

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import sklearn
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
df = pd.read_csv('train_data.csv')
df.head()
```

C:\Users\97156\AppData\Local\Temp\ipykernel\_6500\2181792710.py:1: DtypeWarning: Columns (7) have mixed types. Specify dtype option on import or set low\_memory=False.  
df = pd.read\_csv('train\_data.csv')

Out[2]:

	Store	DayOfWeek	Date	Sales	Customers	Open	Promo	StateHoliday	SchoolHoliday
0	1	2	2015-06-30	5735	568	1	1	0	0
1	2	2	2015-06-30	9863	877	1	1	0	0
2	3	2	2015-06-30	13261	1072	1	1	0	1
3	4	2	2015-06-30	13106	1488	1	1	0	0
4	5	2	2015-06-30	6635	645	1	1	0	0

In [3]:

```
df['StateHoliday'] = df['StateHoliday'].astype('category')
df= pd.get_dummies(df,prefix=['StateHoliday'], columns = ['StateHoliday'],drop_first=True)
e)
```

In [4]:

```
df[["Year", "Month", "Day"]] = df["Date"].str.split("-", expand = True).astype('int64')
df = df.drop("Date", axis='columns')
```

In [5]:

```
cols = df.columns.values.tolist()
cols.remove('Sales')
cols.append('Sales')
df = df[cols]
```

In [6]:

*#the stores will not make any sales when they are closed, therefore the column is redundant and removing it will reduce the features for better prediction*  
df.drop('Open', inplace=True, axis=1)

In [7]:

```
print(df.head(), '\n', df.shape)
```

	Store	DayOfWeek	Customers	Promo	SchoolHoliday	StateHoliday_0	\
0	1	2	568	1	0	1	
1	2	2	877	1	0	1	
2	3	2	1072	1	1	1	
3	4	2	1488	1	0	1	
4	5	2	645	1	0	1	

n	StateHoliday_a	StateHoliday_b	StateHoliday_c	Year	Month	Day	Sales
0	0	0	0	2015	6	30	5735

0	0	0	0	2015	6	30	9733
1	0	0	0	2015	6	30	9863
2	0	0	0	2015	6	30	13261
3	0	0	0	2015	6	30	13106
4	0	0	0	2015	6	30	6635

(982644, 13)

In [8]:

```
df.nunique()
```

Out[8]:

```
Store          1115
DayOfWeek      7
Customers      4076
Promo          2
SchoolHoliday  2
StateHoliday_0  2
StateHoliday_a  2
StateHoliday_b  2
StateHoliday_c  2
Year           3
Month          12
Day            31
Sales          21642
dtype: int64
```

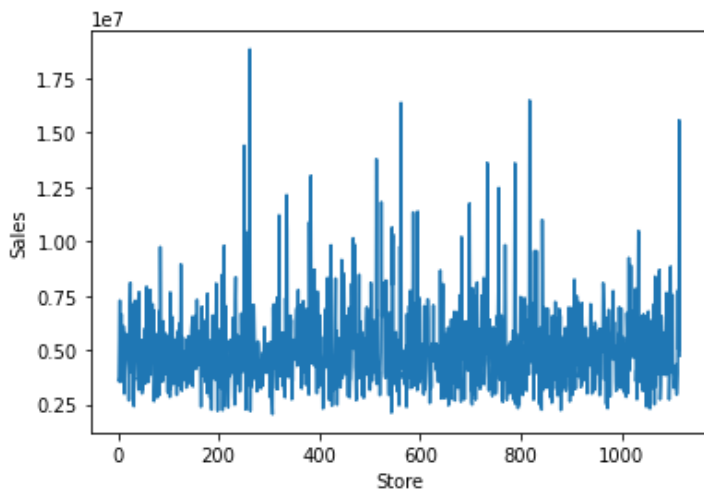
In [9]:

```
plotFeatures=list(df.columns.values)
del plotFeatures[3:10]
del plotFeatures[-1]
for feature in plotFeatures:
    print(df[[feature, 'Sales']].groupby([feature]).sum())
    plt.plot(df[[feature, 'Sales']].groupby([feature]).sum())
    plt.xlabel(feature)
    plt.ylabel('Sales')
    plt.show()
```

```

      Sales
Store
1      3595588
2      3750093
3      5224726
4      7279572
5      3518628
...
1111    3969314
1112    7747622
1113    5015131
1114    15575997
1115    4732642
```

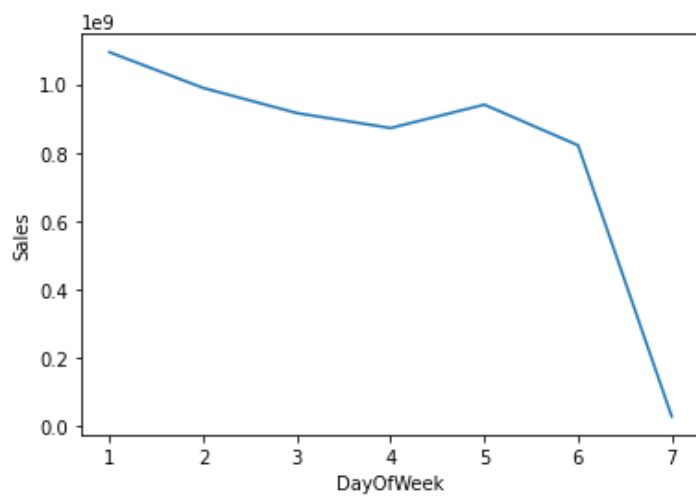
[1115 rows x 1 columns]



Sales

DayOfWeek

1	1093774659
2	989206946
3	915691079
4	871933439
5	940300240
6	821530789
7	28420855

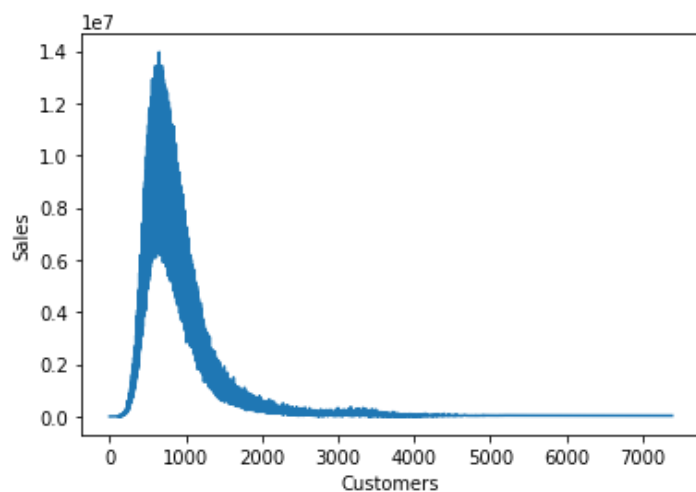


Sales

Customers

0	0
3	0
5	0
8	46
13	124
...	...
5297	37403
5387	34692
5458	38484
5494	35702
7388	27190

[4076 rows x 1 columns]

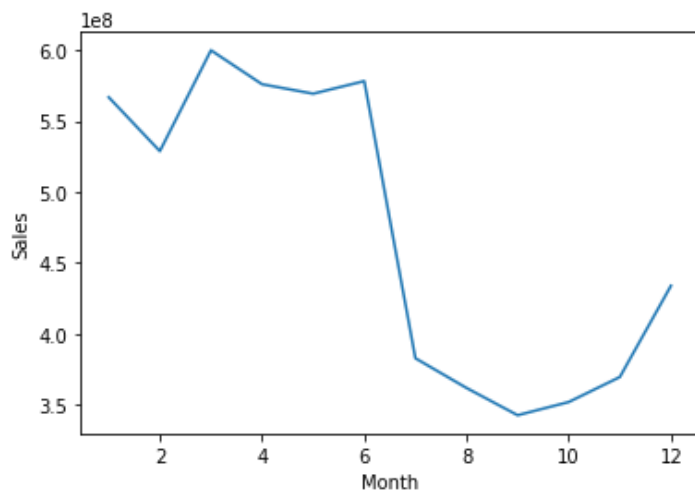


Sales

Month

1	566728724
2	528734410
3	599831906
4	575895295
5	569248217
6	578112775
7	382736589
8	361791202
9	342570131
10	351878728
11	260100077

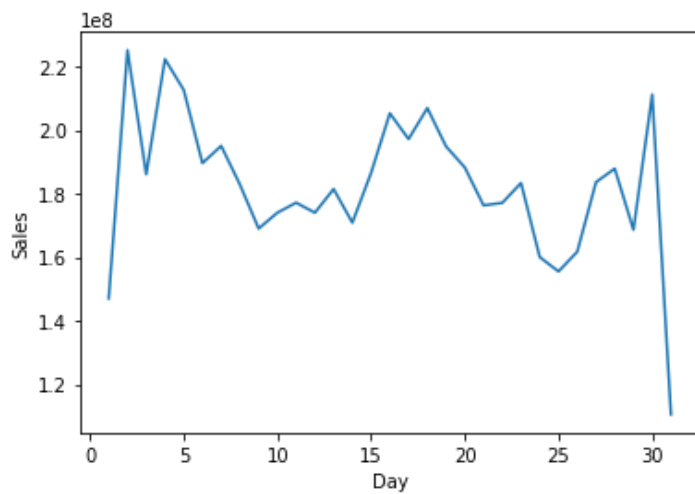
```
11 369498877
12 433831153
```



Sales

Day

```
1 146993888
2 225066876
3 186052424
4 222246734
5 212599928
6 189554066
7 194987463
8 182803145
9 168984245
10 173974454
11 177111067
12 173964974
13 181413450
14 170842725
15 186506818
16 205219196
17 197121554
18 206859185
19 194802541
20 188207587
21 176274324
22 177062398
23 183322033
24 160000458
25 155497913
26 161688063
27 183557587
28 187837724
29 168614277
30 211140763
31 110550147
```

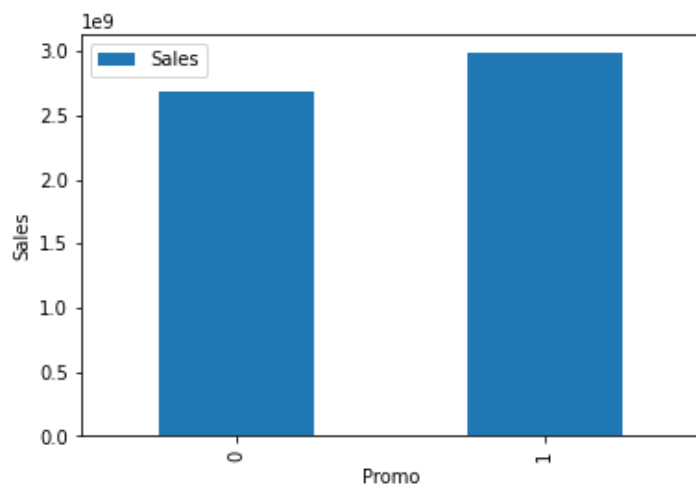


In [116]:

```
countFeatures=list(df.columns.values)
del countFeatures[9:]
del countFeatures[:3]
for feature in countFeatures:
    groupedDF = df[[feature, 'Sales']].groupby([feature]).sum()
    print(groupedDF)
    groupedDF.plot(kind='bar')
    plt.xlabel(feature)
    plt.ylabel('Sales')
    plt.show()
```

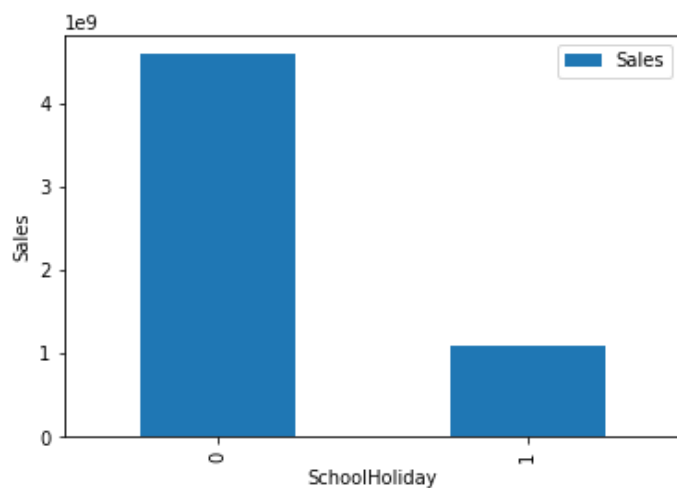
Sales

Promo	Sales
0	2678110016
1	2982747991



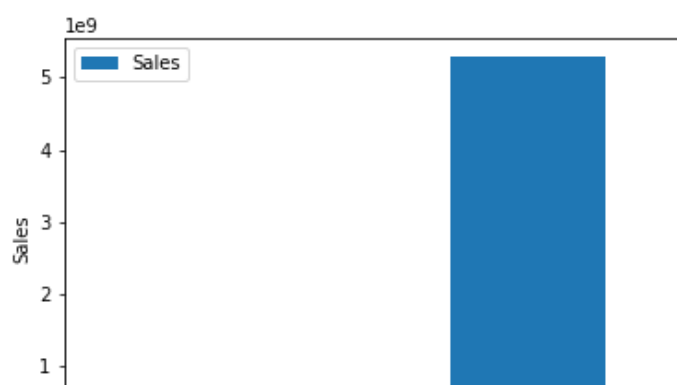
Sales

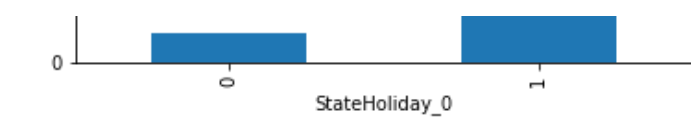
SchoolHoliday	Sales
0	4578696753
1	1082161254



Sales

StateHoliday_0	Sales
0	383164877
1	5277693130

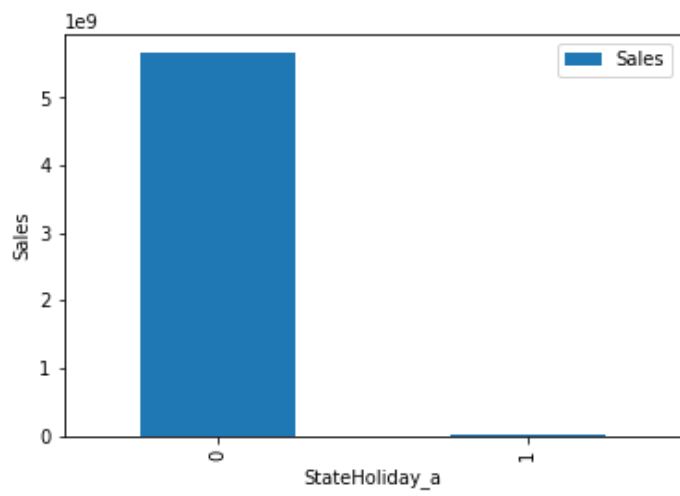




Sales

StateHoliday\_a

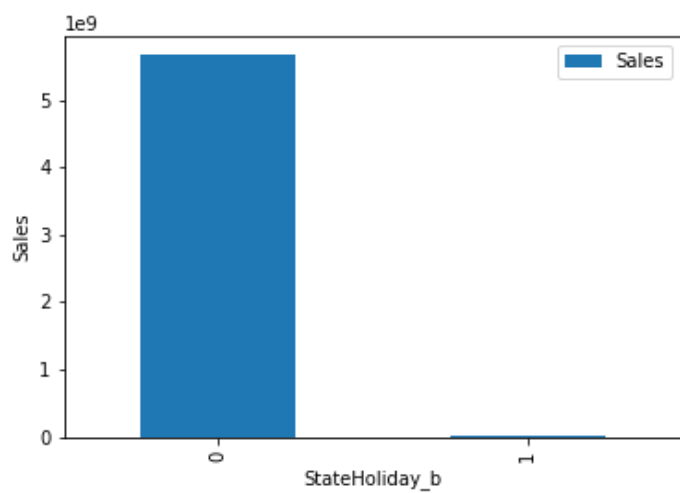
0	5654967702
1	5890305



Sales

StateHoliday\_b

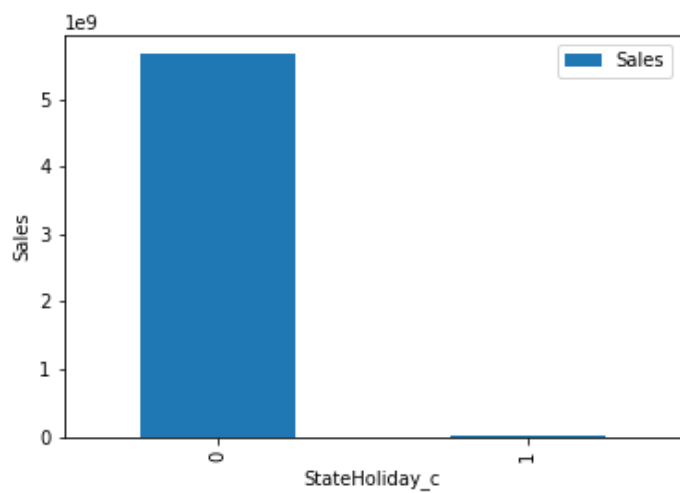
0	5659424263
1	1433744



Sales

StateHoliday\_c

0	5660166201
1	691806



In [10]:

```

from sklearn.model_selection import train_test_split
X = df.iloc[:, :-1].values
y = df.iloc[:, -1].values
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)

```

In [11]:

```

from sklearn.preprocessing import StandardScaler
scx = StandardScaler()
scy = StandardScaler()
X_train = scx.fit_transform(X_train)
X_test = scx.transform(X_test)
y_train = scy.fit_transform(y_train.reshape(-1, 1))
y_test = scy.transform(y_test.reshape(-1, 1))

```

In [13]:

```

from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error

LR= LinearRegression()
LR.fit(X_train, y_train)
LR_y_pred = LR.predict(X_test)
print('mean_squared_error : ', mean_squared_error(y_test, LR_y_pred))
print('mean_absolute_error : ', mean_absolute_error(y_test, LR_y_pred))

```

```

mean_squared_error : 0.15597012094545226
mean_absolute_error : 0.2750183831544253

```

**MSE makes more sense because it is not swayed by outliers as much, which this dataset has alot of. another good metric is the R2 score.**

In [14]:

```

for store in df["Store"].unique():
    storeDF = df.query("Store == {}".format(store))
    X = storeDF.iloc[:, 1:-1].values
    y = storeDF.iloc[:, -1].values
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)
    scx = StandardScaler()
    scy = StandardScaler()
    X_train = scx.fit_transform(X_train)
    X_test = scx.transform(X_test)
    y_train = scy.fit_transform(y_train.reshape(-1, 1))
    y_test = scy.transform(y_test.reshape(-1, 1))
    LR= LinearRegression()
    LR.fit(X_train, y_train)
    LR_y_pred = LR.predict(X_test)
    print('mean_squared_error for store {}: '.format(store), mean_squared_error(y_test, LR_y_pred))

```

```

mean_squared_error for store 1: 0.015416706582390425
mean_squared_error for store 2: 0.03131244988877556
mean_squared_error for store 3: 0.02001218281628088
mean_squared_error for store 4: 0.013467458083986335
mean_squared_error for store 5: 0.03360675158374076
mean_squared_error for store 6: 0.01541659323307572
mean_squared_error for store 7: 0.026395672331876098
mean_squared_error for store 8: 0.020516627396482714
mean_squared_error for store 9: 0.01646086267028367
mean_squared_error for store 10: 0.019282762549142716
mean_squared_error for store 11: 0.03561293571056131
mean_squared_error for store 12: 0.02497843743519996
mean_squared_error for store 13: 0.03019473254102158
mean_squared_error for store 14: 0.011923083654328108
mean_squared_error for store 15: 0.02263293321265975
mean_squared_error for store 16: 0.027304270212270318
mean_squared_error for store 17: 0.027760146790866736
mean_squared_error for store 18: 0.02271148729698237

```

mean_squared_error	for store 19:	0.02668434916389733
mean_squared_error	for store 20:	0.03344385427289764
mean_squared_error	for store 21:	0.029600619478480653
mean_squared_error	for store 22:	0.04376462736411536
mean_squared_error	for store 23:	0.022520146608465456
mean_squared_error	for store 24:	0.019305219894299484
mean_squared_error	for store 25:	0.013278218045999301
mean_squared_error	for store 26:	0.019471128219612364
mean_squared_error	for store 27:	0.018631827557732027
mean_squared_error	for store 28:	0.025091535075114083
mean_squared_error	for store 29:	0.021633532786549812
mean_squared_error	for store 30:	0.022738775772371097
mean_squared_error	for store 31:	0.025575996401529466
mean_squared_error	for store 32:	0.02179872668576223
mean_squared_error	for store 33:	0.01794708181640127
mean_squared_error	for store 34:	0.015606671225520143
mean_squared_error	for store 35:	0.018947674527558724
mean_squared_error	for store 36:	0.015723844208009062
mean_squared_error	for store 37:	0.020485819202784483
mean_squared_error	for store 38:	0.024596028305229875
mean_squared_error	for store 39:	0.020667704537674324
mean_squared_error	for store 40:	0.020986362369398267
mean_squared_error	for store 41:	0.023680556921300208
mean_squared_error	for store 42:	0.02043296405362958
mean_squared_error	for store 43:	0.01974617359747989
mean_squared_error	for store 44:	0.022749536465981574
mean_squared_error	for store 45:	0.014720372956261978
mean_squared_error	for store 46:	0.04308383281423686
mean_squared_error	for store 47:	0.01858300361944441
mean_squared_error	for store 48:	0.02927258031313875
mean_squared_error	for store 49:	0.02515893525540051
mean_squared_error	for store 50:	0.01716619826053529
mean_squared_error	for store 51:	0.02416247577746397
mean_squared_error	for store 52:	0.027347012835657172
mean_squared_error	for store 53:	0.026848550711900575
mean_squared_error	for store 54:	0.02078947305105316
mean_squared_error	for store 55:	0.017752521829323804
mean_squared_error	for store 56:	0.013324910515878967
mean_squared_error	for store 57:	0.017355623482968575
mean_squared_error	for store 58:	0.04387892303393016
mean_squared_error	for store 59:	0.023148846113692296
mean_squared_error	for store 60:	0.024704928250455793
mean_squared_error	for store 61:	0.02572638713155112
mean_squared_error	for store 62:	0.014954835878691236
mean_squared_error	for store 63:	0.022217526446263302
mean_squared_error	for store 64:	0.01709665709346567
mean_squared_error	for store 65:	0.033846888026542274
mean_squared_error	for store 66:	0.014479491333554011
mean_squared_error	for store 67:	0.018697748544888926
mean_squared_error	for store 68:	0.029881392591631528
mean_squared_error	for store 69:	0.018204580246511604
mean_squared_error	for store 70:	0.01819644767428603
mean_squared_error	for store 71:	0.017299928204963285
mean_squared_error	for store 72:	0.05086808054532075
mean_squared_error	for store 73:	0.022462221082201195
mean_squared_error	for store 74:	0.021643471939374534
mean_squared_error	for store 75:	0.025047435180751518
mean_squared_error	for store 76:	0.0318278783102386
mean_squared_error	for store 77:	0.019126856922374362
mean_squared_error	for store 78:	0.0249754090362984
mean_squared_error	for store 79:	0.02324081530499476
mean_squared_error	for store 80:	0.012411264827784744
mean_squared_error	for store 81:	0.019574383946896996
mean_squared_error	for store 82:	0.02071127775789589
mean_squared_error	for store 83:	0.021044960845206045
mean_squared_error	for store 84:	0.023487666051671404
mean_squared_error	for store 85:	0.031110083492745185
mean_squared_error	for store 86:	0.02138096356331145
mean_squared_error	for store 87:	0.015107130705794152
mean_squared_error	for store 88:	0.023794484961733385
mean_squared_error	for store 89:	0.021157411713457277
mean_squared_error	for store 90:	0.01716560709557042



mean_squared_error	for store	91:	0.01737256644600145
mean_squared_error	for store	92:	0.01980094556510364
mean_squared_error	for store	93:	0.022083401549299008
mean_squared_error	for store	94:	0.029827934043326374
mean_squared_error	for store	95:	0.019826384301576072
mean_squared_error	for store	96:	0.02458558040082162
mean_squared_error	for store	97:	0.02114210745490189
mean_squared_error	for store	98:	0.020934005875861576
mean_squared_error	for store	99:	0.03478812802585312
mean_squared_error	for store	100:	0.016465006825172553
mean_squared_error	for store	101:	0.02846689285499082
mean_squared_error	for store	102:	0.023369362976821358
mean_squared_error	for store	103:	0.012429796826606169
mean_squared_error	for store	104:	0.013755842011920007
mean_squared_error	for store	105:	0.04647477923130528
mean_squared_error	for store	106:	0.011402603835337512
mean_squared_error	for store	107:	0.015229217013258297
mean_squared_error	for store	108:	0.019537254058031358
mean_squared_error	for store	109:	0.024180549227616602
mean_squared_error	for store	110:	0.029939522088959405
mean_squared_error	for store	111:	0.01572143655012109
mean_squared_error	for store	112:	0.012196041011442931
mean_squared_error	for store	113:	0.022380757389191392
mean_squared_error	for store	114:	0.02491605765546658
mean_squared_error	for store	115:	0.02165334421850253
mean_squared_error	for store	116:	0.01978740632314166
mean_squared_error	for store	117:	0.018481437865688722
mean_squared_error	for store	118:	0.021867547088609114
mean_squared_error	for store	119:	0.025490835416405292
mean_squared_error	for store	120:	0.016829450871800326
mean_squared_error	for store	121:	0.027445708771693642
mean_squared_error	for store	122:	0.03140819527973085
mean_squared_error	for store	123:	0.0292858178427311
mean_squared_error	for store	124:	0.023327581193683684
mean_squared_error	for store	125:	0.015559153699985047
mean_squared_error	for store	126:	0.5183021090933632
mean_squared_error	for store	127:	0.05218539978004118
mean_squared_error	for store	128:	0.02057480184825436
mean_squared_error	for store	129:	0.02869014722722512
mean_squared_error	for store	130:	0.021845401480045604
mean_squared_error	for store	131:	0.024027050383796145
mean_squared_error	for store	132:	0.028685671550408062
mean_squared_error	for store	133:	0.024131795262280525
mean_squared_error	for store	134:	0.017475532440425573
mean_squared_error	for store	135:	0.017441152487182435
mean_squared_error	for store	136:	0.031746605161677946
mean_squared_error	for store	137:	0.03421993372667369
mean_squared_error	for store	138:	0.03084299995331075
mean_squared_error	for store	139:	0.032471932979574306
mean_squared_error	for store	140:	0.01837941901963031
mean_squared_error	for store	141:	0.02780264814786323
mean_squared_error	for store	142:	0.015656645063302874
mean_squared_error	for store	143:	0.018958715408523345
mean_squared_error	for store	144:	0.028300424869523697
mean_squared_error	for store	145:	0.02646159459157998
mean_squared_error	for store	146:	0.023589803753396428
mean_squared_error	for store	147:	0.02274727682966208
mean_squared_error	for store	148:	0.014500960733161776
mean_squared_error	for store	149:	0.032075956838506
mean_squared_error	for store	150:	0.02082425762766792
mean_squared_error	for store	151:	0.022841444306836205
mean_squared_error	for store	152:	0.02048436526100679
mean_squared_error	for store	153:	0.024665896011557498
mean_squared_error	for store	154:	0.023066901147570904
mean_squared_error	for store	155:	0.028629353684590884
mean_squared_error	for store	156:	0.028146066376575938
mean_squared_error	for store	157:	0.017179564994162747
mean_squared_error	for store	158:	0.0181049831395565
mean_squared_error	for store	159:	0.03687399627887126
mean_squared_error	for store	160:	0.020913824337895383
mean_squared_error	for store	161:	0.018411832412227755
mean_squared_error	for store	162:	0.016892369900097935

mean_squared_error	for store 163:	0.017288526263489205
mean_squared_error	for store 164:	0.04110180782319657
mean_squared_error	for store 165:	0.02406432958396618
mean_squared_error	for store 166:	0.02786123784015114
mean_squared_error	for store 167:	0.02170040756895286
mean_squared_error	for store 168:	0.02362294723217072
mean_squared_error	for store 169:	0.07807343003416892
mean_squared_error	for store 170:	0.01870067202266948
mean_squared_error	for store 171:	0.022090630994811178
mean_squared_error	for store 172:	0.021398772529194754
mean_squared_error	for store 173:	0.015768979565235933
mean_squared_error	for store 174:	0.024868303819668897
mean_squared_error	for store 175:	0.020087543459431936
mean_squared_error	for store 176:	0.024964744390849437
mean_squared_error	for store 177:	0.02103347148369939
mean_squared_error	for store 178:	0.020358202611321784
mean_squared_error	for store 179:	0.018350256900730656
mean_squared_error	for store 180:	0.019010930171752836
mean_squared_error	for store 181:	0.05217826725818409
mean_squared_error	for store 182:	0.023251705030765252
mean_squared_error	for store 183:	0.03891947879580542
mean_squared_error	for store 184:	0.023291945527435604
mean_squared_error	for store 185:	0.020758676756251537
mean_squared_error	for store 186:	0.03435578043142203
mean_squared_error	for store 187:	0.05380597273157099
mean_squared_error	for store 188:	0.021497781157176255
mean_squared_error	for store 189:	0.015824555882974448
mean_squared_error	for store 190:	0.023313358763382155
mean_squared_error	for store 191:	0.022965994216436948
mean_squared_error	for store 192:	0.025666926886796344
mean_squared_error	for store 193:	0.031614061238305555
mean_squared_error	for store 194:	0.025152673666179737
mean_squared_error	for store 195:	0.01653013931008502
mean_squared_error	for store 196:	0.02269897639024727
mean_squared_error	for store 197:	0.023454584749548233
mean_squared_error	for store 198:	0.044065185994342754
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mean_squared_error	for store 910:	0.02669223432556574
mean_squared_error	for store 911:	0.02553102298994957
mean_squared_error	for store 912:	0.02316441932775578
mean_squared_error	for store 913:	0.017726399095001146
mean_squared_error	for store 914:	0.021584452056965082
mean_squared_error	for store 915:	0.02460176001202357
mean_squared_error	for store 916:	0.02061057877362516
mean_squared_error	for store 917:	0.023598230479462336
mean_squared_error	for store 918:	0.030550431599287487
mean_squared_error	for store 919:	0.025182037472954243
mean_squared_error	for store 920:	0.03728622567375282
mean_squared_error	for store 921:	0.011711210802215606
mean_squared_error	for store 922:	0.01683574352327689
mean_squared_error	for store 923:	0.04336478025521309
mean_squared_error	for store 924:	0.01851115541702086
mean_squared_error	for store 925:	0.061877537644051656
mean_squared_error	for store 926:	0.01976633053284418
mean_squared_error	for store 927:	0.02005963520759787
mean_squared_error	for store 928:	0.01912419172633121
mean_squared_error	for store 929:	0.027044271601745083
mean_squared_error	for store 930:	0.01792839115063415
mean_squared_error	for store 931:	0.05298115567957214
mean_squared_error	for store 932:	0.02778160672975776
mean_squared_error	for store 933:	0.026318535849143322
mean_squared_error	for store 934:	0.021262293666145834
mean_squared_error	for store 935:	0.029156835982948496
mean_squared_error	for store 936:	0.016582425210358083
mean_squared_error	for store 937:	0.03916305389047368
mean_squared_error	for store 938:	0.013389184736315776
mean_squared_error	for store 939:	0.022116263100420447
mean_squared_error	for store 940:	0.02818095758573225
mean_squared_error	for store 941:	0.030855161542475164
mean_squared_error	for store 942:	0.016372720043037223
mean_squared_error	for store 943:	0.02257721000578265
mean_squared_error	for store 944:	0.0265516994373457
mean_squared_error	for store 945:	0.03478499267240725
mean_squared_error	for store 946:	0.020320388002585992
mean_squared_error	for store 947:	0.014692809709547623
mean_squared_error	for store 948:	0.12660489911473258
mean_squared_error	for store 949:	0.02752159788229103
mean_squared_error	for store 950:	0.024044364728080542
mean_squared_error	for store 951:	0.0168976188069749
mean_squared_error	for store 952:	0.01860327950450451
mean_squared_error	for store 953:	0.025349352441044973
mean_squared_error	for store 954:	0.029163186566536433

mean_squared_error	for store 955:	0.025778147760062767
mean_squared_error	for store 956:	0.35051337411056765
mean_squared_error	for store 957:	0.022815579595221062
mean_squared_error	for store 958:	0.015686489842181735
mean_squared_error	for store 959:	0.018991016407664978
mean_squared_error	for store 960:	0.021020791875815466
mean_squared_error	for store 961:	0.020971032306056472
mean_squared_error	for store 962:	0.02819240684853311
mean_squared_error	for store 963:	0.020841387488882843
mean_squared_error	for store 964:	0.04249295005212333
mean_squared_error	for store 965:	0.02539964891319063
mean_squared_error	for store 966:	0.02299808120910337
mean_squared_error	for store 967:	0.023106959803834825
mean_squared_error	for store 968:	0.01562280250318884
mean_squared_error	for store 969:	0.03072432836540617
mean_squared_error	for store 970:	0.019793498296594995
mean_squared_error	for store 971:	0.02914050131941966
mean_squared_error	for store 972:	0.024990952573583365
mean_squared_error	for store 973:	0.02818386656897828
mean_squared_error	for store 974:	0.048237649498561096
mean_squared_error	for store 975:	0.028099798454006585
mean_squared_error	for store 976:	0.019153891307174216
mean_squared_error	for store 977:	0.055593368647991685
mean_squared_error	for store 978:	0.019560435502988374
mean_squared_error	for store 979:	0.022263386186152673
mean_squared_error	for store 980:	0.019048840112186587
mean_squared_error	for store 981:	0.03066304205136883
mean_squared_error	for store 982:	0.01562756855362885
mean_squared_error	for store 983:	0.023342556417512702
mean_squared_error	for store 984:	0.0224044205963976
mean_squared_error	for store 985:	0.1459780646729997
mean_squared_error	for store 986:	0.020036869668581307
mean_squared_error	for store 987:	0.02578069687568161
mean_squared_error	for store 988:	0.036649271574533876
mean_squared_error	for store 989:	0.026616111479531288
mean_squared_error	for store 990:	0.01873825531511662
mean_squared_error	for store 991:	0.01873945801945056
mean_squared_error	for store 992:	0.013226084056108513
mean_squared_error	for store 993:	0.021126968347559713
mean_squared_error	for store 994:	0.024734571679331054
mean_squared_error	for store 995:	0.014979033769627004
mean_squared_error	for store 996:	0.022173872269023794
mean_squared_error	for store 997:	0.025626469089889282
mean_squared_error	for store 998:	0.024134525463149644
mean_squared_error	for store 999:	0.02231901939102285
mean_squared_error	for store 1000:	0.024820560537704445
mean_squared_error	for store 1001:	0.021822803344898785
mean_squared_error	for store 1002:	0.018775991813928132
mean_squared_error	for store 1003:	0.026035184686556273
mean_squared_error	for store 1004:	0.04641953262110356
mean_squared_error	for store 1005:	0.018157324369568573
mean_squared_error	for store 1006:	0.019919135747287944
mean_squared_error	for store 1007:	0.02445230748067108
mean_squared_error	for store 1008:	0.021290008635029733
mean_squared_error	for store 1009:	0.021108104791407876
mean_squared_error	for store 1010:	0.019628322841331276
mean_squared_error	for store 1011:	0.024268793822380685
mean_squared_error	for store 1012:	0.029162452992225602
mean_squared_error	for store 1013:	0.022801817667096994
mean_squared_error	for store 1014:	0.017753265754731944
mean_squared_error	for store 1015:	0.024804230289641183
mean_squared_error	for store 1016:	0.026747594346044182
mean_squared_error	for store 1017:	0.014488144276709228
mean_squared_error	for store 1018:	0.02234365997718895
mean_squared_error	for store 1019:	0.037969221018778095
mean_squared_error	for store 1020:	0.01468423971517144
mean_squared_error	for store 1021:	0.02521225729113574
mean_squared_error	for store 1022:	0.023261181236725218
mean_squared_error	for store 1023:	0.018539278567942446
mean_squared_error	for store 1024:	0.02236816390123761
mean_squared_error	for store 1025:	0.012247214919619612
mean_squared_error	for store 1026:	0.020393449496450444

mean_squared_error	for store	1027:	0.04737505964166548
mean_squared_error	for store	1028:	0.02866166473104344
mean_squared_error	for store	1029:	0.01592843058149232
mean_squared_error	for store	1030:	0.02392743353794802
mean_squared_error	for store	1031:	0.0194750697619954
mean_squared_error	for store	1032:	0.020797892537251565
mean_squared_error	for store	1033:	0.014248571693658306
mean_squared_error	for store	1034:	0.03140864062865794
mean_squared_error	for store	1035:	0.02718390129206407
mean_squared_error	for store	1036:	0.022928100058437678
mean_squared_error	for store	1037:	0.020766011897488623
mean_squared_error	for store	1038:	0.02807321399710367
mean_squared_error	for store	1039:	0.017762746496810193
mean_squared_error	for store	1040:	0.02437608066622172
mean_squared_error	for store	1041:	0.025834072296935382
mean_squared_error	for store	1042:	0.024958684641637627
mean_squared_error	for store	1043:	0.019560102715434353
mean_squared_error	for store	1044:	0.02153987778152565
mean_squared_error	for store	1045:	0.039731387360070286
mean_squared_error	for store	1046:	0.027196979819900352
mean_squared_error	for store	1047:	0.07037906743714316
mean_squared_error	for store	1048:	0.029626730464677866
mean_squared_error	for store	1049:	0.03722531020658269
mean_squared_error	for store	1050:	0.01902245035151926
mean_squared_error	for store	1051:	0.01660178430484416
mean_squared_error	for store	1052:	0.018790617744194108
mean_squared_error	for store	1053:	0.02373649778896053
mean_squared_error	for store	1054:	0.026958314620425108
mean_squared_error	for store	1055:	0.019017189566729705
mean_squared_error	for store	1056:	0.04925795778404667
mean_squared_error	for store	1057:	0.027337338411772754
mean_squared_error	for store	1058:	0.01997172514170968
mean_squared_error	for store	1059:	0.01937241187955055
mean_squared_error	for store	1060:	0.022167906541244814
mean_squared_error	for store	1061:	0.014692692697138762
mean_squared_error	for store	1062:	0.021394325187319048
mean_squared_error	for store	1063:	0.02325567599657112
mean_squared_error	for store	1064:	0.018504796018155273
mean_squared_error	for store	1065:	0.02529965933813136
mean_squared_error	for store	1066:	0.014313272463628521
mean_squared_error	for store	1067:	0.01769032139235787
mean_squared_error	for store	1068:	0.022917590889009326
mean_squared_error	for store	1069:	0.031215875777075568
mean_squared_error	for store	1070:	0.018286983641722997
mean_squared_error	for store	1071:	0.02208158831254254
mean_squared_error	for store	1072:	0.02015150847504877
mean_squared_error	for store	1073:	0.02054442894445581
mean_squared_error	for store	1074:	0.022647142721707484
mean_squared_error	for store	1075:	0.014745381715262823
mean_squared_error	for store	1076:	0.03716765572486478
mean_squared_error	for store	1077:	0.026196423518674662
mean_squared_error	for store	1078:	0.022500571089932413
mean_squared_error	for store	1079:	0.016563300403291636
mean_squared_error	for store	1080:	0.023841835399738377
mean_squared_error	for store	1081:	0.024924053497637624
mean_squared_error	for store	1082:	0.02560969369537319
mean_squared_error	for store	1083:	0.024583870349692546
mean_squared_error	for store	1084:	0.020580688144112628
mean_squared_error	for store	1085:	0.017026660775142262
mean_squared_error	for store	1086:	0.024725886247064583
mean_squared_error	for store	1087:	0.022994740241759376
mean_squared_error	for store	1088:	0.022556271707888258
mean_squared_error	for store	1089:	0.01699603735036941
mean_squared_error	for store	1090:	0.02238997803941329
mean_squared_error	for store	1091:	0.023472521619692214
mean_squared_error	for store	1092:	0.020181576985273036
mean_squared_error	for store	1093:	0.01970479847702349
mean_squared_error	for store	1094:	0.029453861033111838
mean_squared_error	for store	1095:	0.02166983913369546
mean_squared_error	for store	1096:	0.03126399655009899
mean_squared_error	for store	1097:	0.22447695686748637
mean_squared_error	for store	1098:	0.012188753329336242

```

mean_squared_error for store 1099: 0.06928558263810425
mean_squared_error for store 1100: 0.03241089213167385
mean_squared_error for store 1101: 0.01775667482296442
mean_squared_error for store 1102: 0.0232630842766913
mean_squared_error for store 1103: 0.02437611277312494
mean_squared_error for store 1104: 0.03063397755893058
mean_squared_error for store 1105: 0.024472180637290262
mean_squared_error for store 1106: 0.02425397622043392
mean_squared_error for store 1107: 0.06180276642913939
mean_squared_error for store 1108: 0.02438000039196402
mean_squared_error for store 1109: 0.0420681569250674
mean_squared_error for store 1110: 0.021600489000907257
mean_squared_error for store 1111: 0.01921433719296972
mean_squared_error for store 1112: 0.023559610435138555
mean_squared_error for store 1113: 0.03470574474719885
mean_squared_error for store 1114: 0.019515310091042744
mean_squared_error for store 1115: 0.016336182615984303

```

**This performs better because the store id number, an identification feature with no predictive power, was contributing to the weight tuning in the first model. it also reveals the variability of the sales for individual stores**

In [15]:

```

import xgboost as xgb
sc = StandardScaler()
Sdf = pd.DataFrame(sc.fit_transform(df))
X = Sdf.iloc[:, :-1].values
y = Sdf.iloc[:, -1].values
data_dmatrix = xgb.DMatrix(data=X, label=y)
params = {"objective": "reg:squarederror", 'colsample_bytree': 0.3, 'learning_rate': 0.1, 'max_depth': 5, 'alpha': 10}
cv_results = xgb.cv(dtrain=data_dmatrix, params=params, nfold=5, num_boost_round=50, early_stopping_rounds=10, metrics="rmse", as_pandas=True, seed=123)
print( cv_results["test-rmse-mean"].tail(1).to_numpy()[0])

```

0.37442589036609

In [16]:

```

from sklearn.linear_model import Ridge
X = df.iloc[:, :-1].values
y = df.iloc[:, -1].values
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)
scx = StandardScaler()
scy = StandardScaler()
X_train = scx.fit_transform(X_train)
X_test = scx.transform(X_test)
y_train = scy.fit_transform(y_train.reshape(-1, 1))
y_test = scy.transform(y_test.reshape(-1, 1))
RR = Ridge()
RR.fit(X_train, y_train)
RR_y_pred = RR.predict(X_test)
print('mean_squared_error : ', mean_squared_error(y_test, RR_y_pred))

```

mean\_squared\_error : 0.15597011303401465

In [19]:

```

from sklearn.ensemble import RandomForestRegressor
from sklearn.decomposition import PCA
RFR = RandomForestRegressor(max_depth=2, random_state=1)
pca = PCA(n_components=6)
X_train= pca.fit_transform(X_train)
X_test = pca.transform(X_test)
RFR.fit(X_train, y_train)
RFR_y_pred = RFR.predict(X_test)
print('mean_squared_error : ', mean_squared_error(y_test, RFR_y_pred))

```

C:\Users\97156\AppData\Local\Temp\ipykernel\_6500\3678561823.py:7: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to

```
o (n_samples,), for example using ravel().
RFR.fit(X_train, y_train)
```

```
mean_squared_error : 0.39909739807409866
```

```
In [22]:
```

```
for store in df["Store"].unique():
    storeDF = df.query("Store == {}".format(store))
    X = storeDF.iloc[:, 1:-1].values
    y = storeDF.iloc[:, -1].values
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)
    scx = StandardScaler()
    scy = StandardScaler()
    X_train = scx.fit_transform(X_train)
    X_test = scx.transform(X_test)
    y_train = scy.fit_transform(y_train.reshape(-1, 1))
    y_test = scy.transform(y_test.reshape(-1, 1))
    pca = PCA(n_components=6)
    X_train = pca.fit_transform(X_train)
    X_test = pca.transform(X_test)
    RFR = RandomForestRegressor(max_depth=2, random_state=1)
    RFR.fit(X_train, y_train)
    RFR_y_pred = RFR.predict(X_test)
    print('mean_squared_error for store {}: '.format(store), mean_squared_error(y_test, RFR_y_pred))
```

```
mean_squared_error for store 1: 0.1350240161693304
mean_squared_error for store 2: 0.12322680298840624
mean_squared_error for store 3: 0.12209501170166644
mean_squared_error for store 4: 0.10849916883466762
mean_squared_error for store 5: 0.13737948515766726
mean_squared_error for store 6: 0.1298101749017048
mean_squared_error for store 7: 0.12383269586267591
mean_squared_error for store 8: 0.09337936584881354
mean_squared_error for store 9: 0.09378589577427589
mean_squared_error for store 10: 0.07694124098618335
mean_squared_error for store 11: 0.22249620530315684
mean_squared_error for store 12: 0.0945925960533788
mean_squared_error for store 13: 0.1901045819848244
mean_squared_error for store 14: 0.1394163757015218
mean_squared_error for store 15: 0.11016472651668117
mean_squared_error for store 16: 0.11485700138169061
mean_squared_error for store 17: 0.15088599391477114
mean_squared_error for store 18: 0.13786816881168298
mean_squared_error for store 19: 0.14629599998689347
mean_squared_error for store 20: 0.12730846990600628
mean_squared_error for store 21: 0.12057124235798371
mean_squared_error for store 22: 0.14135940066143643
mean_squared_error for store 23: 0.13550703801986522
mean_squared_error for store 24: 0.10590493450989945
mean_squared_error for store 25: 0.19087130444982386
mean_squared_error for store 26: 0.14910498999559602
mean_squared_error for store 27: 0.0964995213794301
mean_squared_error for store 28: 0.1837668396547786
mean_squared_error for store 29: 0.10653064211629783
mean_squared_error for store 30: 0.222247359578631
mean_squared_error for store 31: 0.13970145290256394
mean_squared_error for store 32: 0.1051419177387478
mean_squared_error for store 33: 0.12038390903435779
mean_squared_error for store 34: 0.08306752144997398
mean_squared_error for store 35: 0.07991199842659694
mean_squared_error for store 36: 0.06783439472440368
mean_squared_error for store 37: 0.2821494454533609
mean_squared_error for store 38: 0.16161266038016223
mean_squared_error for store 39: 0.09869330621724595
mean_squared_error for store 40: 0.31845868730069077
mean_squared_error for store 41: 0.194448220117834
mean_squared_error for store 42: 0.08908397204931015
mean_squared_error for store 43: 0.13658044189137203
mean_squared_error for store 44: 0.13751948516560497
mean_squared_error for store 45: 0.1715051064380813
```



mean\_squared\_error for store 45: 0.1713031004300013  
mean\_squared\_error for store 46: 0.20396777948704511  
mean\_squared\_error for store 47: 0.10587796736697516  
mean\_squared\_error for store 48: 0.1317011277404776  
mean\_squared\_error for store 49: 0.1818280636165864  
mean\_squared\_error for store 50: 0.1396559516532577  
mean\_squared\_error for store 51: 0.26325990761003365  
mean\_squared\_error for store 52: 0.2604571406214373  
mean\_squared\_error for store 53: 0.17576492873270244  
mean\_squared\_error for store 54: 0.24026973222870082  
mean\_squared\_error for store 55: 0.15957358752034378  
mean\_squared\_error for store 56: 0.15623148926294184  
mean\_squared\_error for store 57: 0.19266377944916277  
mean\_squared\_error for store 58: 0.21507710373207767  
mean\_squared\_error for store 59: 0.13228261217926668  
mean\_squared\_error for store 60: 0.1401379475012066  
mean\_squared\_error for store 61: 0.13083840704144592  
mean\_squared\_error for store 62: 0.10830965358519647  
mean\_squared\_error for store 63: 0.1887523808327028  
mean\_squared\_error for store 64: 0.12895007235725897  
mean\_squared\_error for store 65: 0.15709845365216085  
mean\_squared\_error for store 66: 0.10189110126148188  
mean\_squared\_error for store 67: 0.09788241710054478  
mean\_squared\_error for store 68: 0.24000417022355255  
mean\_squared\_error for store 69: 0.12076005512912653  
mean\_squared\_error for store 70: 0.1100851346677528  
mean\_squared\_error for store 71: 0.13491359128608854  
mean\_squared\_error for store 72: 0.1552671527392208  
mean\_squared\_error for store 73: 0.12148718961925753  
mean\_squared\_error for store 74: 0.14017101267454263  
mean\_squared\_error for store 75: 0.15319369044424788  
mean\_squared\_error for store 76: 0.14777042474702254  
mean\_squared\_error for store 77: 0.12298760608731486  
mean\_squared\_error for store 78: 0.15365147260324072  
mean\_squared\_error for store 79: 0.09273531011816381  
mean\_squared\_error for store 80: 0.16702220206083254  
mean\_squared\_error for store 81: 0.16632571078308256  
mean\_squared\_error for store 82: 0.16269044367872487  
mean\_squared\_error for store 83: 0.11390665233209955  
mean\_squared\_error for store 84: 0.10176726288381978  
mean\_squared\_error for store 85: 0.3486817309424967  
mean\_squared\_error for store 86: 0.12332461551466863  
mean\_squared\_error for store 87: 0.08746292145547575  
mean\_squared\_error for store 88: 0.09658979391892156  
mean\_squared\_error for store 89: 0.10090952140824966  
mean\_squared\_error for store 90: 0.1304811094123383  
mean\_squared\_error for store 91: 0.18691723683291203  
mean\_squared\_error for store 92: 0.11992477478011056  
mean\_squared\_error for store 93: 0.12118571101949299  
mean\_squared\_error for store 94: 0.11921412461643759  
mean\_squared\_error for store 95: 0.11867845905565803  
mean\_squared\_error for store 96: 0.09013003721501499  
mean\_squared\_error for store 97: 0.14711912227249635  
mean\_squared\_error for store 98: 0.12084978749713071  
mean\_squared\_error for store 99: 0.19982743932235555  
mean\_squared\_error for store 100: 0.20391099232864066  
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mean\_squared\_error for store 837: 0.22500005100320354

mean_squared_error	for store 837:	0.2230303103320354
mean_squared_error	for store 838:	0.13050729741508915
mean_squared_error	for store 839:	0.12225835863920113
mean_squared_error	for store 840:	0.08149946379517037
mean_squared_error	for store 841:	0.13017927443351374
mean_squared_error	for store 842:	0.1544044518578767
mean_squared_error	for store 843:	0.1342316588409107
mean_squared_error	for store 844:	0.12459491155603475
mean_squared_error	for store 845:	0.1887080199606618
mean_squared_error	for store 846:	0.11731889509458644
mean_squared_error	for store 847:	0.18054302045050372
mean_squared_error	for store 848:	0.24536625773292087
mean_squared_error	for store 849:	0.12109252815519787
mean_squared_error	for store 850:	0.10243889737311274
mean_squared_error	for store 851:	0.17620125732022482
mean_squared_error	for store 852:	0.165287933746948
mean_squared_error	for store 853:	0.09412771452004058
mean_squared_error	for store 854:	0.15453939054977556
mean_squared_error	for store 855:	0.09910536433736758
mean_squared_error	for store 856:	0.08503309494654135
mean_squared_error	for store 857:	0.2146646116804216
mean_squared_error	for store 858:	0.09474988965823838
mean_squared_error	for store 859:	0.11685546048215546
mean_squared_error	for store 860:	0.19897745973081357
mean_squared_error	for store 861:	0.29405959627209466
mean_squared_error	for store 862:	0.14338344423303093
mean_squared_error	for store 863:	0.18573043198409572
mean_squared_error	for store 864:	0.11781763218910507
mean_squared_error	for store 865:	0.18925935645680567
mean_squared_error	for store 866:	0.12772947877271193
mean_squared_error	for store 867:	0.2564780518297829
mean_squared_error	for store 868:	0.11028624720413423
mean_squared_error	for store 869:	0.1104963221589752
mean_squared_error	for store 870:	0.12305718365720743
mean_squared_error	for store 871:	0.3404207046577942
mean_squared_error	for store 872:	0.14052861365738523
mean_squared_error	for store 873:	0.12909921159806678
mean_squared_error	for store 874:	0.11842939393870494
mean_squared_error	for store 875:	0.1395568809458517
mean_squared_error	for store 876:	0.11851868627028427
mean_squared_error	for store 877:	0.1650874755973453
mean_squared_error	for store 878:	0.12359633386555671
mean_squared_error	for store 879:	0.16058675764054767
mean_squared_error	for store 880:	0.0854354635346859
mean_squared_error	for store 881:	0.1209671542465617
mean_squared_error	for store 882:	0.2332345120739256
mean_squared_error	for store 883:	0.16933882699952885
mean_squared_error	for store 884:	0.14516877749572274
mean_squared_error	for store 885:	0.15651213137968714
mean_squared_error	for store 886:	0.1274288479178991
mean_squared_error	for store 887:	0.1581015910539661
mean_squared_error	for store 888:	0.1392667036627522
mean_squared_error	for store 889:	0.13854066468543721
mean_squared_error	for store 890:	0.15987344935947803
mean_squared_error	for store 891:	0.17470619459250444
mean_squared_error	for store 892:	0.12396004846176717
mean_squared_error	for store 893:	0.12941762791373687
mean_squared_error	for store 894:	0.1119448640659094
mean_squared_error	for store 895:	0.08266217820750024
mean_squared_error	for store 896:	0.12910716679747197
mean_squared_error	for store 897:	0.3835095614736598
mean_squared_error	for store 898:	0.1514079908156419
mean_squared_error	for store 899:	0.11175732943054945
mean_squared_error	for store 900:	0.11835177717916452
mean_squared_error	for store 901:	0.13787798276650412
mean_squared_error	for store 902:	0.19209366568733288
mean_squared_error	for store 903:	0.16635454111182538
mean_squared_error	for store 904:	0.19889335048549
mean_squared_error	for store 905:	0.19439172223442727
mean_squared_error	for store 906:	0.1427525526384137
mean_squared_error	for store 907:	0.17276113749644534
mean_squared_error	for store 908:	0.07168642340937847
mean_squared_error	for store 909:	0.3087153160565806

mean_squared_error	for store 909:	0.3087133406303000
mean_squared_error	for store 910:	0.13387999476737866
mean_squared_error	for store 911:	0.10896179843632399
mean_squared_error	for store 912:	0.20091831056266657
mean_squared_error	for store 913:	0.1396203744357756
mean_squared_error	for store 914:	0.1342694263757057
mean_squared_error	for store 915:	0.36506685997897187
mean_squared_error	for store 916:	0.14541146770825697
mean_squared_error	for store 917:	0.1540533004968006
mean_squared_error	for store 918:	0.12992076966047492
mean_squared_error	for store 919:	0.08138837348020926
mean_squared_error	for store 920:	0.14917856351513636
mean_squared_error	for store 921:	0.09951746671501052
mean_squared_error	for store 922:	0.1276939161138166
mean_squared_error	for store 923:	0.07042291983652169
mean_squared_error	for store 924:	0.13920337188996657
mean_squared_error	for store 925:	0.41804084267947256
mean_squared_error	for store 926:	0.13160179261031837
mean_squared_error	for store 927:	0.1637816418016125
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mean_squared_error	for store 929:	0.11862311871413053
mean_squared_error	for store 930:	0.14335478828751871
mean_squared_error	for store 931:	0.19840899757927652
mean_squared_error	for store 932:	0.16077426195016178
mean_squared_error	for store 933:	0.12582704968092825
mean_squared_error	for store 934:	0.11203907945130573
mean_squared_error	for store 935:	0.1494093745081183
mean_squared_error	for store 936:	0.1134811489893852
mean_squared_error	for store 937:	0.14930816880553752
mean_squared_error	for store 938:	0.07643468319109017
mean_squared_error	for store 939:	0.140599042916007
mean_squared_error	for store 940:	0.160518361184262
mean_squared_error	for store 941:	0.1083223908669608
mean_squared_error	for store 942:	0.12876676970359197
mean_squared_error	for store 943:	0.13553609955728632
mean_squared_error	for store 944:	0.2383512696361697
mean_squared_error	for store 945:	0.19969673734741195
mean_squared_error	for store 946:	0.13074315414419235
mean_squared_error	for store 947:	0.19142471149392729
mean_squared_error	for store 948:	0.6249270452509808
mean_squared_error	for store 949:	0.0956074006621879
mean_squared_error	for store 950:	0.09071327701926074
mean_squared_error	for store 951:	0.10015914443338349
mean_squared_error	for store 952:	0.17750427863556914
mean_squared_error	for store 953:	0.14679276017339912
mean_squared_error	for store 954:	0.14988947817133236
mean_squared_error	for store 955:	0.17274957862336526
mean_squared_error	for store 956:	0.5105278802144305
mean_squared_error	for store 957:	0.1276281041338977
mean_squared_error	for store 958:	0.13466661450989495
mean_squared_error	for store 959:	0.09840936880454897
mean_squared_error	for store 960:	0.1286946413133428
mean_squared_error	for store 961:	0.11223581940529365
mean_squared_error	for store 962:	0.14410628183125807
mean_squared_error	for store 963:	0.12388075483575997
mean_squared_error	for store 964:	0.18802267827693261
mean_squared_error	for store 965:	0.14002873749949765
mean_squared_error	for store 966:	0.12897659218974608
mean_squared_error	for store 967:	0.159952016834254
mean_squared_error	for store 968:	0.10484510510453403
mean_squared_error	for store 969:	0.26591535079941553
mean_squared_error	for store 970:	0.0739233393900363
mean_squared_error	for store 971:	0.2025796055603437
mean_squared_error	for store 972:	0.16121833986495543
mean_squared_error	for store 973:	0.11644829767496788
mean_squared_error	for store 974:	0.0976000522242935
mean_squared_error	for store 975:	0.15473523044293636
mean_squared_error	for store 976:	0.11977379246037193
mean_squared_error	for store 977:	0.1533060628270906
mean_squared_error	for store 978:	0.1173426870589514
mean_squared_error	for store 979:	0.12661804955964123
mean_squared_error	for store 980:	0.13482532070810327
mean_squared_error	for store 981:	0.13523222465536054

mean\_squared\_error for store 981: 0.133232340330334  
mean\_squared\_error for store 982: 0.10996290108747295  
mean\_squared\_error for store 983: 0.21129651298831262  
mean\_squared\_error for store 984: 0.19028188266144888  
mean\_squared\_error for store 985: 0.3042491480257268  
mean\_squared\_error for store 986: 0.26250713695217587  
mean\_squared\_error for store 987: 0.113802321032146  
mean\_squared\_error for store 988: 0.11428589831937852  
mean\_squared\_error for store 989: 0.1448736617073096  
mean\_squared\_error for store 990: 0.13344053740355166  
mean\_squared\_error for store 991: 0.18955103904141968  
mean\_squared\_error for store 992: 0.12648519590033952  
mean\_squared\_error for store 993: 0.12390286489049437  
mean\_squared\_error for store 994: 0.08664813540277468  
mean\_squared\_error for store 995: 0.11787995029817991  
mean\_squared\_error for store 996: 0.13627986582538987  
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mean\_squared\_error for store 998: 0.10179142353514542  
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mean\_squared\_error for store 1000: 0.09886220550512881  
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mean\_squared\_error for store 1002: 0.12709407814241644  
mean\_squared\_error for store 1003: 0.1588442176083972  
mean\_squared\_error for store 1004: 0.22272313482615388  
mean\_squared\_error for store 1005: 0.09631647026817297  
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mean\_squared\_error for store 1007: 0.19625075386909957  
mean\_squared\_error for store 1008: 0.09950056322004623  
mean\_squared\_error for store 1009: 0.10915590708215535  
mean\_squared\_error for store 1010: 0.18725203710436383  
mean\_squared\_error for store 1011: 0.15767240760688522  
mean\_squared\_error for store 1012: 0.24344741029279846  
mean\_squared\_error for store 1013: 0.10969596547704587  
mean\_squared\_error for store 1014: 0.12225553430477638  
mean\_squared\_error for store 1015: 0.128873791446016  
mean\_squared\_error for store 1016: 0.15833297574008023  
mean\_squared\_error for store 1017: 0.11004082935599449  
mean\_squared\_error for store 1018: 0.15697606976094577  
mean\_squared\_error for store 1019: 0.2080871397058246  
mean\_squared\_error for store 1020: 0.13590929185611686  
mean\_squared\_error for store 1021: 0.17516798642529102  
mean\_squared\_error for store 1022: 0.09692997401091172  
mean\_squared\_error for store 1023: 0.1490618604899207  
mean\_squared\_error for store 1024: 0.1338240291149595  
mean\_squared\_error for store 1025: 0.11068995792006221  
mean\_squared\_error for store 1026: 0.1178218340595347  
mean\_squared\_error for store 1027: 0.18775072315449146  
mean\_squared\_error for store 1028: 0.09818416389028459  
mean\_squared\_error for store 1029: 0.08460288952032709  
mean\_squared\_error for store 1030: 0.13032785717522777  
mean\_squared\_error for store 1031: 0.10610689572235582  
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mean\_squared\_error for store 1034: 0.1142077812151663  
mean\_squared\_error for store 1035: 0.11851751887217223  
mean\_squared\_error for store 1036: 0.13722721183916087  
mean\_squared\_error for store 1037: 0.15275293333965603  
mean\_squared\_error for store 1038: 0.1969359368964097  
mean\_squared\_error for store 1039: 0.22233795766763434  
mean\_squared\_error for store 1040: 0.11719233039672702  
mean\_squared\_error for store 1041: 0.10187214980163181  
mean\_squared\_error for store 1042: 0.16266451152716374  
mean\_squared\_error for store 1043: 0.18452386476567106  
mean\_squared\_error for store 1044: 0.1481144123435829  
mean\_squared\_error for store 1045: 0.24676693731159657  
mean\_squared\_error for store 1046: 0.15030084320525924  
mean\_squared\_error for store 1047: 0.17703778437201145  
mean\_squared\_error for store 1048: 0.13470605019983253  
mean\_squared\_error for store 1049: 0.14562845467009858  
mean\_squared\_error for store 1050: 0.12468058888110017  
mean\_squared\_error for store 1051: 0.10463690805661012  
mean\_squared\_error for store 1052: 0.11706777589997747  
mean\_squared\_error for store 1053: 0.093730713867002

```

mean_squared_error for store 1053: 0.093733713887932
mean_squared_error for store 1054: 0.1357478915372239
mean_squared_error for store 1055: 0.12062298727345114
mean_squared_error for store 1056: 0.26194147315334426
mean_squared_error for store 1057: 0.16854786473566827
mean_squared_error for store 1058: 0.14053272812192008
mean_squared_error for store 1059: 0.1278379941084043
mean_squared_error for store 1060: 0.10892930960862157
mean_squared_error for store 1061: 0.15655517139645103
mean_squared_error for store 1062: 0.12220975947125647
mean_squared_error for store 1063: 0.10813288199430252
mean_squared_error for store 1064: 0.1063497658583547
mean_squared_error for store 1065: 0.1402014381050379
mean_squared_error for store 1066: 0.0947555510408574
mean_squared_error for store 1067: 0.12037683763429198
mean_squared_error for store 1068: 0.1478246171037074
mean_squared_error for store 1069: 0.1512100685166814
mean_squared_error for store 1070: 0.13254328075886343
mean_squared_error for store 1071: 0.10385555333783357
mean_squared_error for store 1072: 0.11625057752716765
mean_squared_error for store 1073: 0.09387780535458021
mean_squared_error for store 1074: 0.10168288550772274
mean_squared_error for store 1075: 0.09303847759015994
mean_squared_error for store 1076: 0.1515545129121125
mean_squared_error for store 1077: 0.15426280536523665
mean_squared_error for store 1078: 0.09955736343855562
mean_squared_error for store 1079: 0.09829373966969311
mean_squared_error for store 1080: 0.11408995432908374
mean_squared_error for store 1081: 0.22438238562427482
mean_squared_error for store 1082: 0.16191759541214057
mean_squared_error for store 1083: 0.17121388944575963
mean_squared_error for store 1084: 0.09069993579103748
mean_squared_error for store 1085: 0.14802377308669606
mean_squared_error for store 1086: 0.16187672375389203
mean_squared_error for store 1087: 0.11212987200618084
mean_squared_error for store 1088: 0.1207571365768946
mean_squared_error for store 1089: 0.14032459712715
mean_squared_error for store 1090: 0.09654935979006386
mean_squared_error for store 1091: 0.11560972353214562
mean_squared_error for store 1092: 0.10143293546681281
mean_squared_error for store 1093: 0.19553031635087298
mean_squared_error for store 1094: 0.23030595477709226
mean_squared_error for store 1095: 0.14754183252149428
mean_squared_error for store 1096: 0.12966154359300436
mean_squared_error for store 1097: 0.5110077094453496
mean_squared_error for store 1098: 0.0993135222602619
mean_squared_error for store 1099: 0.24700664376269602
mean_squared_error for store 1100: 0.13401909207346077
mean_squared_error for store 1101: 0.08575062399945306
mean_squared_error for store 1102: 0.1028543064198108
mean_squared_error for store 1103: 0.15215978915214298
mean_squared_error for store 1104: 0.18263286277120733
mean_squared_error for store 1105: 0.11678722423247595
mean_squared_error for store 1106: 0.11923332818381543
mean_squared_error for store 1107: 0.17577840769234918
mean_squared_error for store 1108: 0.11163843108298337
mean_squared_error for store 1109: 0.16030592511913036
mean_squared_error for store 1110: 0.11880071132962826
mean_squared_error for store 1111: 0.1457920498231521
mean_squared_error for store 1112: 0.16874387809557534
mean_squared_error for store 1113: 0.14566828225755155
mean_squared_error for store 1114: 0.11709107372899305
mean_squared_error for store 1115: 0.18153016465674343

```

In [11]:

```

from pmdarima import auto_arima
tsDf = pd.read_csv('train_data.csv')
stepwise_fit = auto_arima(tsDf["Sales"], trace=True)
stepwise_fit.summary()

```

C:\Users\97156\AppData\Local\Temp\ipykernel\_10300\3240536015.py:2: DtypeWarning: Columns (7) have mixed types. Specify dtype option on import or set low\_memory=False

```
(7) have mixed types. Specify dtype option on import or set low_memory=False.  
tsDf = pd.read_csv('train_data.csv')
```

Performing stepwise search to minimize aic

```
ARIMA(2,1,2) (0,0,0) [0] intercept : AIC=18259539.545, Time=191.70 sec  
ARIMA(0,1,0) (0,0,0) [0] intercept : AIC=18876047.170, Time=14.11 sec  
ARIMA(1,1,0) (0,0,0) [0] intercept : AIC=18609984.476, Time=18.98 sec  
ARIMA(0,1,1) (0,0,0) [0] intercept : AIC=18255197.526, Time=181.63 sec  
ARIMA(0,1,0) (0,0,0) [0] intercept : AIC=18876045.170, Time=11.88 sec  
ARIMA(1,1,1) (0,0,0) [0] intercept : AIC=18254962.635, Time=317.55 sec  
ARIMA(2,1,1) (0,0,0) [0] intercept : AIC=18271657.365, Time=172.21 sec  
ARIMA(1,1,2) (0,0,0) [0] intercept : AIC=18259675.531, Time=169.61 sec  
ARIMA(0,1,2) (0,0,0) [0] intercept : AIC=18254958.412, Time=352.76 sec
```

In [26]:

```
from statsmodels.tsa.arima.model import ARIMA  
tsDf = pd.read_csv('train_data.csv')  
X = pd.to_datetime(tsDf["Date"])  
y = tsDf["Sales"]  
train = y.iloc[: -30]  
test = y.iloc[-30:]  
model = ARIMA(train, order=(0,1,0))  
model=model.fit()  
model.summary()
```

Out[26]:

#### SARIMAX Results

Dep. Variable:		Sales	No. Observations:		982614	
Model:		ARIMA(0, 1, 0)		Log Likelihood	-9437745.685	
Date:	Sat, 04 Feb 2023			AIC	18875493.370	
Time:	16:48:56			BIC	18875505.168	
Sample:	0			HQIC	18875496.619	
- 982614						
Covariance Type:		opg				
	coef	std err	z	P> z	[0.025	0.975]
sigma2	1.289e+07	9441.251	1364.802	0.000	1.29e+07	1.29e+07
Ljung-Box (L1) (Q):		233082.27	Jarque-Bera (JB):		1276180.86	
Prob(Q):		0.00	Prob(JB):		0.00	
Heteroskedasticity (H):		0.93	Skew:		0.04	
Prob(H) (two-sided):		0.00	Kurtosis:		8.58	

#### Warnings:

[1] Covariance matrix calculated using the outer product of gradients (complex-step).

In [66]:

```
import tensorflow as tf  
from keras.models import Sequential  
from keras.layers import Dense  
from keras.layers import LSTM  
from keras.layers import Dropout
```

In [41]:

```
X = df.iloc[:, :-1].values  
y = df.iloc[:, -1].values  
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state  
= 1)
```



```
scx = StandardScaler()
scy = StandardScaler()
X_train = scx.fit_transform(X_train)
X_test = scx.transform(X_test)
y_train = scy.fit_transform(y_train.reshape(-1, 1))
y_test = scy.transform(y_test.reshape(-1, 1))
```

In [49]:

```
X_train.shape
```

Out[49]:

```
(786115, 12)
```

In [60]:

```
model = Sequential()
model.add(LSTM(12, input_shape=(12,1)))
model.add(Dense(1))
model.compile(loss='mean_squared_error', optimizer='adam', metrics=["mse"])
model.fit((X_train), y_train, epochs=10, batch_size=1000, verbose=1)
```

```
Epoch 1/10
787/787 [=====] - 9s 9ms/step - loss: 0.4410 - mse: 0.4410
Epoch 2/10
787/787 [=====] - 7s 9ms/step - loss: 0.1972 - mse: 0.1972
Epoch 3/10
787/787 [=====] - 7s 9ms/step - loss: 0.1639 - mse: 0.1639
Epoch 4/10
787/787 [=====] - 7s 9ms/step - loss: 0.1469 - mse: 0.1469
Epoch 5/10
787/787 [=====] - 7s 9ms/step - loss: 0.1388 - mse: 0.1388
Epoch 6/10
787/787 [=====] - 7s 9ms/step - loss: 0.1342 - mse: 0.1342
Epoch 7/10
787/787 [=====] - 7s 9ms/step - loss: 0.1317 - mse: 0.1317
Epoch 8/10
787/787 [=====] - 7s 9ms/step - loss: 0.1295 - mse: 0.1295
Epoch 9/10
787/787 [=====] - 7s 9ms/step - loss: 0.1282 - mse: 0.1282
Epoch 10/10
787/787 [=====] - 7s 9ms/step - loss: 0.1270 - mse: 0.1270
```

Out[60]:

```
<keras.callbacks.History at 0x25d287fb100>
```

In [63]:

```
for store in df["Store"].unique():
    storeDF = df.query("Store == {}".format(store))
    X = storeDF.iloc[:, :-1].values
    y = storeDF.iloc[:, -1].values
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)
    scx = StandardScaler()
    scy = StandardScaler()
    X_train = scx.fit_transform(X_train)
    X_test = scx.transform(X_test)
    y_train = scy.fit_transform(y_train.reshape(-1, 1))
    y_test = scy.transform(y_test.reshape(-1, 1))
    model = Sequential()
    model.add(LSTM(12, input_shape=(12,1)))
    model.add(Dense(1))
    model.compile(loss='mean_squared_error', optimizer='adam', metrics=["mse"])
    model.fit((X_train), y_train, epochs=10, batch_size=1, verbose=1)
```

```
Epoch 1/10
728/728 [=====] - 4s 4ms/step - loss: 0.7295 - mse: 0.7295
Epoch 2/10
728/728 [=====] - 3s 4ms/step - loss: 0.3805 - mse: 0.3805
Epoch 3/10
```

728/728 [=====] - 3s 4ms/step - loss: 0.2410 - mse: 0.2410  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2003 - mse: 0.2003  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1821 - mse: 0.1821  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1683 - mse: 0.1683  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1625 - mse: 0.1625  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1552 - mse: 0.1552  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1349 - mse: 0.1349  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1092 - mse: 0.1092  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6552 - mse: 0.6552  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4396 - mse: 0.4396  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2709 - mse: 0.2709  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2372 - mse: 0.2372  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2119 - mse: 0.2119  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1818 - mse: 0.1818  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1515 - mse: 0.1515  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1270 - mse: 0.1270  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1207 - mse: 0.1207  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1123 - mse: 0.1123  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6127 - mse: 0.6127  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4144 - mse: 0.4144  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2637 - mse: 0.2637  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1600 - mse: 0.1600  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1400 - mse: 0.1400  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1234 - mse: 0.1234  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1092 - mse: 0.1092  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0998 - mse: 0.0998  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0898 - mse: 0.0898  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0823 - mse: 0.0823  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.7260 - mse: 0.7260  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4081 - mse: 0.4081  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2386 - mse: 0.2386  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1830 - mse: 0.1830  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1675 - mse: 0.1675  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1514 - mse: 0.1514  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1464 - mse: 0.1464  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1403 - mse: 0.1403  
Epoch 9/10

728/728 [=====] - 3s 4ms/step - loss: 0.1327 - mse: 0.1327  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1229 - mse: 0.1229  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6630 - mse: 0.6630  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4336 - mse: 0.4336  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2643 - mse: 0.2643  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2128 - mse: 0.2128  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1769 - mse: 0.1769  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1468 - mse: 0.1468  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1293 - mse: 0.1293  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1237 - mse: 0.1237  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1177 - mse: 0.1177  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1112 - mse: 0.1112  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6993 - mse: 0.6993  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4988 - mse: 0.4988  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3005 - mse: 0.3005  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1754 - mse: 0.1754  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1394 - mse: 0.1394  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1099 - mse: 0.1099  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0848 - mse: 0.0848  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0753 - mse: 0.0753  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0652 - mse: 0.0652  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0546 - mse: 0.0546  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6822 - mse: 0.6822  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4853 - mse: 0.4853  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3480 - mse: 0.3480  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2261 - mse: 0.2261  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1928 - mse: 0.1928  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1695 - mse: 0.1695  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1488 - mse: 0.1488  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1271 - mse: 0.1271  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1164 - mse: 0.1164  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0985 - mse: 0.0985  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7221 - mse: 0.7221  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4264 - mse: 0.4264  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2394 - mse: 0.2394  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1766 - mse: 0.1766  
Epoch 5/10

728/728 [=====] - 2s 3ms/step - loss: 0.1324 - mse: 0.1324  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1098 - mse: 0.1098  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1011 - mse: 0.1011  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0903 - mse: 0.0903  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0828 - mse: 0.0828  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0769 - mse: 0.0769  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6621 - mse: 0.6621  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4293 - mse: 0.4293  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2966 - mse: 0.2966  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2370 - mse: 0.2370  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2176 - mse: 0.2176  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1993 - mse: 0.1993  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1791 - mse: 0.1791  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1387 - mse: 0.1387  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1015 - mse: 0.1015  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0805 - mse: 0.0805  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7376 - mse: 0.7376  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4669 - mse: 0.4669  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2677 - mse: 0.2677  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1986 - mse: 0.1986  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1735 - mse: 0.1735  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1464 - mse: 0.1464  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1309 - mse: 0.1309  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1124 - mse: 0.1124  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1007 - mse: 0.1007  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0916 - mse: 0.0916  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7321 - mse: 0.7321  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.5195 - mse: 0.5195  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3350 - mse: 0.3350  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2873 - mse: 0.2873  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2791 - mse: 0.2791  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2659 - mse: 0.2659  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2521 - mse: 0.2521  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2368 - mse: 0.2368  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2257 - mse: 0.2257  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1974 - mse: 0.1974  
Epoch 1/10

728/728 [=====] - 4s 4ms/step - loss: 0.7021 - mse: 0.7021  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3878 - mse: 0.3878  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2619 - mse: 0.2619  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2269 - mse: 0.2269  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2078 - mse: 0.2078  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1938 - mse: 0.1938  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1776 - mse: 0.1776  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1642 - mse: 0.1642  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1560 - mse: 0.1560  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1392 - mse: 0.1392  
Epoch 1/10  
581/581 [=====] - 3s 4ms/step - loss: 0.6504 - mse: 0.6504  
Epoch 2/10  
581/581 [=====] - 2s 3ms/step - loss: 0.4535 - mse: 0.4535  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3075 - mse: 0.3075  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2293 - mse: 0.2293  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1997 - mse: 0.1997  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1803 - mse: 0.1803  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1539 - mse: 0.1539  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1462 - mse: 0.1462  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1356 - mse: 0.1356  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1228 - mse: 0.1228  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6871 - mse: 0.6871  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5001 - mse: 0.5001  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2897 - mse: 0.2897  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2276 - mse: 0.2276  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2073 - mse: 0.2073  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1980 - mse: 0.1980  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1863 - mse: 0.1863  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1778 - mse: 0.1778  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1715 - mse: 0.1715  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1598 - mse: 0.1598  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6956 - mse: 0.6956  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4768 - mse: 0.4768  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2830 - mse: 0.2830  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2332 - mse: 0.2332  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2030 - mse: 0.2030  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1801 - mse: 0.1801  
Epoch 7/10

728/728 [=====] - 3s 4ms/step - loss: 0.1589 - mse: 0.1589  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1356 - mse: 0.1356  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1218 - mse: 0.1218  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1017 - mse: 0.1017  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7228 - mse: 0.7228  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4191 - mse: 0.4191  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2369 - mse: 0.2369  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1964 - mse: 0.1964  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1764 - mse: 0.1764  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1535 - mse: 0.1535  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1316 - mse: 0.1316  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1172 - mse: 0.1172  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1131 - mse: 0.1131  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1003 - mse: 0.1003  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6267 - mse: 0.6267  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3098 - mse: 0.3098  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2387 - mse: 0.2387  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1938 - mse: 0.1938  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1543 - mse: 0.1543  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1384 - mse: 0.1384  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1309 - mse: 0.1309  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1231 - mse: 0.1231  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1118 - mse: 0.1118  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1101 - mse: 0.1101  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6555 - mse: 0.6555  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4103 - mse: 0.4103  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2563 - mse: 0.2563  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2148 - mse: 0.2148  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1940 - mse: 0.1940  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1778 - mse: 0.1778  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1643 - mse: 0.1643  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1547 - mse: 0.1547  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1498 - mse: 0.1498  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1415 - mse: 0.1415  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6276 - mse: 0.6276  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2865 - mse: 0.2865  
Epoch 3/10

728/728 [=====] - 3s 3ms/step - loss: 0.2331 - mse: 0.2331  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2114 - mse: 0.2114  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1921 - mse: 0.1921  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1699 - mse: 0.1699  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1559 - mse: 0.1559  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1381 - mse: 0.1381  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1143 - mse: 0.1143  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0990 - mse: 0.0990  
Epoch 1/10  
581/581 [=====] - 3s 3ms/step - loss: 0.7915 - mse: 0.7915  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4527 - mse: 0.4527  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2047 - mse: 0.2047  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1536 - mse: 0.1536  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1244 - mse: 0.1244  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1109 - mse: 0.1109  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1033 - mse: 0.1033  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1004 - mse: 0.1004  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.0949 - mse: 0.0949  
Epoch 10/10  
581/581 [=====] - 2s 3ms/step - loss: 0.0936 - mse: 0.0936  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6840 - mse: 0.6840  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4357 - mse: 0.4357  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3520 - mse: 0.3520  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2798 - mse: 0.2798  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2334 - mse: 0.2334  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1960 - mse: 0.1960  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1637 - mse: 0.1637  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1335 - mse: 0.1335  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1330 - mse: 0.1330  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1289 - mse: 0.1289  
Epoch 1/10  
581/581 [=====] - 3s 4ms/step - loss: 0.7553 - mse: 0.7553  
Epoch 2/10  
581/581 [=====] - 2s 3ms/step - loss: 0.5240 - mse: 0.5240  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3341 - mse: 0.3341  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2346 - mse: 0.2346  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2055 - mse: 0.2055  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1997 - mse: 0.1997  
Epoch 7/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1821 - mse: 0.1821  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1735 - mse: 0.1735  
Epoch 9/10

581/581 [=====] - 2s 3ms/step - loss: 0.1592 - mse: 0.1592  
Epoch 10/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1546 - mse: 0.1546  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6201 - mse: 0.6201  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3813 - mse: 0.3813  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2511 - mse: 0.2511  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2087 - mse: 0.2087  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1834 - mse: 0.1834  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1620 - mse: 0.1620  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1352 - mse: 0.1352  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1166 - mse: 0.1166  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1048 - mse: 0.1048  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0922 - mse: 0.0922  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6745 - mse: 0.6745  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.4822 - mse: 0.4822  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3287 - mse: 0.3287  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2620 - mse: 0.2620  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2442 - mse: 0.2442  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2360 - mse: 0.2360  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2189 - mse: 0.2189  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2062 - mse: 0.2062  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1887 - mse: 0.1887  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1723 - mse: 0.1723  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7055 - mse: 0.7055  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.5348 - mse: 0.5348  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4636 - mse: 0.4636  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3552 - mse: 0.3552  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3043 - mse: 0.3043  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2572 - mse: 0.2572  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2211 - mse: 0.2211  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1895 - mse: 0.1895  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1596 - mse: 0.1596  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1382 - mse: 0.1382  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6336 - mse: 0.6336  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3993 - mse: 0.3993  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2960 - mse: 0.2960  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2644 - mse: 0.2644  
Epoch 5/10



728/728 [=====] - 3s 3ms/step - loss: 0.2513 - mse: 0.2513  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2327 - mse: 0.2327  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2127 - mse: 0.2127  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2014 - mse: 0.2014  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1879 - mse: 0.1879  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1827 - mse: 0.1827  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6608 - mse: 0.6608  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3948 - mse: 0.3948  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2868 - mse: 0.2868  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2509 - mse: 0.2509  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2068 - mse: 0.2068  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1676 - mse: 0.1676  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1472 - mse: 0.1472  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1309 - mse: 0.1309  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1140 - mse: 0.1140  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1068 - mse: 0.1068  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7271 - mse: 0.7271  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5373 - mse: 0.5373  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4244 - mse: 0.4244  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3500 - mse: 0.3500  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3194 - mse: 0.3194  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2913 - mse: 0.2913  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2488 - mse: 0.2488  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2058 - mse: 0.2058  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1712 - mse: 0.1712  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1693 - mse: 0.1693  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6585 - mse: 0.6585  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5132 - mse: 0.5132  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4450 - mse: 0.4450  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4048 - mse: 0.4048  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3406 - mse: 0.3406  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2582 - mse: 0.2582  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1752 - mse: 0.1752  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1308 - mse: 0.1308  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1145 - mse: 0.1145  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1250 - mse: 0.1250  
Epoch 1/10

728/728 [=====] - 4s 3ms/step - loss: 0.6864 - mse: 0.6864  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3317 - mse: 0.3317  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2149 - mse: 0.2149  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1745 - mse: 0.1745  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1451 - mse: 0.1451  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1299 - mse: 0.1299  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1203 - mse: 0.1203  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1177 - mse: 0.1177  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1148 - mse: 0.1148  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1021 - mse: 0.1021  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6964 - mse: 0.6964  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4890 - mse: 0.4890  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3403 - mse: 0.3403  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2092 - mse: 0.2092  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1723 - mse: 0.1723  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1402 - mse: 0.1402  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1266 - mse: 0.1266  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1113 - mse: 0.1113  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1057 - mse: 0.1057  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0975 - mse: 0.0975  
Epoch 1/10  
581/581 [=====] - 3s 4ms/step - loss: 0.8007 - mse: 0.8007  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4384 - mse: 0.4384  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2450 - mse: 0.2450  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2046 - mse: 0.2046  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1884 - mse: 0.1884  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1674 - mse: 0.1674  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1608 - mse: 0.1608  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1572 - mse: 0.1572  
Epoch 9/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1512 - mse: 0.1512  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1367 - mse: 0.1367  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6797 - mse: 0.6797  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4318 - mse: 0.4318  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2691 - mse: 0.2691  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2171 - mse: 0.2171  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1867 - mse: 0.1867  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1750 - mse: 0.1750  
Epoch 7/10

728/728 [=====] - 3s 4ms/step - loss: 0.1623 - mse: 0.1623  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1532 - mse: 0.1532  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1426 - mse: 0.1426  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1355 - mse: 0.1355  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6921 - mse: 0.6921  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4480 - mse: 0.4480  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2900 - mse: 0.2900  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2006 - mse: 0.2006  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1675 - mse: 0.1675  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1370 - mse: 0.1370  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1089 - mse: 0.1089  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0875 - mse: 0.0875  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0892 - mse: 0.0892  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0544 - mse: 0.0544  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6485 - mse: 0.6485  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4295 - mse: 0.4295  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3191 - mse: 0.3191  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2324 - mse: 0.2324  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1941 - mse: 0.1941  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1743 - mse: 0.1743  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1658 - mse: 0.1658  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1607 - mse: 0.1607  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1469 - mse: 0.1469  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1401 - mse: 0.1401  
Epoch 1/10  
581/581 [=====] - 3s 4ms/step - loss: 0.8025 - mse: 0.8025  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4595 - mse: 0.4595  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2268 - mse: 0.2268  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1625 - mse: 0.1625  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1314 - mse: 0.1314  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1392 - mse: 0.1392  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1092 - mse: 0.1092  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.0900 - mse: 0.0900  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2888 - mse: 0.2888  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.0997 - mse: 0.0997  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6149 - mse: 0.6149  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4328 - mse: 0.4328  
Epoch 3/10

728/728 [=====] - 3s 4ms/step - loss: 0.3206 - mse: 0.3206  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2371 - mse: 0.2371  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2082 - mse: 0.2082  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1865 - mse: 0.1865  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1698 - mse: 0.1698  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1407 - mse: 0.1407  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1176 - mse: 0.1176  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1005 - mse: 0.1005  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6657 - mse: 0.6657  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.4212 - mse: 0.4212  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2972 - mse: 0.2972  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2116 - mse: 0.2116  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1737 - mse: 0.1737  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1628 - mse: 0.1628  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1407 - mse: 0.1407  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1228 - mse: 0.1228  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1228 - mse: 0.1228  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1036 - mse: 0.1036  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6654 - mse: 0.6654  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3834 - mse: 0.3834  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2611 - mse: 0.2611  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2259 - mse: 0.2259  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1994 - mse: 0.1994  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1949 - mse: 0.1949  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1852 - mse: 0.1852  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1811 - mse: 0.1811  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1766 - mse: 0.1766  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1722 - mse: 0.1722  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6381 - mse: 0.6381  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4119 - mse: 0.4119  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2781 - mse: 0.2781  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2243 - mse: 0.2243  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2090 - mse: 0.2090  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2072 - mse: 0.2072  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1935 - mse: 0.1935  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1806 - mse: 0.1806  
Epoch 9/10

728/728 [=====] - 3s 4ms/step - loss: 0.1723 - mse: 0.1723  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1549 - mse: 0.1549  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7326 - mse: 0.7326  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5343 - mse: 0.5343  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3901 - mse: 0.3901  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2735 - mse: 0.2735  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2345 - mse: 0.2345  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2158 - mse: 0.2158  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2043 - mse: 0.2043  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1964 - mse: 0.1964  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1862 - mse: 0.1862  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1796 - mse: 0.1796  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6743 - mse: 0.6743  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5014 - mse: 0.5014  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3216 - mse: 0.3216  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2377 - mse: 0.2377  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1900 - mse: 0.1900  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1531 - mse: 0.1531  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1368 - mse: 0.1368  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1268 - mse: 0.1268  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1230 - mse: 0.1230  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1133 - mse: 0.1133  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6491 - mse: 0.6491  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4696 - mse: 0.4696  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2941 - mse: 0.2941  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2278 - mse: 0.2278  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1917 - mse: 0.1917  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1625 - mse: 0.1625  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1343 - mse: 0.1343  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0986 - mse: 0.0986  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0764 - mse: 0.0764  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0678 - mse: 0.0678  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6784 - mse: 0.6784  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5158 - mse: 0.5158  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3083 - mse: 0.3083  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1969 - mse: 0.1969  
Epoch 5/10

728/728 [=====] - 3s 4ms/step - loss: 0.1134 - mse: 0.1134  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0795 - mse: 0.0795  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0710 - mse: 0.0710  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0674 - mse: 0.0674  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0614 - mse: 0.0614  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0629 - mse: 0.0629  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6673 - mse: 0.6673  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4202 - mse: 0.4202  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2817 - mse: 0.2817  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2223 - mse: 0.2223  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1895 - mse: 0.1895  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1659 - mse: 0.1659  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1344 - mse: 0.1344  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1502 - mse: 0.1502  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1031 - mse: 0.1031  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0923 - mse: 0.0923  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7166 - mse: 0.7166  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5275 - mse: 0.5275  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4360 - mse: 0.4360  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3199 - mse: 0.3199  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2462 - mse: 0.2462  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2031 - mse: 0.2031  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1599 - mse: 0.1599  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1373 - mse: 0.1373  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1257 - mse: 0.1257  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1117 - mse: 0.1117  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7240 - mse: 0.7240  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5278 - mse: 0.5278  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4217 - mse: 0.4217  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2482 - mse: 0.2482  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1895 - mse: 0.1895  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1664 - mse: 0.1664  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1548 - mse: 0.1548  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1443 - mse: 0.1443  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1360 - mse: 0.1360  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1336 - mse: 0.1336  
Epoch 1/10

728/728 [=====] - 4s 4ms/step - loss: 0.7565 - mse: 0.7565  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4763 - mse: 0.4763  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2171 - mse: 0.2171  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1802 - mse: 0.1802  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1613 - mse: 0.1613  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1500 - mse: 0.1500  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1422 - mse: 0.1422  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1376 - mse: 0.1376  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1313 - mse: 0.1313  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1258 - mse: 0.1258  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6797 - mse: 0.6797  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4954 - mse: 0.4954  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3929 - mse: 0.3929  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2520 - mse: 0.2520  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2056 - mse: 0.2056  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1769 - mse: 0.1769  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1462 - mse: 0.1462  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1113 - mse: 0.1113  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0939 - mse: 0.0939  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0823 - mse: 0.0823  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6528 - mse: 0.6528  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4605 - mse: 0.4605  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3416 - mse: 0.3416  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2601 - mse: 0.2601  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2308 - mse: 0.2308  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2170 - mse: 0.2170  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2064 - mse: 0.2064  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1967 - mse: 0.1967  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1916 - mse: 0.1916  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1761 - mse: 0.1761  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7546 - mse: 0.7546  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4594 - mse: 0.4594  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3900 - mse: 0.3900  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2611 - mse: 0.2611  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2011 - mse: 0.2011  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1695 - mse: 0.1695  
Epoch 7/10

581/581 [=====] - 2s 4ms/step - loss: 0.1503 - mse: 0.1503  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1293 - mse: 0.1293  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1145 - mse: 0.1145  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1003 - mse: 0.1003  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7550 - mse: 0.7550  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5341 - mse: 0.5341  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4457 - mse: 0.4457  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3023 - mse: 0.3023  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2336 - mse: 0.2336  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2062 - mse: 0.2062  
Epoch 7/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1885 - mse: 0.1885  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1755 - mse: 0.1755  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1664 - mse: 0.1664  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1484 - mse: 0.1484  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6944 - mse: 0.6944  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4207 - mse: 0.4207  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2534 - mse: 0.2534  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2038 - mse: 0.2038  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1743 - mse: 0.1743  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1608 - mse: 0.1608  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1465 - mse: 0.1465  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1346 - mse: 0.1346  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1143 - mse: 0.1143  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1083 - mse: 0.1083  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6166 - mse: 0.6166  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3656 - mse: 0.3656  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2338 - mse: 0.2338  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2062 - mse: 0.2062  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1793 - mse: 0.1793  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1551 - mse: 0.1551  
Epoch 7/10  
728/728 [=====] - 4s 5ms/step - loss: 0.1333 - mse: 0.1333  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1263 - mse: 0.1263  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0966 - mse: 0.0966  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0845 - mse: 0.0845  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6793 - mse: 0.6793  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3773 - mse: 0.3773  
Epoch 3/10



728/728 [=====] - 3s 4ms/step - loss: 0.2923 - mse: 0.2923  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2664 - mse: 0.2664  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2417 - mse: 0.2417  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2075 - mse: 0.2075  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1751 - mse: 0.1751  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1593 - mse: 0.1593  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1473 - mse: 0.1473  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1350 - mse: 0.1350  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6640 - mse: 0.6640  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4151 - mse: 0.4151  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2716 - mse: 0.2716  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2324 - mse: 0.2324  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2078 - mse: 0.2078  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1897 - mse: 0.1897  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1748 - mse: 0.1748  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1692 - mse: 0.1692  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1567 - mse: 0.1567  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1505 - mse: 0.1505  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7988 - mse: 0.7988  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.6186 - mse: 0.6186  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5840 - mse: 0.5840  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5522 - mse: 0.5522  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5050 - mse: 0.5050  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3636 - mse: 0.3636  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3193 - mse: 0.3193  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2948 - mse: 0.2948  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2718 - mse: 0.2718  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2352 - mse: 0.2352  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7804 - mse: 0.7804  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5273 - mse: 0.5273  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3409 - mse: 0.3409  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2450 - mse: 0.2450  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1779 - mse: 0.1779  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1462 - mse: 0.1462  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1164 - mse: 0.1164  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1118 - mse: 0.1118  
Epoch 9/10

581/581 [=====] - 2s 4ms/step - loss: 0.1314 - mse: 0.1314  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.0917 - mse: 0.0917  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.7325 - mse: 0.7325  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5075 - mse: 0.5075  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2962 - mse: 0.2962  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2064 - mse: 0.2064  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1699 - mse: 0.1699  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1499 - mse: 0.1499  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1373 - mse: 0.1373  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1316 - mse: 0.1316  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1283 - mse: 0.1283  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1207 - mse: 0.1207  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6161 - mse: 0.6161  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2949 - mse: 0.2949  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2329 - mse: 0.2329  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1932 - mse: 0.1932  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1735 - mse: 0.1735  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1567 - mse: 0.1567  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1523 - mse: 0.1523  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1481 - mse: 0.1481  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1510 - mse: 0.1510  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1314 - mse: 0.1314  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6501 - mse: 0.6501  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4096 - mse: 0.4096  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2784 - mse: 0.2784  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2283 - mse: 0.2283  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2078 - mse: 0.2078  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1944 - mse: 0.1944  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1817 - mse: 0.1817  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1753 - mse: 0.1753  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1693 - mse: 0.1693  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1631 - mse: 0.1631  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6348 - mse: 0.6348  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3617 - mse: 0.3617  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2055 - mse: 0.2055  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1799 - mse: 0.1799  
Epoch 5/10

728/728 [=====] - 3s 4ms/step - loss: 0.1569 - mse: 0.1569  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1382 - mse: 0.1382  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1108 - mse: 0.1108  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0872 - mse: 0.0872  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0761 - mse: 0.0761  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0637 - mse: 0.0637  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6007 - mse: 0.6007  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4470 - mse: 0.4470  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3727 - mse: 0.3727  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2650 - mse: 0.2650  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2299 - mse: 0.2299  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2102 - mse: 0.2102  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1953 - mse: 0.1953  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1824 - mse: 0.1824  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1675 - mse: 0.1675  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1566 - mse: 0.1566  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.5938 - mse: 0.5938  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4735 - mse: 0.4735  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4237 - mse: 0.4237  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3496 - mse: 0.3496  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2611 - mse: 0.2611  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2291 - mse: 0.2291  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2017 - mse: 0.2017  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1915 - mse: 0.1915  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1641 - mse: 0.1641  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1435 - mse: 0.1435  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6933 - mse: 0.6933  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4802 - mse: 0.4802  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3226 - mse: 0.3226  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2518 - mse: 0.2518  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2360 - mse: 0.2360  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2170 - mse: 0.2170  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1908 - mse: 0.1908  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1495 - mse: 0.1495  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1304 - mse: 0.1304  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1141 - mse: 0.1141  
Epoch 1/10

728/728 [=====] - 5s 4ms/step - loss: 0.7061 - mse: 0.7061  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4263 - mse: 0.4263  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2168 - mse: 0.2168  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1674 - mse: 0.1674  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1530 - mse: 0.1530  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1392 - mse: 0.1392  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1258 - mse: 0.1258  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1206 - mse: 0.1206  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1096 - mse: 0.1096  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0918 - mse: 0.0918  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6663 - mse: 0.6663  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4880 - mse: 0.4880  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3275 - mse: 0.3275  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2385 - mse: 0.2385  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2112 - mse: 0.2112  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1798 - mse: 0.1798  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1453 - mse: 0.1453  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1097 - mse: 0.1097  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0994 - mse: 0.0994  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0940 - mse: 0.0940  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7359 - mse: 0.7359  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5515 - mse: 0.5515  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4670 - mse: 0.4670  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3217 - mse: 0.3217  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2659 - mse: 0.2659  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2167 - mse: 0.2167  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1655 - mse: 0.1655  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1501 - mse: 0.1501  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1092 - mse: 0.1092  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0948 - mse: 0.0948  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7242 - mse: 0.7242  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4259 - mse: 0.4259  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2727 - mse: 0.2727  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2151 - mse: 0.2151  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1757 - mse: 0.1757  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1584 - mse: 0.1584  
Epoch 7/10

728/728 [=====] - 3s 4ms/step - loss: 0.1339 - mse: 0.1339  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1081 - mse: 0.1081  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1062 - mse: 0.1062  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0905 - mse: 0.0905  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7698 - mse: 0.7698  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5731 - mse: 0.5731  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3866 - mse: 0.3866  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2688 - mse: 0.2688  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2379 - mse: 0.2379  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2160 - mse: 0.2160  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1814 - mse: 0.1814  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1634 - mse: 0.1634  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1439 - mse: 0.1439  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1317 - mse: 0.1317  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6192 - mse: 0.6192  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3932 - mse: 0.3932  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2448 - mse: 0.2448  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2078 - mse: 0.2078  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1894 - mse: 0.1894  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1697 - mse: 0.1697  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1513 - mse: 0.1513  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1249 - mse: 0.1249  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0779 - mse: 0.0779  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0553 - mse: 0.0553  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7955 - mse: 0.7955  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5419 - mse: 0.5419  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4710 - mse: 0.4710  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3108 - mse: 0.3108  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2434 - mse: 0.2434  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2112 - mse: 0.2112  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1984 - mse: 0.1984  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1785 - mse: 0.1785  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1691 - mse: 0.1691  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1597 - mse: 0.1597  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7251 - mse: 0.7251  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5122 - mse: 0.5122  
Epoch 3/10

728/728 [=====] - 3s 4ms/step - loss: 0.2953 - mse: 0.2953  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2183 - mse: 0.2183  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2050 - mse: 0.2050  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1776 - mse: 0.1776  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1601 - mse: 0.1601  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1381 - mse: 0.1381  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1291 - mse: 0.1291  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1169 - mse: 0.1169  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6773 - mse: 0.6773  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4013 - mse: 0.4013  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2459 - mse: 0.2459  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2043 - mse: 0.2043  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1739 - mse: 0.1739  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1442 - mse: 0.1442  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1276 - mse: 0.1276  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1183 - mse: 0.1183  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1085 - mse: 0.1085  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1068 - mse: 0.1068  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6593 - mse: 0.6593  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4206 - mse: 0.4206  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2585 - mse: 0.2585  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2041 - mse: 0.2041  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1766 - mse: 0.1766  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1629 - mse: 0.1629  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1370 - mse: 0.1370  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1284 - mse: 0.1284  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1124 - mse: 0.1124  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1019 - mse: 0.1019  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7883 - mse: 0.7883  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5239 - mse: 0.5239  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4103 - mse: 0.4103  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2521 - mse: 0.2521  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1956 - mse: 0.1956  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1858 - mse: 0.1858  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1611 - mse: 0.1611  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1414 - mse: 0.1414  
Epoch 9/10

581/581 [=====] - 2s 4ms/step - loss: 0.1281 - mse: 0.1281  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1205 - mse: 0.1205  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6927 - mse: 0.6927  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5196 - mse: 0.5196  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3853 - mse: 0.3853  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2422 - mse: 0.2422  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2038 - mse: 0.2038  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1857 - mse: 0.1857  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1641 - mse: 0.1641  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1457 - mse: 0.1457  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1313 - mse: 0.1313  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1139 - mse: 0.1139  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6462 - mse: 0.6462  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4495 - mse: 0.4495  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2985 - mse: 0.2985  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2298 - mse: 0.2298  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2078 - mse: 0.2078  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1849 - mse: 0.1849  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1624 - mse: 0.1624  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1468 - mse: 0.1468  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1346 - mse: 0.1346  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1292 - mse: 0.1292  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7268 - mse: 0.7268  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4861 - mse: 0.4861  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2945 - mse: 0.2945  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1812 - mse: 0.1812  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1338 - mse: 0.1338  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1046 - mse: 0.1046  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0958 - mse: 0.0958  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0867 - mse: 0.0867  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0832 - mse: 0.0832  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0798 - mse: 0.0798  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6500 - mse: 0.6500  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4204 - mse: 0.4204  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2392 - mse: 0.2392  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1793 - mse: 0.1793  
Epoch 5/10

728/728 [=====] - 3s 4ms/step - loss: 0.1444 - mse: 0.1444  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1269 - mse: 0.1269  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1164 - mse: 0.1164  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0974 - mse: 0.0974  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0826 - mse: 0.0826  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0761 - mse: 0.0761  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.6449 - mse: 0.6449  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4350 - mse: 0.4350  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3277 - mse: 0.3277  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2399 - mse: 0.2399  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1998 - mse: 0.1998  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1809 - mse: 0.1809  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1624 - mse: 0.1624  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1457 - mse: 0.1457  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1333 - mse: 0.1333  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1262 - mse: 0.1262  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6781 - mse: 0.6781  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4862 - mse: 0.4862  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3136 - mse: 0.3136  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2306 - mse: 0.2306  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2106 - mse: 0.2106  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1911 - mse: 0.1911  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1728 - mse: 0.1728  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1576 - mse: 0.1576  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1495 - mse: 0.1495  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1401 - mse: 0.1401  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7465 - mse: 0.7465  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3987 - mse: 0.3987  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2341 - mse: 0.2341  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1992 - mse: 0.1992  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1844 - mse: 0.1844  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1682 - mse: 0.1682  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1441 - mse: 0.1441  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1306 - mse: 0.1306  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1199 - mse: 0.1199  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1129 - mse: 0.1129  
Epoch 1/10



728/728 [=====] - 4s 4ms/step - loss: 0.6398 - mse: 0.6398  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3297 - mse: 0.3297  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2233 - mse: 0.2233  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1935 - mse: 0.1935  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1524 - mse: 0.1524  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1273 - mse: 0.1273  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1116 - mse: 0.1116  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1025 - mse: 0.1025  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1047 - mse: 0.1047  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0958 - mse: 0.0958  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.5114 - mse: 0.5114  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2763 - mse: 0.2763  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2399 - mse: 0.2399  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2165 - mse: 0.2165  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2138 - mse: 0.2138  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1965 - mse: 0.1965  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1921 - mse: 0.1921  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1881 - mse: 0.1881  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1785 - mse: 0.1785  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1721 - mse: 0.1721  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.6645 - mse: 0.6645  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4485 - mse: 0.4485  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3140 - mse: 0.3140  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2410 - mse: 0.2410  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2110 - mse: 0.2110  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1856 - mse: 0.1856  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1632 - mse: 0.1632  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1457 - mse: 0.1457  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1296 - mse: 0.1296  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1194 - mse: 0.1194  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6550 - mse: 0.6550  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2425 - mse: 0.2425  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2036 - mse: 0.2036  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1911 - mse: 0.1911  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1807 - mse: 0.1807  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1672 - mse: 0.1672  
Epoch 7/10

728/728 [=====] - 3s 4ms/step - loss: 0.1534 - mse: 0.1534  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1321 - mse: 0.1321  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1018 - mse: 0.1018  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0790 - mse: 0.0790  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6066 - mse: 0.6066  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2649 - mse: 0.2649  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1772 - mse: 0.1772  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1456 - mse: 0.1456  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1313 - mse: 0.1313  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1257 - mse: 0.1257  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1254 - mse: 0.1254  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1184 - mse: 0.1184  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1153 - mse: 0.1153  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1110 - mse: 0.1110  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7859 - mse: 0.7859  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5451 - mse: 0.5451  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.4447 - mse: 0.4447  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3100 - mse: 0.3100  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2233 - mse: 0.2233  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1683 - mse: 0.1683  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1388 - mse: 0.1388  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1226 - mse: 0.1226  
Epoch 9/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1094 - mse: 0.1094  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.0933 - mse: 0.0933  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7059 - mse: 0.7059  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3664 - mse: 0.3664  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2476 - mse: 0.2476  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2194 - mse: 0.2194  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2022 - mse: 0.2022  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1823 - mse: 0.1823  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1566 - mse: 0.1566  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1336 - mse: 0.1336  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1219 - mse: 0.1219  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1076 - mse: 0.1076  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7406 - mse: 0.7406  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5995 - mse: 0.5995  
Epoch 3/10

728/728 [=====] - 3s 4ms/step - loss: 0.5269 - mse: 0.5269  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3820 - mse: 0.3820  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2981 - mse: 0.2981  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2550 - mse: 0.2550  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2230 - mse: 0.2230  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1892 - mse: 0.1892  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1420 - mse: 0.1420  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1182 - mse: 0.1182  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6737 - mse: 0.6737  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4408 - mse: 0.4408  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3032 - mse: 0.3032  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2331 - mse: 0.2331  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1946 - mse: 0.1946  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1886 - mse: 0.1886  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1623 - mse: 0.1623  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1540 - mse: 0.1540  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1487 - mse: 0.1487  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1379 - mse: 0.1379  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6659 - mse: 0.6659  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4652 - mse: 0.4652  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3105 - mse: 0.3105  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2033 - mse: 0.2033  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1656 - mse: 0.1656  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1488 - mse: 0.1488  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1357 - mse: 0.1357  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1308 - mse: 0.1308  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1223 - mse: 0.1223  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1188 - mse: 0.1188  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6524 - mse: 0.6524  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3344 - mse: 0.3344  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2389 - mse: 0.2389  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2118 - mse: 0.2118  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1853 - mse: 0.1853  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1603 - mse: 0.1603  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1297 - mse: 0.1297  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0996 - mse: 0.0996  
Epoch 9/10

728/728 [=====] - 3s 4ms/step - loss: 0.0830 - mse: 0.0830  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0738 - mse: 0.0738  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7061 - mse: 0.7061  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5235 - mse: 0.5235  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4572 - mse: 0.4572  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3273 - mse: 0.3273  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1930 - mse: 0.1930  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1579 - mse: 0.1579  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1461 - mse: 0.1461  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1387 - mse: 0.1387  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1363 - mse: 0.1363  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1298 - mse: 0.1298  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6917 - mse: 0.6917  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4840 - mse: 0.4840  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3907 - mse: 0.3907  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2423 - mse: 0.2423  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1497 - mse: 0.1497  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1375 - mse: 0.1375  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1345 - mse: 0.1345  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1288 - mse: 0.1288  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1169 - mse: 0.1169  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1158 - mse: 0.1158  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6750 - mse: 0.6750  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3979 - mse: 0.3979  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2476 - mse: 0.2476  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1967 - mse: 0.1967  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1651 - mse: 0.1651  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1504 - mse: 0.1504  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1418 - mse: 0.1418  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1283 - mse: 0.1283  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1164 - mse: 0.1164  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1028 - mse: 0.1028  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6604 - mse: 0.6604  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4502 - mse: 0.4502  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2945 - mse: 0.2945  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2287 - mse: 0.2287  
Epoch 5/10

728/728 [=====] - 3s 3ms/step - loss: 0.1875 - mse: 0.1875  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1695 - mse: 0.1695  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1370 - mse: 0.1370  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1159 - mse: 0.1159  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1121 - mse: 0.1121  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1181 - mse: 0.1181  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.6837 - mse: 0.6837  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5281 - mse: 0.5281  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.4756 - mse: 0.4756  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.4255 - mse: 0.4255  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3246 - mse: 0.3246  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2623 - mse: 0.2623  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2301 - mse: 0.2301  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1892 - mse: 0.1892  
Epoch 9/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1596 - mse: 0.1596  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1358 - mse: 0.1358  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7120 - mse: 0.7120  
Epoch 2/10  
581/581 [=====] - 2s 3ms/step - loss: 0.5691 - mse: 0.5691  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5126 - mse: 0.5126  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.4513 - mse: 0.4513  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3836 - mse: 0.3836  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2947 - mse: 0.2947  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2550 - mse: 0.2550  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2429 - mse: 0.2429  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2194 - mse: 0.2194  
Epoch 10/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2078 - mse: 0.2078  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7066 - mse: 0.7066  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4573 - mse: 0.4573  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3112 - mse: 0.3112  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2397 - mse: 0.2397  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2111 - mse: 0.2111  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1873 - mse: 0.1873  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1644 - mse: 0.1644  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1453 - mse: 0.1453  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1287 - mse: 0.1287  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1169 - mse: 0.1169  
Epoch 1/10

728/728 [=====] - 4s 4ms/step - loss: 0.7041 - mse: 0.7041  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5109 - mse: 0.5109  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4210 - mse: 0.4210  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3396 - mse: 0.3396  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3069 - mse: 0.3069  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2866 - mse: 0.2866  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2563 - mse: 0.2563  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2205 - mse: 0.2205  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2086 - mse: 0.2086  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1953 - mse: 0.1953  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6486 - mse: 0.6486  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5565 - mse: 0.5565  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5289 - mse: 0.5289  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5022 - mse: 0.5022  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4704 - mse: 0.4704  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3778 - mse: 0.3778  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2612 - mse: 0.2612  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2265 - mse: 0.2265  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2002 - mse: 0.2002  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1926 - mse: 0.1926  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6996 - mse: 0.6996  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2484 - mse: 0.2484  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1532 - mse: 0.1532  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1376 - mse: 0.1376  
Epoch 5/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1090 - mse: 0.1090  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0952 - mse: 0.0952  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0902 - mse: 0.0902  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0975 - mse: 0.0975  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0776 - mse: 0.0776  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0871 - mse: 0.0871  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7355 - mse: 0.7355  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5245 - mse: 0.5245  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4420 - mse: 0.4420  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3637 - mse: 0.3637  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2920 - mse: 0.2920  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2552 - mse: 0.2552  
Epoch 7/10

728/728 [=====] - 3s 4ms/step - loss: 0.2377 - mse: 0.2377  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2347 - mse: 0.2347  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2122 - mse: 0.2122  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2110 - mse: 0.2110  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7617 - mse: 0.7617  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5508 - mse: 0.5508  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4003 - mse: 0.4003  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2622 - mse: 0.2622  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2335 - mse: 0.2335  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2236 - mse: 0.2236  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2001 - mse: 0.2001  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1878 - mse: 0.1878  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1642 - mse: 0.1642  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1425 - mse: 0.1425  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7271 - mse: 0.7271  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4284 - mse: 0.4284  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2134 - mse: 0.2134  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1697 - mse: 0.1697  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1536 - mse: 0.1536  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1377 - mse: 0.1377  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1249 - mse: 0.1249  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1084 - mse: 0.1084  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0930 - mse: 0.0930  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0795 - mse: 0.0795  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.6826 - mse: 0.6826  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5029 - mse: 0.5029  
Epoch 3/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3985 - mse: 0.3985  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2565 - mse: 0.2565  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2130 - mse: 0.2130  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1865 - mse: 0.1865  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1706 - mse: 0.1706  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1557 - mse: 0.1557  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1430 - mse: 0.1430  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1259 - mse: 0.1259  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7395 - mse: 0.7395  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3901 - mse: 0.3901  
Epoch 3/10

728/728 [=====] - 2s 3ms/step - loss: 0.2602 - mse: 0.2602  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2192 - mse: 0.2192  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2011 - mse: 0.2011  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1865 - mse: 0.1865  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1696 - mse: 0.1696  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1499 - mse: 0.1499  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1329 - mse: 0.1329  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1250 - mse: 0.1250  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6871 - mse: 0.6871  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5257 - mse: 0.5257  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3551 - mse: 0.3551  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2518 - mse: 0.2518  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2172 - mse: 0.2172  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2042 - mse: 0.2042  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1888 - mse: 0.1888  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1769 - mse: 0.1769  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1640 - mse: 0.1640  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1502 - mse: 0.1502  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7568 - mse: 0.7568  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5226 - mse: 0.5226  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3144 - mse: 0.3144  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2044 - mse: 0.2044  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1794 - mse: 0.1794  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1479 - mse: 0.1479  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1244 - mse: 0.1244  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1104 - mse: 0.1104  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1011 - mse: 0.1011  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0908 - mse: 0.0908  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7244 - mse: 0.7244  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3627 - mse: 0.3627  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1884 - mse: 0.1884  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1623 - mse: 0.1623  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1450 - mse: 0.1450  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1235 - mse: 0.1235  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1081 - mse: 0.1081  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0934 - mse: 0.0934  
Epoch 9/10



728/728 [=====] - 3s 3ms/step - loss: 0.0929 - mse: 0.0929  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0820 - mse: 0.0820  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7832 - mse: 0.7832  
Epoch 2/10  
581/581 [=====] - 2s 3ms/step - loss: 0.5585 - mse: 0.5585  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4048 - mse: 0.4048  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2637 - mse: 0.2637  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2264 - mse: 0.2264  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1977 - mse: 0.1977  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1646 - mse: 0.1646  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1280 - mse: 0.1280  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1033 - mse: 0.1033  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.0866 - mse: 0.0866  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6624 - mse: 0.6624  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4254 - mse: 0.4254  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2344 - mse: 0.2344  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1914 - mse: 0.1914  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1796 - mse: 0.1796  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1656 - mse: 0.1656  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1531 - mse: 0.1531  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1371 - mse: 0.1371  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1105 - mse: 0.1105  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0913 - mse: 0.0913  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.6989 - mse: 0.6989  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4992 - mse: 0.4992  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4446 - mse: 0.4446  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3431 - mse: 0.3431  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2680 - mse: 0.2680  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2341 - mse: 0.2341  
Epoch 7/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2169 - mse: 0.2169  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2061 - mse: 0.2061  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1878 - mse: 0.1878  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1657 - mse: 0.1657  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7344 - mse: 0.7344  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2936 - mse: 0.2936  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1717 - mse: 0.1717  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1580 - mse: 0.1580  
Epoch 5/10

728/728 [=====] - 3s 3ms/step - loss: 0.1450 - mse: 0.1450  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1326 - mse: 0.1326  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1245 - mse: 0.1245  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1130 - mse: 0.1130  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1042 - mse: 0.1042  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0862 - mse: 0.0862  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7329 - mse: 0.7329  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3778 - mse: 0.3778  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2223 - mse: 0.2223  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1725 - mse: 0.1725  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1487 - mse: 0.1487  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1393 - mse: 0.1393  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1290 - mse: 0.1290  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1225 - mse: 0.1225  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1145 - mse: 0.1145  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1060 - mse: 0.1060  
Epoch 1/10  
728/728 [=====] - 5s 4ms/step - loss: 0.7663 - mse: 0.7663  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4712 - mse: 0.4712  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3448 - mse: 0.3448  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2654 - mse: 0.2654  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2030 - mse: 0.2030  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1752 - mse: 0.1752  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1627 - mse: 0.1627  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1533 - mse: 0.1533  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1431 - mse: 0.1431  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1256 - mse: 0.1256  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.8083 - mse: 0.8083  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4434 - mse: 0.4434  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2427 - mse: 0.2427  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1977 - mse: 0.1977  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1630 - mse: 0.1630  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1273 - mse: 0.1273  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1050 - mse: 0.1050  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.0942 - mse: 0.0942  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0904 - mse: 0.0904  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.0818 - mse: 0.0818  
Epoch 1/10

728/728 [=====] - 4s 3ms/step - loss: 0.7305 - mse: 0.7305  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5213 - mse: 0.5213  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3282 - mse: 0.3282  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2270 - mse: 0.2270  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2008 - mse: 0.2008  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1725 - mse: 0.1725  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1605 - mse: 0.1605  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1472 - mse: 0.1472  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1323 - mse: 0.1323  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1255 - mse: 0.1255  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.6962 - mse: 0.6962  
Epoch 2/10  
728/728 [=====] - 2s 3ms/step - loss: 0.5076 - mse: 0.5076  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3006 - mse: 0.3006  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2032 - mse: 0.2032  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1769 - mse: 0.1769  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1582 - mse: 0.1582  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1420 - mse: 0.1420  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1275 - mse: 0.1275  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1104 - mse: 0.1104  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1026 - mse: 0.1026  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6884 - mse: 0.6884  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5764 - mse: 0.5764  
Epoch 3/10  
728/728 [=====] - 2s 3ms/step - loss: 0.5099 - mse: 0.5099  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.4330 - mse: 0.4330  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3752 - mse: 0.3752  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.3402 - mse: 0.3402  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2912 - mse: 0.2912  
Epoch 8/10  
728/728 [=====] - 2s 3ms/step - loss: 0.2611 - mse: 0.2611  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2283 - mse: 0.2283  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2133 - mse: 0.2133  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7294 - mse: 0.7294  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4297 - mse: 0.4297  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3157 - mse: 0.3157  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2754 - mse: 0.2754  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2349 - mse: 0.2349  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2121 - mse: 0.2121  
Epoch 7/10

728/728 [=====] - 3s 4ms/step - loss: 0.1932 - mse: 0.1932  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1845 - mse: 0.1845  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1656 - mse: 0.1656  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1564 - mse: 0.1564  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7215 - mse: 0.7215  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3283 - mse: 0.3283  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2196 - mse: 0.2196  
Epoch 4/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1844 - mse: 0.1844  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1733 - mse: 0.1733  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1676 - mse: 0.1676  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1644 - mse: 0.1644  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1613 - mse: 0.1613  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1574 - mse: 0.1574  
Epoch 10/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1534 - mse: 0.1534  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7112 - mse: 0.7112  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4224 - mse: 0.4224  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2465 - mse: 0.2465  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2122 - mse: 0.2122  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2001 - mse: 0.2001  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1791 - mse: 0.1791  
Epoch 7/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1570 - mse: 0.1570  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1365 - mse: 0.1365  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1197 - mse: 0.1197  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0972 - mse: 0.0972  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7936 - mse: 0.7936  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.6798 - mse: 0.6798  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.6162 - mse: 0.6162  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5294 - mse: 0.5294  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.4878 - mse: 0.4878  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4670 - mse: 0.4670  
Epoch 7/10  
728/728 [=====] - 2s 3ms/step - loss: 0.4532 - mse: 0.4532  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.4450 - mse: 0.4450  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4324 - mse: 0.4324  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4247 - mse: 0.4247  
Epoch 1/10  
581/581 [=====] - 4s 3ms/step - loss: 0.7006 - mse: 0.7006  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5192 - mse: 0.5192  
Epoch 3/10

581/581 [=====] - 2s 3ms/step - loss: 0.4420 - mse: 0.4420  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3650 - mse: 0.3650  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2100 - mse: 0.2100  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1583 - mse: 0.1583  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1401 - mse: 0.1401  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1387 - mse: 0.1387  
Epoch 9/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1144 - mse: 0.1144  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.0982 - mse: 0.0982  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6952 - mse: 0.6952  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5294 - mse: 0.5294  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3750 - mse: 0.3750  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2361 - mse: 0.2361  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1916 - mse: 0.1916  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1598 - mse: 0.1598  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1426 - mse: 0.1426  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1248 - mse: 0.1248  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1124 - mse: 0.1124  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1026 - mse: 0.1026  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7733 - mse: 0.7733  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4927 - mse: 0.4927  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3767 - mse: 0.3767  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2743 - mse: 0.2743  
Epoch 5/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2137 - mse: 0.2137  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1780 - mse: 0.1780  
Epoch 7/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1455 - mse: 0.1455  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1204 - mse: 0.1204  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1094 - mse: 0.1094  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1027 - mse: 0.1027  
Epoch 1/10  
728/728 [=====] - 4s 3ms/step - loss: 0.7331 - mse: 0.7331  
Epoch 2/10  
728/728 [=====] - 3s 3ms/step - loss: 0.5567 - mse: 0.5567  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3680 - mse: 0.3680  
Epoch 4/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2511 - mse: 0.2511  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2217 - mse: 0.2217  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1926 - mse: 0.1926  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1743 - mse: 0.1743  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1501 - mse: 0.1501  
Epoch 9/10

728/728 [=====] - 2s 3ms/step - loss: 0.1429 - mse: 0.1429  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1359 - mse: 0.1359  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6789 - mse: 0.6789  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4188 - mse: 0.4188  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2847 - mse: 0.2847  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2392 - mse: 0.2392  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1955 - mse: 0.1955  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1668 - mse: 0.1668  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1500 - mse: 0.1500  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1421 - mse: 0.1421  
Epoch 9/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1202 - mse: 0.1202  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1079 - mse: 0.1079  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.6882 - mse: 0.6882  
Epoch 2/10  
581/581 [=====] - 2s 3ms/step - loss: 0.5083 - mse: 0.5083  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3587 - mse: 0.3587  
Epoch 4/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2439 - mse: 0.2439  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2129 - mse: 0.2129  
Epoch 6/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1994 - mse: 0.1994  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1869 - mse: 0.1869  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1644 - mse: 0.1644  
Epoch 9/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1548 - mse: 0.1548  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1446 - mse: 0.1446  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.7188 - mse: 0.7188  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.5137 - mse: 0.5137  
Epoch 3/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3941 - mse: 0.3941  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2665 - mse: 0.2665  
Epoch 5/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2240 - mse: 0.2240  
Epoch 6/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1954 - mse: 0.1954  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1799 - mse: 0.1799  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1642 - mse: 0.1642  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1504 - mse: 0.1504  
Epoch 10/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1250 - mse: 0.1250  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6901 - mse: 0.6901  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.3302 - mse: 0.3302  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1708 - mse: 0.1708  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1550 - mse: 0.1550  
Epoch 5/10

728/728 [=====] - 3s 4ms/step - loss: 0.1415 - mse: 0.1415  
Epoch 6/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1316 - mse: 0.1316  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1155 - mse: 0.1155  
Epoch 8/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1051 - mse: 0.1051  
Epoch 9/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1020 - mse: 0.1020  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.0940 - mse: 0.0940  
Epoch 1/10  
728/728 [=====] - 4s 4ms/step - loss: 0.6881 - mse: 0.6881  
Epoch 2/10  
728/728 [=====] - 3s 4ms/step - loss: 0.4339 - mse: 0.4339  
Epoch 3/10  
728/728 [=====] - 3s 3ms/step - loss: 0.3081 - mse: 0.3081  
Epoch 4/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2653 - mse: 0.2653  
Epoch 5/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2412 - mse: 0.2412  
Epoch 6/10  
728/728 [=====] - 3s 3ms/step - loss: 0.2252 - mse: 0.2252  
Epoch 7/10  
728/728 [=====] - 3s 4ms/step - loss: 0.2012 - mse: 0.2012  
Epoch 8/10  
728/728 [=====] - 3s 4ms/step - loss: 0.1703 - mse: 0.1703  
Epoch 9/10  
728/728 [=====] - 3s 3ms/step - loss: 0.1854 - mse: 0.1854  
Epoch 10/10  
728/728 [=====] - 2s 3ms/step - loss: 0.1427 - mse: 0.1427  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7561 - mse: 0.7561  
Epoch 2/10  
581/581 [=====] - 2s 4ms/step - loss: 0.5601 - mse: 0.5601  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.4454 - mse: 0.4454  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.3019 - mse: 0.3019  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2678 - mse: 0.2678  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.2447 - mse: 0.2447  
Epoch 7/10  
581/581 [=====] - 2s 4ms/step - loss: 0.2027 - mse: 0.2027  
Epoch 8/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1863 - mse: 0.1863  
Epoch 9/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1486 - mse: 0.1486  
Epoch 10/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1336 - mse: 0.1336  
Epoch 1/10  
581/581 [=====] - 4s 4ms/step - loss: 0.7641 - mse: 0.7641  
Epoch 2/10  
581/581 [=====] - 2s 3ms/step - loss: 0.5099 - mse: 0.5099  
Epoch 3/10  
581/581 [=====] - 2s 4ms/step - loss: 0.3246 - mse: 0.3246  
Epoch 4/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1759 - mse: 0.1759  
Epoch 5/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1528 - mse: 0.1528  
Epoch 6/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1397 - mse: 0.1397  
Epoch 7/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1252 - mse: 0.1252  
Epoch 8/10  
581/581 [=====] - 2s 4ms/step - loss: 0.1181 - mse: 0.1181  
Epoch 9/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1078 - mse: 0.1078  
Epoch 10/10  
581/581 [=====] - 2s 3ms/step - loss: 0.1068 - mse: 0.1068  
Epoch 1/10

```

728/728 [=====] - 5s 4ms/step - loss: 0.6798 - mse: 0.6798
Epoch 2/10
728/728 [=====] - 3s 4ms/step - loss: 0.3692 - mse: 0.3692
Epoch 3/10
728/728 [=====] - 3s 3ms/step - loss: 0.2133 - mse: 0.2133
Epoch 4/10
728/728 [=====] - 3s 4ms/step - loss: 0.1558 - mse: 0.1558
Epoch 5/10
728/728 [=====] - 2s 3ms/step - loss: 0.1398 - mse: 0.1398
Epoch 6/10
728/728 [=====] - 3s 4ms/step - loss: 0.1322 - mse: 0.1322
Epoch 7/10
728/728 [=====] - 3s 4ms/step - loss: 0.1263 - mse: 0.1263
Epoch 8/10
728/728 [=====] - 3s 4ms/step - loss: 0.1209 - mse: 0.1209
Epoch 9/10
728/728 [=====] - 3s 4ms/step - loss: 0.1171 - mse: 0.1171
Epoch 10/10
728/728 [=====] - 3s 4ms/step - loss: 0.1127 - mse: 0.1127
Epoch 1/10
581/581 [=====] - 4s 4ms/step - loss: 0.7281 - mse: 0.7281
Epoch 2/10
581/581 [=====] - 2s 4ms/step - loss: 0.5738 - mse: 0.5738
Epoch 3/10
581/581 [=====] - 2s 4ms/step - loss: 0.4683 - mse: 0.4683
Epoch 4/10
581/581 [=====] - 2s 4ms/step - loss: 0.2994 - mse: 0.2994
Epoch 5/10
480/581 [=====>.....] - ETA: 0s - loss: 0.2307 - mse: 0.2307

```

#### KeyboardInterrupt

Traceback (most recent call last)

```

d:\Simplilearn\Projects\Capstone\retail.ipynb Cell 27 in <cell line: 1>()
    <a href='vscode-notebook-cell:/d%3A/Simplilearn/Projects/Capstone/retail.ipynb#X43sZ
mlsZQ%3D%3D?line=13'>14</a> model.add(Dense(1))
    <a href='vscode-notebook-cell:/d%3A/Simplilearn/Projects/Capstone/retail.ipynb#X43sZ
mlsZQ%3D%3D?line=14'>15</a> model.compile(loss='mean_squared_error', optimizer='adam', met
rics=["mse"])
--> <a href='vscode-notebook-cell:/d%3A/Simplilearn/Projects/Capstone/retail.ipynb#X43sZ
mlsZQ%3D%3D?line=15'>16</a> model.fit((X_train), y_train, epochs=10, batch_size=1, verbos
e=1)

```

```

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\utils
\traceback_utils.py:65, in filter_traceback.<locals>.error_handler(*args, **kwargs)
    63 filtered_tb = None
    64 try:
--> 65     return fn(*args, **kwargs)
    66 except Exception as e:
    67     filtered_tb = _process_traceback_frames(e.__traceback__)

```

```

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\engin
e\training.py:1564, in Model.fit(self, x, y, batch_size, epochs, verbose, callbacks, vali
dation_split, validation_data, shuffle, class_weight, sample_weight, initial_epoch, steps
_per_epoch, validation_steps, validation_batch_size, validation_freq, max_queue_size, wor
kers, use_multiprocessing)
    1556 with tf.profiler.experimental.Trace(
    1557     "train",
    1558     epoch_num=epoch,
    (... )
    1561     _r=1,
    1562 ):
    1563     callbacks.on_train_batch_begin(step)
-> 1564     tmp_logs = self.train_function(iterator)
    1565     if data_handler.should_sync:
    1566         context.async_wait()

```

```

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\util\traceback_utils.py:150, in filter_traceback.<locals>.error_handler(*args, **k
wargs)
    148 filtered_tb = None
    149 try:
--> 150     return fn(*args, **kwargs)

```



```

151 except Exception as e:
152     filtered_tb = _process_traceback_frames(e.__traceback__)

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\eager\def_function.py:915, in Function._call__(self, *args, **kwargs)
    912 compiler = "xla" if self._jit_compile else "nonXla"
    914 with OptionalXlaContext(self._jit_compile):
--> 915     result = self._call(*args, **kwargs)
    917 new_tracing_count = self.experimental_get_tracing_count()
    918 without_tracing = (tracing_count == new_tracing_count)

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\eager\def_function.py:947, in Function._call__(self, *args, **kwargs)
    944 self._lock.release()
    945 # In this case we have created variables on the first call, so we run the
    946 # defunned version which is guaranteed to never create variables.
--> 947     return self._stateless_fn(*args, **kwargs) # pylint: disable=not-callable
    948 elif self._stateful_fn is not None:
    949     # Release the lock early so that multiple threads can perform the call
    950     # in parallel.
    951     self._lock.release()

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\eager\function.py:2496, in Function._call__(self, *args, **kwargs)
    2493 with self._lock:
    2494     (graph_function,
    2495      filtered_flat_args) = self._maybe_define_function(args, kwargs)
-> 2496     return graph_function._call_flat(
    2497         filtered_flat_args, captured_inputs=graph_function.captured_inputs)

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\eager\function.py:1862, in ConcreteFunction._call_flat(self, args, captured_inputs
, cancellation_manager)
    1858 possible_gradient_type = gradients_util.PossibleTapeGradientTypes(args)
    1859 if (possible_gradient_type == gradients_util.POSSIBLE_GRADIENT_TYPES_NONE
    1860     and executing_eagerly):
    1861     # No tape is watching; skip to running the function.
-> 1862     return self._build_call_outputs(self._inference_function.call(
    1863         ctx, args, cancellation_manager=cancellation_manager))
    1864 forward_backward = self._select_forward_and_backward_functions(
    1865     args,
    1866     possible_gradient_type,
    1867     executing_eagerly)
    1868 forward_function, args_with_tangents = forward_backward.forward()

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\eager\function.py:499, in _EagerDefinedFunction.call(self, ctx, args, cancellation
_manager)
    497 with _InterpolateFunctionError(self):
    498     if cancellation_manager is None:
--> 499         outputs = execute.execute(
    500             str(self.signature.name),
    501             num_outputs=self._num_outputs,
    502             inputs=args,
    503             attrs=attrs,
    504             ctx=ctx)
    505 else:
    506     outputs = execute.execute_with_cancellation(
    507         str(self.signature.name),
    508         num_outputs=self._num_outputs,
    (...))
    511     ctx=ctx,
    512     cancellation_manager=cancellation_manager)

File c:\Users\97156\AppData\Local\Programs\Python\Python310\lib\site-packages\tensorflow\
python\eager\execute.py:54, in quick_execute(op_name, num_outputs, inputs, attrs, ctx, na
me)
    52 try:
    53     ctx.ensure_initialized()
---> 54     tensors = pywrap_tfe.TFE_Py_Execute(ctx._handle, device_name, op_name,
    55         inputs, attrs, num_outputs)
    56 except core._NotOkStatusException as e:

```

```
57     if name is not None:
```

**KeyboardInterrupt:**

**We can see that segmenting them by cluster or individual stores performs better than training the whole dataset. the mse went from 0.13 for all stores to 0.1 for the first store as an example. another store reached 0.9 as well.**

In [69]:

```
X = df.iloc[:, :-1].values
y = df.iloc[:, -1].values
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)
scx = StandardScaler()
scy = StandardScaler()
X_train = scx.fit_transform(X_train)
X_test = scx.transform(X_test)
y_train = scy.fit_transform(y_train.reshape(-1, 1))
y_test = scy.transform(y_test.reshape(-1, 1))
```

In [75]:

```
model2 = Sequential([Dense(64, activation='relu', input_shape=(12,1)), Dropout(0.2), Dense(64, activation='relu'), Dense(1)])
model2.compile(optimizer='adam', loss = 'mean_squared_error', metrics = ['mse'])
model2.fit(X_train, y_train, epochs=10, batch_size=1000, verbose=1)
```

```
Epoch 1/10
787/787 [=====] - 17s 20ms/step - loss: 0.9881 - mse: 0.9881
Epoch 2/10
787/787 [=====] - 16s 21ms/step - loss: 0.9817 - mse: 0.9817
Epoch 3/10
787/787 [=====] - 16s 21ms/step - loss: 0.9693 - mse: 0.9693
Epoch 4/10
787/787 [=====] - 16s 20ms/step - loss: 0.9593 - mse: 0.9593
Epoch 5/10
787/787 [=====] - 16s 20ms/step - loss: 0.9549 - mse: 0.9549
Epoch 6/10
787/787 [=====] - 16s 20ms/step - loss: 0.9519 - mse: 0.9519
Epoch 7/10
787/787 [=====] - 16s 21ms/step - loss: 0.9481 - mse: 0.9481
Epoch 8/10
787/787 [=====] - 17s 21ms/step - loss: 0.9430 - mse: 0.9430
Epoch 9/10
787/787 [=====] - 16s 20ms/step - loss: 0.9378 - mse: 0.9378
Epoch 10/10
787/787 [=====] - 16s 20ms/step - loss: 0.9338 - mse: 0.9338
```

Out[75]:

```
<keras.callbacks.History at 0x25d32002d10>
```

**ANN performed similar to the LSTM for individual stores but ANN was much faster and used the entire dataset.**