
19/19 [==============================] - 0s 4ms/step - loss: 21715070.0000 - val_los
s: 20987920.0000
Epoch 321/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 21703764.0000 - val_los
s: 20971926.0000
Epoch 322/400
19/19 [==============================] - 0s 4ms/step - loss: 21685764.0000 - val_los
s: 20957720.0000
Epoch 323/400
19/19 [==============================] - 0s 4ms/step - loss: 21691992.0000 - val_los
s: 20940466.0000
Epoch 324/400
19/19 [==============================] - 0s 5ms/step - loss: 21662766.0000 - val_los
s: 20924762.0000
Epoch 325/400
19/19 [==============================] - 0s 4ms/step - loss: 21658610.0000 - val_los
s: 20913682.0000
Epoch 326/400
19/19 [==============================] - 0s 4ms/step - loss: 21638206.0000 - val_los
s: 20901322.0000
Epoch 327/400
19/19 [==============================] - 0s 4ms/step - loss: 21619902.0000 - val_los
s: 20880818.0000
Epoch 328/400
19/19 [==============================] - 0s 4ms/step - loss: 21612972.0000 - val_los
s: 20891378.0000
Epoch 329/400
19/19 [==============================] - 0s 4ms/step - loss: 21600258.0000 - val_los
s: 20849050.0000
Epoch 330/400
19/19 [==============================] - 0s 4ms/step - loss: 21588562.0000 - val_los
s: 20834944.0000
Epoch 331/400
19/19 [==============================] - 0s 4ms/step - loss: 21558092.0000 - val_los
s: 20859732.0000
Epoch 332/400
19/19 [==============================] - 0s 4ms/step - loss: 21588000.0000 - val_los
s: 20814264.0000
Epoch 333/400
19/19 [==============================] - 0s 4ms/step - loss: 21540624.0000 - val_los
s: 20795186.0000
Epoch 334/400
19/19 [==============================] - 0s 4ms/step - loss: 21527532.0000 - val_los
s: 20771216.0000
Epoch 335/400
19/19 [==============================] - 0s 5ms/step - loss: 21531614.0000 - val_los
s: 20755938.0000
Epoch 336/400
19/19 [==============================] - 0s 5ms/step - loss: 21490688.0000 - val_los
s: 20746766.0000
Epoch 337/400
19/19 [==============================] - 0s 4ms/step - loss: 21481730.0000 - val_los
s: 20731376.0000
Epoch 338/400
19/19 [==============================] - 0s 4ms/step - loss: 21476418.0000 - val_los
s: 20717908.0000
Epoch 339/400
19/19 [==============================] - 0s 4ms/step - loss: 21459580.0000 - val_los
s: 20719834.0000
Epoch 340/400
19/19 [==============================] - 0s 4ms/step - loss: 21446528.0000 - val_los
s: 20694892.0000
Epoch 341/400
19/19 [==============================] - 0s 4ms/step - loss: 21436902.0000 - val_los
s: 20684720.0000
Epoch 342/400
19/19 [==============================] - 0s 4ms/step - loss: 21428766.0000 - val_los
s: 20670730.0000
Epoch 343/400
19/19 [==============================] - 0s 4ms/step - loss: 21422732.0000 - val_los
s: 20663662.0000
Epoch 344/400
```

```
19/19 [==============================] - 0s 4ms/step - loss: 21421746.0000 - val_los
s: 20643782.0000
Epoch 345/400
19/19 [==============================] - 0s 4ms/step - loss: 21384962.0000 - val_los
s: 20627154.0000
Epoch 346/400
19/19 [==============================] - 0s 4ms/step - loss: 21371480.0000 - val_los
s: 20636800.0000
Epoch 347/400
19/19 [==============================] - 0s 4ms/step - loss: 21367858.0000 - val_los
s: 20601062.0000
Epoch 348/400
19/19 [==============================] - 0s 4ms/step - loss: 21343452.0000 - val_los
s: 20594216.0000
Epoch 349/400
19/19 [==============================] - 0s 4ms/step - loss: 21351298.0000 - val_los
s: 20578138.0000
Epoch 350/400
19/19 [==============================] - 0s 4ms/step - loss: 21318678.0000 - val_los
s: 20568810.0000
Epoch 351/400
19/19 [==============================] - 0s 3ms/step - loss: 21301632.0000 - val_los
s: 20556080.0000
Epoch 352/400
19/19 [==============================] - 0s 3ms/step - loss: 21300700.0000 - val_los
s: 20553762.0000
Epoch 353/400
19/19 [==============================] - 0s 3ms/step - loss: 21289770.0000 - val_los
s: 20531988.0000
Epoch 354/400
19/19 [==============================] - 0s 3ms/step - loss: 21278594.0000 - val_los
s: 20523964.0000
Epoch 355/400
19/19 [==============================] - 0s 3ms/step - loss: 21269404.0000 - val_los
s: 20510956.0000
Epoch 356/400
19/19 [==============================] - 0s 3ms/step - loss: 21250412.0000 - val_los
s: 20497302.0000
Epoch 357/400
19/19 [==============================] - 0s 4ms/step - loss: 21245082.0000 - val_los
s: 20530732.0000
Epoch 358/400
19/19 [==============================] - 0s 4ms/step - loss: 21266940.0000 - val_los
s: 20496666.0000
Epoch 359/400
19/19 [==============================] - 0s 4ms/step - loss: 21249044.0000 - val_los
s: 20502304.0000
Epoch 360/400
19/19 [==============================] - 0s 3ms/step - loss: 21218282.0000 - val_los
s: 20459296.0000
Epoch 361/400
19/19 [==============================] - 0s 4ms/step - loss: 21207950.0000 - val_los
s: 20453264.0000
Epoch 362/400
19/19 [==============================] - 0s 4ms/step - loss: 21195844.0000 - val_los
s: 20439102.0000
Epoch 363/400
19/19 [==============================] - 0s 4ms/step - loss: 21186338.0000 - val_los
s: 20430568.0000
Epoch 364/400
19/19 [==============================] - 0s 4ms/step - loss: 21169934.0000 - val_los
s: 20486404.0000
Epoch 365/400
19/19 [==============================] - 0s 3ms/step - loss: 21208076.0000 - val_los
s: 20441200.0000
Epoch 366/400
19/19 [==============================] - 0s 3ms/step - loss: 21172284.0000 - val_los
s: 20459556.0000
Epoch 367/400
```

```
19/19 [==============================] - 0s 3ms/step - loss: 21141770.0000 - val_los
s: 20401734.0000
Epoch 368/400
19/19 [==============================] - 0s 4ms/step - loss: 21142952.0000 - val_los
s: 20386502.0000
Epoch 369/400
19/19 [==============================] - 0s 4ms/step - loss: 21124572.0000 - val_los
s: 20383160.0000
Epoch 370/400
19/19 [==============================] - 0s 4ms/step - loss: 21114816.0000 - val_los
s: 20384210.0000
Epoch 371/400
19/19 [==============================] - 0s 3ms/step - loss: 21114842.0000 - val_los
s: 20364870.0000
Epoch 372/400
19/19 [==============================] - 0s 3ms/step - loss: 21107180.0000 - val_los
s: 20361444.0000
Epoch 373/400
19/19 [==============================] - 0s 3ms/step - loss: 21096202.0000 - val_los
s: 20349998.0000
Epoch 374/400
19/19 [==============================] - 0s 3ms/step - loss: 21069666.0000 - val_los
s: 20342672.0000
Epoch 375/400
19/19 [==============================] - 0s 3ms/step - loss: 21086154.0000 - val_los
s: 20328526.0000
Epoch 376/400
19/19 [==============================] - 0s 3ms/step - loss: 21059920.0000 - val_los
s: 20321668.0000
Epoch 377/400
19/19 [==============================] - 0s 3ms/step - loss: 21080436.0000 - val_los
s: 20332422.0000
Epoch 378/400
19/19 [==============================] - 0s 4ms/step - loss: 21054522.0000 - val_los
s: 20315202.0000
Epoch 379/400
19/19 [==============================] - 0s 4ms/step - loss: 21046398.0000 - val_los
s: 20296608.0000
Epoch 380/400
19/19 [==============================] - 0s 4ms/step - loss: 21025134.0000 - val_los
s: 20287758.0000
Epoch 381/400
19/19 [==============================] - 0s 4ms/step - loss: 21021114.0000 - val_los
s: 20283468.0000
Epoch 382/400
19/19 [==============================] - 0s 4ms/step - loss: 21016814.0000 - val_los
s: 20274836.0000
Epoch 383/400
19/19 [==============================] - 0s 4ms/step - loss: 21011002.0000 - val_los
s: 20272242.0000
Epoch 384/400
19/19 [==============================] - 0s 4ms/step - loss: 21004470.0000 - val_los
s: 20268626.0000
Epoch 385/400
19/19 [==============================] - 0s 4ms/step - loss: 20988084.0000 - val_los
s: 20250728.0000
Epoch 386/400
19/19 [==============================] - 0s 4ms/step - loss: 20986366.0000 - val_los
s: 20239332.0000
Epoch 387/400
19/19 [==============================] - 0s 3ms/step - loss: 20980614.0000 - val_los
s: 20235608.0000
Epoch 388/400
19/19 [==============================] - 0s 3ms/step - loss: 20966020.0000 - val_los
s: 20243696.0000
Epoch 389/400
19/19 [==============================] - 0s 3ms/step - loss: 21026812.0000 - val_los
s: 20240398.0000
Epoch 390/400
```

```
19/19 [==============================] - 0s 3ms/step - loss: 20945226.0000 - val_los
s: 20227216.0000
Epoch 391/400
19/19 [==============================] - 0s 3ms/step - loss: 20944742.0000 - val_los
s: 20214380.0000
Epoch 392/400
19/19 [==============================] - 0s 3ms/step - loss: 20927724.0000 - val_los
s: 20217562.0000
Epoch 393/400
19/19 [==============================] - 0s 3ms/step - loss: 20969794.0000 - val_los
s: 20211964.0000
Epoch 394/400
19/19 [==============================] - 0s 3ms/step - loss: 20918460.0000 - val_los
s: 20194316.0000
Epoch 395/400
19/19 [==============================] - 0s 3ms/step - loss: 20939338.0000 - val_los
s: 20183826.0000
Epoch 396/400
19/19 [==============================] - 0s 3ms/step - loss: 20915062.0000 - val_los
s: 20175052.0000
Epoch 397/400
19/19 [==============================] - 0s 4ms/step - loss: 20898768.0000 - val_los
s: 20183070.0000
Epoch 398/400
19/19 [==============================] - 0s 4ms/step - loss: 20889044.0000 - val_los
s: 20168256.0000
Epoch 399/400
19/19 [==============================] - 0s 4ms/step - loss: 20878848.0000 - val_los
s: 20164704.0000
Epoch 400/400
19/19 [==============================] - 0s 4ms/step - loss: 20876748.0000 - val_los
s: 20152546.0000
```

Out[21]: <tensorflow.python.keras.callbacks.History at 0x17956e4edc0>

In [22]:

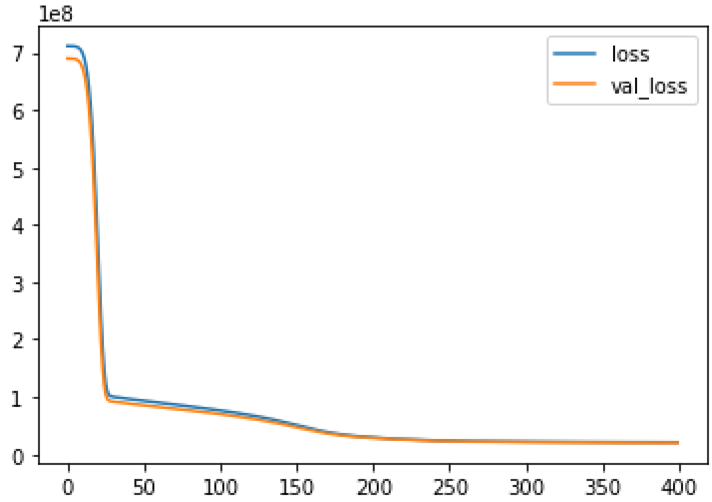
```
# Loss değerlerinin minimize olma eğrisi

loss_df = model.history.history

loss_train = loss_df["loss"]      # type --> liste
loss_train = np.array(loss_train)   # train verisine göre loss
loss_test = loss_df["val_loss"]    # test verisine göre validasyon loss
loss_test = np.array(loss_test)

axis = range(0,400)   # epoch --> 400
plt.plot(axis,loss_train, label="loss")
plt.plot(axis,loss_test, label="val_loss")
plt.legend()
```

Out[22]: <matplotlib.legend.Legend at 0x1795855e190>



In [23]:

```
# Tahminler

tahminler = model.predict(x_test)
sayı = tahminler.shape[0]
tahminler = pd.Series(tahminler.reshape(sayı,))

resultFrame = pd.DataFrame(y_test,columns=["Gerçek Fiyat"])
resultFrame["Tahmin"] = tahminler
resultFrame
```

Out[23]:

	Gerçek Fiyat	Tahmin
0	23780	20585.091797
1	14991	14599.619141
2	21498	22662.232422
3	13000	14559.989258
4	17000	19074.125000
...	...	...
3916	14990	17351.855469
3917	17299	20213.093750
3918	24810	22377.546875
3919	20640	21893.986328
3920	26995	19470.316406

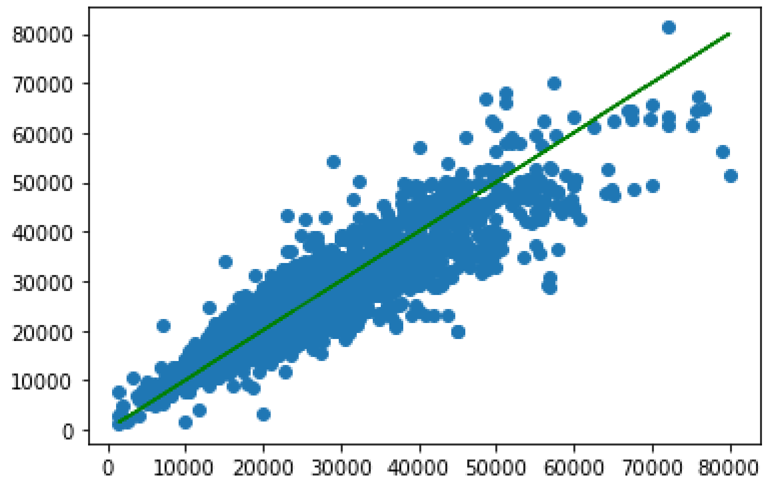
3921 rows × 2 columns

In [24]:

```
plt.scatter(y_test,tahminler)
plt.plot(y_test,y_test,color="green")
```

Out[24]:

```
[<matplotlib.lines.Line2D at 0x17958663bb0>]
```



In [25]:

```
# Hata oranı değerlendirilmesi

from sklearn.metrics import mean_absolute_error

sapma = round(mean_absolute_error(resultFrame["Gerçek Fiyat"],resultFrame["Tahmin"])
ort_fiyat = round(dataFrame["price"].mean())

# yüzde hesabı
# 24078 pound fiyatta 3170 pound sapıyorsa % yüzde kaç sapar?
yuzde_sapma = (100 * sapma) / ort_fiyat
dogruluk_oranı = round(100 - yuzde_sapma)

dogruluk_oranı  # --> %87
```

Out[25]: 87

In [26]:

```
deneme = pd.Series([2019,1000,145,22.1,4.0])   # gerçek fiyat --> 75729
deneme = scaler.transform(deneme.values.reshape(-1,5))   # 5 özelliği matrise çevir
model.predict(deneme)
```

Out[26]: array([[64345.66]], dtype=float32)

In [ ]: