# Predicting Rider Count

## Loading Python Libraries

In [1]:

```
!pip install ucimlrepo
!pip install lazypredict
```

```
Requirement already satisfied: ucimlrepo in /usr/local/lib/python3.10/dist-
packages (0.0.3)
Requirement already satisfied: lazypredict in /usr/local/lib/python3.10/dis
t-packages (0.2.12)
Requirement already satisfied: click in /usr/local/lib/python3.10/dist-pack
ages (from lazypredict) (8.1.7)
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/di
st-packages (from lazypredict) (1.2.2)
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-pac
kages (from lazypredict) (1.5.3)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packa
ges (from lazypredict) (4.66.1)
Requirement already satisfied: joblib in /usr/local/lib/python3.10/dist-pac
kages (from lazypredict) (1.3.2)
Requirement already satisfied: lightgbm in /usr/local/lib/python3.10/dist-p
ackages (from lazypredict) (4.1.0)
Requirement already satisfied: xgboost in /usr/local/lib/python3.10/dist-pa
ckages (from lazypredict) (2.0.3)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-pack
ages (from lightgbm->lazypredict) (1.23.5)
Requirement already satisfied: scipy in /usr/local/lib/python3.10/dist-pack
ages (from lightgbm->lazypredict) (1.11.4)
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/pyt
hon3.10/dist-packages (from pandas->lazypredict) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/di
st-packages (from pandas->lazypredict) (2023.4)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/pytho
n3.10/dist-packages (from scikit-learn->lazypredict) (3.2.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-p
ackages (from python-dateutil>=2.8.1->pandas->lazypredict) (1.16.0)
```

In [2]:

```
# Let's import the required python packages
import numpy as np
import pandas as pd
import seaborn as sns
import missingno as msno
import plotly.express as px
import plotly.graph_objs as go
import matplotlib.pyplot as plt
from xgboost import XGBRegressor
from ucimlrepo import fetch_ucirepo
from sklearn.metrics import r2_score
from wordcloud import WordCloud, STOPWORDS
from sklearn.preprocessing import MinMaxScaler
from lazypredict.Supervised import LazyRegressor
from sklearn.model_selection import train_test_split

%matplotlib inline
# plt.style.use('seaborn-dark')
plt.style.context('grayscale')
```

Out[2]:

```
<contextlib._GeneratorContextManager at 0x78e38c5b7880>
```

## Importing the Data

In [3]:

```
# Let's fetch the bike sharing dataset into a data_frame
bike_sharing_dataset = fetch_ucirepo(id=275)

X = bike_sharing_dataset.data.features
y = bike_sharing_dataset.data.targets

bike_sharing_df = pd.concat([X, y], axis=1)

# Let's take a quick look at the shape of the dataframe
print("Bike Rentals data shape -->", bike_sharing_df.shape)
print()

# Let's take a brief look at the contents of the dataframe
bike_sharing_df.head().style.background_gradient()
```

```
Bike Rentals data shape --> (17379, 14)
```

Out[3]:

| | dteday | season | yr | mnth | hr | holiday | weekday | workingday | weathersit | temp |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 2011-01-01 | 1 | 0 | 1 | 0 | 0 | 6 | 0 | 1 | 0.240000 |
| **1** | 2011-01-01 | 1 | 0 | 1 | 1 | 0 | 6 | 0 | 1 | 0.220000 |
| **2** | 2011-01-01 | 1 | 0 | 1 | 2 | 0 | 6 | 0 | 1 | 0.220000 |
| **3** | 2011-01-01 | 1 | 0 | 1 | 3 | 0 | 6 | 0 | 1 | 0.240000 |
| **4** | 2011-01-01 | 1 | 0 | 1 | 4 | 0 | 6 | 0 | 1 | 0.240000 |

## Gaining Insights from Data

In [4]:

```
# Let's obtain a brief overview of the dataframe
bike_sharing_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 17379 entries, 0 to 17378
Data columns (total 14 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   dteday      17379 non-null  object 
 1   season      17379 non-null  int64  
 2   yr          17379 non-null  int64  
 3   mnth        17379 non-null  int64  
 4   hr          17379 non-null  int64  
 5   holiday     17379 non-null  int64  
 6   weekday     17379 non-null  int64  
 7   workingday  17379 non-null  int64  
 8   weathersit  17379 non-null  int64  
 9   temp        17379 non-null  float64
 10  atemp       17379 non-null  float64
 11  hum         17379 non-null  float64
 12  windspeed   17379 non-null  float64
 13  cnt         17379 non-null  int64  
dtypes: float64(4), int64(9), object(1)
memory usage: 1.9+ MB
```

In [5]:

```
# Let's see descriptive statistics for all numeric columns
bike_sharing_df.describe()
```

Out[5]:

| | season | yr | mnth | hr | holiday | weekday | workingday | weathersit |
|---|---|---|---|---|---|---|---|---|
| **count** | 17379.00 | 17379.00 | 17379.00 | 17379.00 | 17379.00 | 17379.00 | 17379.00 | 17379.00 |
| **mean** | 2.50 | 0.50 | 6.54 | 11.55 | 0.03 | 3.00 | 0.68 | 1.43 |
| **std** | 1.11 | 0.50 | 3.44 | 6.91 | 0.17 | 2.01 | 0.47 | 0.64 |
| **min** | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| **25%** | 2.00 | 0.00 | 4.00 | 6.00 | 0.00 | 1.00 | 0.00 | 1.00 |
| **50%** | 3.00 | 1.00 | 7.00 | 12.00 | 0.00 | 3.00 | 1.00 | 1.00 |
| **75%** | 3.00 | 1.00 | 10.00 | 18.00 | 0.00 | 5.00 | 1.00 | 2.00 |
| **max** | 4.00 | 1.00 | 12.00 | 23.00 | 1.00 | 6.00 | 1.00 | 4.00 |

### Observations

1. **The cnt variable, representing the count of bike rentals, has a wide range. The minimum is 1, and the maximum is 977, indicating significant variability in the number of bikes rented.**
2. **The season column has a mean close to 2.5, suggesting that the data is fairly evenly distributed across the four seasons.**

## Data Cleaning

In [6]:

```
## Let's drop the unnecessary columns like dteday because dteday is the
## date when experiment was performed.
bike_sharing_df.drop(["dteday"], axis=1, inplace=True)
```

### Check Duplicate Values

In [7]:

```
# Let's check for the duplicate values
bike_sharing_df[bike_sharing_df.duplicated(keep=False)].style.background_gra
```

Out[7]:

| | season | yr | mnth | hr | holiday | weekday | workingday | weathersit | temp | atem |
|---|---|---|---|---|---|---|---|---|---|---|
| **7958** | 4 | 0 | 12 | 6 | 0 | 6 | 0 | 1 | 0.240000 | 0.25760 |
| **8126** | 4 | 0 | 12 | 6 | 0 | 6 | 0 | 1 | 0.240000 | 0.25760 |
| **13559** | 3 | 1 | 7 | 4 | 0 | 2 | 1 | 1 | 0.660000 | 0.60610 |
| **13727** | 3 | 1 | 7 | 4 | 0 | 2 | 1 | 1 | 0.660000 | 0.60610 |

### Drop duplicate values

In [8]:

```
# Let's drop the duplicate values from the dataframe
bike_sharing_df = bike_sharing_df.drop_duplicates()
```

In [9]:

```
# Let's take a quick look at the shape of the dataframe
print("Bike Sharing data shape -->", bike_sharing_df.shape)
print()

# Let's take a brief look at the contents of the dataframe
bike_sharing_df.head().style.background_gradient()
```

```
Bike Sharing data shape --> (17377, 13)
```

Out[9]:

| | season | yr | mnth | hr | holiday | weekday | workingday | weathersit | temp | atemp | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 0 | 1 | 0 | 0 | 6 | 0 | 1 | 0.240000 | 0.287900 | 0. |
| **1** | 1 | 0 | 1 | 1 | 0 | 6 | 0 | 1 | 0.220000 | 0.272700 | 0. |
| **2** | 1 | 0 | 1 | 2 | 0 | 6 | 0 | 1 | 0.220000 | 0.272700 | 0. |
| **3** | 1 | 0 | 1 | 3 | 0 | 6 | 0 | 1 | 0.240000 | 0.287900 | 0. |
| **4** | 1 | 0 | 1 | 4 | 0 | 6 | 0 | 1 | 0.240000 | 0.287900 | 0. |

In [10]:

```
# Function to get unique_counts based on specific column
def value_counts(column_name):
    return bike_sharing_df.loc[
        :, column_name
    ].value_counts()  # Returns the unique value counts
```

In [11]:

```
# Iterates over all the columns of the dataframe and calls value_counts func
required_columns = [
    "season",
    "yr",
    "mnth",
    "holiday",
]
for column_name in required_columns:
    print(f"Value Counts of {column_name}")
    value_counts_data = value_counts(column_name=column_name)
    for index, value in value_counts_data.items():
        print(f"{column_name} {index}: {value}")
    print()
```

```
Value Counts of season
season 3: 4495
season 2: 4409
season 1: 4242
season 4: 4231

Value Counts of yr
yr 1: 8733
yr 0: 8644

Value Counts of mnth
mnth 5: 1488
mnth 7: 1487
mnth 12: 1482
mnth 8: 1475
mnth 3: 1473
mnth 10: 1451
mnth 6: 1440
mnth 4: 1437
mnth 9: 1437
mnth 11: 1437
mnth 1: 1429
mnth 2: 1341

Value Counts of holiday
holiday 0: 16877
holiday 1: 500
```

## See how many missing data points we have

In [12]:

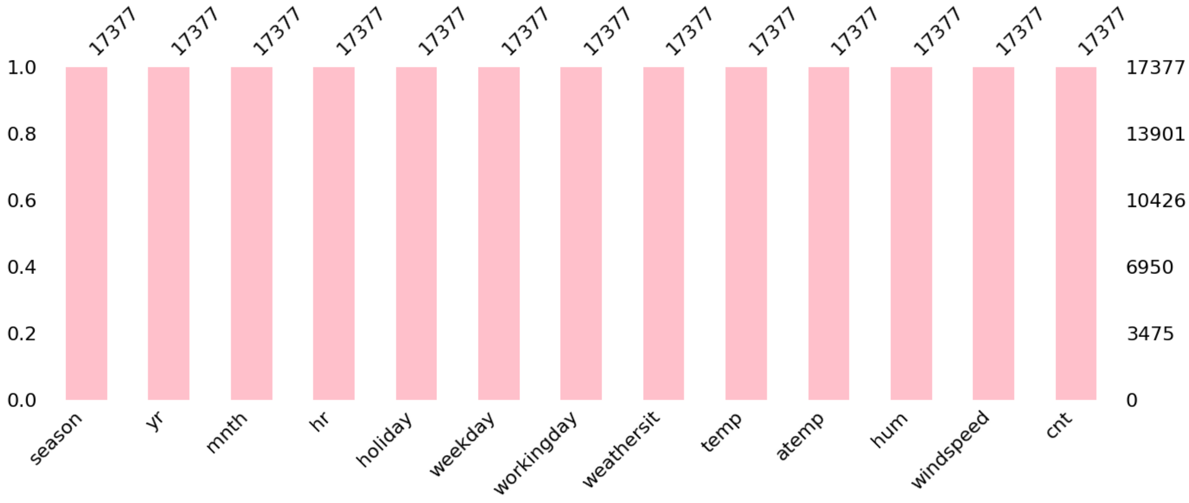
```
bike_sharing_df.isnull().sum()
```

Out[12]:

```
season        0
yr            0
mnth          0
hr            0
holiday       0
weekday       0
workingday    0
weathersit    0
temp          0
atemp         0
hum           0
windspeed     0
cnt           0
dtype: int64
```

In [13]:

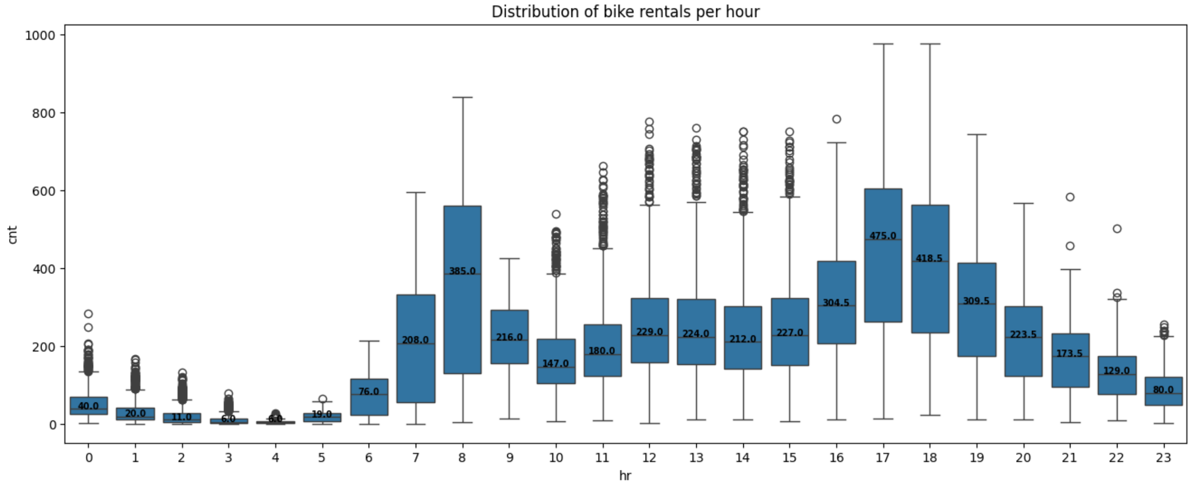
```
msno.bar(bike_sharing_df, figsize = (16,5),color = "pink")
plt.show()
```



## Exploratory Data Analysis

In [14]:

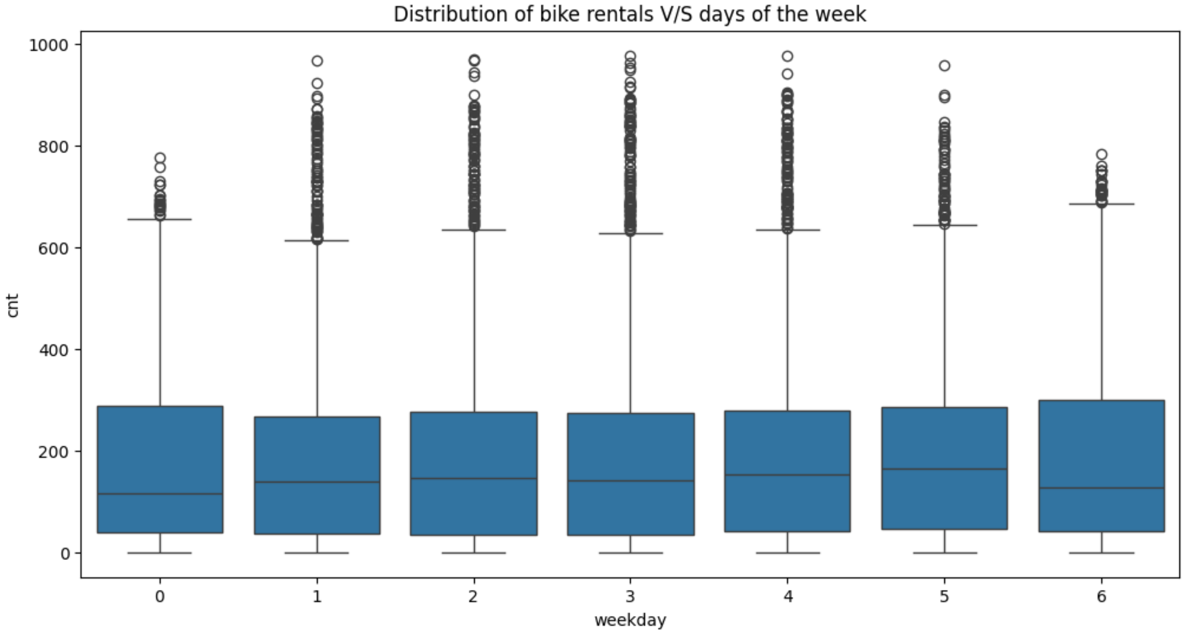
```
plt.figure(figsize=(16, 6))
ax = sns.boxplot(x="hr", y="cnt", data=bike_sharing_df)
plt.title("Distribution of bike rentals per hour")

# Annotating the median value of each box
medians = bike_sharing_df.groupby(['hr'])['cnt'].median().values
median_labels = [str(np.round(s, 2)) for s in medians]

pos = range(len(medians))
for tick, label in zip(pos, ax.get_xticks()):
    ax.text(pos[tick], medians[tick] + 0.03, median_labels[tick],
            horizontalalignment='center', size='x-small', color='black', wei

plt.show()
```



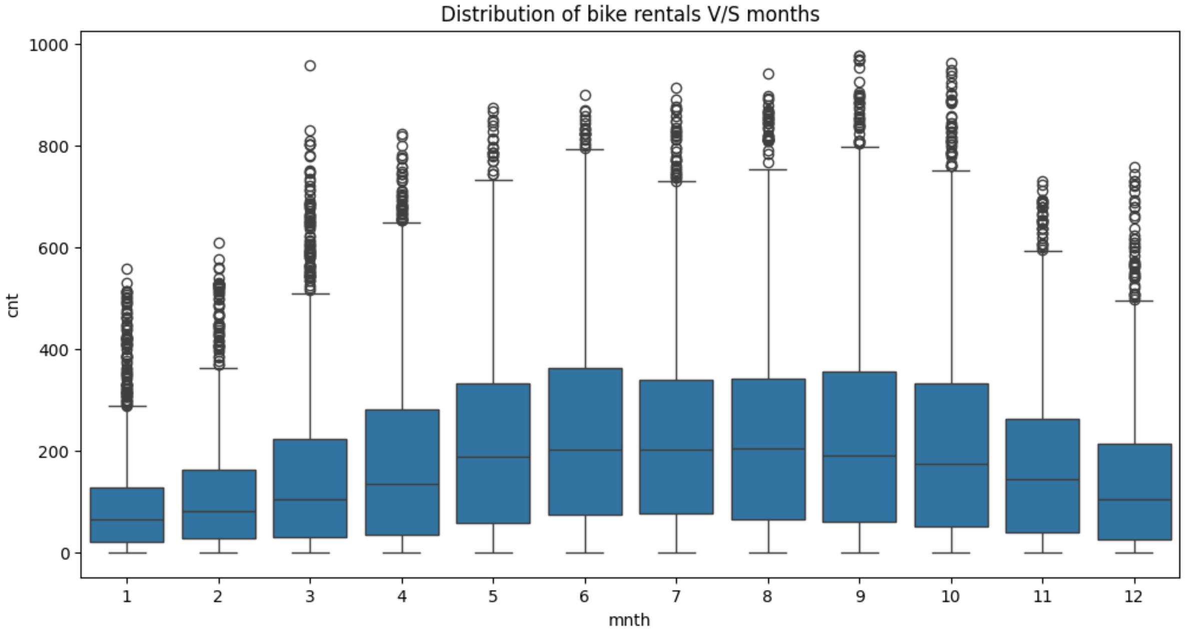
In [15]:

```
plt.figure(figsize=(12,6))
sns.boxplot(x="weekday", y="cnt", data=bike_sharing_df)
plt.title("Distribution of bike rentals V/S days of the week")
```

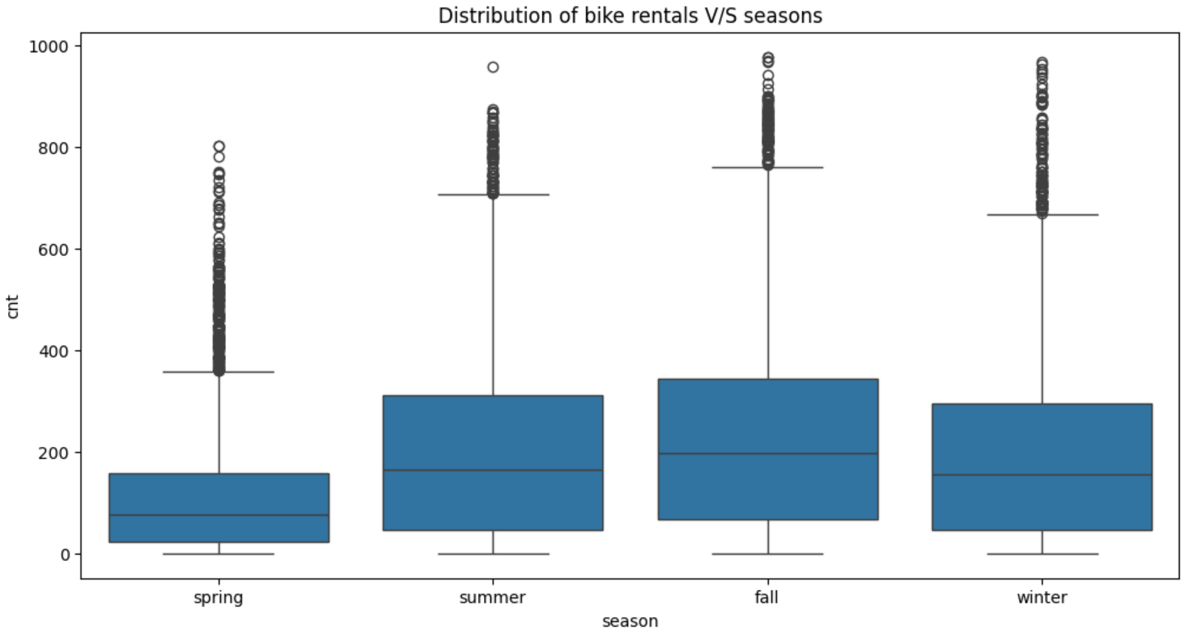
Out[15]:
```
Text(0.5, 1.0, 'Distribution of bike rentals V/S days of the week')
```



In [16]:
```
plt.figure(figsize=(12,6))
sns.boxplot(x="mnth", y="cnt", data=bike_sharing_df)
plt.title("Distribution of bike rentals V/S months")
plt.show()
```

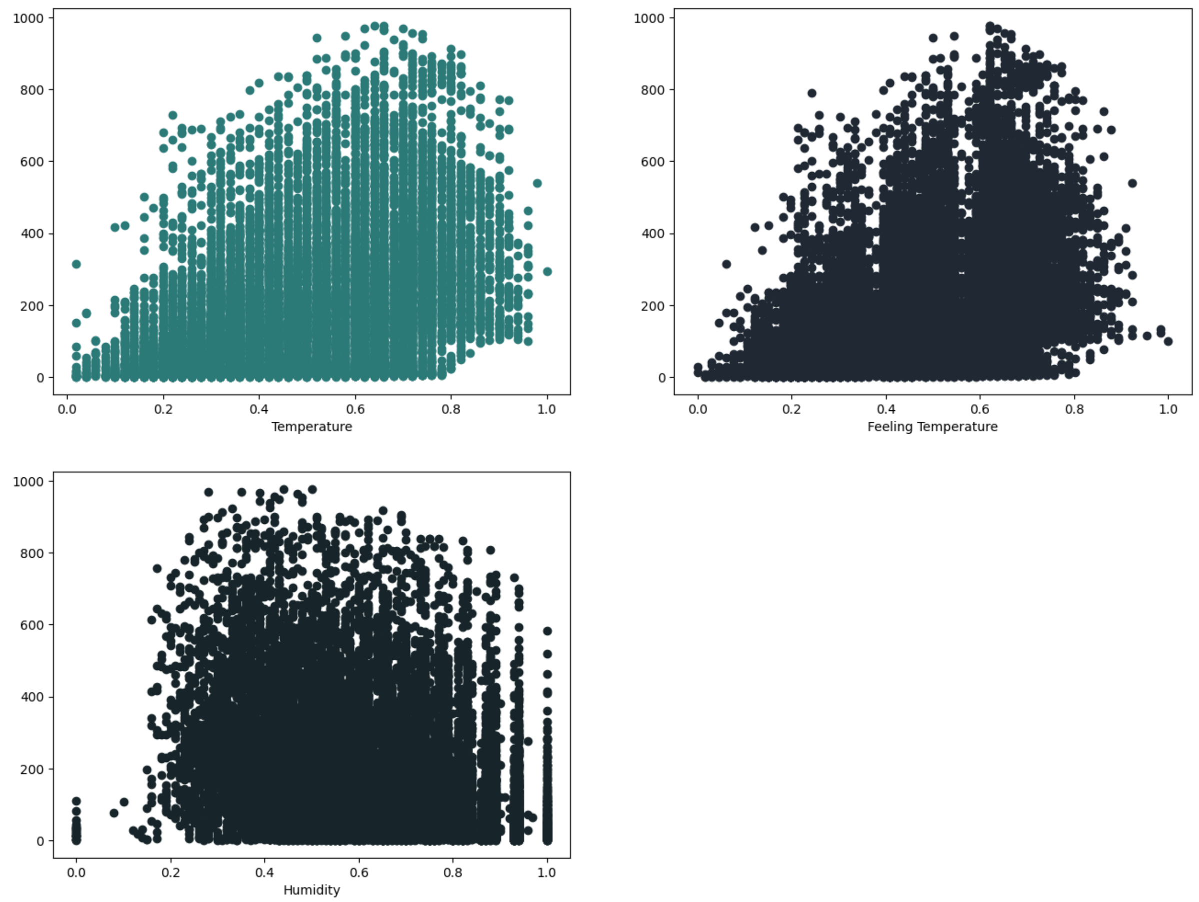


In [17]:
```
bike_sharing_df_plot = bike_sharing_df.copy()
bike_sharing_df_plot['season'] = bike_sharing_df_plot["season"].map({1: 'spr
plt.figure(figsize=(12,6))
sns.boxplot(x='season', y='cnt', data=bike_sharing_df_plot)
plt.title('Distribution of bike rentals V/S seasons')
plt.show()
```



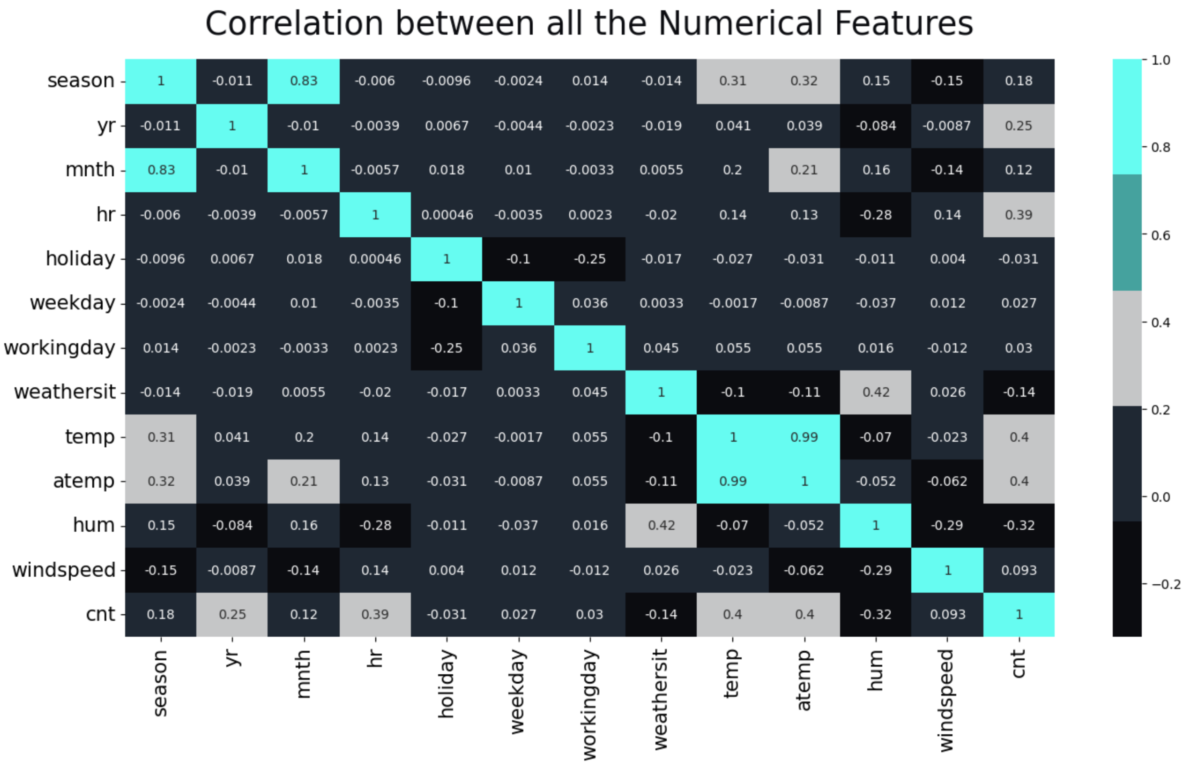
In [18]:

```
# Visualizing the Numerical Columns (Hidden Input) and treating outliers

plt.figure(figsize=[16,12])
plt.subplot(2,2,1)
plt.scatter(x=bike_sharing_df['temp'], y=bike_sharing_df['cnt'], c="#2b7a78"
plt.xlabel("Temperature")
plt.grid(False)
plt.subplot(2,2,2)
plt.scatter( x=bike_sharing_df['atemp'], y=bike_sharing_df['cnt'], c='#1f283
plt.xlabel("Feeling Temperature")
plt.grid(False)
plt.subplot(2,2,3)
plt.scatter( x=bike_sharing_df['hum'], y=bike_sharing_df['cnt'], c='#17252a'
plt.xlabel("Humidity")
plt.grid(False)
```



In [19]:

```
heat = bike_sharing_df.corr()
plt.figure(figsize=[16,8])
plt.title("Correlation between all the Numerical Features", size=25, pad=20,
sns.heatmap(heat, cmap=['#0b0c10', '#1f2833','#c5c6c7','#45a29e','#66fcf1'],
plt.xticks(size=15)
plt.yticks(size=15, rotation=360)
plt.show()
```



Correlation between all the Numerical Features

## Data Split

In [20]:
```
# Let's split the data into X and y
y = bike_sharing_df.pop('cnt')
X = bike_sharing_df

# Performing the train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=0.7, ra
```

## Data Normalization

In [21]:
```
# Normalizing our data...

scaler = MinMaxScaler()

X_train = scaler.fit_transform(X_train)

X_test = scaler.transform(X_test)
```

## Comparing Performance of Different Models

```
In [22]: model = LazyRegressor(verbose=0, ignore_warnings=False, custom_metric=None)
         models, predictions = model.fit(X_train, X_test, y_train, y_test)
         print(models)
```

```
 79%|████████  | 33/42 [01:50<00:12,  1.39s/it]
QuantileRegressor model failed to execute
Solver interior-point is not anymore available in SciPy >= 1.11.0.
100%|██████████| 42/42 [02:07<00:00,  3.02s/it]
```

```
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of t
esting was 0.000428 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 289
[LightGBM] [Info] Number of data points in the train set: 12163, number of
used features: 12
[LightGBM] [Info] Start training from score 189.227822
                               Adjusted R-Squared  R-Squared   RMSE  \
Model
XGBRegressor                                 0.95       0.95  39.90
ExtraTreesRegressor                          0.95       0.95  40.46
HistGradientBoostingRegressor                0.95       0.95  41.07
LGBMRegressor                                0.95       0.95  41.28
RandomForestRegressor                        0.95       0.95  41.97
BaggingRegressor                             0.94       0.94  44.19
DecisionTreeRegressor                        0.91       0.91  55.82
ExtraTreeRegressor                           0.89       0.89  60.96
GradientBoostingRegressor                    0.86       0.86  67.83
AdaBoostRegressor                            0.69       0.69 101.23
KNeighborsRegressor                          0.62       0.62 112.16
MLPRegressor                                 0.60       0.60 115.36
NuSVR                                        0.40       0.40 141.36
LassoCV                                      0.39       0.40 141.90
LinearRegression                             0.39       0.40 141.90
TransformedTargetRegressor                   0.39       0.40 141.90
Lars                                         0.39       0.40 141.90
LarsCV                                       0.39       0.40 141.90
LassoLarsCV                                  0.39       0.40 141.90
LassoLarsIC                                  0.39       0.40 141.90
Ridge                                        0.39       0.40 141.90
RidgeCV                                      0.39       0.40 141.91
BayesianRidge                                0.39       0.40 141.91
LassoLars                                    0.39       0.40 141.92
Lasso                                        0.39       0.40 141.92
OrthogonalMatchingPursuitCV                  0.39       0.39 142.03
PoissonRegressor                             0.39       0.39 142.08
ElasticNetCV                                 0.39       0.39 142.15
SGDRegressor                                 0.39       0.39 142.23
SVR                                          0.38       0.38 143.74
ElasticNet                                   0.37       0.37 145.12
HuberRegressor                               0.36       0.36 146.13
GammaRegressor                               0.34       0.34 148.19
LinearSVR                                    0.33       0.34 148.79
TweedieRegressor                             0.33       0.33 148.89
PassiveAggressiveRegressor                   0.29       0.29 153.70
OrthogonalMatchingPursuit                    0.16       0.17 166.78
RANSACRegressor                              0.16       0.16 166.87
DummyRegressor                              -0.00      -0.00 182.56
KernelRidge                                 -0.69      -0.69 237.36
GaussianProcessRegressor                    -1.02      -1.01 259.03

                               Time Taken
Model
XGBRegressor                         0.23
ExtraTreesRegressor                  3.44
HistGradientBoostingRegressor        0.46
LGBMRegressor                        0.18
RandomForestRegressor                4.60
```

```
BaggingRegressor                     0.41
DecisionTreeRegressor                0.14
ExtraTreeRegressor                   0.10
GradientBoostingRegressor            1.17
AdaBoostRegressor                    0.64
KNeighborsRegressor                  0.47
MLPRegressor                        10.91
NuSVR                                7.36
LassoCV                              0.23
LinearRegression                     0.04
TransformedTargetRegressor           0.02
Lars                                 0.02
LarsCV                               0.05
LassoLarsCV                          0.05
LassoLarsIC                          0.05
Ridge                                0.02
RidgeCV                              0.03
BayesianRidge                        0.03
LassoLars                            0.02
Lasso                                0.06
OrthogonalMatchingPursuitCV          0.03
PoissonRegressor                     0.31
ElasticNetCV                         0.20
SGDRegressor                         0.06
SVR                                 10.87
ElasticNet                           0.01
HuberRegressor                       0.06
GammaRegressor                       0.11
LinearSVR                            0.05
TweedieRegressor                     0.08
PassiveAggressiveRegressor           0.03
OrthogonalMatchingPursuit            0.02
RANSACRegressor                      0.19
DummyRegressor                       0.01
KernelRidge                         20.03
GaussianProcessRegressor            64.20
```

## Model Building(ML)

In [23]:

```
xgb_regressor = XGBRegressor()
xgb_regressor.fit(X_train, y_train)
```

```
Out[23]:
▾                          XGBRegressor
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, device=None, early_stopping_rou
nds=None,
             enable_categorical=False, eval_metric=None, feature_ty
pes=None,
             gamma=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_
bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=None, max_leaves=None,
```

```
In [24]: y_pred = xgb_regressor.predict(X_test)
         print("R2 score on test data: ", r2_score(y_true=y_test, y_pred=y_pred))
```

```
R2 score on test data:  0.9522321207805912
```

## Hyperparameter Tuning with Grid Search

```
In [25]: from sklearn.model_selection import GridSearchCV

         param_grid = {
             'n_estimators': [100, 200, 300, 400, 600, 800, 1000, 1200],
             'learning_rate': [0.01, 0.05, 0.06, 0.07, 0.1, 0.2, 0.3, 0.4],
             'max_depth': [3, 4, 5, 6, 7, 8, 9, 10],
             # Add more parameters here
         }

         xgb_regressor = XGBRegressor()

         grid_search = GridSearchCV(estimator=xgb_regressor, param_grid=param_grid, c
         grid_search.fit(X_train, y_train)

         best_params = grid_search.best_params_
         print(f"Best parameters: {best_params}")
```

```
Fitting 3 folds for each of 512 candidates, totalling 1536 fits
Best parameters: {'learning_rate': 0.06, 'max_depth': 8, 'n_estimators': 30
0}
```

```
In [26]: xgb_regressor = XGBRegressor(learning_rate=0.06, max_depth=8, n_estimators=3
         xgb_regressor.fit(X_train, y_train)
```

Out[26]:

```
▾                               XGBRegressor
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, device=None, early_stopping_rou
nds=None,
             enable_categorical=False, eval_metric=None, feature_ty
pes=None,
             gamma=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=0.06, max_
bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=8, max_leaves=None,
```

In [27]:

```python
y_pred = xgb_regressor.predict(X_test)
print("R2 score on test data: ", r2_score(y_true=y_test, y_pred=y_pred))
```

```
R2 score on test data:  0.9552281426618424
```

## Model Building(Neural Networks)

In [28]:

```python
X_train = X_train.astype('float32')
y_train = y_train.astype('float32')
X_test = X_test.astype('float32')
y_test = y_test.astype('float32')
```

In [29]:

```python
import keras.backend as K
from keras.layers import Dense
from keras.models import Sequential

def r_squared(y_true, y_pred):
    SS_res =  K.sum(K.square(y_true - y_pred))
    SS_tot = K.sum(K.square(y_true - K.mean(y_true)))
    return ( 1 - SS_res/(SS_tot + K.epsilon()) )

# Custom Metric for RMSE
def root_mean_squared_error(y_true, y_pred):
    return K.sqrt(K.mean(K.square(y_pred - y_true)))
```

### Neural Network Architecture

- **Model**: Sequential 3-layer network.
- **Layers**:
  - Dense layer with 64 neurons, ReLU activation (Input layer).
  - Two Dense layers with 128 neurons each, ReLU activation.
  - Output Dense layer with 1 neuron, linear activation.

### Training

- **Epochs**: 100
- **Batch size**: 32
- **Training R2 score**: 0.9411
- **Validation R2 score**: 0.9342

In [30]:

```
# Let's train the model
# Define the model
model_3_layer = Sequential()
model_3_layer.add(Dense(64, input_dim=X_train.shape[1], activation='relu'))
model_3_layer.add(Dense(128, activation='relu'))
model_3_layer.add(Dense(128, activation='relu'))
model_3_layer.add(Dense(1, activation='linear'))

# Compile the model
model_3_layer.compile(loss=root_mean_squared_error,
              optimizer='adam',
              metrics=[root_mean_squared_error, r_squared])

# Summary of the model
model_3_layer.summary()
model_3_layer_regressor = model_3_layer.fit(X_train, y_train, validation_dat
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 dense (Dense)               (None, 64)                832       
                                                                 
 dense_1 (Dense)             (None, 128)               8320      
                                                                 
 dense_2 (Dense)             (None, 128)               16512     
                                                                 
 dense_3 (Dense)             (None, 1)                 129       
                                                                 
=================================================================
Total params: 25793 (100.75 KB)
Trainable params: 25793 (100.75 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
Epoch 1/100
381/381 [==============================] - 7s 5ms/step - loss: 166.0716 - r
oot_mean_squared_error: 166.2390 - r_squared: 0.0141 - val_loss: 139.0383 -
val_root_mean_squared_error: 139.0347 - val_r_squared: 0.3777
Epoch 2/100
381/381 [==============================] - 2s 4ms/step - loss: 137.2610 - r
oot_mean_squared_error: 137.3133 - r_squared: 0.3773 - val_loss: 135.8840 -
val_root_mean_squared_error: 135.8822 - val_r_squared: 0.4004
Epoch 3/100
381/381 [==============================] - 1s 4ms/step - loss: 132.2747 - r
oot_mean_squared_error: 132.3663 - r_squared: 0.4131 - val_loss: 128.6736 -
val_root_mean_squared_error: 128.6716 - val_r_squared: 0.4691
Epoch 4/100
381/381 [==============================] - 2s 4ms/step - loss: 126.4132 - r
oot_mean_squared_error: 126.2942 - r_squared: 0.4694 - val_loss: 122.2327 -
val_root_mean_squared_error: 122.2319 - val_r_squared: 0.5208
Epoch 5/100
381/381 [==============================] - 2s 5ms/step - loss: 119.3512 - r
oot_mean_squared_error: 119.1608 - r_squared: 0.5250 - val_loss: 116.6033 -
val_root_mean_squared_error: 116.6028 - val_r_squared: 0.5663
Epoch 6/100
381/381 [==============================] - 2s 5ms/step - loss: 113.4619 - r
oot_mean_squared_error: 113.2947 - r_squared: 0.5719 - val_loss: 112.7410 -
val_root_mean_squared_error: 112.7408 - val_r_squared: 0.5972
Epoch 7/100
381/381 [==============================] - 2s 4ms/step - loss: 109.2487 - r
oot_mean_squared_error: 109.3259 - r_squared: 0.6025 - val_loss: 106.8173 -
val_root_mean_squared_error: 106.8190 - val_r_squared: 0.6354
Epoch 8/100
381/381 [==============================] - 2s 4ms/step - loss: 106.6888 - r
oot_mean_squared_error: 106.4615 - r_squared: 0.6236 - val_loss: 104.8294 -
val_root_mean_squared_error: 104.8297 - val_r_squared: 0.6500
Epoch 9/100
381/381 [==============================] - 2s 4ms/step - loss: 105.1516 - r
oot_mean_squared_error: 104.9325 - r_squared: 0.6329 - val_loss: 100.8466 -
val_root_mean_squared_error: 100.8504 - val_r_squared: 0.6719
Epoch 10/100
381/381 [==============================] - 1s 4ms/step - loss: 103.1801 - r
oot_mean_squared_error: 103.1751 - r_squared: 0.6466 - val_loss: 101.4347 -
val_root_mean_squared_error: 101.4346 - val_r_squared: 0.6721
Epoch 11/100
381/381 [==============================] - 2s 4ms/step - loss: 101.6014 - r
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oot_mean_squared_error: 101.4440 - r_squared: 0.6533 - val_loss: 99.2173 -
val_root_mean_squared_error: 99.2178 - val_r_squared: 0.6851
Epoch 12/100
381/381 [==============================] - 2s 4ms/step - loss: 99.6436 - ro
ot_mean_squared_error: 99.5358 - r_squared: 0.6688 - val_loss: 95.3171 - va
l_root_mean_squared_error: 95.3203 - val_r_squared: 0.7059
Epoch 13/100
381/381 [==============================] - 2s 5ms/step - loss: 97.4386 - ro
ot_mean_squared_error: 97.4874 - r_squared: 0.6778 - val_loss: 93.9542 - va
l_root_mean_squared_error: 93.9563 - val_r_squared: 0.7164
Epoch 14/100
381/381 [==============================] - 2s 4ms/step - loss: 96.1350 - ro
ot_mean_squared_error: 96.0936 - r_squared: 0.6747 - val_loss: 92.1574 - va
l_root_mean_squared_error: 92.1605 - val_r_squared: 0.7244
Epoch 15/100
381/381 [==============================] - 2s 4ms/step - loss: 93.0573 - ro
ot_mean_squared_error: 93.0620 - r_squared: 0.7078 - val_loss: 89.1740 - va
l_root_mean_squared_error: 89.1754 - val_r_squared: 0.7431
Epoch 16/100
381/381 [==============================] - 2s 4ms/step - loss: 90.3009 - ro
ot_mean_squared_error: 90.3300 - r_squared: 0.7228 - val_loss: 87.6583 - va
l_root_mean_squared_error: 87.6549 - val_r_squared: 0.7534
Epoch 17/100
381/381 [==============================] - 1s 4ms/step - loss: 86.9064 - ro
ot_mean_squared_error: 86.9508 - r_squared: 0.7294 - val_loss: 83.2334 - va
l_root_mean_squared_error: 83.2327 - val_r_squared: 0.7742
Epoch 18/100
381/381 [==============================] - 2s 4ms/step - loss: 83.3601 - ro
ot_mean_squared_error: 83.4254 - r_squared: 0.7530 - val_loss: 78.8973 - va
l_root_mean_squared_error: 78.8931 - val_r_squared: 0.7972
Epoch 19/100
381/381 [==============================] - 2s 4ms/step - loss: 78.8004 - ro
ot_mean_squared_error: 78.7327 - r_squared: 0.7883 - val_loss: 74.4516 - va
l_root_mean_squared_error: 74.4464 - val_r_squared: 0.8190
Epoch 20/100
381/381 [==============================] - 2s 5ms/step - loss: 74.5443 - ro
ot_mean_squared_error: 74.5550 - r_squared: 0.8121 - val_loss: 75.9065 - va
l_root_mean_squared_error: 75.9041 - val_r_squared: 0.8077
Epoch 21/100
381/381 [==============================] - 2s 4ms/step - loss: 71.2327 - ro
ot_mean_squared_error: 71.2394 - r_squared: 0.8254 - val_loss: 70.3457 - va
l_root_mean_squared_error: 70.3400 - val_r_squared: 0.8398
Epoch 22/100
381/381 [==============================] - 2s 4ms/step - loss: 67.5626 - ro
ot_mean_squared_error: 67.4703 - r_squared: 0.8426 - val_loss: 64.7933 - va
l_root_mean_squared_error: 64.7888 - val_r_squared: 0.8609
Epoch 23/100
381/381 [==============================] - 2s 4ms/step - loss: 64.3969 - ro
ot_mean_squared_error: 64.3619 - r_squared: 0.8553 - val_loss: 64.1438 - va
l_root_mean_squared_error: 64.1363 - val_r_squared: 0.8659
Epoch 24/100
381/381 [==============================] - 2s 4ms/step - loss: 62.2092 - ro
ot_mean_squared_error: 62.1887 - r_squared: 0.8630 - val_loss: 61.6963 - va
l_root_mean_squared_error: 61.6869 - val_r_squared: 0.8757
Epoch 25/100
381/381 [==============================] - 2s 4ms/step - loss: 60.7388 - ro
ot_mean_squared_error: 60.8257 - r_squared: 0.8692 - val_loss: 61.5251 - va
l_root_mean_squared_error: 61.5168 - val_r_squared: 0.8759
Epoch 26/100
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381/381 [==============================] - 2s 4ms/step - loss: 58.7418 - ro
ot_mean_squared_error: 58.8883 - r_squared: 0.8797 - val_loss: 57.1614 - va
l_root_mean_squared_error: 57.1521 - val_r_squared: 0.8903
Epoch 27/100
381/381 [==============================] - 2s 5ms/step - loss: 57.0584 - ro
ot_mean_squared_error: 57.0928 - r_squared: 0.8826 - val_loss: 56.7262 - va
l_root_mean_squared_error: 56.7175 - val_r_squared: 0.8919
Epoch 28/100
381/381 [==============================] - 2s 5ms/step - loss: 55.9539 - ro
ot_mean_squared_error: 56.0038 - r_squared: 0.8875 - val_loss: 58.5196 - va
l_root_mean_squared_error: 58.5154 - val_r_squared: 0.8823
Epoch 29/100
381/381 [==============================] - 2s 4ms/step - loss: 54.5253 - ro
ot_mean_squared_error: 54.5672 - r_squared: 0.8948 - val_loss: 53.6994 - va
l_root_mean_squared_error: 53.6916 - val_r_squared: 0.9011
Epoch 30/100
381/381 [==============================] - 2s 4ms/step - loss: 53.3821 - ro
ot_mean_squared_error: 53.2826 - r_squared: 0.8971 - val_loss: 52.7875 - va
l_root_mean_squared_error: 52.7811 - val_r_squared: 0.9045
Epoch 31/100
381/381 [==============================] - 2s 4ms/step - loss: 52.8305 - ro
ot_mean_squared_error: 52.8167 - r_squared: 0.9014 - val_loss: 52.5713 - va
l_root_mean_squared_error: 52.5636 - val_r_squared: 0.9062
Epoch 32/100
381/381 [==============================] - 2s 4ms/step - loss: 52.5012 - ro
ot_mean_squared_error: 52.3950 - r_squared: 0.9006 - val_loss: 52.7709 - va
l_root_mean_squared_error: 52.7661 - val_r_squared: 0.9056
Epoch 33/100
381/381 [==============================] - 2s 4ms/step - loss: 51.5011 - ro
ot_mean_squared_error: 51.4509 - r_squared: 0.9045 - val_loss: 50.6573 - va
l_root_mean_squared_error: 50.6513 - val_r_squared: 0.9128
Epoch 34/100
381/381 [==============================] - 2s 4ms/step - loss: 49.8269 - ro
ot_mean_squared_error: 49.7265 - r_squared: 0.9108 - val_loss: 49.2905 - va
l_root_mean_squared_error: 49.2845 - val_r_squared: 0.9154
Epoch 35/100
381/381 [==============================] - 2s 5ms/step - loss: 49.5278 - ro
ot_mean_squared_error: 49.4887 - r_squared: 0.9100 - val_loss: 49.7122 - va
l_root_mean_squared_error: 49.7057 - val_r_squared: 0.9162
Epoch 36/100
381/381 [==============================] - 2s 4ms/step - loss: 48.5846 - ro
ot_mean_squared_error: 48.5163 - r_squared: 0.9135 - val_loss: 48.4652 - va
l_root_mean_squared_error: 48.4603 - val_r_squared: 0.9190
Epoch 37/100
381/381 [==============================] - 2s 4ms/step - loss: 48.8720 - ro
ot_mean_squared_error: 48.8312 - r_squared: 0.9143 - val_loss: 51.2806 - va
l_root_mean_squared_error: 51.2753 - val_r_squared: 0.9092
Epoch 38/100
381/381 [==============================] - 2s 4ms/step - loss: 48.7823 - ro
ot_mean_squared_error: 48.8220 - r_squared: 0.9106 - val_loss: 52.3280 - va
l_root_mean_squared_error: 52.3225 - val_r_squared: 0.9081
Epoch 39/100
381/381 [==============================] - 2s 4ms/step - loss: 47.5293 - ro
ot_mean_squared_error: 47.5769 - r_squared: 0.9161 - val_loss: 46.8817 - va
l_root_mean_squared_error: 46.8766 - val_r_squared: 0.9246
Epoch 40/100
381/381 [==============================] - 2s 4ms/step - loss: 47.5408 - ro
ot_mean_squared_error: 47.6456 - r_squared: 0.9181 - val_loss: 46.8492 - va
l_root_mean_squared_error: 46.8418 - val_r_squared: 0.9238
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Epoch 41/100
381/381 [==============================] - 2s 4ms/step - loss: 47.4053 - ro
ot_mean_squared_error: 47.3063 - r_squared: 0.9174 - val_loss: 46.7584 - va
l_root_mean_squared_error: 46.7537 - val_r_squared: 0.9250
Epoch 42/100
381/381 [==============================] - 2s 6ms/step - loss: 47.1662 - ro
ot_mean_squared_error: 47.0867 - r_squared: 0.9175 - val_loss: 48.5643 - va
l_root_mean_squared_error: 48.5586 - val_r_squared: 0.9191
Epoch 43/100
381/381 [==============================] - 2s 4ms/step - loss: 46.4351 - ro
ot_mean_squared_error: 46.4445 - r_squared: 0.9217 - val_loss: 48.5887 - va
l_root_mean_squared_error: 48.5809 - val_r_squared: 0.9177
Epoch 44/100
381/381 [==============================] - 2s 4ms/step - loss: 46.8095 - ro
ot_mean_squared_error: 46.9245 - r_squared: 0.9069 - val_loss: 46.0430 - va
l_root_mean_squared_error: 46.0368 - val_r_squared: 0.9274
Epoch 45/100
381/381 [==============================] - 1s 4ms/step - loss: 46.0416 - ro
ot_mean_squared_error: 45.9948 - r_squared: 0.9211 - val_loss: 48.8171 - va
l_root_mean_squared_error: 48.8122 - val_r_squared: 0.9180
Epoch 46/100
381/381 [==============================] - 2s 4ms/step - loss: 46.1634 - ro
ot_mean_squared_error: 46.1382 - r_squared: 0.9192 - val_loss: 48.4422 - va
l_root_mean_squared_error: 48.4377 - val_r_squared: 0.9176
Epoch 47/100
381/381 [==============================] - 2s 4ms/step - loss: 45.5946 - ro
ot_mean_squared_error: 45.6205 - r_squared: 0.9237 - val_loss: 50.0015 - va
l_root_mean_squared_error: 49.9953 - val_r_squared: 0.9161
Epoch 48/100
381/381 [==============================] - 2s 4ms/step - loss: 45.3493 - ro
ot_mean_squared_error: 45.3212 - r_squared: 0.9192 - val_loss: 46.1309 - va
l_root_mean_squared_error: 46.1265 - val_r_squared: 0.9258
Epoch 49/100
381/381 [==============================] - 2s 6ms/step - loss: 44.8036 - ro
ot_mean_squared_error: 44.9855 - r_squared: 0.9248 - val_loss: 45.0836 - va
l_root_mean_squared_error: 45.0784 - val_r_squared: 0.9302
Epoch 50/100
381/381 [==============================] - 2s 4ms/step - loss: 44.7912 - ro
ot_mean_squared_error: 44.7172 - r_squared: 0.9255 - val_loss: 48.8242 - va
l_root_mean_squared_error: 48.8189 - val_r_squared: 0.9189
Epoch 51/100
381/381 [==============================] - 2s 4ms/step - loss: 44.3824 - ro
ot_mean_squared_error: 44.3514 - r_squared: 0.9268 - val_loss: 43.9187 - va
l_root_mean_squared_error: 43.9138 - val_r_squared: 0.9326
Epoch 52/100
381/381 [==============================] - 2s 4ms/step - loss: 44.3919 - ro
ot_mean_squared_error: 44.4166 - r_squared: 0.9257 - val_loss: 45.1728 - va
l_root_mean_squared_error: 45.1682 - val_r_squared: 0.9292
Epoch 53/100
381/381 [==============================] - 2s 4ms/step - loss: 43.7641 - ro
ot_mean_squared_error: 43.8079 - r_squared: 0.9272 - val_loss: 44.5799 - va
l_root_mean_squared_error: 44.5747 - val_r_squared: 0.9306
Epoch 54/100
381/381 [==============================] - 2s 4ms/step - loss: 43.8690 - ro
ot_mean_squared_error: 43.7698 - r_squared: 0.9289 - val_loss: 45.0590 - va
l_root_mean_squared_error: 45.0551 - val_r_squared: 0.9284
Epoch 55/100
381/381 [==============================] - 2s 4ms/step - loss: 43.7301 - ro
ot_mean_squared_error: 43.8760 - r_squared: 0.9280 - val_loss: 44.5935 - va
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l_root_mean_squared_error: 44.5893 - val_r_squared: 0.9306
Epoch 56/100
381/381 [==============================] - 2s 5ms/step - loss: 43.9380 - ro
ot_mean_squared_error: 43.8897 - r_squared: 0.9282 - val_loss: 45.0239 - va
l_root_mean_squared_error: 45.0208 - val_r_squared: 0.9281
Epoch 57/100
381/381 [==============================] - 2s 5ms/step - loss: 43.2270 - ro
ot_mean_squared_error: 43.2435 - r_squared: 0.9292 - val_loss: 46.0184 - va
l_root_mean_squared_error: 46.0139 - val_r_squared: 0.9277
Epoch 58/100
381/381 [==============================] - 2s 4ms/step - loss: 43.3203 - ro
ot_mean_squared_error: 43.3685 - r_squared: 0.9312 - val_loss: 49.1539 - va
l_root_mean_squared_error: 49.1530 - val_r_squared: 0.9151
Epoch 59/100
381/381 [==============================] - 2s 4ms/step - loss: 43.1867 - ro
ot_mean_squared_error: 43.0996 - r_squared: 0.9308 - val_loss: 44.2024 - va
l_root_mean_squared_error: 44.1961 - val_r_squared: 0.9314
Epoch 60/100
381/381 [==============================] - 2s 4ms/step - loss: 42.7852 - ro
ot_mean_squared_error: 42.7405 - r_squared: 0.9321 - val_loss: 45.8216 - va
l_root_mean_squared_error: 45.8158 - val_r_squared: 0.9282
Epoch 61/100
381/381 [==============================] - 2s 4ms/step - loss: 43.1717 - ro
ot_mean_squared_error: 43.1720 - r_squared: 0.9309 - val_loss: 44.7115 - va
l_root_mean_squared_error: 44.7077 - val_r_squared: 0.9305
Epoch 62/100
381/381 [==============================] - 1s 4ms/step - loss: 42.6396 - ro
ot_mean_squared_error: 42.8672 - r_squared: 0.3164 - val_loss: 52.7760 - va
l_root_mean_squared_error: 52.7709 - val_r_squared: 0.9078
Epoch 63/100
381/381 [==============================] - 2s 4ms/step - loss: 42.5941 - ro
ot_mean_squared_error: 42.5462 - r_squared: 0.9320 - val_loss: 42.8850 - va
l_root_mean_squared_error: 42.8791 - val_r_squared: 0.9363
Epoch 64/100
381/381 [==============================] - 2s 5ms/step - loss: 42.2430 - ro
ot_mean_squared_error: 42.2551 - r_squared: 0.9333 - val_loss: 44.8783 - va
l_root_mean_squared_error: 44.8736 - val_r_squared: 0.9311
Epoch 65/100
381/381 [==============================] - 2s 4ms/step - loss: 42.4586 - ro
ot_mean_squared_error: 42.4016 - r_squared: 0.9354 - val_loss: 45.4419 - va
l_root_mean_squared_error: 45.4350 - val_r_squared: 0.9290
Epoch 66/100
381/381 [==============================] - 2s 4ms/step - loss: 42.3172 - ro
ot_mean_squared_error: 42.3831 - r_squared: 0.9332 - val_loss: 46.1106 - va
l_root_mean_squared_error: 46.1031 - val_r_squared: 0.9264
Epoch 67/100
381/381 [==============================] - 2s 4ms/step - loss: 42.4000 - ro
ot_mean_squared_error: 42.3103 - r_squared: 0.9317 - val_loss: 42.3736 - va
l_root_mean_squared_error: 42.3683 - val_r_squared: 0.9368
Epoch 68/100
381/381 [==============================] - 2s 4ms/step - loss: 41.5832 - ro
ot_mean_squared_error: 41.5760 - r_squared: 0.9348 - val_loss: 42.3936 - va
l_root_mean_squared_error: 42.3894 - val_r_squared: 0.9377
Epoch 69/100
381/381 [==============================] - 2s 4ms/step - loss: 42.1302 - ro
ot_mean_squared_error: 42.0763 - r_squared: 0.9344 - val_loss: 42.6524 - va
l_root_mean_squared_error: 42.6475 - val_r_squared: 0.9373
Epoch 70/100
381/381 [==============================] - 2s 4ms/step - loss: 41.4384 - ro
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ot_mean_squared_error: 41.3604 - r_squared: 0.9336 - val_loss: 47.8695 - va
l_root_mean_squared_error: 47.8636 - val_r_squared: 0.9221
Epoch 71/100
381/381 [==============================] - 2s 6ms/step - loss: 41.3133 - ro
ot_mean_squared_error: 41.2916 - r_squared: 0.9367 - val_loss: 43.5186 - va
l_root_mean_squared_error: 43.5143 - val_r_squared: 0.9327
Epoch 72/100
381/381 [==============================] - 2s 4ms/step - loss: 41.9132 - ro
ot_mean_squared_error: 42.0076 - r_squared: 0.9353 - val_loss: 42.6565 - va
l_root_mean_squared_error: 42.6513 - val_r_squared: 0.9376
Epoch 73/100
381/381 [==============================] - 1s 4ms/step - loss: 41.4159 - ro
ot_mean_squared_error: 41.4210 - r_squared: 0.9335 - val_loss: 42.8614 - va
l_root_mean_squared_error: 42.8580 - val_r_squared: 0.9353
Epoch 74/100
381/381 [==============================] - 2s 4ms/step - loss: 41.3183 - ro
ot_mean_squared_error: 41.2389 - r_squared: 0.9364 - val_loss: 44.3162 - va
l_root_mean_squared_error: 44.3097 - val_r_squared: 0.9334
Epoch 75/100
381/381 [==============================] - 2s 4ms/step - loss: 41.1265 - ro
ot_mean_squared_error: 41.1587 - r_squared: 0.9367 - val_loss: 47.1895 - va
l_root_mean_squared_error: 47.1820 - val_r_squared: 0.9208
Epoch 76/100
381/381 [==============================] - 2s 4ms/step - loss: 41.2488 - ro
ot_mean_squared_error: 41.1952 - r_squared: 0.9354 - val_loss: 44.4441 - va
l_root_mean_squared_error: 44.4411 - val_r_squared: 0.9316
Epoch 77/100
381/381 [==============================] - 2s 4ms/step - loss: 41.0430 - ro
ot_mean_squared_error: 41.1561 - r_squared: 0.9352 - val_loss: 43.1352 - va
l_root_mean_squared_error: 43.1305 - val_r_squared: 0.9340
Epoch 78/100
381/381 [==============================] - 2s 6ms/step - loss: 41.0165 - ro
ot_mean_squared_error: 41.0052 - r_squared: 0.9385 - val_loss: 47.3425 - va
l_root_mean_squared_error: 47.3372 - val_r_squared: 0.9240
Epoch 79/100
381/381 [==============================] - 2s 4ms/step - loss: 40.5473 - ro
ot_mean_squared_error: 40.5555 - r_squared: 0.9386 - val_loss: 43.0778 - va
l_root_mean_squared_error: 43.0751 - val_r_squared: 0.9352
Epoch 80/100
381/381 [==============================] - 2s 4ms/step - loss: 41.2730 - ro
ot_mean_squared_error: 41.2488 - r_squared: 0.9371 - val_loss: 45.2310 - va
l_root_mean_squared_error: 45.2251 - val_r_squared: 0.9306
Epoch 81/100
381/381 [==============================] - 2s 4ms/step - loss: 39.9949 - ro
ot_mean_squared_error: 39.9287 - r_squared: 0.9403 - val_loss: 41.1640 - va
l_root_mean_squared_error: 41.1609 - val_r_squared: 0.9404
Epoch 82/100
381/381 [==============================] - 2s 4ms/step - loss: 40.8233 - ro
ot_mean_squared_error: 40.8206 - r_squared: 0.9374 - val_loss: 42.0932 - va
l_root_mean_squared_error: 42.0870 - val_r_squared: 0.9387
Epoch 83/100
381/381 [==============================] - 2s 4ms/step - loss: 40.3253 - ro
ot_mean_squared_error: 40.3870 - r_squared: 0.9333 - val_loss: 40.9061 - va
l_root_mean_squared_error: 40.9008 - val_r_squared: 0.9407
Epoch 84/100
381/381 [==============================] - 2s 4ms/step - loss: 39.9680 - ro
ot_mean_squared_error: 39.9624 - r_squared: 0.9417 - val_loss: 44.7142 - va
l_root_mean_squared_error: 44.7108 - val_r_squared: 0.9317
Epoch 85/100
```

```
381/381 [==============================] - 2s 5ms/step - loss: 40.6583 - ro
ot_mean_squared_error: 40.6213 - r_squared: 0.9381 - val_loss: 40.7326 - va
l_root_mean_squared_error: 40.7273 - val_r_squared: 0.9423
Epoch 86/100
381/381 [==============================] - 2s 4ms/step - loss: 39.9811 - ro
ot_mean_squared_error: 39.9502 - r_squared: 0.9398 - val_loss: 41.2651 - va
l_root_mean_squared_error: 41.2590 - val_r_squared: 0.9410
Epoch 87/100
381/381 [==============================] - 2s 4ms/step - loss: 40.1091 - ro
ot_mean_squared_error: 40.0908 - r_squared: 0.9400 - val_loss: 43.6750 - va
l_root_mean_squared_error: 43.6671 - val_r_squared: 0.9333
Epoch 88/100
381/381 [==============================] - 2s 4ms/step - loss: 39.8897 - ro
ot_mean_squared_error: 39.9001 - r_squared: 0.9410 - val_loss: 43.3992 - va
l_root_mean_squared_error: 43.3950 - val_r_squared: 0.9352
Epoch 89/100
381/381 [==============================] - 2s 4ms/step - loss: 40.0857 - ro
ot_mean_squared_error: 40.0069 - r_squared: 0.9404 - val_loss: 41.8160 - va
l_root_mean_squared_error: 41.8095 - val_r_squared: 0.9391
Epoch 90/100
381/381 [==============================] - 2s 4ms/step - loss: 39.5679 - ro
ot_mean_squared_error: 39.5835 - r_squared: 0.9405 - val_loss: 41.5337 - va
l_root_mean_squared_error: 41.5296 - val_r_squared: 0.9393
Epoch 91/100
381/381 [==============================] - 2s 4ms/step - loss: 39.6811 - ro
ot_mean_squared_error: 39.6340 - r_squared: 0.9401 - val_loss: 42.1050 - va
l_root_mean_squared_error: 42.0981 - val_r_squared: 0.9376
Epoch 92/100
381/381 [==============================] - 2s 5ms/step - loss: 39.5166 - ro
ot_mean_squared_error: 39.6440 - r_squared: 0.9400 - val_loss: 41.9273 - va
l_root_mean_squared_error: 41.9237 - val_r_squared: 0.9384
Epoch 93/100
381/381 [==============================] - 2s 5ms/step - loss: 39.5504 - ro
ot_mean_squared_error: 39.4827 - r_squared: 0.9407 - val_loss: 40.7390 - va
l_root_mean_squared_error: 40.7350 - val_r_squared: 0.9418
Epoch 94/100
381/381 [==============================] - 2s 4ms/step - loss: 39.2622 - ro
ot_mean_squared_error: 39.2582 - r_squared: 0.9418 - val_loss: 40.7573 - va
l_root_mean_squared_error: 40.7541 - val_r_squared: 0.9417
Epoch 95/100
381/381 [==============================] - 2s 4ms/step - loss: 38.8163 - ro
ot_mean_squared_error: 38.7785 - r_squared: 0.9421 - val_loss: 43.1004 - va
l_root_mean_squared_error: 43.0954 - val_r_squared: 0.9360
Epoch 96/100
381/381 [==============================] - 2s 4ms/step - loss: 38.9495 - ro
ot_mean_squared_error: 38.9049 - r_squared: 0.9442 - val_loss: 42.6577 - va
l_root_mean_squared_error: 42.6521 - val_r_squared: 0.9372
Epoch 97/100
381/381 [==============================] - 2s 4ms/step - loss: 38.8956 - ro
ot_mean_squared_error: 38.8753 - r_squared: 0.9441 - val_loss: 41.7969 - va
l_root_mean_squared_error: 41.7916 - val_r_squared: 0.9395
Epoch 98/100
381/381 [==============================] - 2s 4ms/step - loss: 38.6137 - ro
ot_mean_squared_error: 38.6004 - r_squared: 0.9463 - val_loss: 41.2599 - va
l_root_mean_squared_error: 41.2580 - val_r_squared: 0.9401
Epoch 99/100
381/381 [==============================] - 2s 5ms/step - loss: 38.6951 - ro
ot_mean_squared_error: 38.6135 - r_squared: 0.9454 - val_loss: 42.7083 - va
l_root_mean_squared_error: 42.7055 - val_r_squared: 0.9374
```

```
Epoch 100/100
381/381 [==============================] - 2s 5ms/step - loss: 38.8469 - ro
ot_mean_squared_error: 38.8513 - r_squared: 0.9415 - val_loss: 42.4121 - va
l_root_mean_squared_error: 42.4085 - val_r_squared: 0.9363
```

In [31]:

```
# Predictions on Test Data
test_predictions = model_3_layer.predict(X_test)

test_r2_score = r2_score(y_test, test_predictions)
print("3 Layer ANN, Test R2 Score:", test_r2_score)
```

```
163/163 [==============================] - 0s 1ms/step
3 Layer ANN, Test R2 Score: 0.9420452334260017
```

### Neural Network Architecture

- **Model**: Sequential 5-layer network.
- **Layers**:
  - Dense layer with 64 neurons, ReLU activation (Input layer).
  - Two Dense layers with 128 neurons each, ReLU activation.
  - Dense layer with 64 neurons, ReLU activation.
  - Dense layer with 32 neurons, ReLU activation.
  - Output Dense layer with 1 neuron, linear activation.

### Training

- **Epochs**: 100
- **Batch size**: 32
- **Training R2 score**: 0.9545
- **Validation R2 score**: 0.9373

In [32]:

```
# Let's train the model
# Define the model
model_5_layer = Sequential()
model_5_layer.add(Dense(64, input_dim=X_train.shape[1], activation='relu'))
model_5_layer.add(Dense(128, activation='relu'))
model_5_layer.add(Dense(128, activation='relu'))
model_5_layer.add(Dense(64, activation='relu'))
model_5_layer.add(Dense(32, activation='relu'))
model_5_layer.add(Dense(1, activation='linear'))

# Compile the model
model_5_layer.compile(loss=root_mean_squared_error,
              optimizer='adam',
              metrics=[root_mean_squared_error, r_squared])

# Summary of the model
model_5_layer.summary()
model_5_layer_regressor = model_5_layer.fit(X_train, y_train, validation_dat
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 dense_4 (Dense)             (None, 64)                832       
                                                                 
 dense_5 (Dense)             (None, 128)               8320      
                                                                 
 dense_6 (Dense)             (None, 128)               16512     
                                                                 
 dense_7 (Dense)             (None, 64)                8256      
                                                                 
 dense_8 (Dense)             (None, 32)                2080      
                                                                 
 dense_9 (Dense)             (None, 1)                 33        
                                                                 
=================================================================
Total params: 36033 (140.75 KB)
Trainable params: 36033 (140.75 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
Epoch 1/100
381/381 [==============================] - 4s 5ms/step - loss: 157.4876 - r
oot_mean_squared_error: 157.3457 - r_squared: 0.1425 - val_loss: 139.5196 -
val_root_mean_squared_error: 139.5138 - val_r_squared: 0.3762
Epoch 2/100
381/381 [==============================] - 2s 5ms/step - loss: 133.3705 - r
oot_mean_squared_error: 133.1989 - r_squared: 0.4059 - val_loss: 124.6572 -
val_root_mean_squared_error: 124.6543 - val_r_squared: 0.5000
Epoch 3/100
381/381 [==============================] - 2s 5ms/step - loss: 118.9453 - r
oot_mean_squared_error: 118.7840 - r_squared: 0.5263 - val_loss: 111.3295 -
val_root_mean_squared_error: 111.3296 - val_r_squared: 0.6035
Epoch 4/100
381/381 [==============================] - 2s 5ms/step - loss: 109.1618 - r
oot_mean_squared_error: 109.1975 - r_squared: 0.6027 - val_loss: 109.5863 -
val_root_mean_squared_error: 109.5877 - val_r_squared: 0.6184
Epoch 5/100
381/381 [==============================] - 2s 5ms/step - loss: 104.2189 - r
oot_mean_squared_error: 104.1593 - r_squared: 0.6393 - val_loss: 99.9060 -
val_root_mean_squared_error: 99.9136 - val_r_squared: 0.6734
Epoch 6/100
381/381 [==============================] - 2s 4ms/step - loss: 99.4148 - ro
ot_mean_squared_error: 99.4279 - r_squared: 0.6673 - val_loss: 93.7884 - va
l_root_mean_squared_error: 93.7927 - val_r_squared: 0.7151
Epoch 7/100
381/381 [==============================] - 2s 4ms/step - loss: 94.3388 - ro
ot_mean_squared_error: 94.3069 - r_squared: 0.7042 - val_loss: 96.2122 - va
l_root_mean_squared_error: 96.2103 - val_r_squared: 0.7043
Epoch 8/100
381/381 [==============================] - 2s 5ms/step - loss: 84.8615 - ro
ot_mean_squared_error: 84.9413 - r_squared: 0.7439 - val_loss: 76.4006 - va
l_root_mean_squared_error: 76.4001 - val_r_squared: 0.8089
Epoch 9/100
381/381 [==============================] - 2s 5ms/step - loss: 74.2008 - ro
ot_mean_squared_error: 74.1733 - r_squared: 0.8110 - val_loss: 68.4257 - va
l_root_mean_squared_error: 68.4204 - val_r_squared: 0.8482
Epoch 10/100
381/381 [==============================] - 2s 4ms/step - loss: 65.8638 - ro
```

```
ot_mean_squared_error: 65.7279 - r_squared: 0.8466 - val_loss: 62.5936 - va
l_root_mean_squared_error: 62.5893 - val_r_squared: 0.8681
Epoch 11/100
381/381 [==============================] - 2s 6ms/step - loss: 61.9943 - ro
ot_mean_squared_error: 62.0476 - r_squared: 0.8638 - val_loss: 66.8296 - va
l_root_mean_squared_error: 66.8261 - val_r_squared: 0.8544
Epoch 12/100
381/381 [==============================] - 2s 5ms/step - loss: 57.5014 - ro
ot_mean_squared_error: 57.5386 - r_squared: 0.8809 - val_loss: 62.6037 - va
l_root_mean_squared_error: 62.6015 - val_r_squared: 0.8717
Epoch 13/100
381/381 [==============================] - 2s 5ms/step - loss: 55.6285 - ro
ot_mean_squared_error: 55.5081 - r_squared: 0.8894 - val_loss: 65.4886 - va
l_root_mean_squared_error: 65.4910 - val_r_squared: 0.8600
Epoch 14/100
381/381 [==============================] - 2s 5ms/step - loss: 54.1256 - ro
ot_mean_squared_error: 54.2277 - r_squared: 0.8948 - val_loss: 49.2858 - va
l_root_mean_squared_error: 49.2788 - val_r_squared: 0.9176
Epoch 15/100
381/381 [==============================] - 2s 5ms/step - loss: 52.5280 - ro
ot_mean_squared_error: 52.5509 - r_squared: 0.8995 - val_loss: 50.8357 - va
l_root_mean_squared_error: 50.8283 - val_r_squared: 0.9102
Epoch 16/100
381/381 [==============================] - 2s 5ms/step - loss: 50.9219 - ro
ot_mean_squared_error: 50.9443 - r_squared: 0.9054 - val_loss: 49.8843 - va
l_root_mean_squared_error: 49.8787 - val_r_squared: 0.9154
Epoch 17/100
381/381 [==============================] - 2s 5ms/step - loss: 50.4056 - ro
ot_mean_squared_error: 50.3736 - r_squared: 0.9077 - val_loss: 58.3469 - va
l_root_mean_squared_error: 58.3404 - val_r_squared: 0.8864
Epoch 18/100
381/381 [==============================] - 2s 5ms/step - loss: 49.9520 - ro
ot_mean_squared_error: 50.1371 - r_squared: 0.9035 - val_loss: 62.6897 - va
l_root_mean_squared_error: 62.6899 - val_r_squared: 0.8710
Epoch 19/100
381/381 [==============================] - 2s 5ms/step - loss: 48.6883 - ro
ot_mean_squared_error: 48.6775 - r_squared: 0.9162 - val_loss: 51.7699 - va
l_root_mean_squared_error: 51.7650 - val_r_squared: 0.9087
Epoch 20/100
381/381 [==============================] - 2s 5ms/step - loss: 48.2670 - ro
ot_mean_squared_error: 48.3223 - r_squared: 0.9153 - val_loss: 49.7112 - va
l_root_mean_squared_error: 49.7087 - val_r_squared: 0.9132
Epoch 21/100
381/381 [==============================] - 2s 4ms/step - loss: 48.5474 - ro
ot_mean_squared_error: 48.8024 - r_squared: 0.9124 - val_loss: 44.3512 - va
l_root_mean_squared_error: 44.3449 - val_r_squared: 0.9323
Epoch 22/100
381/381 [==============================] - 2s 5ms/step - loss: 47.9731 - ro
ot_mean_squared_error: 47.8971 - r_squared: 0.9168 - val_loss: 44.6916 - va
l_root_mean_squared_error: 44.6851 - val_r_squared: 0.9303
Epoch 23/100
381/381 [==============================] - 2s 5ms/step - loss: 46.2305 - ro
ot_mean_squared_error: 46.1372 - r_squared: 0.9231 - val_loss: 43.3995 - va
l_root_mean_squared_error: 43.3952 - val_r_squared: 0.9339
Epoch 24/100
381/381 [==============================] - 2s 7ms/step - loss: 45.3485 - ro
ot_mean_squared_error: 45.3705 - r_squared: 0.9248 - val_loss: 46.1494 - va
l_root_mean_squared_error: 46.1423 - val_r_squared: 0.9271
Epoch 25/100
```

```
381/381 [==============================] - 2s 5ms/step - loss: 44.5675 - ro
ot_mean_squared_error: 44.5633 - r_squared: 0.9283 - val_loss: 48.4732 - va
l_root_mean_squared_error: 48.4700 - val_r_squared: 0.9187
Epoch 26/100
381/381 [==============================] - 2s 5ms/step - loss: 45.2361 - ro
ot_mean_squared_error: 45.4955 - r_squared: 0.9231 - val_loss: 47.8968 - va
l_root_mean_squared_error: 47.8942 - val_r_squared: 0.9211
Epoch 27/100
381/381 [==============================] - 2s 5ms/step - loss: 45.7980 - ro
ot_mean_squared_error: 45.7144 - r_squared: 0.9214 - val_loss: 43.9424 - va
l_root_mean_squared_error: 43.9397 - val_r_squared: 0.9326
Epoch 28/100
381/381 [==============================] - 2s 5ms/step - loss: 44.7777 - ro
ot_mean_squared_error: 44.7834 - r_squared: 0.9250 - val_loss: 45.7281 - va
l_root_mean_squared_error: 45.7252 - val_r_squared: 0.9270
Epoch 29/100
381/381 [==============================] - 2s 5ms/step - loss: 44.0296 - ro
ot_mean_squared_error: 43.9806 - r_squared: 0.9311 - val_loss: 48.0921 - va
l_root_mean_squared_error: 48.0852 - val_r_squared: 0.9204
Epoch 30/100
381/381 [==============================] - 2s 5ms/step - loss: 44.2893 - ro
ot_mean_squared_error: 44.2695 - r_squared: 0.9265 - val_loss: 51.5852 - va
l_root_mean_squared_error: 51.5810 - val_r_squared: 0.9074
Epoch 31/100
381/381 [==============================] - 2s 5ms/step - loss: 43.8670 - ro
ot_mean_squared_error: 43.7763 - r_squared: 0.9298 - val_loss: 45.7338 - va
l_root_mean_squared_error: 45.7279 - val_r_squared: 0.9290
Epoch 32/100
381/381 [==============================] - 2s 4ms/step - loss: 43.6143 - ro
ot_mean_squared_error: 43.5590 - r_squared: 0.9306 - val_loss: 46.2055 - va
l_root_mean_squared_error: 46.1985 - val_r_squared: 0.9280
Epoch 33/100
381/381 [==============================] - 2s 5ms/step - loss: 42.9745 - ro
ot_mean_squared_error: 42.9656 - r_squared: 0.9322 - val_loss: 57.4081 - va
l_root_mean_squared_error: 57.4118 - val_r_squared: 0.8854
Epoch 34/100
381/381 [==============================] - 2s 5ms/step - loss: 43.1894 - ro
ot_mean_squared_error: 43.1254 - r_squared: 0.9320 - val_loss: 43.1599 - va
l_root_mean_squared_error: 43.1564 - val_r_squared: 0.9358
Epoch 35/100
381/381 [==============================] - 2s 4ms/step - loss: 42.7192 - ro
ot_mean_squared_error: 42.7173 - r_squared: 0.9316 - val_loss: 49.3269 - va
l_root_mean_squared_error: 49.3231 - val_r_squared: 0.9190
Epoch 36/100
381/381 [==============================] - 2s 5ms/step - loss: 42.4493 - ro
ot_mean_squared_error: 42.4357 - r_squared: 0.9309 - val_loss: 44.6661 - va
l_root_mean_squared_error: 44.6604 - val_r_squared: 0.9308
Epoch 37/100
381/381 [==============================] - 3s 7ms/step - loss: 43.5109 - ro
ot_mean_squared_error: 43.5859 - r_squared: 0.9289 - val_loss: 41.4878 - va
l_root_mean_squared_error: 41.4836 - val_r_squared: 0.9407
Epoch 38/100
381/381 [==============================] - 2s 5ms/step - loss: 42.2174 - ro
ot_mean_squared_error: 42.3070 - r_squared: 0.9329 - val_loss: 43.7658 - va
l_root_mean_squared_error: 43.7668 - val_r_squared: 0.9328
Epoch 39/100
381/381 [==============================] - 2s 4ms/step - loss: 41.9507 - ro
ot_mean_squared_error: 41.8930 - r_squared: 0.9350 - val_loss: 41.2857 - va
l_root_mean_squared_error: 41.2828 - val_r_squared: 0.9405
```

```
Epoch 40/100
381/381 [==============================] - 2s 5ms/step - loss: 42.2731 - ro
ot_mean_squared_error: 42.2038 - r_squared: 0.9339 - val_loss: 42.8152 - va
l_root_mean_squared_error: 42.8154 - val_r_squared: 0.9356
Epoch 41/100
381/381 [==============================] - 2s 5ms/step - loss: 42.4032 - ro
ot_mean_squared_error: 42.4194 - r_squared: 0.9331 - val_loss: 42.6472 - va
l_root_mean_squared_error: 42.6430 - val_r_squared: 0.9362
Epoch 42/100
381/381 [==============================] - 2s 5ms/step - loss: 41.4491 - ro
ot_mean_squared_error: 41.4677 - r_squared: 0.9349 - val_loss: 47.3219 - va
l_root_mean_squared_error: 47.3225 - val_r_squared: 0.9218
Epoch 43/100
381/381 [==============================] - 2s 5ms/step - loss: 41.7061 - ro
ot_mean_squared_error: 41.6461 - r_squared: 0.9356 - val_loss: 47.8591 - va
l_root_mean_squared_error: 47.8546 - val_r_squared: 0.9207
Epoch 44/100
381/381 [==============================] - 2s 5ms/step - loss: 41.6543 - ro
ot_mean_squared_error: 41.6160 - r_squared: 0.9363 - val_loss: 44.8698 - va
l_root_mean_squared_error: 44.8644 - val_r_squared: 0.9312
Epoch 45/100
381/381 [==============================] - 2s 5ms/step - loss: 41.7434 - ro
ot_mean_squared_error: 41.8690 - r_squared: 0.9337 - val_loss: 43.1151 - va
l_root_mean_squared_error: 43.1157 - val_r_squared: 0.9355
Epoch 46/100
381/381 [==============================] - 2s 5ms/step - loss: 42.0189 - ro
ot_mean_squared_error: 41.9357 - r_squared: 0.9355 - val_loss: 49.5119 - va
l_root_mean_squared_error: 49.5060 - val_r_squared: 0.9176
Epoch 47/100
381/381 [==============================] - 2s 5ms/step - loss: 40.3663 - ro
ot_mean_squared_error: 40.4817 - r_squared: 0.9363 - val_loss: 42.5617 - va
l_root_mean_squared_error: 42.5628 - val_r_squared: 0.9358
Epoch 48/100
381/381 [==============================] - 2s 5ms/step - loss: 41.3390 - ro
ot_mean_squared_error: 41.4359 - r_squared: 0.9364 - val_loss: 45.3558 - va
l_root_mean_squared_error: 45.3533 - val_r_squared: 0.9276
Epoch 49/100
381/381 [==============================] - 2s 4ms/step - loss: 41.1366 - ro
ot_mean_squared_error: 41.0879 - r_squared: 0.9391 - val_loss: 41.9322 - va
l_root_mean_squared_error: 41.9283 - val_r_squared: 0.9385
Epoch 50/100
381/381 [==============================] - 2s 6ms/step - loss: 39.1929 - ro
ot_mean_squared_error: 39.1494 - r_squared: 0.9434 - val_loss: 40.5092 - va
l_root_mean_squared_error: 40.5083 - val_r_squared: 0.9420
Epoch 51/100
381/381 [==============================] - 2s 5ms/step - loss: 40.1994 - ro
ot_mean_squared_error: 40.1662 - r_squared: 0.9396 - val_loss: 44.0851 - va
l_root_mean_squared_error: 44.0827 - val_r_squared: 0.9323
Epoch 52/100
381/381 [==============================] - 2s 5ms/step - loss: 39.8435 - ro
ot_mean_squared_error: 39.8348 - r_squared: 0.9417 - val_loss: 41.5056 - va
l_root_mean_squared_error: 41.5034 - val_r_squared: 0.9398
Epoch 53/100
381/381 [==============================] - 2s 5ms/step - loss: 39.5055 - ro
ot_mean_squared_error: 39.4771 - r_squared: 0.9418 - val_loss: 47.2386 - va
l_root_mean_squared_error: 47.2393 - val_r_squared: 0.9213
Epoch 54/100
381/381 [==============================] - 2s 5ms/step - loss: 39.9719 - ro
ot_mean_squared_error: 39.8972 - r_squared: 0.9401 - val_loss: 51.3288 - va
```

```
l_root_mean_squared_error: 51.3269 - val_r_squared: 0.9124
Epoch 55/100
381/381 [==============================] - 2s 5ms/step - loss: 39.5856 - ro
ot_mean_squared_error: 39.5524 - r_squared: 0.9425 - val_loss: 45.4388 - va
l_root_mean_squared_error: 45.4391 - val_r_squared: 0.9295
Epoch 56/100
381/381 [==============================] - 2s 5ms/step - loss: 40.8098 - ro
ot_mean_squared_error: 40.7270 - r_squared: 0.9382 - val_loss: 48.3320 - va
l_root_mean_squared_error: 48.3284 - val_r_squared: 0.9225
Epoch 57/100
381/381 [==============================] - 2s 5ms/step - loss: 39.1277 - ro
ot_mean_squared_error: 39.1146 - r_squared: 0.9429 - val_loss: 42.3338 - va
l_root_mean_squared_error: 42.3335 - val_r_squared: 0.9365
Epoch 58/100
381/381 [==============================] - 2s 5ms/step - loss: 38.8470 - ro
ot_mean_squared_error: 38.7865 - r_squared: 0.9441 - val_loss: 41.9688 - va
l_root_mean_squared_error: 41.9655 - val_r_squared: 0.9387
Epoch 59/100
381/381 [==============================] - 2s 4ms/step - loss: 38.6454 - ro
ot_mean_squared_error: 38.6339 - r_squared: 0.9451 - val_loss: 40.7636 - va
l_root_mean_squared_error: 40.7620 - val_r_squared: 0.9414
Epoch 60/100
381/381 [==============================] - 2s 5ms/step - loss: 39.6651 - ro
ot_mean_squared_error: 39.6318 - r_squared: 0.9426 - val_loss: 45.9990 - va
l_root_mean_squared_error: 46.0010 - val_r_squared: 0.9249
Epoch 61/100
381/381 [==============================] - 2s 5ms/step - loss: 38.8322 - ro
ot_mean_squared_error: 38.7779 - r_squared: 0.9454 - val_loss: 44.9083 - va
l_root_mean_squared_error: 44.9033 - val_r_squared: 0.9315
Epoch 62/100
381/381 [==============================] - 2s 5ms/step - loss: 37.6533 - ro
ot_mean_squared_error: 37.6139 - r_squared: 0.9486 - val_loss: 42.8497 - va
l_root_mean_squared_error: 42.8460 - val_r_squared: 0.9365
Epoch 63/100
381/381 [==============================] - 2s 6ms/step - loss: 37.3930 - ro
ot_mean_squared_error: 37.3868 - r_squared: 0.9481 - val_loss: 40.0515 - va
l_root_mean_squared_error: 40.0479 - val_r_squared: 0.9438
Epoch 64/100
381/381 [==============================] - 2s 4ms/step - loss: 37.8812 - ro
ot_mean_squared_error: 37.8206 - r_squared: 0.9462 - val_loss: 40.3791 - va
l_root_mean_squared_error: 40.3763 - val_r_squared: 0.9430
Epoch 65/100
381/381 [==============================] - 2s 5ms/step - loss: 37.9614 - ro
ot_mean_squared_error: 37.9000 - r_squared: 0.9467 - val_loss: 43.1247 - va
l_root_mean_squared_error: 43.1253 - val_r_squared: 0.9329
Epoch 66/100
381/381 [==============================] - 2s 5ms/step - loss: 37.1333 - ro
ot_mean_squared_error: 37.0868 - r_squared: 0.9481 - val_loss: 44.2520 - va
l_root_mean_squared_error: 44.2462 - val_r_squared: 0.9324
Epoch 67/100
381/381 [==============================] - 2s 5ms/step - loss: 36.9003 - ro
ot_mean_squared_error: 36.8431 - r_squared: 0.9502 - val_loss: 45.5735 - va
l_root_mean_squared_error: 45.5755 - val_r_squared: 0.9267
Epoch 68/100
381/381 [==============================] - 2s 5ms/step - loss: 37.2822 - ro
ot_mean_squared_error: 37.2294 - r_squared: 0.9492 - val_loss: 42.2971 - va
l_root_mean_squared_error: 42.2966 - val_r_squared: 0.9380
Epoch 69/100
381/381 [==============================] - 2s 6ms/step - loss: 38.3981 - ro
```

```
ot_mean_squared_error: 38.3213 - r_squared: 0.9447 - val_loss: 44.8000 - va
l_root_mean_squared_error: 44.8036 - val_r_squared: 0.9283
Epoch 70/100
381/381 [==============================] - 2s 5ms/step - loss: 36.8116 - ro
ot_mean_squared_error: 36.7440 - r_squared: 0.9489 - val_loss: 39.5126 - va
l_root_mean_squared_error: 39.5142 - val_r_squared: 0.9447
Epoch 71/100
381/381 [==============================] - 2s 5ms/step - loss: 38.1281 - ro
ot_mean_squared_error: 38.1009 - r_squared: 0.9473 - val_loss: 40.4011 - va
l_root_mean_squared_error: 40.4002 - val_r_squared: 0.9436
Epoch 72/100
381/381 [==============================] - 2s 5ms/step - loss: 36.4133 - ro
ot_mean_squared_error: 36.4632 - r_squared: 0.9432 - val_loss: 41.6869 - va
l_root_mean_squared_error: 41.6830 - val_r_squared: 0.9397
Epoch 73/100
381/381 [==============================] - 2s 5ms/step - loss: 36.1967 - ro
ot_mean_squared_error: 36.1641 - r_squared: 0.9503 - val_loss: 40.6882 - va
l_root_mean_squared_error: 40.6859 - val_r_squared: 0.9414
Epoch 74/100
381/381 [==============================] - 2s 5ms/step - loss: 36.1677 - ro
ot_mean_squared_error: 36.1513 - r_squared: 0.9511 - val_loss: 46.9853 - va
l_root_mean_squared_error: 46.9813 - val_r_squared: 0.9251
Epoch 75/100
381/381 [==============================] - 2s 5ms/step - loss: 37.3403 - ro
ot_mean_squared_error: 37.2690 - r_squared: 0.9493 - val_loss: 40.5189 - va
l_root_mean_squared_error: 40.5170 - val_r_squared: 0.9420
Epoch 76/100
381/381 [==============================] - 2s 6ms/step - loss: 36.2506 - ro
ot_mean_squared_error: 36.2139 - r_squared: 0.9507 - val_loss: 50.2120 - va
l_root_mean_squared_error: 50.2119 - val_r_squared: 0.9140
Epoch 77/100
381/381 [==============================] - 2s 5ms/step - loss: 36.5335 - ro
ot_mean_squared_error: 36.4721 - r_squared: 0.9492 - val_loss: 44.2229 - va
l_root_mean_squared_error: 44.2203 - val_r_squared: 0.9326
Epoch 78/100
381/381 [==============================] - 2s 5ms/step - loss: 36.9713 - ro
ot_mean_squared_error: 36.9223 - r_squared: 0.9480 - val_loss: 42.4613 - va
l_root_mean_squared_error: 42.4594 - val_r_squared: 0.9367
Epoch 79/100
381/381 [==============================] - 2s 4ms/step - loss: 36.3485 - ro
ot_mean_squared_error: 36.3273 - r_squared: 0.9506 - val_loss: 41.7051 - va
l_root_mean_squared_error: 41.7076 - val_r_squared: 0.9379
Epoch 80/100
381/381 [==============================] - 2s 4ms/step - loss: 35.2566 - ro
ot_mean_squared_error: 35.2298 - r_squared: 0.9547 - val_loss: 40.7808 - va
l_root_mean_squared_error: 40.7826 - val_r_squared: 0.9408
Epoch 81/100
381/381 [==============================] - 2s 5ms/step - loss: 35.9966 - ro
ot_mean_squared_error: 35.9334 - r_squared: 0.9520 - val_loss: 38.9972 - va
l_root_mean_squared_error: 38.9956 - val_r_squared: 0.9467
Epoch 82/100
381/381 [==============================] - 2s 6ms/step - loss: 35.8774 - ro
ot_mean_squared_error: 35.8374 - r_squared: 0.9508 - val_loss: 40.1067 - va
l_root_mean_squared_error: 40.1059 - val_r_squared: 0.9442
Epoch 83/100
381/381 [==============================] - 2s 4ms/step - loss: 36.0372 - ro
ot_mean_squared_error: 36.0057 - r_squared: 0.9515 - val_loss: 43.3886 - va
l_root_mean_squared_error: 43.3928 - val_r_squared: 0.9337
Epoch 84/100
```

```
381/381 [==============================] - 2s 5ms/step - loss: 35.3989 - ro
ot_mean_squared_error: 35.3423 - r_squared: 0.9539 - val_loss: 41.1998 - va
l_root_mean_squared_error: 41.1973 - val_r_squared: 0.9411
Epoch 85/100
381/381 [==============================] - 2s 5ms/step - loss: 35.6853 - ro
ot_mean_squared_error: 35.7500 - r_squared: 0.9526 - val_loss: 44.0136 - va
l_root_mean_squared_error: 44.0081 - val_r_squared: 0.9352
Epoch 86/100
381/381 [==============================] - 2s 5ms/step - loss: 35.6380 - ro
ot_mean_squared_error: 35.6109 - r_squared: 0.9519 - val_loss: 40.4503 - va
l_root_mean_squared_error: 40.4494 - val_r_squared: 0.9426
Epoch 87/100
381/381 [==============================] - 2s 5ms/step - loss: 35.5201 - ro
ot_mean_squared_error: 35.4675 - r_squared: 0.9521 - val_loss: 40.5388 - va
l_root_mean_squared_error: 40.5344 - val_r_squared: 0.9439
Epoch 88/100
381/381 [==============================] - 2s 5ms/step - loss: 36.0095 - ro
ot_mean_squared_error: 36.0601 - r_squared: 0.8578 - val_loss: 41.1150 - va
l_root_mean_squared_error: 41.1142 - val_r_squared: 0.9413
Epoch 89/100
381/381 [==============================] - 2s 5ms/step - loss: 35.2279 - ro
ot_mean_squared_error: 35.2639 - r_squared: 0.9533 - val_loss: 40.7530 - va
l_root_mean_squared_error: 40.7496 - val_r_squared: 0.9427
Epoch 90/100
381/381 [==============================] - 2s 5ms/step - loss: 35.2253 - ro
ot_mean_squared_error: 35.2885 - r_squared: 0.9527 - val_loss: 43.1775 - va
l_root_mean_squared_error: 43.1736 - val_r_squared: 0.9362
Epoch 91/100
381/381 [==============================] - 2s 5ms/step - loss: 35.0271 - ro
ot_mean_squared_error: 34.9701 - r_squared: 0.9555 - val_loss: 39.2057 - va
l_root_mean_squared_error: 39.2055 - val_r_squared: 0.9450
Epoch 92/100
381/381 [==============================] - 2s 5ms/step - loss: 35.0255 - ro
ot_mean_squared_error: 35.0148 - r_squared: 0.9516 - val_loss: 38.7477 - va
l_root_mean_squared_error: 38.7483 - val_r_squared: 0.9471
Epoch 93/100
381/381 [==============================] - 2s 5ms/step - loss: 34.8927 - ro
ot_mean_squared_error: 34.8767 - r_squared: 0.9503 - val_loss: 41.1146 - va
l_root_mean_squared_error: 41.1098 - val_r_squared: 0.9422
Epoch 94/100
381/381 [==============================] - 2s 5ms/step - loss: 35.2279 - ro
ot_mean_squared_error: 35.2281 - r_squared: 0.9540 - val_loss: 41.1303 - va
l_root_mean_squared_error: 41.1262 - val_r_squared: 0.9423
Epoch 95/100
381/381 [==============================] - 2s 6ms/step - loss: 34.7041 - ro
ot_mean_squared_error: 34.6767 - r_squared: 0.9548 - val_loss: 40.9348 - va
l_root_mean_squared_error: 40.9337 - val_r_squared: 0.9409
Epoch 96/100
381/381 [==============================] - 2s 5ms/step - loss: 35.0566 - ro
ot_mean_squared_error: 34.9948 - r_squared: 0.9548 - val_loss: 39.7473 - va
l_root_mean_squared_error: 39.7471 - val_r_squared: 0.9447
Epoch 97/100
381/381 [==============================] - 2s 5ms/step - loss: 35.1171 - ro
ot_mean_squared_error: 35.0948 - r_squared: 0.9537 - val_loss: 41.0581 - va
l_root_mean_squared_error: 41.0584 - val_r_squared: 0.9405
Epoch 98/100
381/381 [==============================] - 2s 5ms/step - loss: 34.4425 - ro
ot_mean_squared_error: 34.4394 - r_squared: 0.9560 - val_loss: 38.5150 - va
l_root_mean_squared_error: 38.5140 - val_r_squared: 0.9475
```

```
Epoch 99/100
381/381 [==============================] - 2s 5ms/step - loss: 34.0212 - ro
ot_mean_squared_error: 33.9786 - r_squared: 0.9573 - val_loss: 40.9851 - va
l_root_mean_squared_error: 40.9807 - val_r_squared: 0.9424
Epoch 100/100
381/381 [==============================] - 2s 5ms/step - loss: 34.5919 - ro
ot_mean_squared_error: 34.5611 - r_squared: 0.9552 - val_loss: 38.4115 - va
l_root_mean_squared_error: 38.4093 - val_r_squared: 0.9481
```

In [33]:

```
# Predictions on Test Data
test_predictions = model_5_layer.predict(X_test)

test_r2_score = r2_score(y_test, test_predictions)
print("5 Layer ANN, Test R2 Score:", test_r2_score)
```

```
163/163 [==============================] - 0s 2ms/step
5 Layer ANN, Test R2 Score: 0.952174006713812
```

### Neural Network Architecture

- **Model**: Sequential 7-layer network.
- **Layers**:
  - Dense layer with 64 neurons, ReLU activation (Input layer).
  - Three Dense layers with 128 neurons each, ReLU activation.
  - Two Dense layers with 64 neurons each, ReLU activation.
  - Dense layer with 32 neurons, ReLU activation.
  - Output Dense layer with 1 neuron, linear activation.

### Training

- **Epochs**: 250
- **Batch size**: 32
- **Training R2 score**: 0.9822
- **Validation R2 score**: 0.9452

In [34]:

```
# Let's train the model
# Define the model
model_7_layer = Sequential()
model_7_layer.add(Dense(64, input_dim=X_train.shape[1], activation='relu'))
model_7_layer.add(Dense(128, activation='relu'))
model_7_layer.add(Dense(128, activation='relu'))
model_7_layer.add(Dense(128, activation='relu'))
model_7_layer.add(Dense(64, activation='relu'))
model_7_layer.add(Dense(64, activation='relu'))
model_7_layer.add(Dense(32, activation='relu'))
model_7_layer.add(Dense(1, activation='linear'))

# Compile the model
model_7_layer.compile(loss=root_mean_squared_error,
              optimizer='adam',
              metrics=[root_mean_squared_error, r_squared])

# Summary of the model
model_7_layer.summary()
model_7_layer_regressor = model_7_layer.fit(X_train, y_train, validation_dat
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 dense_10 (Dense)            (None, 64)                832       
                                                                 
 dense_11 (Dense)            (None, 128)               8320      
                                                                 
 dense_12 (Dense)            (None, 128)               16512     
                                                                 
 dense_13 (Dense)            (None, 128)               16512     
                                                                 
 dense_14 (Dense)            (None, 64)                8256      
                                                                 
 dense_15 (Dense)            (None, 64)                4160      
                                                                 
 dense_16 (Dense)            (None, 32)                2080      
                                                                 
 dense_17 (Dense)            (None, 1)                 33        
                                                                 
=================================================================
Total params: 56705 (221.50 KB)
Trainable params: 56705 (221.50 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
Epoch 1/250
381/381 [==============================] - 4s 6ms/step - loss: 149.3845 - r
oot_mean_squared_error: 149.1671 - r_squared: 0.2394 - val_loss: 133.4724 - 
val_root_mean_squared_error: 133.4742 - val_r_squared: 0.4114
Epoch 2/250
381/381 [==============================] - 2s 6ms/step - loss: 120.7167 - r
oot_mean_squared_error: 120.5259 - r_squared: 0.5121 - val_loss: 110.3009 - 
val_root_mean_squared_error: 110.3027 - val_r_squared: 0.6102
Epoch 3/250
381/381 [==============================] - 2s 5ms/step - loss: 108.6985 - r
oot_mean_squared_error: 108.6762 - r_squared: 0.6067 - val_loss: 110.9172 - 
val_root_mean_squared_error: 110.9258 - val_r_squared: 0.5854
Epoch 4/250
381/381 [==============================] - 2s 5ms/step - loss: 103.1863 - r
oot_mean_squared_error: 103.2647 - r_squared: -0.2251 - val_loss: 98.6838 - 
val_root_mean_squared_error: 98.6850 - val_r_squared: 0.6894
Epoch 5/250
381/381 [==============================] - 2s 5ms/step - loss: 96.7797 - ro
ot_mean_squared_error: 96.6211 - r_squared: 0.6851 - val_loss: 94.6571 - va
l_root_mean_squared_error: 94.6531 - val_r_squared: 0.7099
Epoch 6/250
381/381 [==============================] - 2s 5ms/step - loss: 88.4160 - ro
ot_mean_squared_error: 88.2359 - r_squared: 0.7325 - val_loss: 75.7912 - va
l_root_mean_squared_error: 75.7921 - val_r_squared: 0.8118
Epoch 7/250
381/381 [==============================] - 2s 5ms/step - loss: 78.5055 - ro
ot_mean_squared_error: 78.5862 - r_squared: 0.7839 - val_loss: 72.8547 - va
l_root_mean_squared_error: 72.8595 - val_r_squared: 0.8261
Epoch 8/250
381/381 [==============================] - 2s 6ms/step - loss: 68.1357 - ro
ot_mean_squared_error: 68.0767 - r_squared: 0.8391 - val_loss: 62.4424 - va
l_root_mean_squared_error: 62.4410 - val_r_squared: 0.8685
Epoch 9/250
381/381 [==============================] - 2s 5ms/step - loss: 63.2009 - ro
```

```
ot_mean_squared_error: 63.3154 - r_squared: 0.8562 - val_loss: 56.2321 - va
l_root_mean_squared_error: 56.2271 - val_r_squared: 0.8934
Epoch 10/250
381/381 [==============================] - 2s 5ms/step - loss: 60.9950 - ro
ot_mean_squared_error: 60.9973 - r_squared: 0.8678 - val_loss: 57.1905 - va
l_root_mean_squared_error: 57.1871 - val_r_squared: 0.8907
Epoch 11/250
381/381 [==============================] - 2s 5ms/step - loss: 58.0299 - ro
ot_mean_squared_error: 57.9143 - r_squared: 0.8712 - val_loss: 54.1525 - va
l_root_mean_squared_error: 54.1508 - val_r_squared: 0.9025
Epoch 12/250
381/381 [==============================] - 2s 5ms/step - loss: 53.6157 - ro
ot_mean_squared_error: 53.5403 - r_squared: 0.8927 - val_loss: 48.8752 - va
l_root_mean_squared_error: 48.8723 - val_r_squared: 0.9187
Epoch 13/250
381/381 [==============================] - 2s 5ms/step - loss: 52.1820 - ro
ot_mean_squared_error: 52.1502 - r_squared: 0.9027 - val_loss: 48.5604 - va
l_root_mean_squared_error: 48.5544 - val_r_squared: 0.9200
Epoch 14/250
381/381 [==============================] - 2s 6ms/step - loss: 50.8454 - ro
ot_mean_squared_error: 50.7926 - r_squared: 0.8718 - val_loss: 51.6037 - va
l_root_mean_squared_error: 51.5989 - val_r_squared: 0.9112
Epoch 15/250
381/381 [==============================] - 2s 6ms/step - loss: 48.1292 - ro
ot_mean_squared_error: 48.2739 - r_squared: 0.9150 - val_loss: 52.7413 - va
l_root_mean_squared_error: 52.7347 - val_r_squared: 0.9066
Epoch 16/250
381/381 [==============================] - 2s 5ms/step - loss: 51.0705 - ro
ot_mean_squared_error: 51.0369 - r_squared: 0.9032 - val_loss: 53.1244 - va
l_root_mean_squared_error: 53.1205 - val_r_squared: 0.9045
Epoch 17/250
381/381 [==============================] - 2s 5ms/step - loss: 47.0709 - ro
ot_mean_squared_error: 47.1129 - r_squared: 0.9165 - val_loss: 46.4090 - va
l_root_mean_squared_error: 46.4062 - val_r_squared: 0.9257
Epoch 18/250
381/381 [==============================] - 2s 5ms/step - loss: 46.0716 - ro
ot_mean_squared_error: 46.0992 - r_squared: 0.9171 - val_loss: 51.1667 - va
l_root_mean_squared_error: 51.1645 - val_r_squared: 0.9124
Epoch 19/250
381/381 [==============================] - 2s 6ms/step - loss: 45.7490 - ro
ot_mean_squared_error: 45.6715 - r_squared: 0.9232 - val_loss: 45.4794 - va
l_root_mean_squared_error: 45.4754 - val_r_squared: 0.9288
Epoch 20/250
381/381 [==============================] - 2s 6ms/step - loss: 46.4919 - ro
ot_mean_squared_error: 46.4462 - r_squared: 0.9200 - val_loss: 54.1805 - va
l_root_mean_squared_error: 54.1811 - val_r_squared: 0.9014
Epoch 21/250
381/381 [==============================] - 2s 5ms/step - loss: 45.1674 - ro
ot_mean_squared_error: 45.2042 - r_squared: 0.9256 - val_loss: 42.6121 - va
l_root_mean_squared_error: 42.6058 - val_r_squared: 0.9371
Epoch 22/250
381/381 [==============================] - 2s 5ms/step - loss: 44.7109 - ro
ot_mean_squared_error: 44.6971 - r_squared: 0.9262 - val_loss: 48.4819 - va
l_root_mean_squared_error: 48.4767 - val_r_squared: 0.9207
Epoch 23/250
381/381 [==============================] - 2s 5ms/step - loss: 43.4774 - ro
ot_mean_squared_error: 43.4163 - r_squared: 0.9297 - val_loss: 50.7433 - va
l_root_mean_squared_error: 50.7388 - val_r_squared: 0.9140
Epoch 24/250
```

```
381/381 [==============================] - 2s 5ms/step - loss: 43.4258 - ro
ot_mean_squared_error: 43.6414 - r_squared: 0.9311 - val_loss: 43.3333 - va
l_root_mean_squared_error: 43.3290 - val_r_squared: 0.9352
Epoch 25/250
381/381 [==============================] - 2s 6ms/step - loss: 43.7771 - ro
ot_mean_squared_error: 43.7025 - r_squared: 0.9296 - val_loss: 56.4719 - va
l_root_mean_squared_error: 56.4656 - val_r_squared: 0.8922
Epoch 26/250
381/381 [==============================] - 2s 6ms/step - loss: 42.5736 - ro
ot_mean_squared_error: 42.5548 - r_squared: 0.9325 - val_loss: 43.4266 - va
l_root_mean_squared_error: 43.4246 - val_r_squared: 0.9333
Epoch 27/250
381/381 [==============================] - 2s 5ms/step - loss: 41.6364 - ro
ot_mean_squared_error: 41.7161 - r_squared: 0.9317 - val_loss: 49.3777 - va
l_root_mean_squared_error: 49.3756 - val_r_squared: 0.9184
Epoch 28/250
381/381 [==============================] - 2s 5ms/step - loss: 42.3440 - ro
ot_mean_squared_error: 42.2952 - r_squared: 0.9336 - val_loss: 43.9255 - va
l_root_mean_squared_error: 43.9228 - val_r_squared: 0.9315
Epoch 29/250
381/381 [==============================] - 2s 5ms/step - loss: 42.2255 - ro
ot_mean_squared_error: 42.1897 - r_squared: 0.9339 - val_loss: 43.5883 - va
l_root_mean_squared_error: 43.5858 - val_r_squared: 0.9342
Epoch 30/250
381/381 [==============================] - 2s 6ms/step - loss: 41.0252 - ro
ot_mean_squared_error: 40.9782 - r_squared: 0.9358 - val_loss: 40.4863 - va
l_root_mean_squared_error: 40.4866 - val_r_squared: 0.9427
Epoch 31/250
381/381 [==============================] - 2s 7ms/step - loss: 40.6489 - ro
ot_mean_squared_error: 40.6900 - r_squared: 0.9350 - val_loss: 43.0423 - va
l_root_mean_squared_error: 43.0400 - val_r_squared: 0.9355
Epoch 32/250
381/381 [==============================] - 2s 5ms/step - loss: 40.3853 - ro
ot_mean_squared_error: 40.4271 - r_squared: 0.9398 - val_loss: 43.5246 - va
l_root_mean_squared_error: 43.5219 - val_r_squared: 0.9353
Epoch 33/250
381/381 [==============================] - 2s 5ms/step - loss: 39.5349 - ro
ot_mean_squared_error: 39.5132 - r_squared: 0.9419 - val_loss: 40.8843 - va
l_root_mean_squared_error: 40.8794 - val_r_squared: 0.9422
Epoch 34/250
381/381 [==============================] - 2s 5ms/step - loss: 38.5926 - ro
ot_mean_squared_error: 38.5393 - r_squared: 0.9431 - val_loss: 44.0554 - va
l_root_mean_squared_error: 44.0487 - val_r_squared: 0.9342
Epoch 35/250
381/381 [==============================] - 2s 5ms/step - loss: 41.4588 - ro
ot_mean_squared_error: 41.4437 - r_squared: 0.9377 - val_loss: 52.7170 - va
l_root_mean_squared_error: 52.7208 - val_r_squared: 0.9059
Epoch 36/250
381/381 [==============================] - 2s 5ms/step - loss: 38.9562 - ro
ot_mean_squared_error: 38.8884 - r_squared: 0.9446 - val_loss: 41.6452 - va
l_root_mean_squared_error: 41.6446 - val_r_squared: 0.9403
Epoch 37/250
381/381 [==============================] - 2s 6ms/step - loss: 38.4218 - ro
ot_mean_squared_error: 38.4360 - r_squared: 0.9455 - val_loss: 43.6593 - va
l_root_mean_squared_error: 43.6562 - val_r_squared: 0.9329
Epoch 38/250
381/381 [==============================] - 2s 6ms/step - loss: 38.0536 - ro
ot_mean_squared_error: 37.9889 - r_squared: 0.9471 - val_loss: 40.4673 - va
l_root_mean_squared_error: 40.4651 - val_r_squared: 0.9426
```

```
Epoch 39/250
381/381 [==============================] - 2s 5ms/step - loss: 39.7482 - ro
ot_mean_squared_error: 39.7587 - r_squared: 0.9399 - val_loss: 40.7398 - va
l_root_mean_squared_error: 40.7373 - val_r_squared: 0.9418
Epoch 40/250
381/381 [==============================] - 2s 5ms/step - loss: 37.2628 - ro
ot_mean_squared_error: 37.3672 - r_squared: 0.9472 - val_loss: 50.6186 - va
l_root_mean_squared_error: 50.6217 - val_r_squared: 0.9091
Epoch 41/250
381/381 [==============================] - 2s 5ms/step - loss: 39.1774 - ro
ot_mean_squared_error: 39.1316 - r_squared: 0.9435 - val_loss: 41.3154 - va
l_root_mean_squared_error: 41.3104 - val_r_squared: 0.9412
Epoch 42/250
381/381 [==============================] - 2s 6ms/step - loss: 37.3337 - ro
ot_mean_squared_error: 37.2889 - r_squared: 0.9477 - val_loss: 42.9506 - va
l_root_mean_squared_error: 42.9460 - val_r_squared: 0.9365
Epoch 43/250
381/381 [==============================] - 2s 6ms/step - loss: 37.5997 - ro
ot_mean_squared_error: 37.6560 - r_squared: 0.9481 - val_loss: 41.6945 - va
l_root_mean_squared_error: 41.6884 - val_r_squared: 0.9399
Epoch 44/250
381/381 [==============================] - 2s 5ms/step - loss: 37.2543 - ro
ot_mean_squared_error: 37.2386 - r_squared: 0.9481 - val_loss: 40.4680 - va
l_root_mean_squared_error: 40.4699 - val_r_squared: 0.9428
Epoch 45/250
381/381 [==============================] - 2s 5ms/step - loss: 38.0255 - ro
ot_mean_squared_error: 38.0148 - r_squared: 0.9443 - val_loss: 42.5668 - va
l_root_mean_squared_error: 42.5652 - val_r_squared: 0.9379
Epoch 46/250
381/381 [==============================] - 2s 5ms/step - loss: 36.1581 - ro
ot_mean_squared_error: 36.2104 - r_squared: 0.9511 - val_loss: 42.6843 - va
l_root_mean_squared_error: 42.6834 - val_r_squared: 0.9364
Epoch 47/250
381/381 [==============================] - 2s 5ms/step - loss: 36.9652 - ro
ot_mean_squared_error: 37.0399 - r_squared: 0.9472 - val_loss: 42.1099 - va
l_root_mean_squared_error: 42.1094 - val_r_squared: 0.9380
Epoch 48/250
381/381 [==============================] - 3s 7ms/step - loss: 37.4318 - ro
ot_mean_squared_error: 37.4599 - r_squared: 0.9459 - val_loss: 41.8614 - va
l_root_mean_squared_error: 41.8600 - val_r_squared: 0.9384
Epoch 49/250
381/381 [==============================] - 2s 5ms/step - loss: 36.2299 - ro
ot_mean_squared_error: 36.1579 - r_squared: 0.9514 - val_loss: 40.8838 - va
l_root_mean_squared_error: 40.8816 - val_r_squared: 0.9415
Epoch 50/250
381/381 [==============================] - 2s 5ms/step - loss: 35.8886 - ro
ot_mean_squared_error: 35.8319 - r_squared: 0.9521 - val_loss: 42.9095 - va
l_root_mean_squared_error: 42.9061 - val_r_squared: 0.9365
Epoch 51/250
381/381 [==============================] - 2s 5ms/step - loss: 35.3915 - ro
ot_mean_squared_error: 35.3509 - r_squared: 0.9531 - val_loss: 40.7876 - va
l_root_mean_squared_error: 40.7877 - val_r_squared: 0.9409
Epoch 52/250
381/381 [==============================] - 2s 5ms/step - loss: 35.7199 - ro
ot_mean_squared_error: 35.6926 - r_squared: 0.9528 - val_loss: 41.2433 - va
l_root_mean_squared_error: 41.2420 - val_r_squared: 0.9404
Epoch 53/250
381/381 [==============================] - 2s 5ms/step - loss: 36.2780 - ro
ot_mean_squared_error: 36.2769 - r_squared: 0.9510 - val_loss: 43.8970 - va
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l_root_mean_squared_error: 43.8927 - val_r_squared: 0.9332
Epoch 54/250
381/381 [==============================] - 2s 6ms/step - loss: 35.7001 - ro
ot_mean_squared_error: 35.6889 - r_squared: 0.9510 - val_loss: 41.9291 - va
l_root_mean_squared_error: 41.9305 - val_r_squared: 0.9378
Epoch 55/250
381/381 [==============================] - 2s 5ms/step - loss: 34.8686 - ro
ot_mean_squared_error: 34.8854 - r_squared: 0.9507 - val_loss: 39.3198 - va
l_root_mean_squared_error: 39.3198 - val_r_squared: 0.9457
Epoch 56/250
381/381 [==============================] - 2s 5ms/step - loss: 34.0237 - ro
ot_mean_squared_error: 33.9569 - r_squared: 0.9568 - val_loss: 40.7088 - va
l_root_mean_squared_error: 40.7086 - val_r_squared: 0.9417
Epoch 57/250
381/381 [==============================] - 2s 5ms/step - loss: 35.0851 - ro
ot_mean_squared_error: 35.0374 - r_squared: 0.9532 - val_loss: 40.2250 - va
l_root_mean_squared_error: 40.2245 - val_r_squared: 0.9429
Epoch 58/250
381/381 [==============================] - 2s 5ms/step - loss: 34.1450 - ro
ot_mean_squared_error: 34.1665 - r_squared: 0.9548 - val_loss: 43.6730 - va
l_root_mean_squared_error: 43.6749 - val_r_squared: 0.9327
Epoch 59/250
381/381 [==============================] - 2s 5ms/step - loss: 34.0862 - ro
ot_mean_squared_error: 34.0424 - r_squared: 0.9562 - val_loss: 41.5401 - va
l_root_mean_squared_error: 41.5434 - val_r_squared: 0.9395
Epoch 60/250
381/381 [==============================] - 2s 6ms/step - loss: 33.6165 - ro
ot_mean_squared_error: 33.6255 - r_squared: 0.9572 - val_loss: 42.1924 - va
l_root_mean_squared_error: 42.1905 - val_r_squared: 0.9378
Epoch 61/250
381/381 [==============================] - 2s 5ms/step - loss: 35.6996 - ro
ot_mean_squared_error: 35.7004 - r_squared: 0.9507 - val_loss: 40.3896 - va
l_root_mean_squared_error: 40.3881 - val_r_squared: 0.9424
Epoch 62/250
381/381 [==============================] - 2s 5ms/step - loss: 33.8804 - ro
ot_mean_squared_error: 33.9187 - r_squared: 0.9564 - val_loss: 39.9938 - va
l_root_mean_squared_error: 39.9899 - val_r_squared: 0.9442
Epoch 63/250
381/381 [==============================] - 2s 5ms/step - loss: 33.7966 - ro
ot_mean_squared_error: 33.7668 - r_squared: 0.9575 - val_loss: 40.7911 - va
l_root_mean_squared_error: 40.7911 - val_r_squared: 0.9408
Epoch 64/250
381/381 [==============================] - 2s 5ms/step - loss: 34.0281 - ro
ot_mean_squared_error: 33.9860 - r_squared: 0.9569 - val_loss: 40.3981 - va
l_root_mean_squared_error: 40.3940 - val_r_squared: 0.9433
Epoch 65/250
381/381 [==============================] - 2s 6ms/step - loss: 32.8964 - ro
ot_mean_squared_error: 32.8930 - r_squared: 0.9601 - val_loss: 39.8095 - va
l_root_mean_squared_error: 39.8103 - val_r_squared: 0.9441
Epoch 66/250
381/381 [==============================] - 2s 6ms/step - loss: 33.1576 - ro
ot_mean_squared_error: 33.1081 - r_squared: 0.9601 - val_loss: 44.5994 - va
l_root_mean_squared_error: 44.5964 - val_r_squared: 0.9325
Epoch 67/250
381/381 [==============================] - 2s 5ms/step - loss: 34.5121 - ro
ot_mean_squared_error: 34.5587 - r_squared: 0.9552 - val_loss: 40.6851 - va
l_root_mean_squared_error: 40.6833 - val_r_squared: 0.9420
Epoch 68/250
381/381 [==============================] - 2s 5ms/step - loss: 34.0505 - ro
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ot_mean_squared_error: 34.0340 - r_squared: 0.9560 - val_loss: 43.0745 - va
l_root_mean_squared_error: 43.0764 - val_r_squared: 0.9342
Epoch 69/250
381/381 [==============================] - 2s 5ms/step - loss: 32.5870 - ro
ot_mean_squared_error: 32.5775 - r_squared: 0.9507 - val_loss: 54.2375 - va
l_root_mean_squared_error: 54.2396 - val_r_squared: 0.8988
Epoch 70/250
381/381 [==============================] - 2s 5ms/step - loss: 32.5148 - ro
ot_mean_squared_error: 32.4876 - r_squared: 0.9604 - val_loss: 42.3703 - va
l_root_mean_squared_error: 42.3691 - val_r_squared: 0.9385
Epoch 71/250
381/381 [==============================] - 2s 6ms/step - loss: 32.9284 - ro
ot_mean_squared_error: 32.9085 - r_squared: 0.9600 - val_loss: 40.5384 - va
l_root_mean_squared_error: 40.5355 - val_r_squared: 0.9419
Epoch 72/250
381/381 [==============================] - 2s 6ms/step - loss: 32.3464 - ro
ot_mean_squared_error: 32.3683 - r_squared: 0.9612 - val_loss: 38.2581 - va
l_root_mean_squared_error: 38.2573 - val_r_squared: 0.9490
Epoch 73/250
381/381 [==============================] - 2s 5ms/step - loss: 31.8865 - ro
ot_mean_squared_error: 31.8679 - r_squared: 0.9629 - val_loss: 40.5227 - va
l_root_mean_squared_error: 40.5214 - val_r_squared: 0.9421
Epoch 74/250
381/381 [==============================] - 2s 5ms/step - loss: 32.1270 - ro
ot_mean_squared_error: 32.1038 - r_squared: 0.9622 - val_loss: 40.2844 - va
l_root_mean_squared_error: 40.2810 - val_r_squared: 0.9440
Epoch 75/250
381/381 [==============================] - 2s 5ms/step - loss: 31.1998 - ro
ot_mean_squared_error: 31.2050 - r_squared: 0.9641 - val_loss: 41.8457 - va
l_root_mean_squared_error: 41.8439 - val_r_squared: 0.9406
Epoch 76/250
381/381 [==============================] - 2s 5ms/step - loss: 34.9094 - ro
ot_mean_squared_error: 34.8711 - r_squared: 0.9541 - val_loss: 39.5788 - va
l_root_mean_squared_error: 39.5731 - val_r_squared: 0.9458
Epoch 77/250
381/381 [==============================] - 2s 6ms/step - loss: 32.6235 - ro
ot_mean_squared_error: 32.6363 - r_squared: 0.9595 - val_loss: 42.1830 - va
l_root_mean_squared_error: 42.1801 - val_r_squared: 0.9382
Epoch 78/250
381/381 [==============================] - 2s 5ms/step - loss: 31.4480 - ro
ot_mean_squared_error: 31.6562 - r_squared: 0.9585 - val_loss: 39.2746 - va
l_root_mean_squared_error: 39.2719 - val_r_squared: 0.9463
Epoch 79/250
381/381 [==============================] - 2s 5ms/step - loss: 32.3456 - ro
ot_mean_squared_error: 32.3374 - r_squared: 0.9605 - val_loss: 39.5474 - va
l_root_mean_squared_error: 39.5430 - val_r_squared: 0.9448
Epoch 80/250
381/381 [==============================] - 2s 5ms/step - loss: 32.6255 - ro
ot_mean_squared_error: 32.6288 - r_squared: 0.9600 - val_loss: 38.9193 - va
l_root_mean_squared_error: 38.9163 - val_r_squared: 0.9478
Epoch 81/250
381/381 [==============================] - 2s 5ms/step - loss: 29.9764 - ro
ot_mean_squared_error: 29.9484 - r_squared: 0.9653 - val_loss: 41.3163 - va
l_root_mean_squared_error: 41.3132 - val_r_squared: 0.9410
Epoch 82/250
381/381 [==============================] - 2s 5ms/step - loss: 31.0806 - ro
ot_mean_squared_error: 31.1056 - r_squared: 0.9630 - val_loss: 38.3270 - va
l_root_mean_squared_error: 38.3257 - val_r_squared: 0.9483
Epoch 83/250
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381/381 [==============================] - 3s 7ms/step - loss: 30.3951 - ro
ot_mean_squared_error: 30.3600 - r_squared: 0.9649 - val_loss: 39.8612 - va
l_root_mean_squared_error: 39.8578 - val_r_squared: 0.9443
Epoch 84/250
381/381 [==============================] - 2s 5ms/step - loss: 33.4505 - ro
ot_mean_squared_error: 33.5053 - r_squared: 0.9546 - val_loss: 39.9003 - va
l_root_mean_squared_error: 39.8989 - val_r_squared: 0.9449
Epoch 85/250
381/381 [==============================] - 2s 5ms/step - loss: 30.4925 - ro
ot_mean_squared_error: 30.4445 - r_squared: 0.9644 - val_loss: 47.0500 - va
l_root_mean_squared_error: 47.0539 - val_r_squared: 0.9233
Epoch 86/250
381/381 [==============================] - 2s 5ms/step - loss: 31.6163 - ro
ot_mean_squared_error: 31.7378 - r_squared: 0.9619 - val_loss: 45.5997 - va
l_root_mean_squared_error: 45.6002 - val_r_squared: 0.9269
Epoch 87/250
381/381 [==============================] - 2s 5ms/step - loss: 30.4265 - ro
ot_mean_squared_error: 30.4015 - r_squared: 0.9644 - val_loss: 39.6857 - va
l_root_mean_squared_error: 39.6828 - val_r_squared: 0.9445
Epoch 88/250
381/381 [==============================] - 2s 6ms/step - loss: 29.9727 - ro
ot_mean_squared_error: 29.9764 - r_squared: 0.9665 - val_loss: 39.6969 - va
l_root_mean_squared_error: 39.6928 - val_r_squared: 0.9444
Epoch 89/250
381/381 [==============================] - 2s 6ms/step - loss: 30.5584 - ro
ot_mean_squared_error: 30.4953 - r_squared: 0.9659 - val_loss: 38.7345 - va
l_root_mean_squared_error: 38.7355 - val_r_squared: 0.9474
Epoch 90/250
381/381 [==============================] - 2s 5ms/step - loss: 29.1797 - ro
ot_mean_squared_error: 29.1296 - r_squared: 0.9675 - val_loss: 39.4630 - va
l_root_mean_squared_error: 39.4653 - val_r_squared: 0.9446
Epoch 91/250
381/381 [==============================] - 2s 5ms/step - loss: 29.7089 - ro
ot_mean_squared_error: 29.6908 - r_squared: 0.9665 - val_loss: 38.8153 - va
l_root_mean_squared_error: 38.8158 - val_r_squared: 0.9470
Epoch 92/250
381/381 [==============================] - 2s 5ms/step - loss: 28.9858 - ro
ot_mean_squared_error: 28.9703 - r_squared: 0.9686 - val_loss: 40.9975 - va
l_root_mean_squared_error: 40.9956 - val_r_squared: 0.9428
Epoch 93/250
381/381 [==============================] - 2s 5ms/step - loss: 29.4986 - ro
ot_mean_squared_error: 29.5893 - r_squared: 0.9650 - val_loss: 38.7324 - va
l_root_mean_squared_error: 38.7294 - val_r_squared: 0.9480
Epoch 94/250
381/381 [==============================] - 2s 6ms/step - loss: 30.5968 - ro
ot_mean_squared_error: 30.5481 - r_squared: 0.9649 - val_loss: 39.2932 - va
l_root_mean_squared_error: 39.2917 - val_r_squared: 0.9464
Epoch 95/250
381/381 [==============================] - 2s 5ms/step - loss: 31.8826 - ro
ot_mean_squared_error: 31.8389 - r_squared: 0.9612 - val_loss: 38.1980 - va
l_root_mean_squared_error: 38.1980 - val_r_squared: 0.9481
Epoch 96/250
381/381 [==============================] - 2s 5ms/step - loss: 28.4384 - ro
ot_mean_squared_error: 28.4149 - r_squared: 0.9692 - val_loss: 40.5085 - va
l_root_mean_squared_error: 40.5052 - val_r_squared: 0.9422
Epoch 97/250
381/381 [==============================] - 2s 5ms/step - loss: 29.1730 - ro
ot_mean_squared_error: 29.1376 - r_squared: 0.9678 - val_loss: 38.6005 - va
l_root_mean_squared_error: 38.5995 - val_r_squared: 0.9480
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Epoch 98/250
381/381 [==============================] - 2s 5ms/step - loss: 29.0443 - ro
ot_mean_squared_error: 29.0103 - r_squared: 0.9681 - val_loss: 37.4900 - va
l_root_mean_squared_error: 37.4879 - val_r_squared: 0.9502
Epoch 99/250
381/381 [==============================] - 2s 5ms/step - loss: 28.7981 - ro
ot_mean_squared_error: 28.7756 - r_squared: 0.9686 - val_loss: 38.4652 - va
l_root_mean_squared_error: 38.4637 - val_r_squared: 0.9486
Epoch 100/250
381/381 [==============================] - 3s 7ms/step - loss: 28.3879 - ro
ot_mean_squared_error: 28.3823 - r_squared: 0.9695 - val_loss: 38.3734 - va
l_root_mean_squared_error: 38.3738 - val_r_squared: 0.9476
Epoch 101/250
381/381 [==============================] - 2s 5ms/step - loss: 29.1042 - ro
ot_mean_squared_error: 29.0721 - r_squared: 0.9680 - val_loss: 38.9803 - va
l_root_mean_squared_error: 38.9785 - val_r_squared: 0.9468
Epoch 102/250
381/381 [==============================] - 2s 5ms/step - loss: 28.3914 - ro
ot_mean_squared_error: 28.3807 - r_squared: 0.9694 - val_loss: 38.6647 - va
l_root_mean_squared_error: 38.6625 - val_r_squared: 0.9483
Epoch 103/250
381/381 [==============================] - 2s 6ms/step - loss: 29.5067 - ro
ot_mean_squared_error: 29.4834 - r_squared: 0.9670 - val_loss: 38.4313 - va
l_root_mean_squared_error: 38.4290 - val_r_squared: 0.9487
Epoch 104/250
381/381 [==============================] - 2s 6ms/step - loss: 28.5036 - ro
ot_mean_squared_error: 28.5036 - r_squared: 0.9700 - val_loss: 38.5057 - va
l_root_mean_squared_error: 38.5039 - val_r_squared: 0.9478
Epoch 105/250
381/381 [==============================] - 3s 7ms/step - loss: 29.1299 - ro
ot_mean_squared_error: 29.0849 - r_squared: 0.9684 - val_loss: 39.0122 - va
l_root_mean_squared_error: 39.0090 - val_r_squared: 0.9468
Epoch 106/250
381/381 [==============================] - 2s 5ms/step - loss: 28.2317 - ro
ot_mean_squared_error: 28.2130 - r_squared: 0.9703 - val_loss: 38.3815 - va
l_root_mean_squared_error: 38.3789 - val_r_squared: 0.9479
Epoch 107/250
381/381 [==============================] - 2s 5ms/step - loss: 28.2188 - ro
ot_mean_squared_error: 28.2125 - r_squared: 0.9684 - val_loss: 39.3268 - va
l_root_mean_squared_error: 39.3299 - val_r_squared: 0.9454
Epoch 108/250
381/381 [==============================] - 2s 5ms/step - loss: 27.6244 - ro
ot_mean_squared_error: 27.6098 - r_squared: 0.9715 - val_loss: 38.8432 - va
l_root_mean_squared_error: 38.8410 - val_r_squared: 0.9476
Epoch 109/250
381/381 [==============================] - 2s 5ms/step - loss: 27.9979 - ro
ot_mean_squared_error: 28.0098 - r_squared: 0.9710 - val_loss: 38.5561 - va
l_root_mean_squared_error: 38.5561 - val_r_squared: 0.9473
Epoch 110/250
381/381 [==============================] - 2s 5ms/step - loss: 27.3136 - ro
ot_mean_squared_error: 27.3136 - r_squared: 0.9718 - val_loss: 39.0399 - va
l_root_mean_squared_error: 39.0399 - val_r_squared: 0.9464
Epoch 111/250
381/381 [==============================] - 3s 7ms/step - loss: 29.5687 - ro
ot_mean_squared_error: 29.5203 - r_squared: 0.9660 - val_loss: 38.4792 - va
l_root_mean_squared_error: 38.4762 - val_r_squared: 0.9485
Epoch 112/250
381/381 [==============================] - 2s 5ms/step - loss: 27.8677 - ro
ot_mean_squared_error: 27.8633 - r_squared: 0.9707 - val_loss: 40.3941 - va
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l_root_mean_squared_error: 40.3905 - val_r_squared: 0.9437
Epoch 113/250
381/381 [==============================] - 2s 5ms/step - loss: 28.0862 - ro
ot_mean_squared_error: 28.0627 - r_squared: 0.9704 - val_loss: 38.2638 - va
l_root_mean_squared_error: 38.2609 - val_r_squared: 0.9480
Epoch 114/250
381/381 [==============================] - 2s 5ms/step - loss: 27.9989 - ro
ot_mean_squared_error: 27.9774 - r_squared: 0.9703 - val_loss: 38.2374 - va
l_root_mean_squared_error: 38.2368 - val_r_squared: 0.9481
Epoch 115/250
381/381 [==============================] - 2s 5ms/step - loss: 27.3250 - ro
ot_mean_squared_error: 27.3312 - r_squared: 0.9724 - val_loss: 40.4763 - va
l_root_mean_squared_error: 40.4738 - val_r_squared: 0.9425
Epoch 116/250
381/381 [==============================] - 2s 6ms/step - loss: 27.0318 - ro
ot_mean_squared_error: 26.9989 - r_squared: 0.9727 - val_loss: 38.8493 - va
l_root_mean_squared_error: 38.8488 - val_r_squared: 0.9467
Epoch 117/250
381/381 [==============================] - 2s 6ms/step - loss: 25.9449 - ro
ot_mean_squared_error: 25.9579 - r_squared: 0.9746 - val_loss: 38.6427 - va
l_root_mean_squared_error: 38.6394 - val_r_squared: 0.9478
Epoch 118/250
381/381 [==============================] - 2s 5ms/step - loss: 27.7454 - ro
ot_mean_squared_error: 27.7735 - r_squared: 0.9706 - val_loss: 38.7101 - va
l_root_mean_squared_error: 38.7094 - val_r_squared: 0.9477
Epoch 119/250
381/381 [==============================] - 2s 5ms/step - loss: 26.9746 - ro
ot_mean_squared_error: 26.9322 - r_squared: 0.9733 - val_loss: 37.4942 - va
l_root_mean_squared_error: 37.4914 - val_r_squared: 0.9506
Epoch 120/250
381/381 [==============================] - 2s 5ms/step - loss: 27.1933 - ro
ot_mean_squared_error: 27.1867 - r_squared: 0.9724 - val_loss: 38.3803 - va
l_root_mean_squared_error: 38.3771 - val_r_squared: 0.9481
Epoch 121/250
381/381 [==============================] - 2s 5ms/step - loss: 26.9866 - ro
ot_mean_squared_error: 26.9530 - r_squared: 0.9727 - val_loss: 39.5065 - va
l_root_mean_squared_error: 39.5031 - val_r_squared: 0.9459
Epoch 122/250
381/381 [==============================] - 2s 6ms/step - loss: 27.7364 - ro
ot_mean_squared_error: 27.7393 - r_squared: 0.9707 - val_loss: 41.0234 - va
l_root_mean_squared_error: 41.0236 - val_r_squared: 0.9403
Epoch 123/250
381/381 [==============================] - 2s 5ms/step - loss: 26.1457 - ro
ot_mean_squared_error: 26.1326 - r_squared: 0.9739 - val_loss: 38.7998 - va
l_root_mean_squared_error: 38.7988 - val_r_squared: 0.9465
Epoch 124/250
381/381 [==============================] - 2s 5ms/step - loss: 26.1238 - ro
ot_mean_squared_error: 26.0702 - r_squared: 0.9739 - val_loss: 40.0770 - va
l_root_mean_squared_error: 40.0810 - val_r_squared: 0.9428
Epoch 125/250
381/381 [==============================] - 2s 5ms/step - loss: 26.1913 - ro
ot_mean_squared_error: 26.1822 - r_squared: 0.9743 - val_loss: 40.1078 - va
l_root_mean_squared_error: 40.1056 - val_r_squared: 0.9431
Epoch 126/250
381/381 [==============================] - 2s 6ms/step - loss: 26.5814 - ro
ot_mean_squared_error: 26.5312 - r_squared: 0.9731 - val_loss: 39.2453 - va
l_root_mean_squared_error: 39.2439 - val_r_squared: 0.9453
Epoch 127/250
381/381 [==============================] - 2s 5ms/step - loss: 26.3957 - ro
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ot_mean_squared_error: 26.3512 - r_squared: 0.9738 - val_loss: 39.9184 - va
l_root_mean_squared_error: 39.9177 - val_r_squared: 0.9445
Epoch 128/250
381/381 [==============================] - 3s 7ms/step - loss: 26.1962 - ro
ot_mean_squared_error: 26.1499 - r_squared: 0.9748 - val_loss: 38.8052 - va
l_root_mean_squared_error: 38.8069 - val_r_squared: 0.9467
Epoch 129/250
381/381 [==============================] - 2s 5ms/step - loss: 26.0982 - ro
ot_mean_squared_error: 26.0774 - r_squared: 0.9740 - val_loss: 37.6937 - va
l_root_mean_squared_error: 37.6913 - val_r_squared: 0.9504
Epoch 130/250
381/381 [==============================] - 2s 5ms/step - loss: 26.4455 - ro
ot_mean_squared_error: 26.4272 - r_squared: 0.9746 - val_loss: 39.3111 - va
l_root_mean_squared_error: 39.3120 - val_r_squared: 0.9452
Epoch 131/250
381/381 [==============================] - 2s 5ms/step - loss: 27.7729 - ro
ot_mean_squared_error: 27.7973 - r_squared: 0.9706 - val_loss: 39.2076 - va
l_root_mean_squared_error: 39.2065 - val_r_squared: 0.9465
Epoch 132/250
381/381 [==============================] - 2s 5ms/step - loss: 26.2255 - ro
ot_mean_squared_error: 26.2391 - r_squared: 0.9744 - val_loss: 40.6231 - va
l_root_mean_squared_error: 40.6193 - val_r_squared: 0.9425
Epoch 133/250
381/381 [==============================] - 3s 7ms/step - loss: 25.6765 - ro
ot_mean_squared_error: 25.6697 - r_squared: 0.9751 - val_loss: 38.4047 - va
l_root_mean_squared_error: 38.4020 - val_r_squared: 0.9476
Epoch 134/250
381/381 [==============================] - 2s 6ms/step - loss: 26.1707 - ro
ot_mean_squared_error: 26.1367 - r_squared: 0.9740 - val_loss: 38.7734 - va
l_root_mean_squared_error: 38.7743 - val_r_squared: 0.9467
Epoch 135/250
381/381 [==============================] - 2s 5ms/step - loss: 25.6234 - ro
ot_mean_squared_error: 25.5833 - r_squared: 0.9755 - val_loss: 38.2570 - va
l_root_mean_squared_error: 38.2576 - val_r_squared: 0.9478
Epoch 136/250
381/381 [==============================] - 2s 5ms/step - loss: 25.1102 - ro
ot_mean_squared_error: 25.1050 - r_squared: 0.9761 - val_loss: 43.5490 - va
l_root_mean_squared_error: 43.5485 - val_r_squared: 0.9332
Epoch 137/250
381/381 [==============================] - 2s 6ms/step - loss: 27.0143 - ro
ot_mean_squared_error: 27.0306 - r_squared: 0.9721 - val_loss: 39.3729 - va
l_root_mean_squared_error: 39.3722 - val_r_squared: 0.9453
Epoch 138/250
381/381 [==============================] - 2s 6ms/step - loss: 25.7694 - ro
ot_mean_squared_error: 25.7394 - r_squared: 0.9749 - val_loss: 39.9302 - va
l_root_mean_squared_error: 39.9311 - val_r_squared: 0.9434
Epoch 139/250
381/381 [==============================] - 2s 6ms/step - loss: 24.8687 - ro
ot_mean_squared_error: 24.8888 - r_squared: 0.9663 - val_loss: 38.8441 - va
l_root_mean_squared_error: 38.8488 - val_r_squared: 0.9470
Epoch 140/250
381/381 [==============================] - 2s 5ms/step - loss: 24.6986 - ro
ot_mean_squared_error: 24.6970 - r_squared: 0.9771 - val_loss: 38.4553 - va
l_root_mean_squared_error: 38.4537 - val_r_squared: 0.9478
Epoch 141/250
381/381 [==============================] - 2s 5ms/step - loss: 25.3554 - ro
ot_mean_squared_error: 25.3413 - r_squared: 0.9760 - val_loss: 38.4062 - va
l_root_mean_squared_error: 38.4030 - val_r_squared: 0.9483
Epoch 142/250
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381/381 [==============================] - 2s 5ms/step - loss: 25.0159 - ro
ot_mean_squared_error: 24.9849 - r_squared: 0.9766 - val_loss: 42.2831 - va
l_root_mean_squared_error: 42.2794 - val_r_squared: 0.9377
Epoch 143/250
381/381 [==============================] - 2s 5ms/step - loss: 24.6487 - ro
ot_mean_squared_error: 24.6285 - r_squared: 0.9768 - val_loss: 38.8676 - va
l_root_mean_squared_error: 38.8702 - val_r_squared: 0.9462
Epoch 144/250
381/381 [==============================] - 3s 7ms/step - loss: 24.8645 - ro
ot_mean_squared_error: 24.8118 - r_squared: 0.9759 - val_loss: 38.3849 - va
l_root_mean_squared_error: 38.3808 - val_r_squared: 0.9479
Epoch 145/250
381/381 [==============================] - 2s 6ms/step - loss: 24.5968 - ro
ot_mean_squared_error: 24.5525 - r_squared: 0.9737 - val_loss: 40.3372 - va
l_root_mean_squared_error: 40.3332 - val_r_squared: 0.9429
Epoch 146/250
381/381 [==============================] - 2s 5ms/step - loss: 24.3937 - ro
ot_mean_squared_error: 24.3511 - r_squared: 0.9781 - val_loss: 38.0761 - va
l_root_mean_squared_error: 38.0730 - val_r_squared: 0.9495
Epoch 147/250
381/381 [==============================] - 2s 6ms/step - loss: 24.2389 - ro
ot_mean_squared_error: 24.2461 - r_squared: 0.9782 - val_loss: 39.8744 - va
l_root_mean_squared_error: 39.8738 - val_r_squared: 0.9438
Epoch 148/250
381/381 [==============================] - 2s 6ms/step - loss: 24.8406 - ro
ot_mean_squared_error: 24.8536 - r_squared: 0.9766 - val_loss: 38.3886 - va
l_root_mean_squared_error: 38.3889 - val_r_squared: 0.9474
Epoch 149/250
381/381 [==============================] - 2s 6ms/step - loss: 25.3852 - ro
ot_mean_squared_error: 25.3624 - r_squared: 0.9755 - val_loss: 38.4154 - va
l_root_mean_squared_error: 38.4145 - val_r_squared: 0.9480
Epoch 150/250
381/381 [==============================] - 3s 7ms/step - loss: 24.0971 - ro
ot_mean_squared_error: 24.1242 - r_squared: 0.9781 - val_loss: 40.5512 - va
l_root_mean_squared_error: 40.5488 - val_r_squared: 0.9420
Epoch 151/250
381/381 [==============================] - 2s 5ms/step - loss: 24.9610 - ro
ot_mean_squared_error: 24.9543 - r_squared: 0.9767 - val_loss: 40.8498 - va
l_root_mean_squared_error: 40.8475 - val_r_squared: 0.9425
Epoch 152/250
381/381 [==============================] - 2s 5ms/step - loss: 24.3751 - ro
ot_mean_squared_error: 24.3825 - r_squared: 0.9776 - val_loss: 39.4008 - va
l_root_mean_squared_error: 39.3963 - val_r_squared: 0.9451
Epoch 153/250
381/381 [==============================] - 2s 5ms/step - loss: 24.4291 - ro
ot_mean_squared_error: 24.3920 - r_squared: 0.9776 - val_loss: 38.9445 - va
l_root_mean_squared_error: 38.9412 - val_r_squared: 0.9460
Epoch 154/250
381/381 [==============================] - 2s 6ms/step - loss: 24.4660 - ro
ot_mean_squared_error: 24.4378 - r_squared: 0.9776 - val_loss: 39.4679 - va
l_root_mean_squared_error: 39.4654 - val_r_squared: 0.9458
Epoch 155/250
381/381 [==============================] - 3s 8ms/step - loss: 24.1300 - ro
ot_mean_squared_error: 24.1713 - r_squared: 0.9778 - val_loss: 40.6273 - va
l_root_mean_squared_error: 40.6241 - val_r_squared: 0.9436
Epoch 156/250
381/381 [==============================] - 2s 5ms/step - loss: 23.2950 - ro
ot_mean_squared_error: 23.2665 - r_squared: 0.9797 - val_loss: 38.3722 - va
l_root_mean_squared_error: 38.3698 - val_r_squared: 0.9479
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Epoch 157/250
381/381 [==============================] - 2s 5ms/step - loss: 24.7770 - ro
ot_mean_squared_error: 24.7485 - r_squared: 0.9765 - val_loss: 38.1340 - va
l_root_mean_squared_error: 38.1317 - val_r_squared: 0.9492
Epoch 158/250
381/381 [==============================] - 2s 5ms/step - loss: 25.7982 - ro
ot_mean_squared_error: 25.7825 - r_squared: 0.9742 - val_loss: 39.2612 - va
l_root_mean_squared_error: 39.2587 - val_r_squared: 0.9457
Epoch 159/250
381/381 [==============================] - 2s 5ms/step - loss: 23.4299 - ro
ot_mean_squared_error: 23.4130 - r_squared: 0.9789 - val_loss: 37.9321 - va
l_root_mean_squared_error: 37.9296 - val_r_squared: 0.9495
Epoch 160/250
381/381 [==============================] - 2s 6ms/step - loss: 23.5083 - ro
ot_mean_squared_error: 23.4702 - r_squared: 0.9794 - val_loss: 48.1280 - va
l_root_mean_squared_error: 48.1256 - val_r_squared: 0.9184
Epoch 161/250
381/381 [==============================] - 2s 6ms/step - loss: 23.9201 - ro
ot_mean_squared_error: 23.8880 - r_squared: 0.9778 - val_loss: 40.0122 - va
l_root_mean_squared_error: 40.0128 - val_r_squared: 0.9435
Epoch 162/250
381/381 [==============================] - 2s 5ms/step - loss: 22.7317 - ro
ot_mean_squared_error: 22.8212 - r_squared: 0.9804 - val_loss: 39.7235 - va
l_root_mean_squared_error: 39.7211 - val_r_squared: 0.9444
Epoch 163/250
381/381 [==============================] - 2s 5ms/step - loss: 25.0880 - ro
ot_mean_squared_error: 25.0554 - r_squared: 0.9755 - val_loss: 38.9182 - va
l_root_mean_squared_error: 38.9172 - val_r_squared: 0.9469
Epoch 164/250
381/381 [==============================] - 2s 5ms/step - loss: 23.7660 - ro
ot_mean_squared_error: 23.7281 - r_squared: 0.9786 - val_loss: 38.4058 - va
l_root_mean_squared_error: 38.4030 - val_r_squared: 0.9476
Epoch 165/250
381/381 [==============================] - 2s 5ms/step - loss: 22.4458 - ro
ot_mean_squared_error: 22.4253 - r_squared: 0.9808 - val_loss: 40.2821 - va
l_root_mean_squared_error: 40.2812 - val_r_squared: 0.9424
Epoch 166/250
381/381 [==============================] - 3s 8ms/step - loss: 23.0324 - ro
ot_mean_squared_error: 22.9977 - r_squared: 0.9796 - val_loss: 40.8317 - va
l_root_mean_squared_error: 40.8276 - val_r_squared: 0.9432
Epoch 167/250
381/381 [==============================] - 2s 6ms/step - loss: 24.5447 - ro
ot_mean_squared_error: 24.5137 - r_squared: 0.9767 - val_loss: 42.5390 - va
l_root_mean_squared_error: 42.5356 - val_r_squared: 0.9363
Epoch 168/250
381/381 [==============================] - 2s 5ms/step - loss: 26.6374 - ro
ot_mean_squared_error: 26.5933 - r_squared: 0.9724 - val_loss: 41.4335 - va
l_root_mean_squared_error: 41.4361 - val_r_squared: 0.9389
Epoch 169/250
381/381 [==============================] - 2s 5ms/step - loss: 22.7900 - ro
ot_mean_squared_error: 22.7831 - r_squared: 0.9800 - val_loss: 38.5311 - va
l_root_mean_squared_error: 38.5299 - val_r_squared: 0.9481
Epoch 170/250
381/381 [==============================] - 2s 5ms/step - loss: 23.0463 - ro
ot_mean_squared_error: 23.0024 - r_squared: 0.9800 - val_loss: 39.4790 - va
l_root_mean_squared_error: 39.4781 - val_r_squared: 0.9449
Epoch 171/250
381/381 [==============================] - 3s 7ms/step - loss: 22.7731 - ro
ot_mean_squared_error: 22.7514 - r_squared: 0.9809 - val_loss: 43.2788 - va
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l_root_mean_squared_error: 43.2774 - val_r_squared: 0.9357
Epoch 172/250
381/381 [==============================] - 2s 6ms/step - loss: 24.0051 - ro
ot_mean_squared_error: 23.9589 - r_squared: 0.9787 - val_loss: 42.8817 - va
l_root_mean_squared_error: 42.8843 - val_r_squared: 0.9358
Epoch 173/250
381/381 [==============================] - 2s 5ms/step - loss: 25.1518 - ro
ot_mean_squared_error: 25.1188 - r_squared: 0.9754 - val_loss: 39.0178 - va
l_root_mean_squared_error: 39.0154 - val_r_squared: 0.9472
Epoch 174/250
381/381 [==============================] - 2s 5ms/step - loss: 22.5143 - ro
ot_mean_squared_error: 22.5227 - r_squared: 0.9803 - val_loss: 41.6808 - va
l_root_mean_squared_error: 41.6777 - val_r_squared: 0.9405
Epoch 175/250
381/381 [==============================] - 2s 6ms/step - loss: 21.9042 - ro
ot_mean_squared_error: 21.8677 - r_squared: 0.9825 - val_loss: 39.9376 - va
l_root_mean_squared_error: 39.9370 - val_r_squared: 0.9440
Epoch 176/250
381/381 [==============================] - 2s 6ms/step - loss: 23.1026 - ro
ot_mean_squared_error: 23.0844 - r_squared: 0.9797 - val_loss: 38.7799 - va
l_root_mean_squared_error: 38.7788 - val_r_squared: 0.9468
Epoch 177/250
381/381 [==============================] - 3s 7ms/step - loss: 22.5529 - ro
ot_mean_squared_error: 22.5248 - r_squared: 0.9809 - val_loss: 39.3694 - va
l_root_mean_squared_error: 39.3694 - val_r_squared: 0.9450
Epoch 178/250
381/381 [==============================] - 2s 5ms/step - loss: 21.9483 - ro
ot_mean_squared_error: 21.9669 - r_squared: 0.9809 - val_loss: 38.7935 - va
l_root_mean_squared_error: 38.7907 - val_r_squared: 0.9466
Epoch 179/250
381/381 [==============================] - 2s 5ms/step - loss: 22.1026 - ro
ot_mean_squared_error: 22.0920 - r_squared: 0.9803 - val_loss: 38.5758 - va
l_root_mean_squared_error: 38.5743 - val_r_squared: 0.9474
Epoch 180/250
381/381 [==============================] - 2s 6ms/step - loss: 21.7558 - ro
ot_mean_squared_error: 21.7564 - r_squared: 0.9819 - val_loss: 38.3940 - va
l_root_mean_squared_error: 38.3916 - val_r_squared: 0.9482
Epoch 181/250
381/381 [==============================] - 2s 5ms/step - loss: 21.6185 - ro
ot_mean_squared_error: 21.6566 - r_squared: 0.9820 - val_loss: 38.3012 - va
l_root_mean_squared_error: 38.3020 - val_r_squared: 0.9482
Epoch 182/250
381/381 [==============================] - 3s 7ms/step - loss: 24.1732 - ro
ot_mean_squared_error: 24.1559 - r_squared: 0.9785 - val_loss: 41.8988 - va
l_root_mean_squared_error: 41.8978 - val_r_squared: 0.9388
Epoch 183/250
381/381 [==============================] - 2s 6ms/step - loss: 22.6047 - ro
ot_mean_squared_error: 22.5738 - r_squared: 0.9811 - val_loss: 40.4180 - va
l_root_mean_squared_error: 40.4137 - val_r_squared: 0.9432
Epoch 184/250
381/381 [==============================] - 2s 6ms/step - loss: 21.8718 - ro
ot_mean_squared_error: 21.9884 - r_squared: 0.9812 - val_loss: 39.0384 - va
l_root_mean_squared_error: 39.0360 - val_r_squared: 0.9461
Epoch 185/250
381/381 [==============================] - 2s 6ms/step - loss: 21.6021 - ro
ot_mean_squared_error: 21.5845 - r_squared: 0.9827 - val_loss: 39.7184 - va
l_root_mean_squared_error: 39.7216 - val_r_squared: 0.9433
Epoch 186/250
381/381 [==============================] - 2s 6ms/step - loss: 22.2710 - ro
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ot_mean_squared_error: 22.2493 - r_squared: 0.9811 - val_loss: 38.4083 - va
l_root_mean_squared_error: 38.4066 - val_r_squared: 0.9479
Epoch 187/250
381/381 [==============================] - 3s 8ms/step - loss: 22.3460 - ro
ot_mean_squared_error: 22.3076 - r_squared: 0.9810 - val_loss: 38.5344 - va
l_root_mean_squared_error: 38.5359 - val_r_squared: 0.9476
Epoch 188/250
381/381 [==============================] - 3s 7ms/step - loss: 21.2213 - ro
ot_mean_squared_error: 21.2024 - r_squared: 0.9831 - val_loss: 40.1799 - va
l_root_mean_squared_error: 40.1776 - val_r_squared: 0.9432
Epoch 189/250
381/381 [==============================] - 3s 7ms/step - loss: 23.0086 - ro
ot_mean_squared_error: 22.9684 - r_squared: 0.9786 - val_loss: 38.8960 - va
l_root_mean_squared_error: 38.8951 - val_r_squared: 0.9469
Epoch 190/250
381/381 [==============================] - 2s 6ms/step - loss: 22.1554 - ro
ot_mean_squared_error: 22.1930 - r_squared: 0.9817 - val_loss: 39.7517 - va
l_root_mean_squared_error: 39.7496 - val_r_squared: 0.9451
Epoch 191/250
381/381 [==============================] - 3s 7ms/step - loss: 23.8371 - ro
ot_mean_squared_error: 23.8300 - r_squared: 0.9767 - val_loss: 39.0366 - va
l_root_mean_squared_error: 39.0375 - val_r_squared: 0.9457
Epoch 192/250
381/381 [==============================] - 3s 8ms/step - loss: 20.5976 - ro
ot_mean_squared_error: 20.5702 - r_squared: 0.9836 - val_loss: 39.1910 - va
l_root_mean_squared_error: 39.1890 - val_r_squared: 0.9458
Epoch 193/250
381/381 [==============================] - 2s 6ms/step - loss: 20.6673 - ro
ot_mean_squared_error: 20.6686 - r_squared: 0.9836 - val_loss: 39.4755 - va
l_root_mean_squared_error: 39.4739 - val_r_squared: 0.9459
Epoch 194/250
381/381 [==============================] - 2s 6ms/step - loss: 21.8955 - ro
ot_mean_squared_error: 21.8756 - r_squared: 0.9820 - val_loss: 39.3391 - va
l_root_mean_squared_error: 39.3401 - val_r_squared: 0.9454
Epoch 195/250
381/381 [==============================] - 2s 6ms/step - loss: 21.9244 - ro
ot_mean_squared_error: 21.9245 - r_squared: 0.9815 - val_loss: 39.6218 - va
l_root_mean_squared_error: 39.6206 - val_r_squared: 0.9442
Epoch 196/250
381/381 [==============================] - 2s 6ms/step - loss: 20.9860 - ro
ot_mean_squared_error: 20.9865 - r_squared: 0.9835 - val_loss: 38.2760 - va
l_root_mean_squared_error: 38.2758 - val_r_squared: 0.9477
Epoch 197/250
381/381 [==============================] - 2s 6ms/step - loss: 20.8209 - ro
ot_mean_squared_error: 20.8157 - r_squared: 0.9837 - val_loss: 39.8558 - va
l_root_mean_squared_error: 39.8526 - val_r_squared: 0.9439
Epoch 198/250
381/381 [==============================] - 2s 5ms/step - loss: 21.2583 - ro
ot_mean_squared_error: 21.2334 - r_squared: 0.9828 - val_loss: 39.8016 - va
l_root_mean_squared_error: 39.8025 - val_r_squared: 0.9438
Epoch 199/250
381/381 [==============================] - 2s 5ms/step - loss: 21.4045 - ro
ot_mean_squared_error: 21.3813 - r_squared: 0.9828 - val_loss: 39.1838 - va
l_root_mean_squared_error: 39.1829 - val_r_squared: 0.9459
Epoch 200/250
381/381 [==============================] - 2s 5ms/step - loss: 21.7693 - ro
ot_mean_squared_error: 21.8252 - r_squared: 0.9798 - val_loss: 38.2691 - va
l_root_mean_squared_error: 38.2678 - val_r_squared: 0.9488
Epoch 201/250
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381/381 [==============================] - 2s 5ms/step - loss: 20.7343 - ro
ot_mean_squared_error: 20.7030 - r_squared: 0.9804 - val_loss: 39.5560 - va
l_root_mean_squared_error: 39.5563 - val_r_squared: 0.9444
Epoch 202/250
381/381 [==============================] - 3s 7ms/step - loss: 20.3675 - ro
ot_mean_squared_error: 20.3379 - r_squared: 0.9842 - val_loss: 39.7008 - va
l_root_mean_squared_error: 39.6963 - val_r_squared: 0.9446
Epoch 203/250
381/381 [==============================] - 2s 5ms/step - loss: 20.7401 - ro
ot_mean_squared_error: 20.7300 - r_squared: 0.9832 - val_loss: 39.0536 - va
l_root_mean_squared_error: 39.0545 - val_r_squared: 0.9455
Epoch 204/250
381/381 [==============================] - 2s 5ms/step - loss: 20.5800 - ro
ot_mean_squared_error: 20.5815 - r_squared: 0.9841 - val_loss: 40.5370 - va
l_root_mean_squared_error: 40.5359 - val_r_squared: 0.9430
Epoch 205/250
381/381 [==============================] - 2s 5ms/step - loss: 20.5484 - ro
ot_mean_squared_error: 20.5205 - r_squared: 0.9838 - val_loss: 39.0971 - va
l_root_mean_squared_error: 39.0962 - val_r_squared: 0.9462
Epoch 206/250
381/381 [==============================] - 2s 5ms/step - loss: 20.8192 - ro
ot_mean_squared_error: 20.7752 - r_squared: 0.9834 - val_loss: 39.2555 - va
l_root_mean_squared_error: 39.2549 - val_r_squared: 0.9457
Epoch 207/250
381/381 [==============================] - 2s 6ms/step - loss: 22.0921 - ro
ot_mean_squared_error: 22.0626 - r_squared: 0.9811 - val_loss: 38.8203 - va
l_root_mean_squared_error: 38.8199 - val_r_squared: 0.9462
Epoch 208/250
381/381 [==============================] - 2s 6ms/step - loss: 20.1212 - ro
ot_mean_squared_error: 20.1048 - r_squared: 0.9848 - val_loss: 38.3347 - va
l_root_mean_squared_error: 38.3330 - val_r_squared: 0.9482
Epoch 209/250
381/381 [==============================] - 2s 5ms/step - loss: 20.6444 - ro
ot_mean_squared_error: 20.6990 - r_squared: 0.9840 - val_loss: 40.2442 - va
l_root_mean_squared_error: 40.2423 - val_r_squared: 0.9429
Epoch 210/250
381/381 [==============================] - 2s 5ms/step - loss: 21.0293 - ro
ot_mean_squared_error: 21.0000 - r_squared: 0.9834 - val_loss: 38.9402 - va
l_root_mean_squared_error: 38.9385 - val_r_squared: 0.9472
Epoch 211/250
381/381 [==============================] - 2s 5ms/step - loss: 21.0825 - ro
ot_mean_squared_error: 21.1386 - r_squared: 0.9831 - val_loss: 40.5452 - va
l_root_mean_squared_error: 40.5420 - val_r_squared: 0.9420
Epoch 212/250
381/381 [==============================] - 2s 5ms/step - loss: 20.3508 - ro
ot_mean_squared_error: 20.3571 - r_squared: 0.9847 - val_loss: 39.2893 - va
l_root_mean_squared_error: 39.2893 - val_r_squared: 0.9451
Epoch 213/250
381/381 [==============================] - 3s 7ms/step - loss: 19.6780 - ro
ot_mean_squared_error: 19.6622 - r_squared: 0.9856 - val_loss: 40.2628 - va
l_root_mean_squared_error: 40.2602 - val_r_squared: 0.9427
Epoch 214/250
381/381 [==============================] - 2s 5ms/step - loss: 22.8018 - ro
ot_mean_squared_error: 22.7693 - r_squared: 0.9796 - val_loss: 38.8932 - va
l_root_mean_squared_error: 38.8949 - val_r_squared: 0.9463
Epoch 215/250
381/381 [==============================] - 2s 5ms/step - loss: 19.4549 - ro
ot_mean_squared_error: 19.4918 - r_squared: 0.9857 - val_loss: 41.0092 - va
l_root_mean_squared_error: 41.0069 - val_r_squared: 0.9416
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Epoch 216/250
381/381 [==============================] - 2s 5ms/step - loss: 19.7433 - ro
ot_mean_squared_error: 19.7914 - r_squared: 0.9850 - val_loss: 39.0146 - va
l_root_mean_squared_error: 39.0133 - val_r_squared: 0.9467
Epoch 217/250
381/381 [==============================] - 2s 5ms/step - loss: 20.2974 - ro
ot_mean_squared_error: 20.3183 - r_squared: 0.9845 - val_loss: 39.6790 - va
l_root_mean_squared_error: 39.6759 - val_r_squared: 0.9452
Epoch 218/250
381/381 [==============================] - 2s 5ms/step - loss: 19.3061 - ro
ot_mean_squared_error: 19.2745 - r_squared: 0.9862 - val_loss: 39.5908 - va
l_root_mean_squared_error: 39.5903 - val_r_squared: 0.9452
Epoch 219/250
381/381 [==============================] - 3s 7ms/step - loss: 19.0357 - ro
ot_mean_squared_error: 19.0271 - r_squared: 0.9860 - val_loss: 38.7193 - va
l_root_mean_squared_error: 38.7178 - val_r_squared: 0.9474
Epoch 220/250
381/381 [==============================] - 2s 5ms/step - loss: 19.1757 - ro
ot_mean_squared_error: 19.1725 - r_squared: 0.9859 - val_loss: 38.5881 - va
l_root_mean_squared_error: 38.5886 - val_r_squared: 0.9476
Epoch 221/250
381/381 [==============================] - 2s 5ms/step - loss: 19.7545 - ro
ot_mean_squared_error: 19.7638 - r_squared: 0.9850 - val_loss: 40.0021 - va
l_root_mean_squared_error: 40.0008 - val_r_squared: 0.9439
Epoch 222/250
381/381 [==============================] - 2s 5ms/step - loss: 20.1636 - ro
ot_mean_squared_error: 20.1457 - r_squared: 0.9845 - val_loss: 39.7366 - va
l_root_mean_squared_error: 39.7380 - val_r_squared: 0.9452
Epoch 223/250
381/381 [==============================] - 2s 5ms/step - loss: 20.2313 - ro
ot_mean_squared_error: 20.2360 - r_squared: 0.9850 - val_loss: 40.2959 - va
l_root_mean_squared_error: 40.2967 - val_r_squared: 0.9427
Epoch 224/250
381/381 [==============================] - 3s 7ms/step - loss: 19.5621 - ro
ot_mean_squared_error: 19.5425 - r_squared: 0.9854 - val_loss: 39.8832 - va
l_root_mean_squared_error: 39.8836 - val_r_squared: 0.9439
Epoch 225/250
381/381 [==============================] - 2s 6ms/step - loss: 19.2734 - ro
ot_mean_squared_error: 19.2730 - r_squared: 0.9857 - val_loss: 39.5363 - va
l_root_mean_squared_error: 39.5376 - val_r_squared: 0.9448
Epoch 226/250
381/381 [==============================] - 2s 5ms/step - loss: 19.3659 - ro
ot_mean_squared_error: 19.3379 - r_squared: 0.9860 - val_loss: 39.6969 - va
l_root_mean_squared_error: 39.6945 - val_r_squared: 0.9440
Epoch 227/250
381/381 [==============================] - 2s 5ms/step - loss: 20.0130 - ro
ot_mean_squared_error: 20.0956 - r_squared: 0.9849 - val_loss: 39.7355 - va
l_root_mean_squared_error: 39.7350 - val_r_squared: 0.9454
Epoch 228/250
381/381 [==============================] - 2s 5ms/step - loss: 19.6190 - ro
ot_mean_squared_error: 19.5947 - r_squared: 0.9859 - val_loss: 40.8299 - va
l_root_mean_squared_error: 40.8284 - val_r_squared: 0.9416
Epoch 229/250
381/381 [==============================] - 2s 5ms/step - loss: 19.2068 - ro
ot_mean_squared_error: 19.1671 - r_squared: 0.9865 - val_loss: 39.0305 - va
l_root_mean_squared_error: 39.0300 - val_r_squared: 0.9468
Epoch 230/250
381/381 [==============================] - 3s 7ms/step - loss: 21.9615 - ro
ot_mean_squared_error: 21.9214 - r_squared: 0.9817 - val_loss: 39.5041 - va
```

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l_root_mean_squared_error: 39.5012 - val_r_squared: 0.9451
Epoch 231/250
381/381 [==============================] - 2s 5ms/step - loss: 19.2241 - ro
ot_mean_squared_error: 19.2194 - r_squared: 0.9858 - val_loss: 41.2242 - va
l_root_mean_squared_error: 41.2235 - val_r_squared: 0.9411
Epoch 232/250
381/381 [==============================] - 2s 5ms/step - loss: 19.0472 - ro
ot_mean_squared_error: 19.0379 - r_squared: 0.9863 - val_loss: 38.5035 - va
l_root_mean_squared_error: 38.5036 - val_r_squared: 0.9479
Epoch 233/250
381/381 [==============================] - 2s 5ms/step - loss: 18.1223 - ro
ot_mean_squared_error: 18.0910 - r_squared: 0.9876 - val_loss: 38.6619 - va
l_root_mean_squared_error: 38.6634 - val_r_squared: 0.9470
Epoch 234/250
381/381 [==============================] - 2s 6ms/step - loss: 19.6975 - ro
ot_mean_squared_error: 19.6920 - r_squared: 0.9845 - val_loss: 38.2475 - va
l_root_mean_squared_error: 38.2471 - val_r_squared: 0.9487
Epoch 235/250
381/381 [==============================] - 3s 7ms/step - loss: 19.6462 - ro
ot_mean_squared_error: 19.6235 - r_squared: 0.9856 - val_loss: 38.4250 - va
l_root_mean_squared_error: 38.4252 - val_r_squared: 0.9480
Epoch 236/250
381/381 [==============================] - 2s 6ms/step - loss: 19.2418 - ro
ot_mean_squared_error: 19.2258 - r_squared: 0.9854 - val_loss: 38.9671 - va
l_root_mean_squared_error: 38.9657 - val_r_squared: 0.9460
Epoch 237/250
381/381 [==============================] - 2s 5ms/step - loss: 18.2845 - ro
ot_mean_squared_error: 18.2573 - r_squared: 0.9869 - val_loss: 39.0705 - va
l_root_mean_squared_error: 39.0699 - val_r_squared: 0.9463
Epoch 238/250
381/381 [==============================] - 2s 5ms/step - loss: 19.4018 - ro
ot_mean_squared_error: 19.3608 - r_squared: 0.9856 - val_loss: 38.4854 - va
l_root_mean_squared_error: 38.4848 - val_r_squared: 0.9475
Epoch 239/250
381/381 [==============================] - 2s 5ms/step - loss: 18.3907 - ro
ot_mean_squared_error: 18.4188 - r_squared: 0.9868 - val_loss: 39.0728 - va
l_root_mean_squared_error: 39.0734 - val_r_squared: 0.9464
Epoch 240/250
381/381 [==============================] - 2s 5ms/step - loss: 19.3272 - ro
ot_mean_squared_error: 19.3294 - r_squared: 0.9857 - val_loss: 39.0848 - va
l_root_mean_squared_error: 39.0839 - val_r_squared: 0.9459
Epoch 241/250
381/381 [==============================] - 3s 8ms/step - loss: 18.7796 - ro
ot_mean_squared_error: 18.7534 - r_squared: 0.9857 - val_loss: 38.9600 - va
l_root_mean_squared_error: 38.9612 - val_r_squared: 0.9463
Epoch 242/250
381/381 [==============================] - 2s 5ms/step - loss: 19.4226 - ro
ot_mean_squared_error: 19.4017 - r_squared: 0.9854 - val_loss: 39.8472 - va
l_root_mean_squared_error: 39.8467 - val_r_squared: 0.9442
Epoch 243/250
381/381 [==============================] - 2s 5ms/step - loss: 18.9125 - ro
ot_mean_squared_error: 18.9097 - r_squared: 0.9863 - val_loss: 39.1999 - va
l_root_mean_squared_error: 39.1985 - val_r_squared: 0.9458
Epoch 244/250
381/381 [==============================] - 2s 5ms/step - loss: 18.8266 - ro
ot_mean_squared_error: 18.8272 - r_squared: 0.9867 - val_loss: 38.8709 - va
l_root_mean_squared_error: 38.8700 - val_r_squared: 0.9466
Epoch 245/250
381/381 [==============================] - 2s 5ms/step - loss: 18.3741 - ro
```

```
ot_mean_squared_error: 18.3625 - r_squared: 0.9870 - val_loss: 40.2643 - va
l_root_mean_squared_error: 40.2625 - val_r_squared: 0.9433
Epoch 246/250
381/381 [==============================] - 2s 6ms/step - loss: 19.5289 - ro
ot_mean_squared_error: 19.5902 - r_squared: 0.9852 - val_loss: 38.9944 - va
l_root_mean_squared_error: 38.9933 - val_r_squared: 0.9459
Epoch 247/250
381/381 [==============================] - 2s 6ms/step - loss: 18.8678 - ro
ot_mean_squared_error: 18.8751 - r_squared: 0.9864 - val_loss: 39.6437 - va
l_root_mean_squared_error: 39.6416 - val_r_squared: 0.9444
Epoch 248/250
381/381 [==============================] - 2s 5ms/step - loss: 18.3966 - ro
ot_mean_squared_error: 18.3599 - r_squared: 0.9870 - val_loss: 39.0359 - va
l_root_mean_squared_error: 39.0356 - val_r_squared: 0.9464
Epoch 249/250
381/381 [==============================] - 2s 5ms/step - loss: 17.9649 - ro
ot_mean_squared_error: 17.9994 - r_squared: 0.9873 - val_loss: 39.2210 - va
l_root_mean_squared_error: 39.2189 - val_r_squared: 0.9451
Epoch 250/250
381/381 [==============================] - 2s 5ms/step - loss: 20.4344 - ro
ot_mean_squared_error: 20.4082 - r_squared: 0.9837 - val_loss: 38.9246 - va
l_root_mean_squared_error: 38.9254 - val_r_squared: 0.9467
```

In [35]:

```
# Predictions on Test Data
test_predictions = model_7_layer.predict(X_test)

test_r2_score = r2_score(y_test, test_predictions)
print("7 Layer ANN, Test R2 Score:", test_r2_score)
```

```
163/163 [==============================] - 0s 2ms/step
7 Layer ANN, Test R2 Score: 0.9510664399181744
```