In [2]:
```
import numpy as np
import random as rnd
import pandas as pd

# visualization
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline

# scaling and train test split
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler

# creating a model
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Activation
from tensorflow.keras.optimizers import Adam

# evaluation on test data
from sklearn.metrics import mean_squared_error,mean_absolute_error,explained_variance_score
from sklearn.metrics import classification_report,confusion_matrix
```

```
C:\ProgramData\Anaconda3\lib\site-packages\scipy\__init__.py:146: UserWarning: A NumPy version >=1.16.5 and <1.23.0 is required
for this version of SciPy (detected version 1.24.3
  warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}"
```

In [3]:
```
df = pd.read_csv("C:/Users/Hp/House Price Prediction (MP)/house_data.csv")
```

In [4]:
```
print(df.columns.values)
```

```
['id' 'date' 'price' 'bedrooms' 'bathrooms' 'sqft_living' 'sqft_lot'
 'floors' 'waterfront' 'view' 'condition' 'grade' 'sqft_above'
 'sqft_basement' 'yr_built' 'yr_renovated' 'zipcode' 'lat' 'long'
 'sqft_living15' 'sqft_lot15']
```

In [5]:
```
df.head()
```

Out[5]:

	id	date	price	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	view	...	grade	sqft_above	sqft_basement
0	7129300520	20141013T000000	221900.0	3	1.00	1180	5650	1.0	0	0	...	7	1180	0
1	6414100192	20141209T000000	538000.0	3	2.25	2570	7242	2.0	0	0	...	7	2170	400
2	5631500400	20150225T000000	180000.0	2	1.00	770	10000	1.0	0	0	...	6	770	0
3	2487200875	20141209T000000	604000.0	4	3.00	1960	5000	1.0	0	0	...	7	1050	910
4	1954400510	20150218T000000	510000.0	3	2.00	1680	8080	1.0	0	0	...	8	1680	0

5 rows × 21 columns

In [6]:

```
df.tail()
```

Out[6]:

	id	date	price	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	view	...	grade	sqft_above	sqft_basem
21608	263000018	20140521T000000	360000.0	3	2.50	1530	1131	3.0	0	0	...	8	1530	
21609	6600060120	20150223T000000	400000.0	4	2.50	2310	5813	2.0	0	0	...	8	2310	
21610	1523300141	20140623T000000	402101.0	2	0.75	1020	1350	2.0	0	0	...	7	1020	
21611	291310100	20150116T000000	400000.0	3	2.50	1600	2388	2.0	0	0	...	8	1600	
21612	1523300157	20141015T000000	325000.0	2	0.75	1020	1076	2.0	0	0	...	7	1020	

5 rows × 21 columns

In [7]:

```
df.isnull().sum()
```

Out[7]:
```
id               0
date             0
price            0
bedrooms         0
bathrooms        0
sqft_living      0
sqft_lot         0
floors           0
waterfront       0
view             0
condition        0
grade            0
sqft_above       0
sqft_basement    0
yr_built         0
yr_renovated     0
zipcode          0
lat              0
long             0
sqft_living15    0
sqft_lot15       0
dtype: int64
```

In [8]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 21613 entries, 0 to 21612
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   id             21613 non-null  int64  
 1   date           21613 non-null  object 
 2   price          21613 non-null  float64
 3   bedrooms       21613 non-null  int64  
 4   bathrooms      21613 non-null  float64
 5   sqft_living    21613 non-null  int64  
 6   sqft_lot       21613 non-null  int64  
 7   floors         21613 non-null  float64
 8   waterfront     21613 non-null  int64  
 9   view           21613 non-null  int64  
 10  condition      21613 non-null  int64  
 11  grade          21613 non-null  int64  
 12  sqft_above     21613 non-null  int64  
 13  sqft_basement  21613 non-null  int64  
 14  yr_built       21613 non-null  int64  
 15  yr_renovated   21613 non-null  int64  
 16  zipcode        21613 non-null  int64  
 17  lat            21613 non-null  float64
 18  long           21613 non-null  float64
 19  sqft_living15  21613 non-null  int64  
 20  sqft_lot15     21613 non-null  int64  
dtypes: float64(5), int64(15), object(1)
memory usage: 3.5+ MB
```

In [9]:
```
df.describe().transpose()
```

Out[9]:

	count	mean	std	min	25%	50%	75%	max
id	21613.0	4.580302e+09	2.876566e+09	1.000102e+06	2.123049e+09	3.904930e+09	7.308900e+09	9.900000e+09
price	21613.0	5.400881e+05	3.671272e+05	7.500000e+04	3.219500e+05	4.500000e+05	6.450000e+05	7.700000e+06
bedrooms	21613.0	3.370842e+00	9.300618e-01	0.000000e+00	3.000000e+00	3.000000e+00	4.000000e+00	3.300000e+01
bathrooms	21613.0	2.114757e+00	7.701632e-01	0.000000e+00	1.750000e+00	2.250000e+00	2.500000e+00	8.000000e+00
sqft_living	21613.0	2.079900e+03	9.184409e+02	2.900000e+02	1.427000e+03	1.910000e+03	2.550000e+03	1.354000e+04
sqft_lot	21613.0	1.510697e+04	4.142051e+04	5.200000e+02	5.040000e+03	7.618000e+03	1.068800e+04	1.651359e+06
floors	21613.0	1.494309e+00	5.399889e-01	1.000000e+00	1.000000e+00	1.500000e+00	2.000000e+00	3.500000e+00
waterfront	21613.0	7.541757e-03	8.651720e-02	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	1.000000e+00
view	21613.0	2.343034e-01	7.663176e-01	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	4.000000e+00
condition	21613.0	3.409430e+00	6.507430e-01	1.000000e+00	3.000000e+00	3.000000e+00	4.000000e+00	5.000000e+00
grade	21613.0	7.656873e+00	1.175459e+00	1.000000e+00	7.000000e+00	7.000000e+00	8.000000e+00	1.300000e+01
sqft_above	21613.0	1.788391e+03	8.280910e+02	2.900000e+02	1.190000e+03	1.560000e+03	2.210000e+03	9.410000e+03
sqft_basement	21613.0	2.915090e+02	4.425750e+02	0.000000e+00	0.000000e+00	0.000000e+00	5.600000e+02	4.820000e+03
yr_built	21613.0	1.971005e+03	2.937341e+01	1.900000e+03	1.951000e+03	1.975000e+03	1.997000e+03	2.015000e+03
yr_renovated	21613.0	8.440226e+01	4.016792e+02	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	2.015000e+03
zipcode	21613.0	9.807794e+04	5.350503e+01	9.800100e+04	9.803300e+04	9.806500e+04	9.811800e+04	9.819900e+04
lat	21613.0	4.756005e+01	1.385637e-01	4.715590e+01	4.747100e+01	4.757180e+01	4.767800e+01	4.777760e+01
long	21613.0	-1.222139e+02	1.408283e-01	-1.225190e+02	-1.223280e+02	-1.222300e+02	-1.221250e+02	-1.213150e+02
sqft_living15	21613.0	1.986552e+03	6.853913e+02	3.990000e+02	1.490000e+03	1.840000e+03	2.360000e+03	6.210000e+03
sqft_lot15	21613.0	1.276846e+04	2.730418e+04	6.510000e+02	5.100000e+03	7.620000e+03	1.008300e+04	8.712000e+05

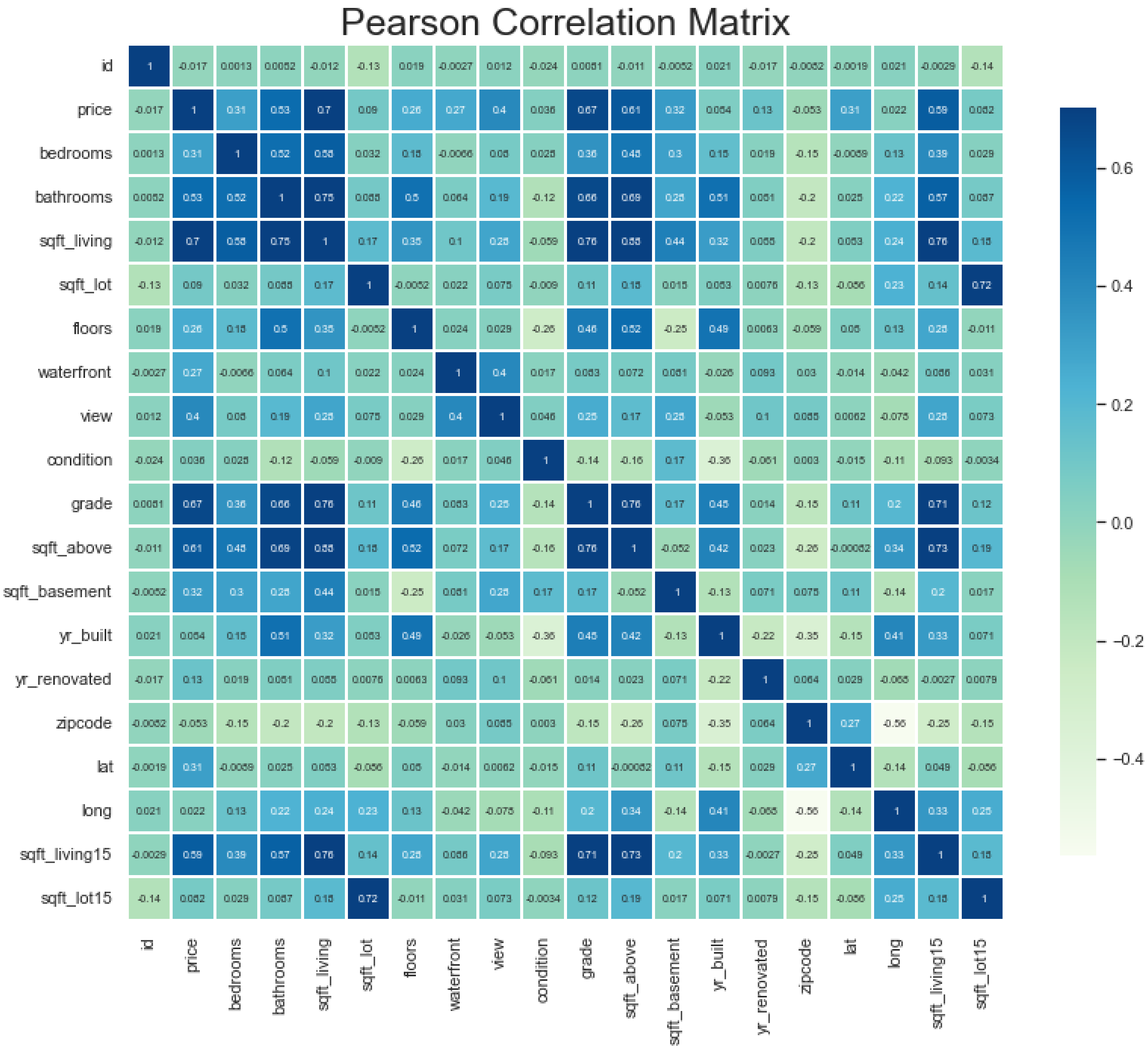
In [10]:

```
# Pearson correlation matrix
# We use the Pearson correlation coefficient to examine the strength and direction of the linear
# relationship between two continuous variables.

# The correlation coefficient can range in value from -1 to +1.
# The larger the absolute value of the coefficient, the stronger the relationship between the variables.
```

```
# For the Pearson correlation, an absolute value of 1 indicates a perfect linear relationship.
# A correlation close to 0 indicates no linear relationship between the variables.

# The sign of the coefficient indicates the direction of the relationship.
# If both variables tend to increase or decrease together, the coefficient is positive, and
# the line that represents the correlation slopes upward.
# If one variable tends to increase as the other decreases, the coefficient is negative, and
# the line that represents the correlation slopes downward.
```

In [11]:
```
sns.set(style="whitegrid", font_scale=1)

plt.figure(figsize=(13,13))
plt.title('Pearson Correlation Matrix',fontsize=25)
sns.heatmap(df.corr(),linewidths=0.25,vmax=0.7,square=True,cmap="GnBu",linecolor='w',
            annot=True, annot_kws={"size":7}, cbar_kws={"shrink": .7})
```

Out[11]:
```
<AxesSubplot:title={'center':'Pearson Correlation Matrix'}>
```

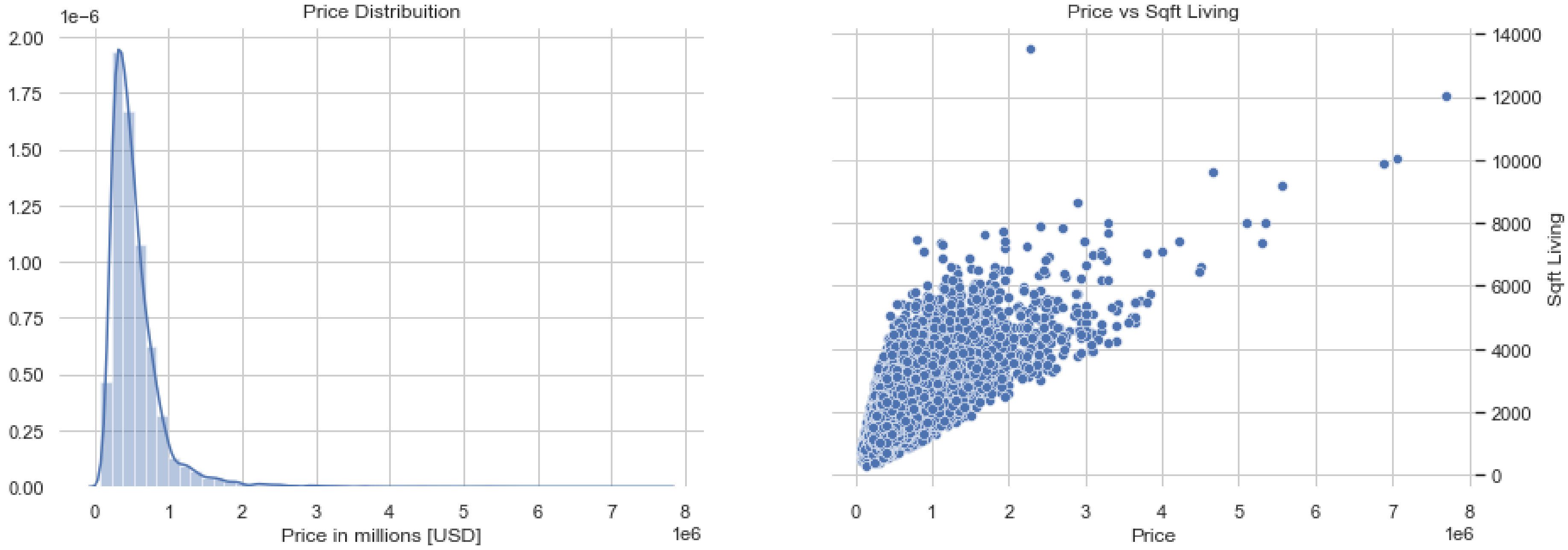

Pearson Correlation Matrix
id
price
bedrooms
bathrooms
sqft_living
sqft_lot
floors
waterfront
view
condition
grade
sqft_above
sqft_basement
yr_built
yr_renovated
zipcode
lat
long
sqft_living15
sqft_lot15
0.6
0.4
0.2
0.0
−0.2
−0.4

In [12]:
```
price_corr = df.corr()['price'].sort_values(ascending=False)
print(price_corr)
```

```
price            1.000000
sqft_living      0.702035
grade            0.667434
sqft_above       0.605567
sqft_living15    0.585379
bathrooms        0.525138
view             0.397293
sqft_basement    0.323816
bedrooms         0.308350
lat              0.307003
waterfront       0.266369
floors           0.256794
yr_renovated     0.126434
sqft_lot         0.089661
sqft_lot15       0.082447
yr_built         0.054012
condition        0.036362
long             0.021626
id              -0.016762
zipcode         -0.053203
Name: price, dtype: float64
```

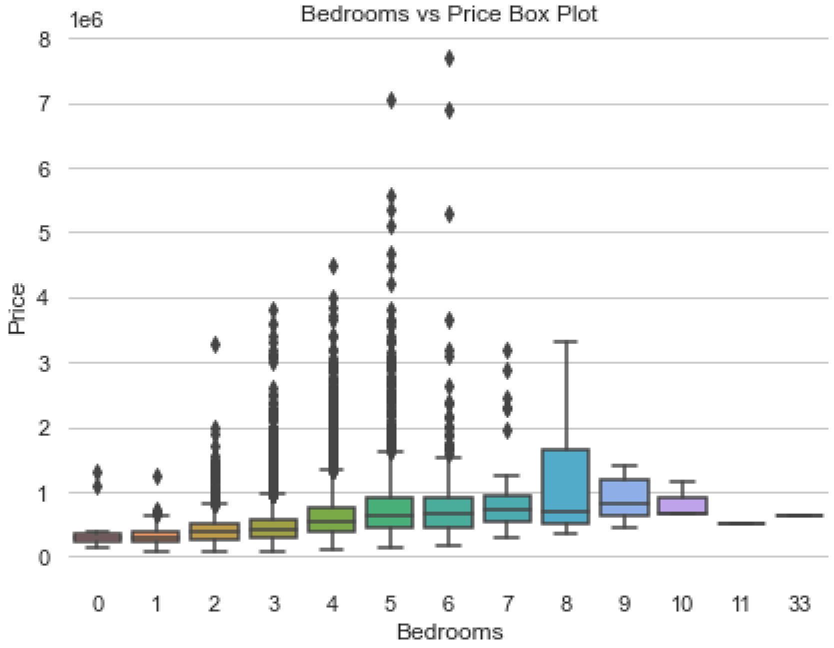
In [13]:
```
f, axes = plt.subplots(1, 2,figsize=(15,5))
sns.distplot(df['price'], ax=axes[0])
sns.scatterplot(x='price',y='sqft_living', data=df, ax=axes[1])
sns.despine(bottom=True, left=True)
axes[0].set(xlabel='Price in millions [USD]', ylabel='', title='Price Distribuition')
axes[1].set(xlabel='Price', ylabel='Sqft Living', title='Price vs Sqft Living')
axes[1].yaxis.set_label_position("right")
axes[1].yaxis.tick_right()
```

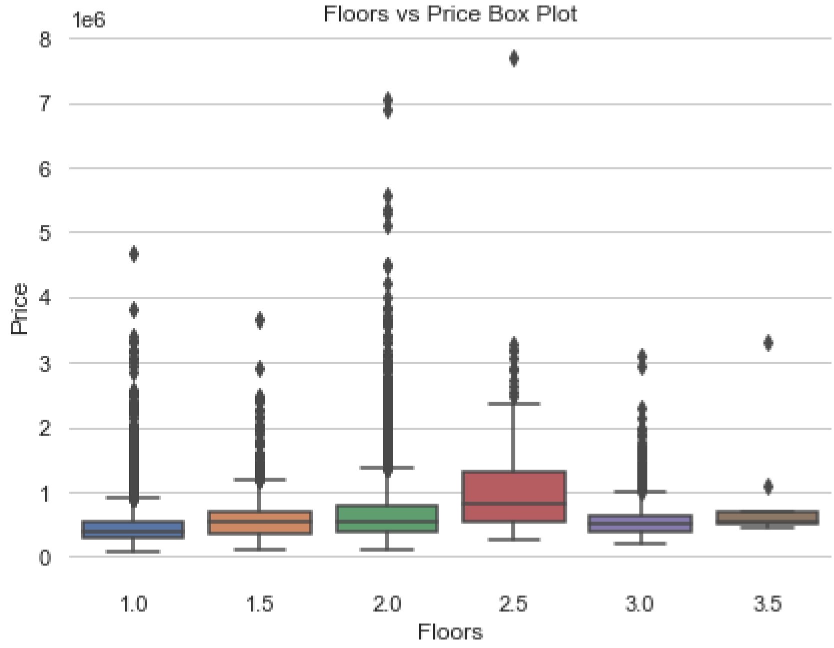
```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and
will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexib
ility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



In [14]:
```
sns.set(style="whitegrid", font_scale=1)

f, axes = plt.subplots(1, 2,figsize=(15,5))
sns.boxplot(x=df['bedrooms'],y=df['price'], ax=axes[0])
sns.boxplot(x=df['floors'],y=df['price'], ax=axes[1])
sns.despine(bottom=True, left=True)
axes[0].set(xlabel='Bedrooms', ylabel='Price', title='Bedrooms vs Price Box Plot')
axes[1].set(xlabel='Floors', ylabel='Price', title='Floors vs Price Box Plot')
```

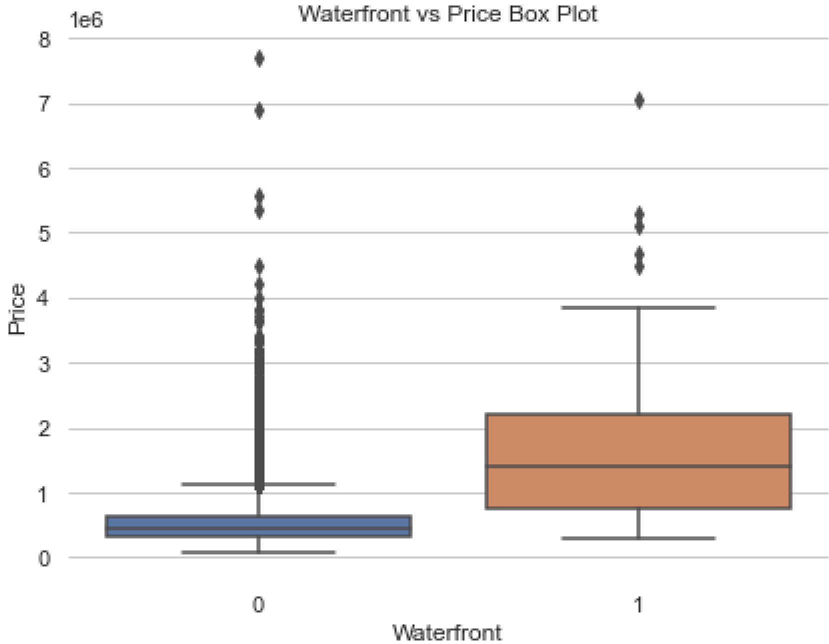
Out[14]:
```
[Text(0.5, 0, 'Floors'),
 Text(0, 0.5, 'Price'),
 Text(0.5, 1.0, 'Floors vs Price Box Plot')]
```

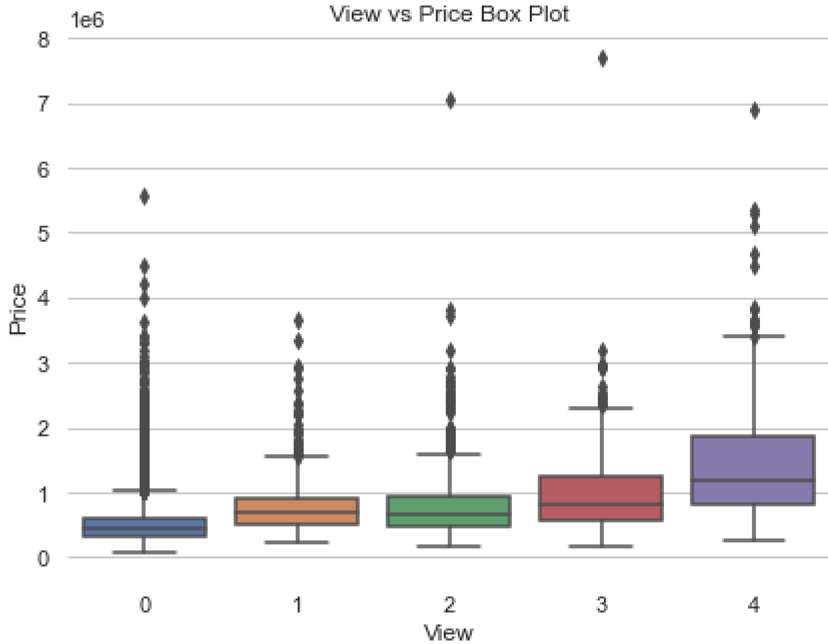


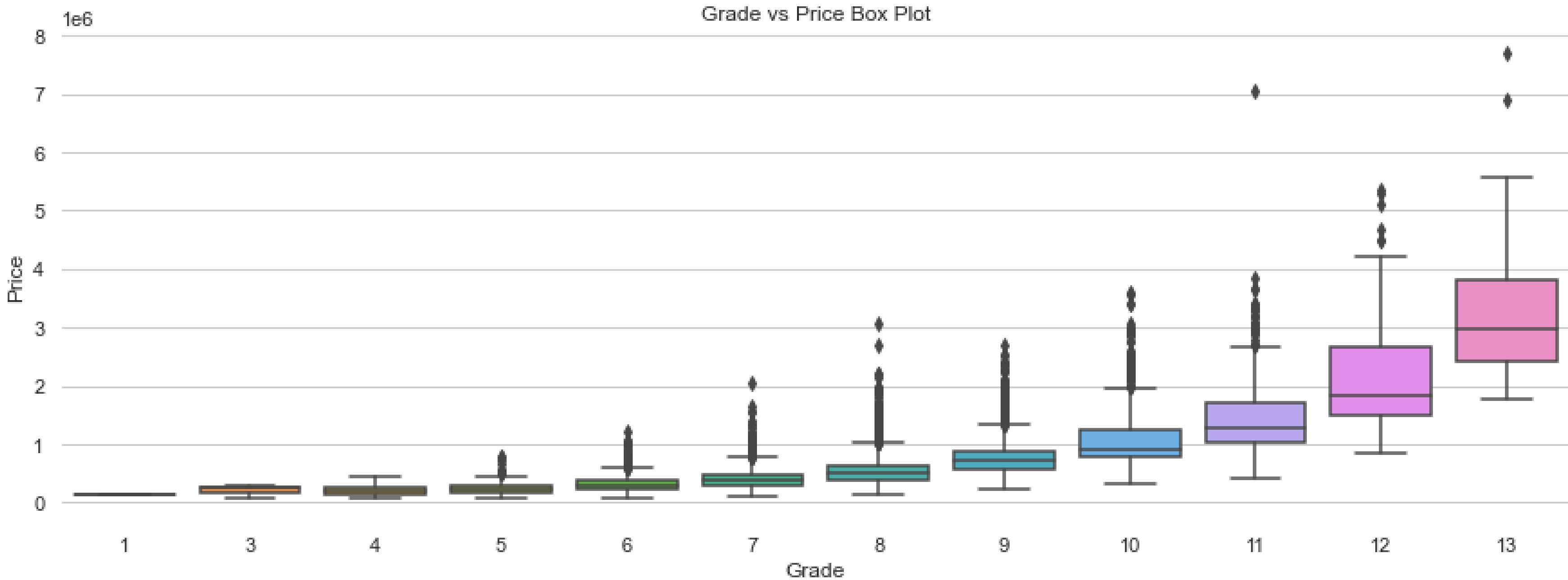


In [15]:
```
f, axes = plt.subplots(1, 2,figsize=(15,5))
sns.boxplot(x=df['waterfront'],y=df['price'], ax=axes[0])
sns.boxplot(x=df['view'],y=df['price'], ax=axes[1])
sns.despine(left=True, bottom=True)
axes[0].set(xlabel='Waterfront', ylabel='Price', title='Waterfront vs Price Box Plot')
axes[1].set(xlabel='View', ylabel='Price', title='View vs Price Box Plot')

f, axe = plt.subplots(1, 1,figsize=(15,5))
sns.boxplot(x=df['grade'],y=df['price'], ax=axe)
sns.despine(left=True, bottom=True)
axe.set(xlabel='Grade', ylabel='Price', title='Grade vs Price Box Plot')
```

Out[15]:
```
[Text(0.5, 0, 'Grade'),
 Text(0, 0.5, 'Price'),
 Text(0.5, 1.0, 'Grade vs Price Box Plot')]
```


Waterfront vs Price Box Plot
1e6
Price
Waterfront
0
1
2
3
4
5
6
7
8


View vs Price Box Plot
1e6
Price
View
0
1
2
3
4
5
6
7
8


Grade vs Price Box Plot
1e6
Price
Grade
0
1
3
4
5
6
7
8
9
10
11
12
13

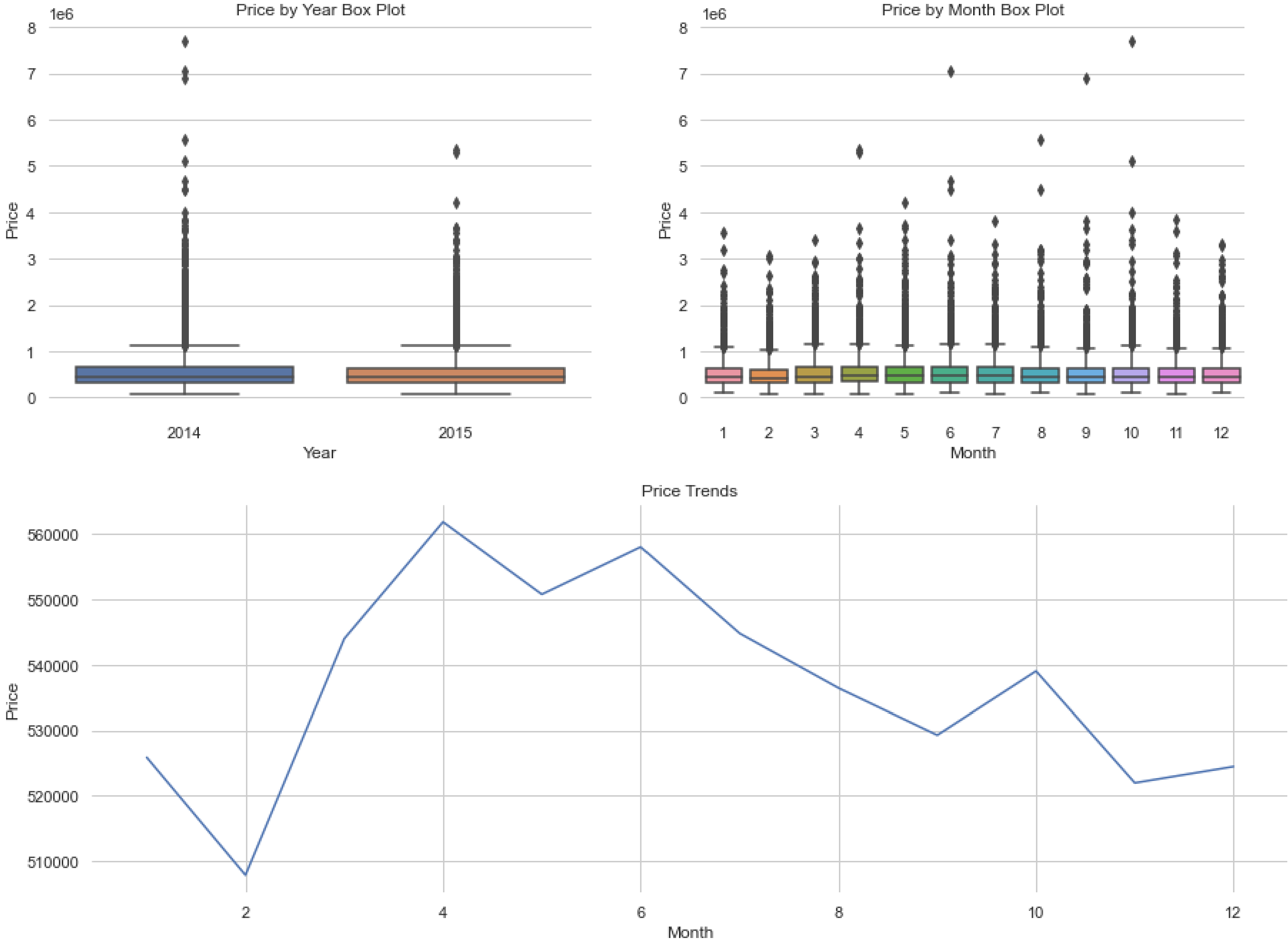
In [16]:
```
df = df.drop('id', axis=1)
df = df.drop('zipcode',axis=1)
```

In [17]:
```
df['date'] = pd.to_datetime(df['date'])

df['month'] = df['date'].apply(lambda date:date.month)
df['year'] = df['date'].apply(lambda date:date.year)

df = df.drop('date',axis=1)

# Check the new columns
print(df.columns.values)
```

```
['price' 'bedrooms' 'bathrooms' 'sqft_living' 'sqft_lot' 'floors'
 'waterfront' 'view' 'condition' 'grade' 'sqft_above' 'sqft_basement'
 'yr_built' 'yr_renovated' 'lat' 'long' 'sqft_living15' 'sqft_lot15'
 'month' 'year']
```

In [18]:
```
f, axes = plt.subplots(1, 2,figsize=(15,5))
sns.boxplot(x='year',y='price',data=df, ax=axes[0])
sns.boxplot(x='month',y='price',data=df, ax=axes[1])
sns.despine(left=True, bottom=True)
axes[0].set(xlabel='Year', ylabel='Price', title='Price by Year Box Plot')
axes[1].set(xlabel='Month', ylabel='Price', title='Price by Month Box Plot')

f, axe = plt.subplots(1, 1,figsize=(15,5))
df.groupby('month').mean()['price'].plot()
sns.despine(left=True, bottom=True)
axe.set(xlabel='Month', ylabel='Price', title='Price Trends')
```

Out[18]:
```
[Text(0.5, 0, 'Month'), Text(0, 0.5, 'Price'), Text(0.5, 1.0, 'Price Trends')]
```


Price by Year Box Plot
1e6
8
7
6
5
4
3
2
1
0
Price
2014
2015
Year
Price by Month Box Plot
1e6
Price
1 2 3 4 5 6 7 8 9 10 11 12
Month
Price Trends
560000
550000
540000
530000
520000
510000
Price
2 4 6 8 10 12
Month

In [19]:
```
X = df.drop('price',axis=1)

# Label
y = df['price']

# Split
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.3,random_state=101)
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(15129, 19)
(6484, 19)
(15129,)
(6484,)
```

In [20]:
```
scaler = MinMaxScaler()

# fit and transfrom
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

# everything has been scaled between 1 and 0
print('Max: ',X_train.max())
print('Min: ', X_train.min())
```

```
Max:  1.0000000000000002
Min:  0.0
```

In [21]:
```
model = Sequential()

# input layer
model.add(Dense(19,activation='relu'))

# hidden layers
model.add(Dense(19,activation='relu'))
model.add(Dense(19,activation='relu'))
model.add(Dense(19,activation='relu'))

# output layer
model.add(Dense(1))

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

In [22]:
```
model.fit(x=X_train,y=y_train.values,
          validation_data=(X_test,y_test.values),
          batch_size=128,epochs=400)
```

```
Epoch 1/400
119/119 [==============================] - 3s 7ms/step - loss: 423613988864.0000 - val_loss: 432936091648.0000
Epoch 2/400
119/119 [==============================] - 0s 4ms/step - loss: 421641388032.0000 - val_loss: 426126082048.0000
Epoch 3/400
119/119 [==============================] - 1s 5ms/step - loss: 396250546176.0000 - val_loss: 368990879744.0000
Epoch 4/400
119/119 [==============================] - 0s 4ms/step - loss: 287508791296.0000 - val_loss: 207805841408.0000
Epoch 5/400
119/119 [==============================] - 1s 4ms/step - loss: 136469938176.0000 - val_loss: 108472688640.0000
Epoch 6/400
119/119 [==============================] - 0s 4ms/step - loss: 99829284864.0000 - val_loss: 103927480320.0000
Epoch 7/400
119/119 [==============================] - 0s 4ms/step - loss: 97950826496.0000 - val_loss: 102285918208.0000
Epoch 8/400
119/119 [==============================] - 0s 4ms/step - loss: 96430546944.0000 - val_loss: 100626317312.0000
Epoch 9/400
119/119 [==============================] - 0s 4ms/step - loss: 94859403264.0000 - val_loss: 98905448448.0000
Epoch 10/400
119/119 [==============================] - 0s 4ms/step - loss: 93240868864.0000 - val_loss: 97155997696.0000
Epoch 11/400
119/119 [==============================] - 0s 4ms/step - loss: 91576672256.0000 - val_loss: 95271247872.0000
Epoch 12/400
119/119 [==============================] - 1s 4ms/step - loss: 89869606912.0000 - val_loss: 93369221120.0000
Epoch 13/400
119/119 [==============================] - 1s 5ms/step - loss: 88051892224.0000 - val_loss: 91448508416.0000
Epoch 14/400
119/119 [==============================] - 1s 5ms/step - loss: 86191521792.0000 - val_loss: 89326010368.0000
Epoch 15/400
119/119 [==============================] - 1s 5ms/step - loss: 84205109248.0000 - val_loss: 87139803136.0000
Epoch 16/400
119/119 [==============================] - 1s 4ms/step - loss: 82082037760.0000 - val_loss: 84809768960.0000
Epoch 17/400
119/119 [==============================] - 0s 4ms/step - loss: 79909183488.0000 - val_loss: 82371518464.0000
Epoch 18/400
119/119 [==============================] - 0s 4ms/step - loss: 77627072512.0000 - val_loss: 79810822144.0000
Epoch 19/400
119/119 [==============================] - 0s 4ms/step - loss: 75230691328.0000 - val_loss: 77111386112.0000
Epoch 20/400
119/119 [==============================] - 0s 4ms/step - loss: 72768266240.0000 - val_loss: 74484834304.0000
Epoch 21/400
119/119 [==============================] - 0s 4ms/step - loss: 70217719808.0000 - val_loss: 71680466944.0000
Epoch 22/400
119/119 [==============================] - 0s 4ms/step - loss: 67710455808.0000 - val_loss: 68763287552.0000
```

```
Epoch 23/400
119/119 [==============================] - 0s 4ms/step - loss: 65177268224.0000 - val_loss: 66019274752.0000
Epoch 24/400
119/119 [==============================] - 0s 4ms/step - loss: 62740652032.0000 - val_loss: 63446376448.0000
Epoch 25/400
119/119 [==============================] - 1s 4ms/step - loss: 60519256064.0000 - val_loss: 61048696832.0000
Epoch 26/400
119/119 [==============================] - 1s 4ms/step - loss: 58495442944.0000 - val_loss: 58881351680.0000
Epoch 27/400
119/119 [==============================] - 1s 4ms/step - loss: 56749973504.0000 - val_loss: 57055948800.0000
Epoch 28/400
119/119 [==============================] - 1s 5ms/step - loss: 55264292864.0000 - val_loss: 55667138560.0000
Epoch 29/400
119/119 [==============================] - 1s 5ms/step - loss: 54129172480.0000 - val_loss: 54410203136.0000
Epoch 30/400
119/119 [==============================] - 1s 5ms/step - loss: 53149380608.0000 - val_loss: 53373616128.0000
Epoch 31/400
119/119 [==============================] - 1s 5ms/step - loss: 52341776384.0000 - val_loss: 52457332736.0000
Epoch 32/400
119/119 [==============================] - 1s 5ms/step - loss: 51571175424.0000 - val_loss: 51725099008.0000
Epoch 33/400
119/119 [==============================] - 1s 5ms/step - loss: 50931769344.0000 - val_loss: 51055792128.0000
Epoch 34/400
119/119 [==============================] - 1s 4ms/step - loss: 50351345664.0000 - val_loss: 50437066752.0000
Epoch 35/400
119/119 [==============================] - 0s 4ms/step - loss: 49785901056.0000 - val_loss: 49969045504.0000
Epoch 36/400
119/119 [==============================] - 1s 4ms/step - loss: 49302372352.0000 - val_loss: 49415860224.0000
Epoch 37/400
119/119 [==============================] - 0s 4ms/step - loss: 48832040960.0000 - val_loss: 48986226688.0000
Epoch 38/400
119/119 [==============================] - 0s 4ms/step - loss: 48375721984.0000 - val_loss: 48514666496.0000
Epoch 39/400
119/119 [==============================] - 0s 4ms/step - loss: 47965421568.0000 - val_loss: 48055619584.0000
Epoch 40/400
119/119 [==============================] - 0s 4ms/step - loss: 47524749312.0000 - val_loss: 47620239360.0000
Epoch 41/400
119/119 [==============================] - 1s 5ms/step - loss: 47128625152.0000 - val_loss: 47162028032.0000
Epoch 42/400
119/119 [==============================] - 0s 4ms/step - loss: 46652321792.0000 - val_loss: 46712086528.0000
Epoch 43/400
119/119 [==============================] - 0s 4ms/step - loss: 46198779904.0000 - val_loss: 46191136768.0000
Epoch 44/400
119/119 [==============================] - 0s 4ms/step - loss: 45697814528.0000 - val_loss: 45727473664.0000
```

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Epoch 45/400
119/119 [==============================] - 1s 4ms/step - loss: 45227720704.0000 - val_loss: 45155995648.0000
Epoch 46/400
119/119 [==============================] - 1s 5ms/step - loss: 44730437632.0000 - val_loss: 44661923840.0000
Epoch 47/400
119/119 [==============================] - 0s 4ms/step - loss: 44319883264.0000 - val_loss: 44277370880.0000
Epoch 48/400
119/119 [==============================] - 0s 4ms/step - loss: 43958489088.0000 - val_loss: 43893891072.0000
Epoch 49/400
119/119 [==============================] - 0s 4ms/step - loss: 43584913408.0000 - val_loss: 43642683392.0000
Epoch 50/400
119/119 [==============================] - 0s 4ms/step - loss: 43248914432.0000 - val_loss: 43219251200.0000
Epoch 51/400
119/119 [==============================] - 0s 4ms/step - loss: 42982662144.0000 - val_loss: 42911113216.0000
Epoch 52/400
119/119 [==============================] - 0s 4ms/step - loss: 42655256576.0000 - val_loss: 42560364544.0000
Epoch 53/400
119/119 [==============================] - 0s 4ms/step - loss: 42410192896.0000 - val_loss: 42317037568.0000
Epoch 54/400
119/119 [==============================] - 0s 4ms/step - loss: 42197352448.0000 - val_loss: 42215518208.0000
Epoch 55/400
119/119 [==============================] - 1s 4ms/step - loss: 41915813888.0000 - val_loss: 41824976896.0000
Epoch 56/400
119/119 [==============================] - 1s 4ms/step - loss: 41633693696.0000 - val_loss: 41655087104.0000
Epoch 57/400
119/119 [==============================] - 0s 4ms/step - loss: 41402847232.0000 - val_loss: 41346600960.0000
Epoch 58/400
119/119 [==============================] - 0s 4ms/step - loss: 41152311296.0000 - val_loss: 41048125440.0000
Epoch 59/400
119/119 [==============================] - 0s 4ms/step - loss: 40870039552.0000 - val_loss: 40669057024.0000
Epoch 60/400
119/119 [==============================] - 0s 4ms/step - loss: 40576733184.0000 - val_loss: 40370257920.0000
Epoch 61/400
119/119 [==============================] - 1s 5ms/step - loss: 40291045376.0000 - val_loss: 40032321536.0000
Epoch 62/400
119/119 [==============================] - 1s 4ms/step - loss: 40049356800.0000 - val_loss: 39744962560.0000
Epoch 63/400
119/119 [==============================] - 0s 4ms/step - loss: 39697076224.0000 - val_loss: 39488634880.0000
Epoch 64/400
119/119 [==============================] - 1s 4ms/step - loss: 39467507712.0000 - val_loss: 39187169280.0000
Epoch 65/400
119/119 [==============================] - 1s 4ms/step - loss: 39200616448.0000 - val_loss: 38953766912.0000
Epoch 66/400
119/119 [==============================] - 0s 4ms/step - loss: 38985289728.0000 - val_loss: 38680535040.0000
```

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Epoch 67/400
119/119 [==============================] - 1s 5ms/step - loss: 38765281280.0000 - val_loss: 38497996800.0000
Epoch 68/400
119/119 [==============================] - 0s 4ms/step - loss: 38543335424.0000 - val_loss: 38430666752.0000
Epoch 69/400
119/119 [==============================] - 1s 4ms/step - loss: 38413160448.0000 - val_loss: 38033190912.0000
Epoch 70/400
119/119 [==============================] - 1s 5ms/step - loss: 38187974656.0000 - val_loss: 37910327296.0000
Epoch 71/400
119/119 [==============================] - 1s 4ms/step - loss: 37967949824.0000 - val_loss: 37613645824.0000
Epoch 72/400
119/119 [==============================] - 0s 4ms/step - loss: 37834682368.0000 - val_loss: 37610401792.0000
Epoch 73/400
119/119 [==============================] - 1s 5ms/step - loss: 37679898624.0000 - val_loss: 37267910656.0000
Epoch 74/400
119/119 [==============================] - 1s 4ms/step - loss: 37494243328.0000 - val_loss: 37085978624.0000
Epoch 75/400
119/119 [==============================] - 0s 4ms/step - loss: 37347057664.0000 - val_loss: 36946153472.0000
Epoch 76/400
119/119 [==============================] - 0s 4ms/step - loss: 37169696768.0000 - val_loss: 36835794944.0000
Epoch 77/400
119/119 [==============================] - 0s 4ms/step - loss: 37065158656.0000 - val_loss: 36650835968.0000
Epoch 78/400
119/119 [==============================] - 0s 4ms/step - loss: 36949360640.0000 - val_loss: 36510851072.0000
Epoch 79/400
119/119 [==============================] - 0s 4ms/step - loss: 36807376896.0000 - val_loss: 36372545536.0000
Epoch 80/400
119/119 [==============================] - 0s 4ms/step - loss: 36708585472.0000 - val_loss: 36287127552.0000
Epoch 81/400
119/119 [==============================] - 0s 3ms/step - loss: 36597039104.0000 - val_loss: 36175974400.0000
Epoch 82/400
119/119 [==============================] - 0s 4ms/step - loss: 36526456832.0000 - val_loss: 36000129024.0000
Epoch 83/400
119/119 [==============================] - 0s 4ms/step - loss: 36374077440.0000 - val_loss: 35910897664.0000
Epoch 84/400
119/119 [==============================] - 0s 3ms/step - loss: 36287741952.0000 - val_loss: 35838451712.0000
Epoch 85/400
119/119 [==============================] - 1s 4ms/step - loss: 36188872704.0000 - val_loss: 35723157504.0000
Epoch 86/400
119/119 [==============================] - 0s 4ms/step - loss: 36089769984.0000 - val_loss: 35691892736.0000
Epoch 87/400
119/119 [==============================] - 1s 5ms/step - loss: 36022878208.0000 - val_loss: 35512045568.0000
Epoch 88/400
119/119 [==============================] - 1s 5ms/step - loss: 35890446336.0000 - val_loss: 35444834304.0000
```

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Epoch 89/400
119/119 [==============================] - 0s 4ms/step - loss: 35843915776.0000 - val_loss: 35347660800.0000
Epoch 90/400
119/119 [==============================] - 0s 3ms/step - loss: 35720486912.0000 - val_loss: 35234959360.0000
Epoch 91/400
119/119 [==============================] - 0s 4ms/step - loss: 35682938880.0000 - val_loss: 35167473664.0000
Epoch 92/400
119/119 [==============================] - 0s 4ms/step - loss: 35584749568.0000 - val_loss: 35102650368.0000
Epoch 93/400
119/119 [==============================] - 0s 4ms/step - loss: 35492134912.0000 - val_loss: 35012902912.0000
Epoch 94/400
119/119 [==============================] - 1s 4ms/step - loss: 35383193600.0000 - val_loss: 35005812736.0000
Epoch 95/400
119/119 [==============================] - 1s 5ms/step - loss: 35307155456.0000 - val_loss: 34879606784.0000
Epoch 96/400
119/119 [==============================] - 0s 4ms/step - loss: 35258085376.0000 - val_loss: 34728849408.0000
Epoch 97/400
119/119 [==============================] - 0s 4ms/step - loss: 35190272000.0000 - val_loss: 34659725312.0000
Epoch 98/400
119/119 [==============================] - 0s 3ms/step - loss: 35118395392.0000 - val_loss: 34578194432.0000
Epoch 99/400
119/119 [==============================] - 1s 4ms/step - loss: 35092000768.0000 - val_loss: 34492997632.0000
Epoch 100/400
119/119 [==============================] - 1s 5ms/step - loss: 34960613376.0000 - val_loss: 34421637120.0000
Epoch 101/400
119/119 [==============================] - 0s 4ms/step - loss: 34914672640.0000 - val_loss: 34362720256.0000
Epoch 102/400
119/119 [==============================] - 0s 4ms/step - loss: 34815709184.0000 - val_loss: 34343864320.0000
Epoch 103/400
119/119 [==============================] - 0s 4ms/step - loss: 34778607616.0000 - val_loss: 34250565632.0000
Epoch 104/400
119/119 [==============================] - 0s 3ms/step - loss: 34707673088.0000 - val_loss: 34167971840.0000
Epoch 105/400
119/119 [==============================] - 0s 4ms/step - loss: 34624114688.0000 - val_loss: 34089238528.0000
Epoch 106/400
119/119 [==============================] - 0s 3ms/step - loss: 34536206336.0000 - val_loss: 34083225600.0000
Epoch 107/400
119/119 [==============================] - 0s 4ms/step - loss: 34472460288.0000 - val_loss: 33953316864.0000
Epoch 108/400
119/119 [==============================] - 1s 5ms/step - loss: 34453807104.0000 - val_loss: 33879619584.0000
Epoch 109/400
119/119 [==============================] - 1s 4ms/step - loss: 34407706624.0000 - val_loss: 33832923136.0000
Epoch 110/400
119/119 [==============================] - 1s 5ms/step - loss: 34325671936.0000 - val_loss: 33801029632.0000
```

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Epoch 111/400
119/119 [==============================] - 1s 5ms/step - loss: 34265538560.0000 - val_loss: 33704673280.0000
Epoch 112/400
119/119 [==============================] - 1s 5ms/step - loss: 34231625728.0000 - val_loss: 33631059968.0000
Epoch 113/400
119/119 [==============================] - 1s 5ms/step - loss: 34170359808.0000 - val_loss: 33666402304.0000
Epoch 114/400
119/119 [==============================] - 0s 4ms/step - loss: 34187499520.0000 - val_loss: 33532704768.0000
Epoch 115/400
119/119 [==============================] - 0s 3ms/step - loss: 34045929472.0000 - val_loss: 33531418624.0000
Epoch 116/400
119/119 [==============================] - 1s 4ms/step - loss: 34014740480.0000 - val_loss: 33444440064.0000
Epoch 117/400
119/119 [==============================] - 1s 5ms/step - loss: 33998247936.0000 - val_loss: 33366534144.0000
Epoch 118/400
119/119 [==============================] - 1s 5ms/step - loss: 33938173952.0000 - val_loss: 33321508864.0000
Epoch 119/400
119/119 [==============================] - 1s 4ms/step - loss: 33904394240.0000 - val_loss: 33409028096.0000
Epoch 120/400
119/119 [==============================] - 1s 4ms/step - loss: 33828687872.0000 - val_loss: 33415825408.0000
Epoch 121/400
119/119 [==============================] - 0s 4ms/step - loss: 33821771776.0000 - val_loss: 33172275200.0000
Epoch 122/400
119/119 [==============================] - 0s 3ms/step - loss: 33757784064.0000 - val_loss: 33115834368.0000
Epoch 123/400
119/119 [==============================] - 0s 3ms/step - loss: 33685446656.0000 - val_loss: 33070665728.0000
Epoch 124/400
119/119 [==============================] - 0s 3ms/step - loss: 33651247104.0000 - val_loss: 33024315392.0000
Epoch 125/400
119/119 [==============================] - 0s 3ms/step - loss: 33590308864.0000 - val_loss: 33056505856.0000
Epoch 126/400
119/119 [==============================] - 1s 4ms/step - loss: 33540769792.0000 - val_loss: 32933941248.0000
Epoch 127/400
119/119 [==============================] - 0s 4ms/step - loss: 33510795264.0000 - val_loss: 32879484928.0000
Epoch 128/400
119/119 [==============================] - 0s 4ms/step - loss: 33494310912.0000 - val_loss: 32842688512.0000
Epoch 129/400
119/119 [==============================] - 0s 4ms/step - loss: 33441357824.0000 - val_loss: 32800417792.0000
Epoch 130/400
119/119 [==============================] - 0s 4ms/step - loss: 33406195712.0000 - val_loss: 32758880256.0000
Epoch 131/400
119/119 [==============================] - 1s 5ms/step - loss: 33388220416.0000 - val_loss: 32701552640.0000
Epoch 132/400
119/119 [==============================] - 1s 4ms/step - loss: 33302888448.0000 - val_loss: 32659169280.0000
```

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Epoch 133/400
119/119 [==============================] - 0s 3ms/step - loss: 33237864448.0000 - val_loss: 32621836288.0000
Epoch 134/400
119/119 [==============================] - 0s 4ms/step - loss: 33226711040.0000 - val_loss: 32574339072.0000
Epoch 135/400
119/119 [==============================] - 0s 4ms/step - loss: 33211701248.0000 - val_loss: 32526942208.0000
Epoch 136/400
119/119 [==============================] - 0s 4ms/step - loss: 33137369088.0000 - val_loss: 32504049664.0000
Epoch 137/400
119/119 [==============================] - 0s 3ms/step - loss: 33120053248.0000 - val_loss: 32578177024.0000
Epoch 138/400
119/119 [==============================] - 0s 4ms/step - loss: 33044488192.0000 - val_loss: 32493694976.0000
Epoch 139/400
119/119 [==============================] - 1s 5ms/step - loss: 33008822272.0000 - val_loss: 32376958976.0000
Epoch 140/400
119/119 [==============================] - 1s 5ms/step - loss: 33007978496.0000 - val_loss: 32342851584.0000
Epoch 141/400
119/119 [==============================] - 1s 4ms/step - loss: 32919789568.0000 - val_loss: 32411983872.0000
Epoch 142/400
119/119 [==============================] - 0s 3ms/step - loss: 32997271552.0000 - val_loss: 32264464384.0000
Epoch 143/400
119/119 [==============================] - 0s 4ms/step - loss: 32863479808.0000 - val_loss: 32316719104.0000
Epoch 144/400
119/119 [==============================] - 1s 5ms/step - loss: 32871452672.0000 - val_loss: 32185753600.0000
Epoch 145/400
119/119 [==============================] - 1s 5ms/step - loss: 32803424256.0000 - val_loss: 32170461184.0000
Epoch 146/400
119/119 [==============================] - 1s 4ms/step - loss: 32849424384.0000 - val_loss: 32122046464.0000
Epoch 147/400
119/119 [==============================] - 0s 4ms/step - loss: 32749785088.0000 - val_loss: 32129480704.0000
Epoch 148/400
119/119 [==============================] - 0s 4ms/step - loss: 32734201856.0000 - val_loss: 32035700736.0000
Epoch 149/400
119/119 [==============================] - 0s 4ms/step - loss: 32726448128.0000 - val_loss: 32013871104.0000
Epoch 150/400
119/119 [==============================] - 0s 3ms/step - loss: 32673536000.0000 - val_loss: 31977738240.0000
Epoch 151/400
119/119 [==============================] - 0s 4ms/step - loss: 32629764096.0000 - val_loss: 32005797888.0000
Epoch 152/400
119/119 [==============================] - 1s 5ms/step - loss: 32655566848.0000 - val_loss: 31916716032.0000
Epoch 153/400
119/119 [==============================] - 0s 4ms/step - loss: 32595310592.0000 - val_loss: 31885774848.0000
Epoch 154/400
119/119 [==============================] - 0s 4ms/step - loss: 32552599552.0000 - val_loss: 31905392640.0000
```

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Epoch 155/400
119/119 [==============================] - 0s 4ms/step - loss: 32503734272.0000 - val_loss: 31824908288.0000
Epoch 156/400
119/119 [==============================] - 1s 4ms/step - loss: 32479557632.0000 - val_loss: 31792156672.0000
Epoch 157/400
119/119 [==============================] - 0s 4ms/step - loss: 32453550080.0000 - val_loss: 31767357440.0000
Epoch 158/400
119/119 [==============================] - 1s 5ms/step - loss: 32430374912.0000 - val_loss: 31736709120.0000
Epoch 159/400
119/119 [==============================] - 0s 3ms/step - loss: 32449142784.0000 - val_loss: 31706609664.0000
Epoch 160/400
119/119 [==============================] - 1s 4ms/step - loss: 32352012288.0000 - val_loss: 31683250176.0000
Epoch 161/400
119/119 [==============================] - 0s 4ms/step - loss: 32331603968.0000 - val_loss: 31663329280.0000
Epoch 162/400
119/119 [==============================] - 1s 5ms/step - loss: 32322385920.0000 - val_loss: 31653869568.0000
Epoch 163/400
119/119 [==============================] - 0s 3ms/step - loss: 32272601088.0000 - val_loss: 31619043328.0000
Epoch 164/400
119/119 [==============================] - 0s 4ms/step - loss: 32255332352.0000 - val_loss: 31584290816.0000
Epoch 165/400
119/119 [==============================] - 0s 4ms/step - loss: 32225964032.0000 - val_loss: 31547021312.0000
Epoch 166/400
119/119 [==============================] - 1s 5ms/step - loss: 32195162112.0000 - val_loss: 31534848000.0000
Epoch 167/400
119/119 [==============================] - 1s 5ms/step - loss: 32184414208.0000 - val_loss: 31540176896.0000
Epoch 168/400
119/119 [==============================] - 1s 5ms/step - loss: 32139079680.0000 - val_loss: 31463362560.0000
Epoch 169/400
119/119 [==============================] - 1s 4ms/step - loss: 32151877632.0000 - val_loss: 31442046976.0000
Epoch 170/400
119/119 [==============================] - 0s 3ms/step - loss: 32076271616.0000 - val_loss: 31437938688.0000
Epoch 171/400
119/119 [==============================] - 0s 4ms/step - loss: 32057645056.0000 - val_loss: 31407958016.0000
Epoch 172/400
119/119 [==============================] - 1s 5ms/step - loss: 32044851200.0000 - val_loss: 31403018240.0000
Epoch 173/400
119/119 [==============================] - 1s 4ms/step - loss: 32019572736.0000 - val_loss: 31420055552.0000
Epoch 174/400
119/119 [==============================] - 0s 3ms/step - loss: 31985000448.0000 - val_loss: 31320612864.0000
Epoch 175/400
119/119 [==============================] - 0s 4ms/step - loss: 31977035776.0000 - val_loss: 31355834368.0000
Epoch 176/400
119/119 [==============================] - 0s 4ms/step - loss: 31936020480.0000 - val_loss: 31287922688.0000
```

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Epoch 177/400
119/119 [==============================] - 1s 4ms/step - loss: 31930202112.0000 - val_loss: 31306862592.0000
Epoch 178/400
119/119 [==============================] - 0s 4ms/step - loss: 31902271488.0000 - val_loss: 31210315776.0000
Epoch 179/400
119/119 [==============================] - 0s 4ms/step - loss: 31874058240.0000 - val_loss: 31199639552.0000
Epoch 180/400
119/119 [==============================] - 0s 4ms/step - loss: 31826022400.0000 - val_loss: 31169701888.0000
Epoch 181/400
119/119 [==============================] - 0s 4ms/step - loss: 31808413696.0000 - val_loss: 31158063104.0000
Epoch 182/400
119/119 [==============================] - 0s 4ms/step - loss: 31796916224.0000 - val_loss: 31283382272.0000
Epoch 183/400
119/119 [==============================] - 0s 3ms/step - loss: 31728947200.0000 - val_loss: 31111827456.0000
Epoch 184/400
119/119 [==============================] - 0s 3ms/step - loss: 31751831552.0000 - val_loss: 31141072896.0000
Epoch 185/400
119/119 [==============================] - 0s 4ms/step - loss: 31702605824.0000 - val_loss: 31102715904.0000
Epoch 186/400
119/119 [==============================] - 0s 4ms/step - loss: 31733424128.0000 - val_loss: 31054487552.0000
Epoch 187/400
119/119 [==============================] - 0s 4ms/step - loss: 31683104768.0000 - val_loss: 31131826176.0000
Epoch 188/400
119/119 [==============================] - 0s 4ms/step - loss: 31638310912.0000 - val_loss: 31035543552.0000
Epoch 189/400
119/119 [==============================] - 0s 4ms/step - loss: 31604645888.0000 - val_loss: 30989393920.0000
Epoch 190/400
119/119 [==============================] - 1s 5ms/step - loss: 31604856832.0000 - val_loss: 31012229120.0000
Epoch 191/400
119/119 [==============================] - 1s 4ms/step - loss: 31604260864.0000 - val_loss: 31012208640.0000
Epoch 192/400
119/119 [==============================] - 1s 5ms/step - loss: 31536601088.0000 - val_loss: 30938302464.0000
Epoch 193/400
119/119 [==============================] - 0s 4ms/step - loss: 31522082816.0000 - val_loss: 30915088384.0000
Epoch 194/400
119/119 [==============================] - 1s 4ms/step - loss: 31543379968.0000 - val_loss: 30930300928.0000
Epoch 195/400
119/119 [==============================] - 0s 4ms/step - loss: 31485216768.0000 - val_loss: 30877132800.0000
Epoch 196/400
119/119 [==============================] - 0s 4ms/step - loss: 31519510528.0000 - val_loss: 30884917248.0000
Epoch 197/400
119/119 [==============================] - 1s 4ms/step - loss: 31436275712.0000 - val_loss: 30820816896.0000
Epoch 198/400
119/119 [==============================] - 1s 5ms/step - loss: 31483889664.0000 - val_loss: 30800058368.0000
```

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Epoch 199/400
119/119 [==============================] - 1s 5ms/step - loss: 31367847936.0000 - val_loss: 30829971456.0000
Epoch 200/400
119/119 [==============================] - 1s 5ms/step - loss: 31390279680.0000 - val_loss: 30771036160.0000
Epoch 201/400
119/119 [==============================] - 1s 5ms/step - loss: 31350607872.0000 - val_loss: 30814959616.0000
Epoch 202/400
119/119 [==============================] - 1s 5ms/step - loss: 31325542400.0000 - val_loss: 30735804416.0000
Epoch 203/400
119/119 [==============================] - 1s 4ms/step - loss: 31363860480.0000 - val_loss: 30787913728.0000
Epoch 204/400
119/119 [==============================] - 1s 4ms/step - loss: 31303110656.0000 - val_loss: 30693701632.0000
Epoch 205/400
119/119 [==============================] - 0s 4ms/step - loss: 31275538432.0000 - val_loss: 30669860864.0000
Epoch 206/400
119/119 [==============================] - 1s 5ms/step - loss: 31277029376.0000 - val_loss: 30695067648.0000
Epoch 207/400
119/119 [==============================] - 1s 5ms/step - loss: 31232116736.0000 - val_loss: 30776156160.0000
Epoch 208/400
119/119 [==============================] - 1s 4ms/step - loss: 31237797888.0000 - val_loss: 30639050752.0000
Epoch 209/400
119/119 [==============================] - 1s 4ms/step - loss: 31182514176.0000 - val_loss: 30648850432.0000
Epoch 210/400
119/119 [==============================] - 1s 5ms/step - loss: 31207329792.0000 - val_loss: 30599264256.0000
Epoch 211/400
119/119 [==============================] - 1s 5ms/step - loss: 31161640960.0000 - val_loss: 30647261184.0000
Epoch 212/400
119/119 [==============================] - 1s 4ms/step - loss: 31151122432.0000 - val_loss: 30589980672.0000
Epoch 213/400
119/119 [==============================] - 1s 4ms/step - loss: 31105873920.0000 - val_loss: 30547359744.0000
Epoch 214/400
119/119 [==============================] - 0s 4ms/step - loss: 31115792384.0000 - val_loss: 30530535424.0000
Epoch 215/400
119/119 [==============================] - 0s 4ms/step - loss: 31093121024.0000 - val_loss: 30550099968.0000
Epoch 216/400
119/119 [==============================] - 1s 4ms/step - loss: 31088263168.0000 - val_loss: 30495666176.0000
Epoch 217/400
119/119 [==============================] - 1s 5ms/step - loss: 31046119424.0000 - val_loss: 30498928640.0000
Epoch 218/400
119/119 [==============================] - 1s 5ms/step - loss: 31011469312.0000 - val_loss: 30502225920.0000
Epoch 219/400
119/119 [==============================] - 1s 4ms/step - loss: 31020392448.0000 - val_loss: 30466924544.0000
Epoch 220/400
119/119 [==============================] - 1s 4ms/step - loss: 30984321024.0000 - val_loss: 30529845248.0000
```

```
Epoch 221/400
119/119 [==============================] - 1s 4ms/step - loss: 31011944448.0000 - val_loss: 30416740352.0000
Epoch 222/400
119/119 [==============================] - 1s 5ms/step - loss: 30969006080.0000 - val_loss: 30473232384.0000
Epoch 223/400
119/119 [==============================] - 1s 4ms/step - loss: 31006117888.0000 - val_loss: 30674302976.0000
Epoch 224/400
119/119 [==============================] - 1s 4ms/step - loss: 30964639744.0000 - val_loss: 30371803136.0000
Epoch 225/400
119/119 [==============================] - 1s 4ms/step - loss: 30942380032.0000 - val_loss: 30355156992.0000
Epoch 226/400
119/119 [==============================] - 1s 4ms/step - loss: 30950197248.0000 - val_loss: 30341238784.0000
Epoch 227/400
119/119 [==============================] - 1s 5ms/step - loss: 30873612288.0000 - val_loss: 30321741824.0000
Epoch 228/400
119/119 [==============================] - 1s 5ms/step - loss: 30880225280.0000 - val_loss: 30307903488.0000
Epoch 229/400
119/119 [==============================] - 1s 4ms/step - loss: 30834642944.0000 - val_loss: 30290612224.0000
Epoch 230/400
119/119 [==============================] - 0s 4ms/step - loss: 30823024640.0000 - val_loss: 30281381888.0000
Epoch 231/400
119/119 [==============================] - 1s 4ms/step - loss: 30782298112.0000 - val_loss: 30265362432.0000
Epoch 232/400
119/119 [==============================] - 1s 4ms/step - loss: 30793054208.0000 - val_loss: 30341812224.0000
Epoch 233/400
119/119 [==============================] - 0s 4ms/step - loss: 30737643520.0000 - val_loss: 30253731840.0000
Epoch 234/400
119/119 [==============================] - 0s 4ms/step - loss: 30777544704.0000 - val_loss: 30324172800.0000
Epoch 235/400
119/119 [==============================] - 0s 4ms/step - loss: 30741731328.0000 - val_loss: 30246215680.0000
Epoch 236/400
119/119 [==============================] - 0s 4ms/step - loss: 30716778496.0000 - val_loss: 30183741440.0000
Epoch 237/400
119/119 [==============================] - 0s 4ms/step - loss: 30705694720.0000 - val_loss: 30240241664.0000
Epoch 238/400
119/119 [==============================] - 0s 4ms/step - loss: 30699624448.0000 - val_loss: 30171664384.0000
Epoch 239/400
119/119 [==============================] - 0s 4ms/step - loss: 30649018368.0000 - val_loss: 30140356608.0000
Epoch 240/400
119/119 [==============================] - 1s 5ms/step - loss: 30635358208.0000 - val_loss: 30124935168.0000
Epoch 241/400
119/119 [==============================] - 0s 3ms/step - loss: 30595176448.0000 - val_loss: 30131312640.0000
Epoch 242/400
119/119 [==============================] - 0s 4ms/step - loss: 30719391744.0000 - val_loss: 30127251456.0000
```

```
Epoch 243/400
119/119 [==============================] - 1s 4ms/step - loss: 30586652672.0000 - val_loss: 30105227264.0000
Epoch 244/400
119/119 [==============================] - 1s 4ms/step - loss: 30572746752.0000 - val_loss: 30086082560.0000
Epoch 245/400
119/119 [==============================] - 0s 4ms/step - loss: 30541998080.0000 - val_loss: 30069880832.0000
Epoch 246/400
119/119 [==============================] - 1s 4ms/step - loss: 30534125568.0000 - val_loss: 30095839232.0000
Epoch 247/400
119/119 [==============================] - 0s 4ms/step - loss: 30537609216.0000 - val_loss: 30049925120.0000
Epoch 248/400
119/119 [==============================] - 0s 4ms/step - loss: 30509852672.0000 - val_loss: 30034755584.0000
Epoch 249/400
119/119 [==============================] - 0s 4ms/step - loss: 30513164288.0000 - val_loss: 30095888384.0000
Epoch 250/400
119/119 [==============================] - 0s 4ms/step - loss: 30557323264.0000 - val_loss: 29990821888.0000
Epoch 251/400
119/119 [==============================] - 0s 3ms/step - loss: 30540490752.0000 - val_loss: 29968304128.0000
Epoch 252/400
119/119 [==============================] - 0s 3ms/step - loss: 30501195776.0000 - val_loss: 29945778176.0000
Epoch 253/400
119/119 [==============================] - 0s 4ms/step - loss: 30449442816.0000 - val_loss: 29949708288.0000
Epoch 254/400
119/119 [==============================] - 0s 4ms/step - loss: 30446442496.0000 - val_loss: 29933410304.0000
Epoch 255/400
119/119 [==============================] - 1s 4ms/step - loss: 30392229888.0000 - val_loss: 29981847552.0000
Epoch 256/400
119/119 [==============================] - 0s 4ms/step - loss: 30417661952.0000 - val_loss: 30028181504.0000
Epoch 257/400
119/119 [==============================] - 0s 4ms/step - loss: 30440318976.0000 - val_loss: 29902153728.0000
Epoch 258/400
119/119 [==============================] - 1s 4ms/step - loss: 30376646656.0000 - val_loss: 29871736832.0000
Epoch 259/400
119/119 [==============================] - 1s 5ms/step - loss: 30347374592.0000 - val_loss: 29901637632.0000
Epoch 260/400
119/119 [==============================] - 1s 4ms/step - loss: 30333186048.0000 - val_loss: 29855619072.0000
Epoch 261/400
119/119 [==============================] - 0s 3ms/step - loss: 30315524096.0000 - val_loss: 29863712768.0000
Epoch 262/400
119/119 [==============================] - 0s 4ms/step - loss: 30277027840.0000 - val_loss: 29830060032.0000
Epoch 263/400
119/119 [==============================] - 0s 4ms/step - loss: 30294949888.0000 - val_loss: 29826973696.0000
Epoch 264/400
119/119 [==============================] - 1s 4ms/step - loss: 30255532032.0000 - val_loss: 29886361600.0000
```

```
Epoch 265/400
119/119 [==============================] - 0s 3ms/step - loss: 30273351680.0000 - val_loss: 29790298112.0000
Epoch 266/400
119/119 [==============================] - 0s 3ms/step - loss: 30254573568.0000 - val_loss: 29773692928.0000
Epoch 267/400
119/119 [==============================] - 0s 4ms/step - loss: 30242641920.0000 - val_loss: 29761712128.0000
Epoch 268/400
119/119 [==============================] - 0s 4ms/step - loss: 30225373184.0000 - val_loss: 29808134144.0000
Epoch 269/400
119/119 [==============================] - 0s 4ms/step - loss: 30236153856.0000 - val_loss: 29818411008.0000
Epoch 270/400
119/119 [==============================] - 0s 3ms/step - loss: 30189506560.0000 - val_loss: 29711613952.0000
Epoch 271/400
119/119 [==============================] - 0s 4ms/step - loss: 30194423808.0000 - val_loss: 29713045504.0000
Epoch 272/400
119/119 [==============================] - 1s 4ms/step - loss: 30106648576.0000 - val_loss: 29867302912.0000
Epoch 273/400
119/119 [==============================] - 0s 4ms/step - loss: 30220003328.0000 - val_loss: 29720113152.0000
Epoch 274/400
119/119 [==============================] - 1s 5ms/step - loss: 30133655552.0000 - val_loss: 29704493056.0000
Epoch 275/400
119/119 [==============================] - 0s 4ms/step - loss: 30122743808.0000 - val_loss: 29641089024.0000
Epoch 276/400
119/119 [==============================] - 0s 4ms/step - loss: 30087852032.0000 - val_loss: 29685467136.0000
Epoch 277/400
119/119 [==============================] - 0s 4ms/step - loss: 30081435648.0000 - val_loss: 29675231232.0000
Epoch 278/400
119/119 [==============================] - 0s 3ms/step - loss: 30068656128.0000 - val_loss: 29606350848.0000
Epoch 279/400
119/119 [==============================] - 0s 4ms/step - loss: 30069745664.0000 - val_loss: 29611261952.0000
Epoch 280/400
119/119 [==============================] - 0s 4ms/step - loss: 30037585920.0000 - val_loss: 29620043776.0000
Epoch 281/400
119/119 [==============================] - 0s 3ms/step - loss: 30040322048.0000 - val_loss: 29578444800.0000
Epoch 282/400
119/119 [==============================] - 1s 5ms/step - loss: 30033270784.0000 - val_loss: 29574537216.0000
Epoch 283/400
119/119 [==============================] - 0s 4ms/step - loss: 30035353600.0000 - val_loss: 29539981312.0000
Epoch 284/400
119/119 [==============================] - 0s 4ms/step - loss: 29971273728.0000 - val_loss: 29516072960.0000
Epoch 285/400
119/119 [==============================] - 1s 5ms/step - loss: 29954105344.0000 - val_loss: 29562267648.0000
Epoch 286/400
119/119 [==============================] - 1s 5ms/step - loss: 30037082112.0000 - val_loss: 29496578048.0000
```

```
Epoch 287/400
119/119 [==============================] - 1s 5ms/step - loss: 29961951232.0000 - val_loss: 29512347648.0000
Epoch 288/400
119/119 [==============================] - 1s 5ms/step - loss: 29949118464.0000 - val_loss: 29463314432.0000
Epoch 289/400
119/119 [==============================] - 1s 4ms/step - loss: 29888727040.0000 - val_loss: 29484873728.0000
Epoch 290/400
119/119 [==============================] - 0s 3ms/step - loss: 29902006272.0000 - val_loss: 29443663872.0000
Epoch 291/400
119/119 [==============================] - 0s 4ms/step - loss: 29887754240.0000 - val_loss: 29444319232.0000
Epoch 292/400
119/119 [==============================] - 0s 4ms/step - loss: 29850605568.0000 - val_loss: 29513037824.0000
Epoch 293/400
119/119 [==============================] - 1s 4ms/step - loss: 29834977280.0000 - val_loss: 29402767360.0000
Epoch 294/400
119/119 [==============================] - 1s 5ms/step - loss: 29852958720.0000 - val_loss: 29430413312.0000
Epoch 295/400
119/119 [==============================] - 1s 4ms/step - loss: 29821222912.0000 - val_loss: 29374728192.0000
Epoch 296/400
119/119 [==============================] - 0s 4ms/step - loss: 29859854336.0000 - val_loss: 29416245248.0000
Epoch 297/400
119/119 [==============================] - 0s 3ms/step - loss: 29778960384.0000 - val_loss: 29389215744.0000
Epoch 298/400
119/119 [==============================] - 1s 5ms/step - loss: 29793591296.0000 - val_loss: 29382467584.0000
Epoch 299/400
119/119 [==============================] - 1s 5ms/step - loss: 29753266176.0000 - val_loss: 29326993408.0000
Epoch 300/400
119/119 [==============================] - 1s 4ms/step - loss: 29744891904.0000 - val_loss: 29303775232.0000
Epoch 301/400
119/119 [==============================] - 1s 4ms/step - loss: 29731768320.0000 - val_loss: 29302249472.0000
Epoch 302/400
119/119 [==============================] - 1s 4ms/step - loss: 29716121600.0000 - val_loss: 29331574784.0000
Epoch 303/400
119/119 [==============================] - 0s 4ms/step - loss: 29734369280.0000 - val_loss: 29367369728.0000
Epoch 304/400
119/119 [==============================] - 0s 4ms/step - loss: 29705820160.0000 - val_loss: 29295730688.0000
Epoch 305/400
119/119 [==============================] - 1s 4ms/step - loss: 29731401728.0000 - val_loss: 29253957632.0000
Epoch 306/400
119/119 [==============================] - 0s 4ms/step - loss: 29645352960.0000 - val_loss: 29218291712.0000
Epoch 307/400
119/119 [==============================] - 1s 5ms/step - loss: 29627959296.0000 - val_loss: 29221513216.0000
Epoch 308/400
119/119 [==============================] - 1s 5ms/step - loss: 29640970240.0000 - val_loss: 29212887040.0000
```

```
Epoch 309/400
119/119 [==============================] - 1s 5ms/step - loss: 29609086976.0000 - val_loss: 29221324800.0000
Epoch 310/400
119/119 [==============================] - 0s 4ms/step - loss: 29631631360.0000 - val_loss: 29181868032.0000
Epoch 311/400
119/119 [==============================] - 0s 4ms/step - loss: 29595285504.0000 - val_loss: 29151176704.0000
Epoch 312/400
119/119 [==============================] - 0s 4ms/step - loss: 29562853376.0000 - val_loss: 29139648512.0000
Epoch 313/400
119/119 [==============================] - 1s 4ms/step - loss: 29584050176.0000 - val_loss: 29122916352.0000
Epoch 314/400
119/119 [==============================] - 0s 3ms/step - loss: 29597671424.0000 - val_loss: 29175474176.0000
Epoch 315/400
119/119 [==============================] - 0s 4ms/step - loss: 29541828608.0000 - val_loss: 29103230976.0000
Epoch 316/400
119/119 [==============================] - 1s 4ms/step - loss: 29525161984.0000 - val_loss: 29093236736.0000
Epoch 317/400
119/119 [==============================] - 1s 4ms/step - loss: 29533376512.0000 - val_loss: 29070419968.0000
Epoch 318/400
119/119 [==============================] - 0s 4ms/step - loss: 29474412544.0000 - val_loss: 29068632064.0000
Epoch 319/400
119/119 [==============================] - 0s 4ms/step - loss: 29462362112.0000 - val_loss: 29056491520.0000
Epoch 320/400
119/119 [==============================] - 0s 4ms/step - loss: 29458454528.0000 - val_loss: 29047687168.0000
Epoch 321/400
119/119 [==============================] - 0s 4ms/step - loss: 29436782592.0000 - val_loss: 29040009216.0000
Epoch 322/400
119/119 [==============================] - 0s 4ms/step - loss: 29474392064.0000 - val_loss: 29061376000.0000
Epoch 323/400
119/119 [==============================] - 0s 4ms/step - loss: 29451808768.0000 - val_loss: 29011402752.0000
Epoch 324/400
119/119 [==============================] - 0s 4ms/step - loss: 29383100416.0000 - val_loss: 29009526784.0000
Epoch 325/400
119/119 [==============================] - 0s 4ms/step - loss: 29383606272.0000 - val_loss: 28973037568.0000
Epoch 326/400
119/119 [==============================] - 0s 4ms/step - loss: 29371062272.0000 - val_loss: 28968822784.0000
Epoch 327/400
119/119 [==============================] - 0s 4ms/step - loss: 29317840896.0000 - val_loss: 28955342848.0000
Epoch 328/400
119/119 [==============================] - 0s 4ms/step - loss: 29300764672.0000 - val_loss: 28984487936.0000
Epoch 329/400
119/119 [==============================] - 0s 3ms/step - loss: 29310773248.0000 - val_loss: 29018167296.0000
Epoch 330/400
119/119 [==============================] - 0s 4ms/step - loss: 29306466304.0000 - val_loss: 28929187840.0000
```

```
Epoch 331/400
119/119 [==============================] - 0s 4ms/step - loss: 29313341440.0000 - val_loss: 28929499136.0000
Epoch 332/400
119/119 [==============================] - 0s 4ms/step - loss: 29227089920.0000 - val_loss: 28892381184.0000
Epoch 333/400
119/119 [==============================] - 0s 3ms/step - loss: 29253662720.0000 - val_loss: 28945885184.0000
Epoch 334/400
119/119 [==============================] - 0s 4ms/step - loss: 29264580608.0000 - val_loss: 29068263424.0000
Epoch 335/400
119/119 [==============================] - 0s 4ms/step - loss: 29235591168.0000 - val_loss: 28917612544.0000
Epoch 336/400
119/119 [==============================] - 0s 4ms/step - loss: 29201557504.0000 - val_loss: 28823185408.0000
Epoch 337/400
119/119 [==============================] - 0s 4ms/step - loss: 29149855744.0000 - val_loss: 28812218368.0000
Epoch 338/400
119/119 [==============================] - 0s 4ms/step - loss: 29174730752.0000 - val_loss: 28808663040.0000
Epoch 339/400
119/119 [==============================] - 0s 4ms/step - loss: 29142669312.0000 - val_loss: 28785154048.0000
Epoch 340/400
119/119 [==============================] - 0s 4ms/step - loss: 29125842944.0000 - val_loss: 28823121920.0000
Epoch 341/400
119/119 [==============================] - 0s 4ms/step - loss: 29116889088.0000 - val_loss: 28766101504.0000
Epoch 342/400
119/119 [==============================] - 1s 4ms/step - loss: 29094354944.0000 - val_loss: 28789182464.0000
Epoch 343/400
119/119 [==============================] - 1s 4ms/step - loss: 29062932480.0000 - val_loss: 28735772672.0000
Epoch 344/400
119/119 [==============================] - 0s 4ms/step - loss: 29063841792.0000 - val_loss: 28723525632.0000
Epoch 345/400
119/119 [==============================] - 0s 4ms/step - loss: 29063133184.0000 - val_loss: 28714176512.0000
Epoch 346/400
119/119 [==============================] - 1s 5ms/step - loss: 29037395968.0000 - val_loss: 28759881728.0000
Epoch 347/400
119/119 [==============================] - 0s 4ms/step - loss: 29021380608.0000 - val_loss: 28676347904.0000
Epoch 348/400
119/119 [==============================] - 0s 4ms/step - loss: 29017585664.0000 - val_loss: 28673835008.0000
Epoch 349/400
119/119 [==============================] - 0s 4ms/step - loss: 28989612032.0000 - val_loss: 28675600384.0000
Epoch 350/400
119/119 [==============================] - 0s 4ms/step - loss: 28990492672.0000 - val_loss: 28848199680.0000
Epoch 351/400
119/119 [==============================] - 0s 4ms/step - loss: 29028139008.0000 - val_loss: 28993503232.0000
Epoch 352/400
119/119 [==============================] - 0s 4ms/step - loss: 28949071872.0000 - val_loss: 28655968256.0000
```

```
Epoch 353/400
119/119 [==============================] - 0s 3ms/step - loss: 28943009792.0000 - val_loss: 28702218240.0000
Epoch 354/400
119/119 [==============================] - 0s 4ms/step - loss: 28915759104.0000 - val_loss: 28605444096.0000
Epoch 355/400
119/119 [==============================] - 0s 3ms/step - loss: 28900100096.0000 - val_loss: 28830234624.0000
Epoch 356/400
119/119 [==============================] - 1s 5ms/step - loss: 28973989888.0000 - val_loss: 28558397440.0000
Epoch 357/400
119/119 [==============================] - 0s 4ms/step - loss: 28887005184.0000 - val_loss: 28642127872.0000
Epoch 358/400
119/119 [==============================] - 1s 4ms/step - loss: 28893284352.0000 - val_loss: 28536643584.0000
Epoch 359/400
119/119 [==============================] - 0s 4ms/step - loss: 28807251968.0000 - val_loss: 28617297920.0000
Epoch 360/400
119/119 [==============================] - 0s 4ms/step - loss: 28807278592.0000 - val_loss: 28574195712.0000
Epoch 361/400
119/119 [==============================] - 0s 4ms/step - loss: 28801204224.0000 - val_loss: 28494305280.0000
Epoch 362/400
119/119 [==============================] - 1s 4ms/step - loss: 28799184896.0000 - val_loss: 28488800256.0000
Epoch 363/400
119/119 [==============================] - 0s 3ms/step - loss: 28796678144.0000 - val_loss: 28460412928.0000
Epoch 364/400
119/119 [==============================] - 0s 3ms/step - loss: 28793896960.0000 - val_loss: 28523945984.0000
Epoch 365/400
119/119 [==============================] - 0s 4ms/step - loss: 28732778496.0000 - val_loss: 28459749376.0000
Epoch 366/400
119/119 [==============================] - 0s 4ms/step - loss: 28736088064.0000 - val_loss: 28462391296.0000
Epoch 367/400
119/119 [==============================] - 1s 4ms/step - loss: 28671784960.0000 - val_loss: 28611211264.0000
Epoch 368/400
119/119 [==============================] - 1s 4ms/step - loss: 28692496384.0000 - val_loss: 28425934848.0000
Epoch 369/400
119/119 [==============================] - 0s 4ms/step - loss: 28742815744.0000 - val_loss: 28393535488.0000
Epoch 370/400
119/119 [==============================] - 0s 4ms/step - loss: 28664647680.0000 - val_loss: 28632965120.0000
Epoch 371/400
119/119 [==============================] - 0s 3ms/step - loss: 28668745728.0000 - val_loss: 28370210816.0000
Epoch 372/400
119/119 [==============================] - 0s 3ms/step - loss: 28605241344.0000 - val_loss: 28346777600.0000
Epoch 373/400
119/119 [==============================] - 0s 4ms/step - loss: 28612376576.0000 - val_loss: 28356196352.0000
Epoch 374/400
119/119 [==============================] - 0s 4ms/step - loss: 28610852864.0000 - val_loss: 28484954112.0000
```

```
Epoch 375/400
119/119 [==============================] - 0s 4ms/step - loss: 28565585920.0000 - val_loss: 28310460416.0000
Epoch 376/400
119/119 [==============================] - 0s 4ms/step - loss: 28558852096.0000 - val_loss: 28302307328.0000
Epoch 377/400
119/119 [==============================] - 0s 4ms/step - loss: 28548110336.0000 - val_loss: 28327620608.0000
Epoch 378/400
119/119 [==============================] - 1s 4ms/step - loss: 28525918208.0000 - val_loss: 28267317248.0000
Epoch 379/400
119/119 [==============================] - 0s 4ms/step - loss: 28479782912.0000 - val_loss: 28294139904.0000
Epoch 380/400
119/119 [==============================] - 0s 4ms/step - loss: 28501995520.0000 - val_loss: 28273096704.0000
Epoch 381/400
119/119 [==============================] - 0s 4ms/step - loss: 28449822720.0000 - val_loss: 28224956416.0000
Epoch 382/400
119/119 [==============================] - 0s 4ms/step - loss: 28434583552.0000 - val_loss: 28203780096.0000
Epoch 383/400
119/119 [==============================] - 1s 4ms/step - loss: 28372133888.0000 - val_loss: 28231297024.0000
Epoch 384/400
119/119 [==============================] - 0s 4ms/step - loss: 28384540672.0000 - val_loss: 28247181312.0000
Epoch 385/400
119/119 [==============================] - 1s 5ms/step - loss: 28404779008.0000 - val_loss: 28192311296.0000
Epoch 386/400
119/119 [==============================] - 0s 4ms/step - loss: 28363997184.0000 - val_loss: 28151840768.0000
Epoch 387/400
119/119 [==============================] - 0s 4ms/step - loss: 28345135104.0000 - val_loss: 28153198592.0000
Epoch 388/400
119/119 [==============================] - 0s 4ms/step - loss: 28326596608.0000 - val_loss: 28132839424.0000
Epoch 389/400
119/119 [==============================] - 1s 5ms/step - loss: 28324511744.0000 - val_loss: 28150126592.0000
Epoch 390/400
119/119 [==============================] - 1s 4ms/step - loss: 28262467584.0000 - val_loss: 28107884544.0000
Epoch 391/400
119/119 [==============================] - 0s 4ms/step - loss: 28338786304.0000 - val_loss: 28110684160.0000
Epoch 392/400
119/119 [==============================] - 0s 4ms/step - loss: 28275306496.0000 - val_loss: 28139655168.0000
Epoch 393/400
119/119 [==============================] - 0s 4ms/step - loss: 28232558592.0000 - val_loss: 28135030784.0000
Epoch 394/400
119/119 [==============================] - 0s 3ms/step - loss: 28216418304.0000 - val_loss: 28077905920.0000
Epoch 395/400
119/119 [==============================] - 0s 3ms/step - loss: 28211036160.0000 - val_loss: 28044828672.0000
Epoch 396/400
119/119 [==============================] - 0s 3ms/step - loss: 28195665920.0000 - val_loss: 28038311936.0000
```

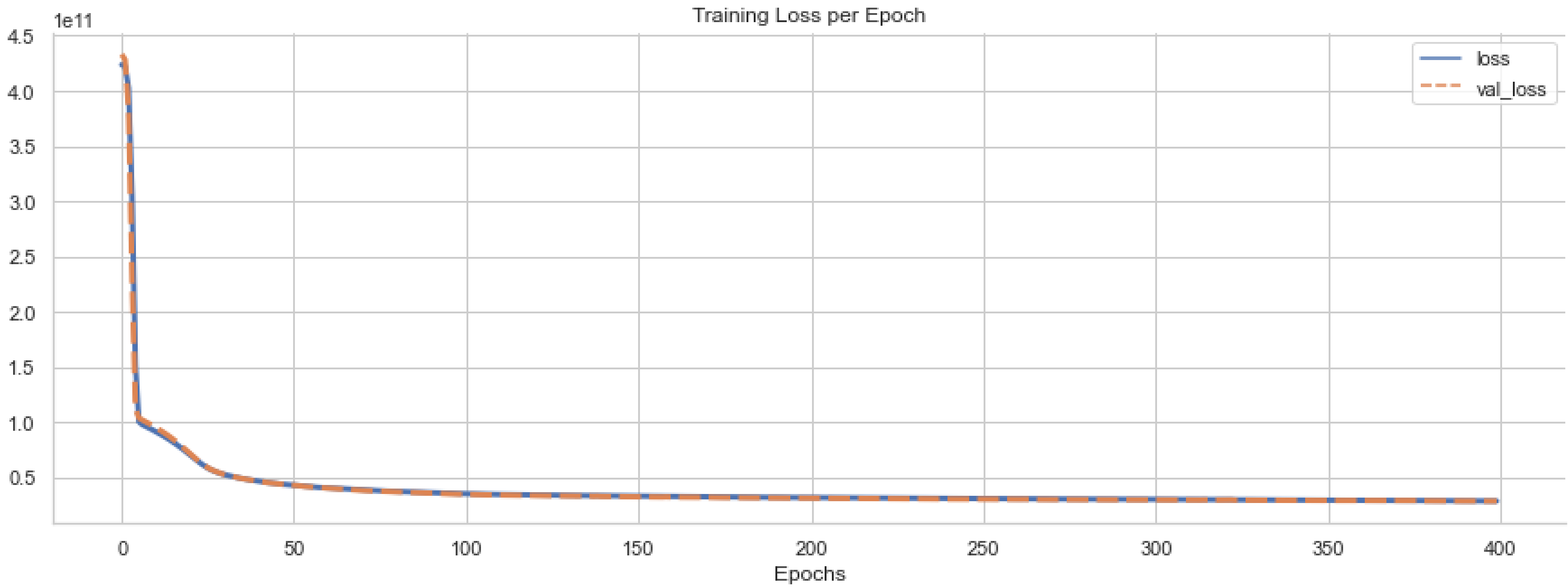
```
Epoch 397/400
119/119 [==============================] - 0s 4ms/step - loss: 28160518144.0000 - val_loss: 28135188480.0000
Epoch 398/400
119/119 [==============================] - 1s 4ms/step - loss: 28124237824.0000 - val_loss: 28031238144.0000
Epoch 399/400
119/119 [==============================] - 0s 4ms/step - loss: 28199258112.0000 - val_loss: 28006215680.0000
Epoch 400/400
119/119 [==============================] - 0s 4ms/step - loss: 28162906112.0000 - val_loss: 28003381248.0000
```

Out[22]:

```
<keras.src.callbacks.History at 0x18b86611220>
```

In [24]:

```python
losses = pd.DataFrame(model.history.history)

plt.figure(figsize=(15,5))
sns.lineplot(data=losses,lw=3)
plt.xlabel('Epochs')
plt.ylabel('')
plt.title('Training Loss per Epoch')
sns.despine()
```



In [23]:

```python
# predictions on the test set
predictions = model.predict(X_test)
```

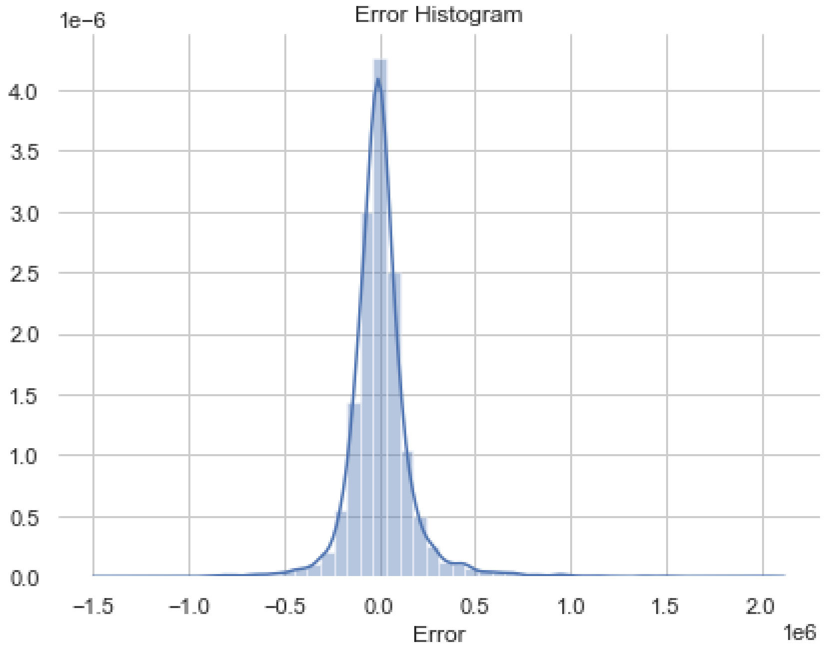
```
print('MAE: ',mean_absolute_error(y_test,predictions))
print('MSE: ',mean_squared_error(y_test,predictions))
print('RMSE: ',np.sqrt(mean_squared_error(y_test,predictions)))
print('Variance Regression Score: ',explained_variance_score(y_test,predictions))

print('\n\nDescriptive Statistics:\n',df['price'].describe())
```

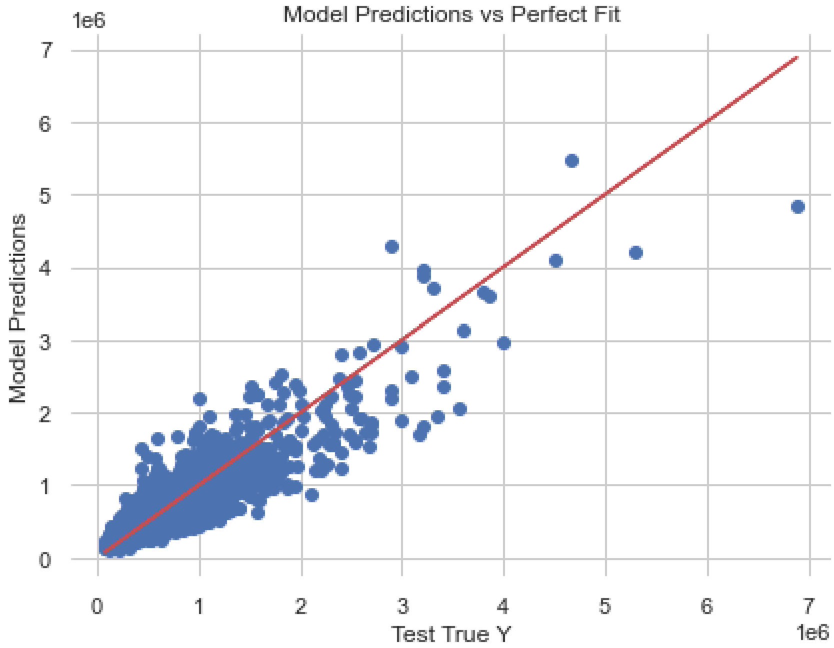
```
203/203 [==============================] - 1s 2ms/step
MAE:  103301.46354006015
MSE:  28003385904.85658
RMSE:  167342.12232685642
Variance Regression Score:  0.800453588663422


Descriptive Statistics:
 count    2.161300e+04
mean     5.400881e+05
std      3.671272e+05
min      7.500000e+04
25%      3.219500e+05
50%      4.500000e+05
75%      6.450000e+05
max      7.700000e+06
Name: price, dtype: float64
```

In [24]:
```
f, axes = plt.subplots(1, 2,figsize=(15,5))

# Our model predictions
plt.scatter(y_test,predictions)

# Perfect predictions
plt.plot(y_test,y_test,'r')

errors = y_test.values.reshape(6484, 1) - predictions
sns.distplot(errors, ax=axes[0])

sns.despine(left=True, bottom=True)
axes[0].set(xlabel='Error', ylabel='', title='Error Histogram')
axes[1].set(xlabel='Test True Y', ylabel='Model Predictions', title='Model Predictions vs Perfect Fit')
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2619: 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 flexib
ility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[24]:
```
[Text(0.5, 0, 'Test True Y'),
 Text(0, 0.5, 'Model Predictions'),
 Text(0.5, 1.0, 'Model Predictions vs Perfect Fit')]
```





In [25]:
```
# fueatures of new house
single_house = df.drop('price',axis=1).iloc[0]
print(f'Features of new house:\n{single_house}')

# reshape the numpy array and scale the features
single_house = scaler.transform(single_house.values.reshape(-1, 19))

# run the model and get the price prediction
print('\nPrediction Price:',model.predict(single_house)[0,0])

# original price
print('\nOriginal Price:',df.iloc[0]['price'])
```

```
Features of new house:
bedrooms               3.0000
bathrooms              1.0000
sqft_living         1180.0000
sqft_lot            5650.0000
floors                 1.0000
waterfront             0.0000
view                   0.0000
condition              3.0000
grade                  7.0000
sqft_above          1180.0000
sqft_basement          0.0000
yr_built            1955.0000
yr_renovated           0.0000
lat                   47.5112
long                -122.2570
sqft_living15       1340.0000
sqft_lot15          5650.0000
month                 10.0000
year                2014.0000
Name: 0, dtype: float64
1/1 [==============================] - 0s 52ms/step

Prediction Price: 282012.62

Original Price: 221900.0
```

```
C:\ProgramData\Anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature names, but MinMaxScal
er was fitted with feature names
  warnings.warn(
```

In [ ]: