AttentionPoints

April 17, 2020

[1]:
```
#Import all the required libraries

import pandas as pd
import sklearn as sk
from keras.utils import normalize
from keras.models import Sequential
from keras.layers import Dense,Dropout
from keras.optimizers import Adam
import numpy as np
import matplotlib.pyplot as plt
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import mean_squared_error
import pickle
import seaborn as sns
```

```
Using TensorFlow backend.
```

1 Dataset

We created the dataset using the Unity software and Tobii eye tracker 4C which tracks the gaze position.

We used 6 different images that represents happiness and neural emotions. Two different images with different emotions are used to create the dataset.

Altogether, we created 1000 data instances along with the labels. It includes 33 different features, of which 3 are target features.

[2]:
```
# Loads the train and test data from train_data.csv and test_data.csv files␣
 ↪respectively.
def load_traindata():
    input_file = pd.read_csv('train_data.csv')
    return input_file
def load_testdata():
    test_file = pd.read_csv('test_data.csv')
    return test_file
```

[3]:
```
features =␣
↪['object1position_x','object1position_y','object1position_z','object1scaling_x',
          ␣
↪'object1scaling_y','object1scaling_z','object2position_x','object2position_y',
          ␣
↪'object2position_z','object2scaling_x','object2scaling_y','object2scaling_z',
          ␣
↪'cameraposition_x','cameraposition_y','cameraposition_z','camerascaling_x',
          ␣
↪'camerascaling_y','camerascaling_z','wallposition_x','wallposition_y',
           'wallposition_z','wallscaling_x','wallscaling_y','wallscaling_z',
           'planeposition_x','planeposition_y','planeposition_z',
           'planescaling_x','planescaling_y','planescaling_z']
output_label=['attentionposition_x','attentionposition_y','attentionposition_z']
```

2 Exploratory data analysis (EDA) for the dataset to visualize the data

2.1 Shape of the dataset (Number of instances, Number of features)

The shape property is used to get the current shape of an array.

[4]:
```
print(load_traindata().shape)
print(load_testdata().shape)
```

```
(800, 33)
(200, 33)
```

2.2 Features in the dataset

The column property is used to get the columns for a given data.

[5]:
```
print(load_traindata().columns)
```

```
Index(['object1position_x', 'object1position_y', 'object1position_z',
       'object1scaling_x', 'object1scaling_y', 'object1scaling_z',
       'object2position_x', 'object2position_y', 'object2position_z',
       'object2scaling_x', 'object2scaling_y', 'object2scaling_z',
       'cameraposition_x', 'cameraposition_y', 'cameraposition_z',
       'camerascaling_x', 'camerascaling_y', 'camerascaling_z',
       'wallposition_x', 'wallposition_y', 'wallposition_z', 'wallscaling_x',
       'wallscaling_y', 'wallscaling_z', 'planeposition_x', 'planeposition_y',
       'planeposition_z', 'planescaling_x', 'planescaling_y', 'planescaling_z',
       'attentionposition_x', 'attentionposition_y', 'attentionposition_z'],
      dtype='object')
```

2.3 First few instances in the dataset

Using the head method, the first three instances of the dataset is printed.

[6]:
```
print(load_traindata().head(3))
```

```
   object1position_x  object1position_y  object1position_z  object1scaling_x  \
0                6.0                2.7               -0.2               150
1               -9.2                1.8               -0.4               150
2                3.1                3.2               -0.2               150

   object1scaling_y  object1scaling_z  object2position_x  object2position_y  \
0               150               150               -5.5                2.5
1               150               150                0.0                3.5
2               150               150                7.4                2.7

   object2position_z  object2scaling_x  …  wallscaling_z  planeposition_x  \
0               -0.4               150  …              1            -2.51
1               -0.2               150  …              1            -2.51
2               -0.4               150  …              1            -2.51

   planeposition_y  planeposition_z  planescaling_x  planescaling_y  \
0            -2.51            -5.04             2.5               1
1            -2.51            -5.04             2.5               1
2            -2.51            -5.04             2.5               1

   planescaling_z  attentionposition_x  attentionposition_y  \
0               1                -8.0                  3.6
1               1                -4.5                  1.8
2               1                -2.7                  2.6

   attentionposition_z
0                 -9.7
1                 -9.4
2                 -8.9

[3 rows x 33 columns]
```

2.4 3D Scatter Plot between the positions of two different objects (features)

From the first few datapoints, we can see the random scaling in the dataset. Thus we need to normalize the data before giving it to the model.

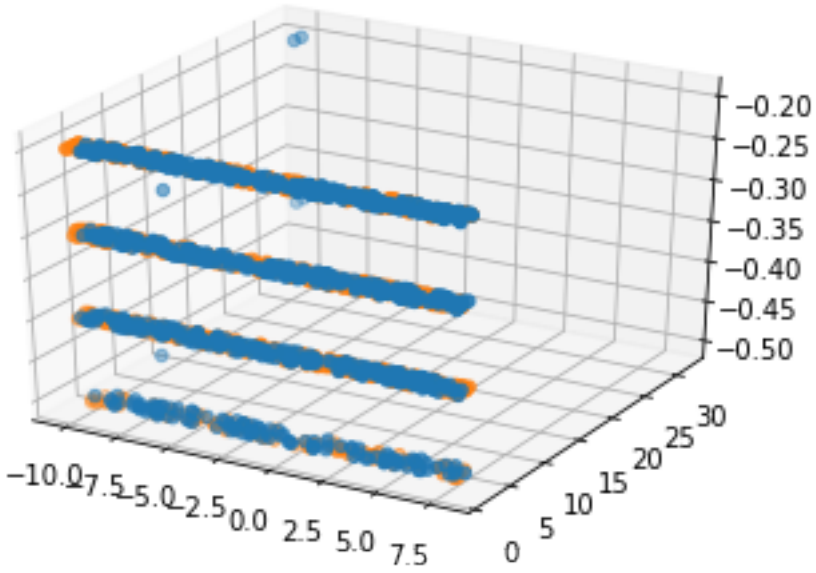
[7]:
```
from mpl_toolkits import mplot3d

def scatter_Plot():
    ax = plt.axes(projection='3d')

    # Data for three-dimensional scattered points
```

```
    zdata = load_traindata()['object1position_z']
    xdata = load_traindata()['object1position_x']
    ydata = load_traindata()['object1position_y']
    z = load_traindata()['object2position_z']
    x = load_traindata()['object2position_x']
    y = load_traindata()['object2position_y']
    ax.scatter3D(xdata, ydata, zdata,cmap='Greens');
    ax.scatter3D(x, y, z,cmap='Oranges');

scatter_Plot()
```



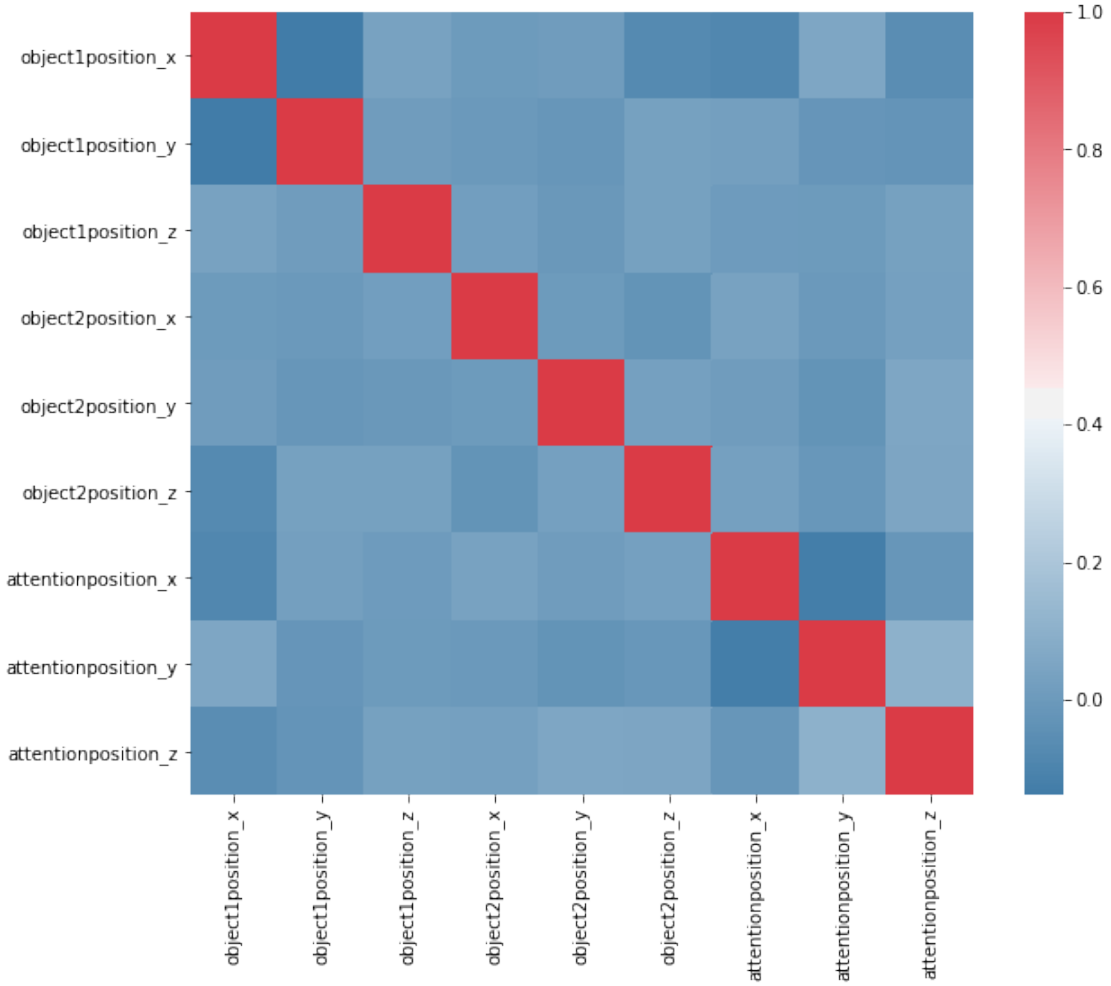
2.5 Correlation Matrix

Heatmap and corr functions are used to plot the correlation matrix.

[8]:
```
def correlation_matrix():
    f, ax = plt.subplots(figsize=(10, 8))
    position_features =␣
↪['object1position_x','object1position_y','object1position_z','object2position_x',
                          ␣
↪'object2position_y','object2position_z','attentionposition_x',
                           'attentionposition_y','attentionposition_z']
    input = load_traindata()[position_features]
    corr = input.corr()
    sns.heatmap(corr, mask = np.zeros_like(corr, dtype = np.bool),
```

```
                cmap = sns.diverging_palette(240,10,as_cmap = True),square =␣
↪True, ax = ax)

correlation_matrix()
```



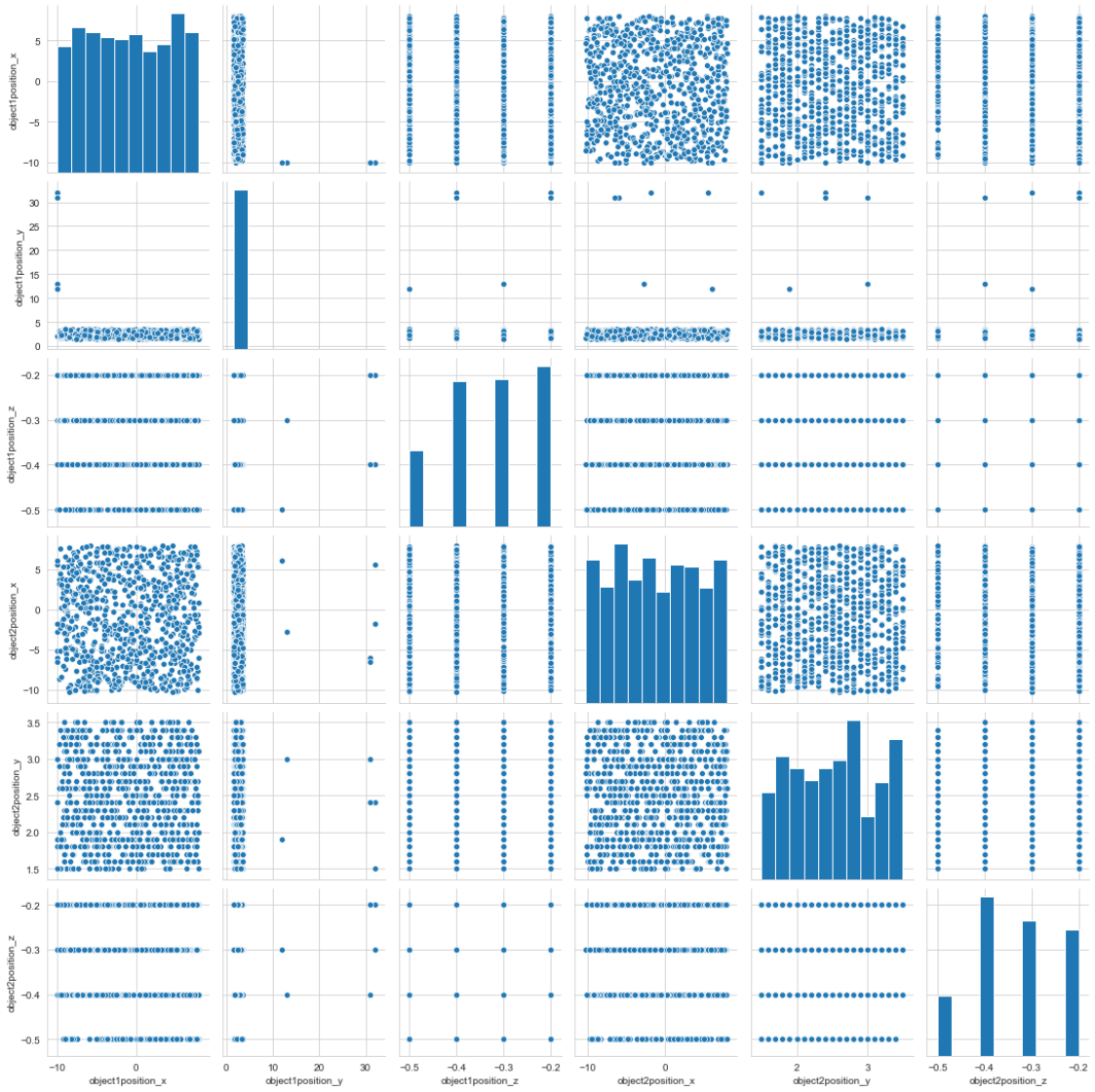
2.6 Pair plot

Pair plot is used to plot the pairwise relationships in a dataset.

[9]:
```
def pair_plot():
    plt.close();
    sns.set_style("whitegrid");
    obj_position =␣
↪['object1position_x','object1position_y','object1position_z','object2position_x',
                  'object2position_y','object2position_z']
```

```
    eye_position =␣
↪['attentionposition_x','attentionposition_y','attentionposition_z']
    input1 = load_traindata()[eye_position]
    sns.pairplot(load_traindata()[obj_position]);
    sns.set(style = "ticks", color_codes = True)
    plt.show()

pair_plot()
```



2.7 Data Normalization

All the input features are normalized using MinMaxScaler.

[10]:
```
def data_normalize():
    scaler_x = MinMaxScaler()
    scaler_y = MinMaxScaler()
    dataset = load_traindata()
    dataset[features] = pd.DataFrame(scaler_x.fit_transform(dataset[features]))
    dataset[output_label] = pd.DataFrame(scaler_y.
 ↪fit_transform(dataset[output_label]))
    x_test = pd.DataFrame(scaler_x.fit_transform(load_testdata()[features]))
    y_test = pd.DataFrame(scaler_y.fit_transform(load_testdata()[output_label]))
    return dataset[features],dataset[output_label],x_test,y_test
```

2.8 Split Data

The input data is split into trianing and validation data.

[11]:
```
def split_data():
    data = data_normalize()
    x_train, x_valid, y_train, y_valid = train_test_split(data[0], data[1],
                                                          test_size = 0.3,␣
 ↪random_state = 42)
    return x_train,x_valid,y_train,y_valid
```

3 Model Buildling

Multilayer perceptron model is built using Adam optimizer and mean squared error as the loss function.

[12]:
```
def build_model():
    model = Sequential()
    model.add(Dense(30, input_dim=30, activation='tanh'))
    model.add(Dropout(0.5))
    model.add(Dense(16,activation='tanh'))
    model.add(Dropout(0.5))
    model.add(Dense(8, activation='tanh'))
    model.add(Dropout(0.5))
    model.add(Dense(3, activation='tanh'))
    opt = Adam(learning_rate=0.0001, beta_1 = 0.88, beta_2 = 0.911,␣
 ↪amsgrad=False)
    model.compile(loss = 'mean_squared_error', optimizer = opt, metrics =␣
 ↪['mse'])
    return model
```

4 Model Training

The built model is compiled and serialized using pickle.

[13]:
```
def train_model():
    X_train,X_valid,y_train,y_valid=split_data()
    built_model = build_model()
    # fit the keras model on the dataset
    #model.fit(X_train, y_train, epochs=20, batch_size=1)
    history = built_model.fit(X_train, y_train, epochs = 350, validation_data =␣
 ↪(X_valid, y_valid))
    filename = 'finalized_model.sav'
    pickle.dump(built_model, open(filename, 'wb'))
    plt.plot(history.history['loss'])
    plt.plot(history.history['val_loss'])
    plt.title('model loss')
    plt.ylabel('loss')
    plt.xlabel('epoch')
    plt.legend(['train', 'test'], loc ='upper left')
    plt.show()
    plt.savefig('loss')
    return built_model
```

5 Model Evaluation

The built model is de-serialized using pickle and evaluated.

[14]:
```
def model_evaluate():
    filename = 'finalized_model.sav'
    Trained_model = pickle.load(open(filename, 'rb'))
    scaler_y = MinMaxScaler()
    scaler_y.fit_transform(load_testdata()[output_label])

    X_train,y_train = split_data()[0],split_data()[2]

    pred_train = Trained_model.predict(X_train)
    print('Training MSE',mean_squared_error(y_train,pred_train))

    X_test,y_test = data_normalize()[2],data_normalize()[3]
    predicted_value = Trained_model.predict(X_test)
    print('Test MSE',mean_squared_error(y_test,predicted_value))

    #predicted_scaler = MinMaxScaler()
    #scaler.fit(predicted_value)
    print("Predicted Value\n ",predicted_value,"\n Denormalized Value\n ",
          scaler_y.inverse_transform(predicted_value).round(1))
    #print(output[0][0],output[0][1],output[0][2])
    #print(predicted)
```

```
    #visualizing object1 and object2 positions in 3D
```

[15]:
```
train_model()
```

```
Train on 560 samples, validate on 240 samples
Epoch 1/350
560/560 [==============================] - 1s 2ms/step - loss: 0.6168 - mse:
0.6168 - val_loss: 0.4385 - val_mse: 0.4385
Epoch 2/350
560/560 [==============================] - 0s 89us/step - loss: 0.5817 - mse:
0.5817 - val_loss: 0.3920 - val_mse: 0.3920
Epoch 3/350
560/560 [==============================] - 0s 81us/step - loss: 0.5883 - mse:
0.5883 - val_loss: 0.3491 - val_mse: 0.3491
Epoch 4/350
560/560 [==============================] - 0s 81us/step - loss: 0.5480 - mse:
0.5480 - val_loss: 0.3094 - val_mse: 0.3094
Epoch 5/350
560/560 [==============================] - 0s 86us/step - loss: 0.4994 - mse:
0.4994 - val_loss: 0.2751 - val_mse: 0.2751
Epoch 6/350
560/560 [==============================] - 0s 88us/step - loss: 0.5076 - mse:
0.5076 - val_loss: 0.2423 - val_mse: 0.2423
Epoch 7/350
560/560 [==============================] - 0s 109us/step - loss: 0.4760 - mse:
0.4760 - val_loss: 0.2123 - val_mse: 0.2123
Epoch 8/350
560/560 [==============================] - 0s 84us/step - loss: 0.4628 - mse:
0.4628 - val_loss: 0.1849 - val_mse: 0.1849
Epoch 9/350
560/560 [==============================] - 0s 91us/step - loss: 0.4548 - mse:
0.4548 - val_loss: 0.1625 - val_mse: 0.1625
Epoch 10/350
560/560 [==============================] - 0s 84us/step - loss: 0.4238 - mse:
0.4238 - val_loss: 0.1423 - val_mse: 0.1423
Epoch 11/350
560/560 [==============================] - 0s 88us/step - loss: 0.4107 - mse:
0.4107 - val_loss: 0.1250 - val_mse: 0.1250
Epoch 12/350
560/560 [==============================] - 0s 84us/step - loss: 0.3937 - mse:
0.3937 - val_loss: 0.1112 - val_mse: 0.1112
Epoch 13/350
560/560 [==============================] - 0s 84us/step - loss: 0.3797 - mse:
0.3797 - val_loss: 0.1012 - val_mse: 0.1012
Epoch 14/350
560/560 [==============================] - 0s 83us/step - loss: 0.3733 - mse:
0.3733 - val_loss: 0.0923 - val_mse: 0.0923
```

```
Epoch 15/350
560/560 [==============================] - 0s 82us/step - loss: 0.3731 - mse:
0.3731 - val_loss: 0.0854 - val_mse: 0.0854
Epoch 16/350
560/560 [==============================] - 0s 83us/step - loss: 0.3489 - mse:
0.3489 - val_loss: 0.0795 - val_mse: 0.0795
Epoch 17/350
560/560 [==============================] - 0s 87us/step - loss: 0.3405 - mse:
0.3405 - val_loss: 0.0753 - val_mse: 0.0753
Epoch 18/350
560/560 [==============================] - 0s 83us/step - loss: 0.3420 - mse:
0.3420 - val_loss: 0.0711 - val_mse: 0.0711
Epoch 19/350
560/560 [==============================] - 0s 98us/step - loss: 0.3213 - mse:
0.3213 - val_loss: 0.0678 - val_mse: 0.0678
Epoch 20/350
560/560 [==============================] - 0s 85us/step - loss: 0.3221 - mse:
0.3221 - val_loss: 0.0656 - val_mse: 0.0656
Epoch 21/350
560/560 [==============================] - 0s 77us/step - loss: 0.3114 - mse:
0.3114 - val_loss: 0.0640 - val_mse: 0.0640
Epoch 22/350
560/560 [==============================] - 0s 78us/step - loss: 0.2873 - mse:
0.2873 - val_loss: 0.0626 - val_mse: 0.0626
Epoch 23/350
560/560 [==============================] - 0s 85us/step - loss: 0.2879 - mse:
0.2879 - val_loss: 0.0627 - val_mse: 0.0627
Epoch 24/350
560/560 [==============================] - 0s 87us/step - loss: 0.2998 - mse:
0.2998 - val_loss: 0.0630 - val_mse: 0.0630
Epoch 25/350
560/560 [==============================] - 0s 82us/step - loss: 0.2864 - mse:
0.2864 - val_loss: 0.0635 - val_mse: 0.0635
Epoch 26/350
560/560 [==============================] - 0s 76us/step - loss: 0.2753 - mse:
0.2753 - val_loss: 0.0638 - val_mse: 0.0638
Epoch 27/350
560/560 [==============================] - 0s 82us/step - loss: 0.2836 - mse:
0.2836 - val_loss: 0.0644 - val_mse: 0.0644
Epoch 28/350
560/560 [==============================] - 0s 101us/step - loss: 0.2919 - mse:
0.2919 - val_loss: 0.0654 - val_mse: 0.0654
Epoch 29/350
560/560 [==============================] - 0s 163us/step - loss: 0.2621 - mse:
0.2621 - val_loss: 0.0660 - val_mse: 0.0660
Epoch 30/350
560/560 [==============================] - 0s 134us/step - loss: 0.2726 - mse:
0.2726 - val_loss: 0.0667 - val_mse: 0.0667
```

```
Epoch 31/350
560/560 [==============================] - 0s 130us/step - loss: 0.2742 - mse:
0.2742 - val_loss: 0.0677 - val_mse: 0.0677
Epoch 32/350
560/560 [==============================] - 0s 132us/step - loss: 0.2773 - mse:
0.2773 - val_loss: 0.0682 - val_mse: 0.0682
Epoch 33/350
560/560 [==============================] - 0s 107us/step - loss: 0.2530 - mse:
0.2530 - val_loss: 0.0689 - val_mse: 0.0689
Epoch 34/350
560/560 [==============================] - 0s 109us/step - loss: 0.2497 - mse:
0.2497 - val_loss: 0.0699 - val_mse: 0.0699
Epoch 35/350
560/560 [==============================] - ETA: 0s - loss: 0.2499 - mse: 0.249 -
0s 137us/step - loss: 0.2531 - mse: 0.2531 - val_loss: 0.0709 - val_mse: 0.0709
Epoch 36/350
560/560 [==============================] - 0s 169us/step - loss: 0.2505 - mse:
0.2505 - val_loss: 0.0717 - val_mse: 0.0717
Epoch 37/350
560/560 [==============================] - 0s 109us/step - loss: 0.2628 - mse:
0.2628 - val_loss: 0.0724 - val_mse: 0.0724
Epoch 38/350
560/560 [==============================] - 0s 147us/step - loss: 0.2478 - mse:
0.2478 - val_loss: 0.0732 - val_mse: 0.0732
Epoch 39/350
560/560 [==============================] - 0s 117us/step - loss: 0.2339 - mse:
0.2339 - val_loss: 0.0741 - val_mse: 0.0741
Epoch 40/350
560/560 [==============================] - 0s 116us/step - loss: 0.2451 - mse:
0.2451 - val_loss: 0.0746 - val_mse: 0.0746
Epoch 41/350
560/560 [==============================] - 0s 128us/step - loss: 0.2417 - mse:
0.2417 - val_loss: 0.0749 - val_mse: 0.0749
Epoch 42/350
560/560 [==============================] - 0s 129us/step - loss: 0.2329 - mse:
0.2329 - val_loss: 0.0756 - val_mse: 0.0756
Epoch 43/350
560/560 [==============================] - 0s 131us/step - loss: 0.2331 - mse:
0.2331 - val_loss: 0.0761 - val_mse: 0.0761
Epoch 44/350
560/560 [==============================] - 0s 126us/step - loss: 0.2408 - mse:
0.2408 - val_loss: 0.0766 - val_mse: 0.0766
Epoch 45/350
560/560 [==============================] - 0s 128us/step - loss: 0.2266 - mse:
0.2266 - val_loss: 0.0767 - val_mse: 0.0767
Epoch 46/350
560/560 [==============================] - 0s 119us/step - loss: 0.2338 - mse:
0.2338 - val_loss: 0.0769 - val_mse: 0.0769
```

```
Epoch 47/350
560/560 [==============================] - 0s 111us/step - loss: 0.2264 - mse:
0.2264 - val_loss: 0.0774 - val_mse: 0.0774
Epoch 48/350
560/560 [==============================] - 0s 98us/step - loss: 0.2413 - mse:
0.2413 - val_loss: 0.0782 - val_mse: 0.0782
Epoch 49/350
560/560 [==============================] - 0s 100us/step - loss: 0.2111 - mse:
0.2111 - val_loss: 0.0787 - val_mse: 0.0787
Epoch 50/350
560/560 [==============================] - 0s 82us/step - loss: 0.2241 - mse:
0.2241 - val_loss: 0.0790 - val_mse: 0.0790
Epoch 51/350
560/560 [==============================] - 0s 78us/step - loss: 0.2195 - mse:
0.2195 - val_loss: 0.0788 - val_mse: 0.0788
Epoch 52/350
560/560 [==============================] - 0s 85us/step - loss: 0.2119 - mse:
0.2119 - val_loss: 0.0789 - val_mse: 0.0789
Epoch 53/350
560/560 [==============================] - 0s 80us/step - loss: 0.2069 - mse:
0.2069 - val_loss: 0.0787 - val_mse: 0.0787
Epoch 54/350
560/560 [==============================] - 0s 82us/step - loss: 0.1992 - mse:
0.1992 - val_loss: 0.0784 - val_mse: 0.0784
Epoch 55/350
560/560 [==============================] - 0s 81us/step - loss: 0.1977 - mse:
0.1977 - val_loss: 0.0784 - val_mse: 0.0784
Epoch 56/350
560/560 [==============================] - 0s 97us/step - loss: 0.2025 - mse:
0.2025 - val_loss: 0.0786 - val_mse: 0.0786
Epoch 57/350
560/560 [==============================] - 0s 111us/step - loss: 0.2143 - mse:
0.2143 - val_loss: 0.0787 - val_mse: 0.0787
Epoch 58/350
560/560 [==============================] - 0s 100us/step - loss: 0.1985 - mse:
0.1985 - val_loss: 0.0784 - val_mse: 0.0784
Epoch 59/350
560/560 [==============================] - 0s 107us/step - loss: 0.2105 - mse:
0.2105 - val_loss: 0.0782 - val_mse: 0.0782
Epoch 60/350
560/560 [==============================] - 0s 85us/step - loss: 0.1985 - mse:
0.1985 - val_loss: 0.0777 - val_mse: 0.0777
Epoch 61/350
560/560 [==============================] - 0s 88us/step - loss: 0.1921 - mse:
0.1921 - val_loss: 0.0772 - val_mse: 0.0772
Epoch 62/350
560/560 [==============================] - 0s 119us/step - loss: 0.1966 - mse:
0.1966 - val_loss: 0.0770 - val_mse: 0.0770
```

```
Epoch 63/350
560/560 [==============================] - 0s 95us/step - loss: 0.1911 - mse:
0.1911 - val_loss: 0.0769 - val_mse: 0.0769
Epoch 64/350
560/560 [==============================] - 0s 92us/step - loss: 0.1868 - mse:
0.1868 - val_loss: 0.0764 - val_mse: 0.0764
Epoch 65/350
560/560 [==============================] - 0s 95us/step - loss: 0.1869 - mse:
0.1869 - val_loss: 0.0756 - val_mse: 0.0756
Epoch 66/350
560/560 [==============================] - 0s 101us/step - loss: 0.1842 - mse:
0.1842 - val_loss: 0.0750 - val_mse: 0.0750
Epoch 67/350
560/560 [==============================] - 0s 86us/step - loss: 0.1804 - mse:
0.1804 - val_loss: 0.0750 - val_mse: 0.0750
Epoch 68/350
560/560 [==============================] - 0s 83us/step - loss: 0.1804 - mse:
0.1804 - val_loss: 0.0749 - val_mse: 0.0749
Epoch 69/350
560/560 [==============================] - 0s 87us/step - loss: 0.1817 - mse:
0.1817 - val_loss: 0.0744 - val_mse: 0.0744
Epoch 70/350
560/560 [==============================] - 0s 90us/step - loss: 0.1798 - mse:
0.1798 - val_loss: 0.0738 - val_mse: 0.0738
Epoch 71/350
560/560 [==============================] - 0s 90us/step - loss: 0.1776 - mse:
0.1776 - val_loss: 0.0734 - val_mse: 0.0734
Epoch 72/350
560/560 [==============================] - 0s 89us/step - loss: 0.1663 - mse:
0.1663 - val_loss: 0.0731 - val_mse: 0.0731
Epoch 73/350
560/560 [==============================] - 0s 81us/step - loss: 0.1688 - mse:
0.1688 - val_loss: 0.0730 - val_mse: 0.0730
Epoch 74/350
560/560 [==============================] - 0s 80us/step - loss: 0.1710 - mse:
0.1710 - val_loss: 0.0725 - val_mse: 0.0725
Epoch 75/350
560/560 [==============================] - 0s 84us/step - loss: 0.1681 - mse:
0.1681 - val_loss: 0.0723 - val_mse: 0.0723
Epoch 76/350
560/560 [==============================] - 0s 100us/step - loss: 0.1828 - mse:
0.1828 - val_loss: 0.0721 - val_mse: 0.0721
Epoch 77/350
560/560 [==============================] - 0s 99us/step - loss: 0.1577 - mse:
0.1577 - val_loss: 0.0714 - val_mse: 0.0714
Epoch 78/350
560/560 [==============================] - 0s 82us/step - loss: 0.1653 - mse:
0.1653 - val_loss: 0.0702 - val_mse: 0.0702
```

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Epoch 79/350
560/560 [==============================] - 0s 92us/step - loss: 0.1543 - mse:
0.1543 - val_loss: 0.0688 - val_mse: 0.0688
Epoch 80/350
560/560 [==============================] - 0s 90us/step - loss: 0.1650 - mse:
0.1650 - val_loss: 0.0676 - val_mse: 0.0676
Epoch 81/350
560/560 [==============================] - 0s 87us/step - loss: 0.1550 - mse:
0.1550 - val_loss: 0.0666 - val_mse: 0.0666
Epoch 82/350
560/560 [==============================] - 0s 79us/step - loss: 0.1538 - mse:
0.1538 - val_loss: 0.0656 - val_mse: 0.0656
Epoch 83/350
560/560 [==============================] - 0s 80us/step - loss: 0.1635 - mse:
0.1635 - val_loss: 0.0652 - val_mse: 0.0652
Epoch 84/350
560/560 [==============================] - 0s 78us/step - loss: 0.1427 - mse:
0.1427 - val_loss: 0.0645 - val_mse: 0.0645
Epoch 85/350
560/560 [==============================] - 0s 76us/step - loss: 0.1452 - mse:
0.1452 - val_loss: 0.0639 - val_mse: 0.0639
Epoch 86/350
560/560 [==============================] - 0s 78us/step - loss: 0.1470 - mse:
0.1470 - val_loss: 0.0633 - val_mse: 0.0633
Epoch 87/350
560/560 [==============================] - 0s 76us/step - loss: 0.1468 - mse:
0.1468 - val_loss: 0.0627 - val_mse: 0.0627
Epoch 88/350
560/560 [==============================] - 0s 78us/step - loss: 0.1500 - mse:
0.1500 - val_loss: 0.0625 - val_mse: 0.0625
Epoch 89/350
560/560 [==============================] - 0s 77us/step - loss: 0.1380 - mse:
0.1380 - val_loss: 0.0615 - val_mse: 0.0615
Epoch 90/350
560/560 [==============================] - 0s 79us/step - loss: 0.1458 - mse:
0.1458 - val_loss: 0.0610 - val_mse: 0.0610
Epoch 91/350
560/560 [==============================] - 0s 82us/step - loss: 0.1444 - mse:
0.1444 - val_loss: 0.0600 - val_mse: 0.0600
Epoch 92/350
560/560 [==============================] - 0s 81us/step - loss: 0.1445 - mse:
0.1445 - val_loss: 0.0590 - val_mse: 0.0590
Epoch 93/350
560/560 [==============================] - 0s 105us/step - loss: 0.1325 - mse:
0.1325 - val_loss: 0.0586 - val_mse: 0.0586
Epoch 94/350
560/560 [==============================] - 0s 87us/step - loss: 0.1382 - mse:
0.1382 - val_loss: 0.0581 - val_mse: 0.0581
```

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Epoch 95/350
560/560 [==============================] - 0s 83us/step - loss: 0.1324 - mse:
0.1324 - val_loss: 0.0580 - val_mse: 0.0580
Epoch 96/350
560/560 [==============================] - 0s 80us/step - loss: 0.1338 - mse:
0.1338 - val_loss: 0.0570 - val_mse: 0.0570
Epoch 97/350
560/560 [==============================] - 0s 80us/step - loss: 0.1347 - mse:
0.1347 - val_loss: 0.0562 - val_mse: 0.0562
Epoch 98/350
560/560 [==============================] - 0s 81us/step - loss: 0.1322 - mse:
0.1322 - val_loss: 0.0555 - val_mse: 0.0555
Epoch 99/350
560/560 [==============================] - 0s 81us/step - loss: 0.1344 - mse:
0.1344 - val_loss: 0.0546 - val_mse: 0.0546
Epoch 100/350
560/560 [==============================] - 0s 106us/step - loss: 0.1244 - mse:
0.1244 - val_loss: 0.0537 - val_mse: 0.0537
Epoch 101/350
560/560 [==============================] - 0s 95us/step - loss: 0.1233 - mse:
0.1233 - val_loss: 0.0528 - val_mse: 0.0528
Epoch 102/350
560/560 [==============================] - 0s 95us/step - loss: 0.1292 - mse:
0.1292 - val_loss: 0.0517 - val_mse: 0.0517
Epoch 103/350
560/560 [==============================] - 0s 85us/step - loss: 0.1125 - mse:
0.1125 - val_loss: 0.0505 - val_mse: 0.0505
Epoch 104/350
560/560 [==============================] - 0s 84us/step - loss: 0.1260 - mse:
0.1260 - val_loss: 0.0500 - val_mse: 0.0500
Epoch 105/350
560/560 [==============================] - 0s 78us/step - loss: 0.1130 - mse:
0.1130 - val_loss: 0.0492 - val_mse: 0.0492
Epoch 106/350
560/560 [==============================] - 0s 76us/step - loss: 0.1293 - mse:
0.1293 - val_loss: 0.0488 - val_mse: 0.0488
Epoch 107/350
560/560 [==============================] - 0s 78us/step - loss: 0.1188 - mse:
0.1188 - val_loss: 0.0487 - val_mse: 0.0487
Epoch 108/350
560/560 [==============================] - 0s 80us/step - loss: 0.1157 - mse:
0.1157 - val_loss: 0.0485 - val_mse: 0.0485
Epoch 109/350
560/560 [==============================] - 0s 81us/step - loss: 0.1202 - mse:
0.1202 - val_loss: 0.0476 - val_mse: 0.0476
Epoch 110/350
560/560 [==============================] - 0s 79us/step - loss: 0.1186 - mse:
0.1186 - val_loss: 0.0472 - val_mse: 0.0472
```

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Epoch 111/350
560/560 [==============================] - 0s 77us/step - loss: 0.1123 - mse:
0.1123 - val_loss: 0.0469 - val_mse: 0.0469
Epoch 112/350
560/560 [==============================] - 0s 81us/step - loss: 0.1094 - mse:
0.1094 - val_loss: 0.0459 - val_mse: 0.0459
Epoch 113/350
560/560 [==============================] - 0s 84us/step - loss: 0.1165 - mse:
0.1165 - val_loss: 0.0449 - val_mse: 0.0449
Epoch 114/350
560/560 [==============================] - 0s 96us/step - loss: 0.1060 - mse:
0.1060 - val_loss: 0.0451 - val_mse: 0.0451
Epoch 115/350
560/560 [==============================] - 0s 80us/step - loss: 0.1064 - mse:
0.1064 - val_loss: 0.0446 - val_mse: 0.0446
Epoch 116/350
560/560 [==============================] - 0s 79us/step - loss: 0.1041 - mse:
0.1041 - val_loss: 0.0444 - val_mse: 0.0444
Epoch 117/350
560/560 [==============================] - 0s 80us/step - loss: 0.1028 - mse:
0.1028 - val_loss: 0.0433 - val_mse: 0.0433
Epoch 118/350
560/560 [==============================] - 0s 79us/step - loss: 0.0997 - mse:
0.0997 - val_loss: 0.0425 - val_mse: 0.0425
Epoch 119/350
560/560 [==============================] - 0s 111us/step - loss: 0.1021 - mse:
0.1021 - val_loss: 0.0418 - val_mse: 0.0418
Epoch 120/350
560/560 [==============================] - 0s 121us/step - loss: 0.0930 - mse:
0.0930 - val_loss: 0.0404 - val_mse: 0.0404
Epoch 121/350
560/560 [==============================] - 0s 103us/step - loss: 0.1001 - mse:
0.1001 - val_loss: 0.0399 - val_mse: 0.0399
Epoch 122/350
560/560 [==============================] - 0s 109us/step - loss: 0.1060 - mse:
0.1060 - val_loss: 0.0391 - val_mse: 0.0391
Epoch 123/350
560/560 [==============================] - 0s 104us/step - loss: 0.0955 - mse:
0.0955 - val_loss: 0.0389 - val_mse: 0.0389
Epoch 124/350
560/560 [==============================] - 0s 83us/step - loss: 0.0917 - mse:
0.0917 - val_loss: 0.0387 - val_mse: 0.0387
Epoch 125/350
560/560 [==============================] - 0s 77us/step - loss: 0.0918 - mse:
0.0918 - val_loss: 0.0384 - val_mse: 0.0384
Epoch 126/350
560/560 [==============================] - 0s 80us/step - loss: 0.0952 - mse:
0.0952 - val_loss: 0.0377 - val_mse: 0.0377
```

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Epoch 127/350
560/560 [==============================] - 0s 80us/step - loss: 0.0852 - mse:
0.0852 - val_loss: 0.0372 - val_mse: 0.0372
Epoch 128/350
560/560 [==============================] - 0s 79us/step - loss: 0.0907 - mse:
0.0907 - val_loss: 0.0369 - val_mse: 0.0369
Epoch 129/350
560/560 [==============================] - 0s 77us/step - loss: 0.0895 - mse:
0.0895 - val_loss: 0.0357 - val_mse: 0.0357
Epoch 130/350
560/560 [==============================] - 0s 78us/step - loss: 0.0917 - mse:
0.0917 - val_loss: 0.0353 - val_mse: 0.0353
Epoch 131/350
560/560 [==============================] - 0s 80us/step - loss: 0.0919 - mse:
0.0919 - val_loss: 0.0353 - val_mse: 0.0353
Epoch 132/350
560/560 [==============================] - 0s 83us/step - loss: 0.0860 - mse:
0.0860 - val_loss: 0.0348 - val_mse: 0.0348
Epoch 133/350
560/560 [==============================] - 0s 153us/step - loss: 0.0864 - mse:
0.0864 - val_loss: 0.0344 - val_mse: 0.0344
Epoch 134/350
560/560 [==============================] - 0s 151us/step - loss: 0.0880 - mse:
0.0880 - val_loss: 0.0340 - val_mse: 0.0340
Epoch 135/350
560/560 [==============================] - 0s 105us/step - loss: 0.0832 - mse:
0.0832 - val_loss: 0.0339 - val_mse: 0.0339
Epoch 136/350
560/560 [==============================] - 0s 94us/step - loss: 0.0833 - mse:
0.0833 - val_loss: 0.0335 - val_mse: 0.0335
Epoch 137/350
560/560 [==============================] - 0s 84us/step - loss: 0.0879 - mse:
0.0879 - val_loss: 0.0329 - val_mse: 0.0329
Epoch 138/350
560/560 [==============================] - 0s 91us/step - loss: 0.0808 - mse:
0.0808 - val_loss: 0.0329 - val_mse: 0.0329
Epoch 139/350
560/560 [==============================] - 0s 83us/step - loss: 0.0817 - mse:
0.0817 - val_loss: 0.0328 - val_mse: 0.0328
Epoch 140/350
560/560 [==============================] - 0s 83us/step - loss: 0.0757 - mse:
0.0757 - val_loss: 0.0324 - val_mse: 0.0324
Epoch 141/350
560/560 [==============================] - 0s 83us/step - loss: 0.0775 - mse:
0.0775 - val_loss: 0.0319 - val_mse: 0.0319
Epoch 142/350
560/560 [==============================] - 0s 93us/step - loss: 0.0806 - mse:
0.0806 - val_loss: 0.0316 - val_mse: 0.0316
```

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Epoch 143/350
560/560 [==============================] - 0s 143us/step - loss: 0.0750 - mse:
0.0750 - val_loss: 0.0311 - val_mse: 0.0311
Epoch 144/350
560/560 [==============================] - 0s 126us/step - loss: 0.0757 - mse:
0.0757 - val_loss: 0.0306 - val_mse: 0.0306
Epoch 145/350
560/560 [==============================] - 0s 129us/step - loss: 0.0737 - mse:
0.0737 - val_loss: 0.0302 - val_mse: 0.0302
Epoch 146/350
560/560 [==============================] - 0s 99us/step - loss: 0.0782 - mse:
0.0782 - val_loss: 0.0301 - val_mse: 0.0301
Epoch 147/350
560/560 [==============================] - 0s 96us/step - loss: 0.0728 - mse:
0.0728 - val_loss: 0.0299 - val_mse: 0.0299
Epoch 148/350
560/560 [==============================] - 0s 87us/step - loss: 0.0751 - mse:
0.0751 - val_loss: 0.0296 - val_mse: 0.0296
Epoch 149/350
560/560 [==============================] - 0s 96us/step - loss: 0.0718 - mse:
0.0718 - val_loss: 0.0294 - val_mse: 0.0294
Epoch 150/350
560/560 [==============================] - 0s 108us/step - loss: 0.0681 - mse:
0.0681 - val_loss: 0.0293 - val_mse: 0.0293
Epoch 151/350
560/560 [==============================] - 0s 123us/step - loss: 0.0740 - mse:
0.0740 - val_loss: 0.0292 - val_mse: 0.0292
Epoch 152/350
560/560 [==============================] - 0s 128us/step - loss: 0.0664 - mse:
0.0664 - val_loss: 0.0290 - val_mse: 0.0290
Epoch 153/350
560/560 [==============================] - 0s 116us/step - loss: 0.0656 - mse:
0.0656 - val_loss: 0.0289 - val_mse: 0.0289
Epoch 154/350
560/560 [==============================] - 0s 109us/step - loss: 0.0658 - mse:
0.0658 - val_loss: 0.0287 - val_mse: 0.0287
Epoch 155/350
560/560 [==============================] - 0s 124us/step - loss: 0.0722 - mse:
0.0722 - val_loss: 0.0284 - val_mse: 0.0284
Epoch 156/350
560/560 [==============================] - 0s 90us/step - loss: 0.0698 - mse:
0.0698 - val_loss: 0.0284 - val_mse: 0.0284
Epoch 157/350
560/560 [==============================] - 0s 89us/step - loss: 0.0650 - mse:
0.0650 - val_loss: 0.0283 - val_mse: 0.0283
Epoch 158/350
560/560 [==============================] - 0s 84us/step - loss: 0.0613 - mse:
0.0613 - val_loss: 0.0281 - val_mse: 0.0281
```

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Epoch 159/350
560/560 [==============================] - 0s 88us/step - loss: 0.0564 - mse:
0.0564 - val_loss: 0.0280 - val_mse: 0.0280
Epoch 160/350
560/560 [==============================] - 0s 96us/step - loss: 0.0645 - mse:
0.0645 - val_loss: 0.0279 - val_mse: 0.0279
Epoch 161/350
560/560 [==============================] - 0s 90us/step - loss: 0.0631 - mse:
0.0631 - val_loss: 0.0277 - val_mse: 0.0277
Epoch 162/350
560/560 [==============================] - 0s 116us/step - loss: 0.0578 - mse:
0.0578 - val_loss: 0.0276 - val_mse: 0.0276
Epoch 163/350
560/560 [==============================] - 0s 125us/step - loss: 0.0628 - mse:
0.0628 - val_loss: 0.0274 - val_mse: 0.0274
Epoch 164/350
560/560 [==============================] - 0s 87us/step - loss: 0.0596 - mse:
0.0596 - val_loss: 0.0273 - val_mse: 0.0273
Epoch 165/350
560/560 [==============================] - 0s 99us/step - loss: 0.0600 - mse:
0.0600 - val_loss: 0.0273 - val_mse: 0.0273
Epoch 166/350
560/560 [==============================] - 0s 164us/step - loss: 0.0605 - mse:
0.0605 - val_loss: 0.0272 - val_mse: 0.0272
Epoch 167/350
560/560 [==============================] - 0s 133us/step - loss: 0.0602 - mse:
0.0602 - val_loss: 0.0272 - val_mse: 0.0272
Epoch 168/350
560/560 [==============================] - 0s 135us/step - loss: 0.0598 - mse:
0.0598 - val_loss: 0.0271 - val_mse: 0.0271
Epoch 169/350
560/560 [==============================] - 0s 125us/step - loss: 0.0587 - mse:
0.0587 - val_loss: 0.0272 - val_mse: 0.0272
Epoch 170/350
560/560 [==============================] - 0s 139us/step - loss: 0.0596 - mse:
0.0596 - val_loss: 0.0270 - val_mse: 0.0270
Epoch 171/350
560/560 [==============================] - 0s 87us/step - loss: 0.0566 - mse:
0.0566 - val_loss: 0.0270 - val_mse: 0.0270
Epoch 172/350
560/560 [==============================] - 0s 78us/step - loss: 0.0536 - mse:
0.0536 - val_loss: 0.0269 - val_mse: 0.0269
Epoch 173/350
560/560 [==============================] - 0s 79us/step - loss: 0.0570 - mse:
0.0570 - val_loss: 0.0269 - val_mse: 0.0269
Epoch 174/350
560/560 [==============================] - 0s 78us/step - loss: 0.0571 - mse:
0.0571 - val_loss: 0.0268 - val_mse: 0.0268
```

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Epoch 175/350
560/560 [==============================] - 0s 89us/step - loss: 0.0526 - mse:
0.0526 - val_loss: 0.0267 - val_mse: 0.0267
Epoch 176/350
560/560 [==============================] - 0s 124us/step - loss: 0.0545 - mse:
0.0545 - val_loss: 0.0267 - val_mse: 0.0267
Epoch 177/350
560/560 [==============================] - 0s 120us/step - loss: 0.0537 - mse:
0.0537 - val_loss: 0.0266 - val_mse: 0.0266
Epoch 178/350
560/560 [==============================] - 0s 130us/step - loss: 0.0563 - mse:
0.0563 - val_loss: 0.0265 - val_mse: 0.0265
Epoch 179/350
560/560 [==============================] - 0s 122us/step - loss: 0.0528 - mse:
0.0528 - val_loss: 0.0265 - val_mse: 0.0265
Epoch 180/350
560/560 [==============================] - 0s 93us/step - loss: 0.0491 - mse:
0.0491 - val_loss: 0.0264 - val_mse: 0.0264
Epoch 181/350
560/560 [==============================] - 0s 88us/step - loss: 0.0519 - mse:
0.0519 - val_loss: 0.0264 - val_mse: 0.0264
Epoch 182/350
560/560 [==============================] - 0s 118us/step - loss: 0.0532 - mse:
0.0532 - val_loss: 0.0263 - val_mse: 0.0263
Epoch 183/350
560/560 [==============================] - 0s 87us/step - loss: 0.0497 - mse:
0.0497 - val_loss: 0.0263 - val_mse: 0.0263
Epoch 184/350
560/560 [==============================] - 0s 97us/step - loss: 0.0533 - mse:
0.0533 - val_loss: 0.0263 - val_mse: 0.0263
Epoch 185/350
560/560 [==============================] - 0s 95us/step - loss: 0.0490 - mse:
0.0490 - val_loss: 0.0263 - val_mse: 0.0263
Epoch 186/350
560/560 [==============================] - 0s 100us/step - loss: 0.0488 - mse:
0.0488 - val_loss: 0.0262 - val_mse: 0.0262
Epoch 187/350
560/560 [==============================] - 0s 87us/step - loss: 0.0518 - mse:
0.0518 - val_loss: 0.0262 - val_mse: 0.0262
Epoch 188/350
560/560 [==============================] - 0s 90us/step - loss: 0.0486 - mse:
0.0486 - val_loss: 0.0261 - val_mse: 0.0261
Epoch 189/350
560/560 [==============================] - 0s 95us/step - loss: 0.0440 - mse:
0.0440 - val_loss: 0.0261 - val_mse: 0.0261
Epoch 190/350
560/560 [==============================] - 0s 86us/step - loss: 0.0465 - mse:
0.0465 - val_loss: 0.0261 - val_mse: 0.0261
```

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Epoch 191/350
560/560 [==============================] - 0s 82us/step - loss: 0.0479 - mse:
0.0479 - val_loss: 0.0261 - val_mse: 0.0261
Epoch 192/350
560/560 [==============================] - 0s 80us/step - loss: 0.0458 - mse:
0.0458 - val_loss: 0.0261 - val_mse: 0.0261
Epoch 193/350
560/560 [==============================] - 0s 79us/step - loss: 0.0476 - mse:
0.0476 - val_loss: 0.0261 - val_mse: 0.0261
Epoch 194/350
560/560 [==============================] - 0s 89us/step - loss: 0.0471 - mse:
0.0471 - val_loss: 0.0261 - val_mse: 0.0261
Epoch 195/350
560/560 [==============================] - 0s 81us/step - loss: 0.0466 - mse:
0.0466 - val_loss: 0.0260 - val_mse: 0.0260
Epoch 196/350
560/560 [==============================] - 0s 79us/step - loss: 0.0459 - mse:
0.0459 - val_loss: 0.0260 - val_mse: 0.0260
Epoch 197/350
560/560 [==============================] - 0s 83us/step - loss: 0.0455 - mse:
0.0455 - val_loss: 0.0260 - val_mse: 0.0260
Epoch 198/350
560/560 [==============================] - 0s 83us/step - loss: 0.0459 - mse:
0.0459 - val_loss: 0.0259 - val_mse: 0.0259
Epoch 199/350
560/560 [==============================] - 0s 83us/step - loss: 0.0427 - mse:
0.0427 - val_loss: 0.0259 - val_mse: 0.0259
Epoch 200/350
560/560 [==============================] - 0s 86us/step - loss: 0.0445 - mse:
0.0445 - val_loss: 0.0258 - val_mse: 0.0258
Epoch 201/350
560/560 [==============================] - 0s 87us/step - loss: 0.0432 - mse:
0.0432 - val_loss: 0.0258 - val_mse: 0.0258
Epoch 202/350
560/560 [==============================] - 0s 92us/step - loss: 0.0448 - mse:
0.0448 - val_loss: 0.0258 - val_mse: 0.0258
Epoch 203/350
560/560 [==============================] - 0s 87us/step - loss: 0.0439 - mse:
0.0439 - val_loss: 0.0258 - val_mse: 0.0258
Epoch 204/350
560/560 [==============================] - 0s 84us/step - loss: 0.0437 - mse:
0.0437 - val_loss: 0.0257 - val_mse: 0.0257
Epoch 205/350
560/560 [==============================] - 0s 87us/step - loss: 0.0438 - mse:
0.0438 - val_loss: 0.0257 - val_mse: 0.0257
Epoch 206/350
560/560 [==============================] - 0s 130us/step - loss: 0.0415 - mse:
0.0415 - val_loss: 0.0257 - val_mse: 0.0257
```

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Epoch 207/350
560/560 [==============================] - 0s 110us/step - loss: 0.0443 - mse:
0.0443 - val_loss: 0.0257 - val_mse: 0.0257
Epoch 208/350
560/560 [==============================] - 0s 95us/step - loss: 0.0445 - mse:
0.0445 - val_loss: 0.0257 - val_mse: 0.0257
Epoch 209/350
560/560 [==============================] - 0s 100us/step - loss: 0.0419 - mse:
0.0419 - val_loss: 0.0257 - val_mse: 0.0257
Epoch 210/350
560/560 [==============================] - 0s 124us/step - loss: 0.0424 - mse:
0.0424 - val_loss: 0.0257 - val_mse: 0.0257
Epoch 211/350
560/560 [==============================] - 0s 113us/step - loss: 0.0420 - mse:
0.0420 - val_loss: 0.0256 - val_mse: 0.0256
Epoch 212/350
560/560 [==============================] - 0s 107us/step - loss: 0.0412 - mse:
0.0412 - val_loss: 0.0256 - val_mse: 0.0256
Epoch 213/350
560/560 [==============================] - 0s 112us/step - loss: 0.0396 - mse:
0.0396 - val_loss: 0.0256 - val_mse: 0.0256
Epoch 214/350
560/560 [==============================] - 0s 104us/step - loss: 0.0400 - mse:
0.0400 - val_loss: 0.0256 - val_mse: 0.0256
Epoch 215/350
560/560 [==============================] - 0s 101us/step - loss: 0.0416 - mse:
0.0416 - val_loss: 0.0256 - val_mse: 0.0256
Epoch 216/350
560/560 [==============================] - 0s 103us/step - loss: 0.0405 - mse:
0.0405 - val_loss: 0.0255 - val_mse: 0.0255
Epoch 217/350
560/560 [==============================] - 0s 106us/step - loss: 0.0403 - mse:
0.0403 - val_loss: 0.0255 - val_mse: 0.0255
Epoch 218/350
560/560 [==============================] - 0s 164us/step - loss: 0.0415 - mse:
0.0415 - val_loss: 0.0255 - val_mse: 0.0255
Epoch 219/350
560/560 [==============================] - 0s 292us/step - loss: 0.0402 - mse:
0.0402 - val_loss: 0.0255 - val_mse: 0.0255
Epoch 220/350
560/560 [==============================] - 0s 152us/step - loss: 0.0359 - mse:
0.0359 - val_loss: 0.0255 - val_mse: 0.0255
Epoch 221/350
560/560 [==============================] - 0s 100us/step - loss: 0.0398 - mse:
0.0398 - val_loss: 0.0254 - val_mse: 0.0254
Epoch 222/350
560/560 [==============================] - 0s 104us/step - loss: 0.0399 - mse:
0.0399 - val_loss: 0.0254 - val_mse: 0.0254
```

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Epoch 223/350
560/560 [==============================] - 0s 114us/step - loss: 0.0394 - mse:
0.0394 - val_loss: 0.0254 - val_mse: 0.0254
Epoch 224/350
560/560 [==============================] - 0s 107us/step - loss: 0.0369 - mse:
0.0369 - val_loss: 0.0253 - val_mse: 0.0253
Epoch 225/350
560/560 [==============================] - 0s 103us/step - loss: 0.0385 - mse:
0.0385 - val_loss: 0.0253 - val_mse: 0.0253
Epoch 226/350
560/560 [==============================] - 0s 99us/step - loss: 0.0398 - mse:
0.0398 - val_loss: 0.0253 - val_mse: 0.0253
Epoch 227/350
560/560 [==============================] - 0s 157us/step - loss: 0.0380 - mse:
0.0380 - val_loss: 0.0253 - val_mse: 0.0253
Epoch 228/350
560/560 [==============================] - 0s 145us/step - loss: 0.0404 - mse:
0.0404 - val_loss: 0.0253 - val_mse: 0.0253
Epoch 229/350
560/560 [==============================] - 0s 101us/step - loss: 0.0374 - mse:
0.0374 - val_loss: 0.0253 - val_mse: 0.0253
Epoch 230/350
560/560 [==============================] - 0s 82us/step - loss: 0.0376 - mse:
0.0376 - val_loss: 0.0252 - val_mse: 0.0252
Epoch 231/350
560/560 [==============================] - 0s 82us/step - loss: 0.0370 - mse:
0.0370 - val_loss: 0.0252 - val_mse: 0.0252
Epoch 232/350
560/560 [==============================] - 0s 81us/step - loss: 0.0371 - mse:
0.0371 - val_loss: 0.0252 - val_mse: 0.0252
Epoch 233/350
560/560 [==============================] - 0s 81us/step - loss: 0.0385 - mse:
0.0385 - val_loss: 0.0252 - val_mse: 0.0252
Epoch 234/350
560/560 [==============================] - 0s 119us/step - loss: 0.0367 - mse:
0.0367 - val_loss: 0.0251 - val_mse: 0.0251
Epoch 235/350
560/560 [==============================] - 0s 96us/step - loss: 0.0369 - mse:
0.0369 - val_loss: 0.0251 - val_mse: 0.0251
Epoch 236/350
560/560 [==============================] - 0s 124us/step - loss: 0.0366 - mse:
0.0366 - val_loss: 0.0251 - val_mse: 0.0251
Epoch 237/350
560/560 [==============================] - 0s 126us/step - loss: 0.0354 - mse:
0.0354 - val_loss: 0.0251 - val_mse: 0.0251
Epoch 238/350
560/560 [==============================] - 0s 108us/step - loss: 0.0360 - mse:
0.0360 - val_loss: 0.0250 - val_mse: 0.0250
```

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Epoch 239/350
560/560 [==============================] - 0s 97us/step - loss: 0.0369 - mse:
0.0369 - val_loss: 0.0250 - val_mse: 0.0250
Epoch 240/350
560/560 [==============================] - 0s 82us/step - loss: 0.0368 - mse:
0.0368 - val_loss: 0.0250 - val_mse: 0.0250
Epoch 241/350
560/560 [==============================] - 0s 80us/step - loss: 0.0356 - mse:
0.0356 - val_loss: 0.0250 - val_mse: 0.0250
Epoch 242/350
560/560 [==============================] - 0s 80us/step - loss: 0.0358 - mse:
0.0358 - val_loss: 0.0250 - val_mse: 0.0250
Epoch 243/350
560/560 [==============================] - 0s 81us/step - loss: 0.0353 - mse:
0.0353 - val_loss: 0.0249 - val_mse: 0.0249
Epoch 244/350
560/560 [==============================] - 0s 85us/step - loss: 0.0362 - mse:
0.0362 - val_loss: 0.0249 - val_mse: 0.0249
Epoch 245/350
560/560 [==============================] - 0s 84us/step - loss: 0.0366 - mse:
0.0366 - val_loss: 0.0249 - val_mse: 0.0249
Epoch 246/350
560/560 [==============================] - 0s 86us/step - loss: 0.0348 - mse:
0.0348 - val_loss: 0.0249 - val_mse: 0.0249
Epoch 247/350
560/560 [==============================] - 0s 87us/step - loss: 0.0372 - mse:
0.0372 - val_loss: 0.0248 - val_mse: 0.0248
Epoch 248/350
560/560 [==============================] - 0s 83us/step - loss: 0.0336 - mse:
0.0336 - val_loss: 0.0248 - val_mse: 0.0248
Epoch 249/350
560/560 [==============================] - 0s 82us/step - loss: 0.0344 - mse:
0.0344 - val_loss: 0.0248 - val_mse: 0.0248
Epoch 250/350
560/560 [==============================] - 0s 79us/step - loss: 0.0350 - mse:
0.0350 - val_loss: 0.0248 - val_mse: 0.0248
Epoch 251/350
560/560 [==============================] - 0s 80us/step - loss: 0.0329 - mse:
0.0329 - val_loss: 0.0247 - val_mse: 0.0247
Epoch 252/350
560/560 [==============================] - 0s 82us/step - loss: 0.0356 - mse:
0.0356 - val_loss: 0.0247 - val_mse: 0.0247
Epoch 253/350
560/560 [==============================] - 0s 86us/step - loss: 0.0350 - mse:
0.0350 - val_loss: 0.0247 - val_mse: 0.0247
Epoch 254/350
560/560 [==============================] - 0s 86us/step - loss: 0.0347 - mse:
0.0347 - val_loss: 0.0247 - val_mse: 0.0247
```

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Epoch 255/350
560/560 [==============================] - 0s 82us/step - loss: 0.0344 - mse:
0.0344 - val_loss: 0.0247 - val_mse: 0.0247
Epoch 256/350
560/560 [==============================] - 0s 84us/step - loss: 0.0340 - mse:
0.0340 - val_loss: 0.0246 - val_mse: 0.0246
Epoch 257/350
560/560 [==============================] - 0s 84us/step - loss: 0.0337 - mse:
0.0337 - val_loss: 0.0246 - val_mse: 0.0246
Epoch 258/350
560/560 [==============================] - 0s 82us/step - loss: 0.0335 - mse:
0.0335 - val_loss: 0.0245 - val_mse: 0.0245
Epoch 259/350
560/560 [==============================] - 0s 83us/step - loss: 0.0337 - mse:
0.0337 - val_loss: 0.0245 - val_mse: 0.0245
Epoch 260/350
560/560 [==============================] - 0s 98us/step - loss: 0.0325 - mse:
0.0325 - val_loss: 0.0245 - val_mse: 0.0245
Epoch 261/350
560/560 [==============================] - 0s 96us/step - loss: 0.0331 - mse:
0.0331 - val_loss: 0.0245 - val_mse: 0.0245
Epoch 262/350
560/560 [==============================] - 0s 92us/step - loss: 0.0340 - mse:
0.0340 - val_loss: 0.0245 - val_mse: 0.0245
Epoch 263/350
560/560 [==============================] - 0s 99us/step - loss: 0.0347 - mse:
0.0347 - val_loss: 0.0244 - val_mse: 0.0244
Epoch 264/350
560/560 [==============================] - 0s 98us/step - loss: 0.0320 - mse:
0.0320 - val_loss: 0.0244 - val_mse: 0.0244
Epoch 265/350
560/560 [==============================] - 0s 82us/step - loss: 0.0328 - mse:
0.0328 - val_loss: 0.0244 - val_mse: 0.0244
Epoch 266/350
560/560 [==============================] - 0s 84us/step - loss: 0.0332 - mse:
0.0332 - val_loss: 0.0244 - val_mse: 0.0244
Epoch 267/350
560/560 [==============================] - 0s 84us/step - loss: 0.0337 - mse:
0.0337 - val_loss: 0.0244 - val_mse: 0.0244
Epoch 268/350
560/560 [==============================] - 0s 83us/step - loss: 0.0341 - mse:
0.0341 - val_loss: 0.0243 - val_mse: 0.0243
Epoch 269/350
560/560 [==============================] - 0s 117us/step - loss: 0.0334 - mse:
0.0334 - val_loss: 0.0243 - val_mse: 0.0243
Epoch 270/350
560/560 [==============================] - 0s 142us/step - loss: 0.0327 - mse:
0.0327 - val_loss: 0.0243 - val_mse: 0.0243
```

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Epoch 271/350
560/560 [==============================] - 0s 164us/step - loss: 0.0324 - mse:
0.0324 - val_loss: 0.0243 - val_mse: 0.0243
Epoch 272/350
560/560 [==============================] - 0s 105us/step - loss: 0.0313 - mse:
0.0313 - val_loss: 0.0242 - val_mse: 0.0242
Epoch 273/350
560/560 [==============================] - 0s 87us/step - loss: 0.0332 - mse:
0.0332 - val_loss: 0.0242 - val_mse: 0.0242
Epoch 274/350
560/560 [==============================] - 0s 82us/step - loss: 0.0335 - mse:
0.0335 - val_loss: 0.0242 - val_mse: 0.0242
Epoch 275/350
560/560 [==============================] - 0s 82us/step - loss: 0.0324 - mse:
0.0324 - val_loss: 0.0242 - val_mse: 0.0242
Epoch 276/350
560/560 [==============================] - 0s 82us/step - loss: 0.0326 - mse:
0.0326 - val_loss: 0.0241 - val_mse: 0.0241
Epoch 277/350
560/560 [==============================] - 0s 82us/step - loss: 0.0313 - mse:
0.0313 - val_loss: 0.0241 - val_mse: 0.0241
Epoch 278/350
560/560 [==============================] - 0s 84us/step - loss: 0.0312 - mse:
0.0312 - val_loss: 0.0241 - val_mse: 0.0241
Epoch 279/350
560/560 [==============================] - 0s 87us/step - loss: 0.0326 - mse:
0.0326 - val_loss: 0.0241 - val_mse: 0.0241
Epoch 280/350
560/560 [==============================] - 0s 84us/step - loss: 0.0311 - mse:
0.0311 - val_loss: 0.0241 - val_mse: 0.0241
Epoch 281/350
560/560 [==============================] - 0s 86us/step - loss: 0.0312 - mse:
0.0312 - val_loss: 0.0241 - val_mse: 0.0241
Epoch 282/350
560/560 [==============================] - 0s 84us/step - loss: 0.0320 - mse:
0.0320 - val_loss: 0.0240 - val_mse: 0.0240
Epoch 283/350
560/560 [==============================] - 0s 92us/step - loss: 0.0316 - mse:
0.0316 - val_loss: 0.0240 - val_mse: 0.0240
Epoch 284/350
560/560 [==============================] - 0s 88us/step - loss: 0.0317 - mse:
0.0317 - val_loss: 0.0239 - val_mse: 0.0239
Epoch 285/350
560/560 [==============================] - 0s 89us/step - loss: 0.0321 - mse:
0.0321 - val_loss: 0.0239 - val_mse: 0.0239
Epoch 286/350
560/560 [==============================] - 0s 83us/step - loss: 0.0304 - mse:
0.0304 - val_loss: 0.0239 - val_mse: 0.0239
```

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Epoch 287/350
560/560 [==============================] - 0s 85us/step - loss: 0.0309 - mse:
0.0309 - val_loss: 0.0238 - val_mse: 0.0238
Epoch 288/350
560/560 [==============================] - 0s 90us/step - loss: 0.0301 - mse:
0.0301 - val_loss: 0.0238 - val_mse: 0.0238
Epoch 289/350
560/560 [==============================] - 0s 96us/step - loss: 0.0321 - mse:
0.0321 - val_loss: 0.0238 - val_mse: 0.0238
Epoch 290/350
560/560 [==============================] - 0s 86us/step - loss: 0.0304 - mse:
0.0304 - val_loss: 0.0237 - val_mse: 0.0237
Epoch 291/350
560/560 [==============================] - 0s 87us/step - loss: 0.0307 - mse:
0.0307 - val_loss: 0.0237 - val_mse: 0.0237
Epoch 292/350
560/560 [==============================] - 0s 101us/step - loss: 0.0308 - mse:
0.0308 - val_loss: 0.0237 - val_mse: 0.0237
Epoch 293/350
560/560 [==============================] - 0s 88us/step - loss: 0.0298 - mse:
0.0298 - val_loss: 0.0237 - val_mse: 0.0237
Epoch 294/350
560/560 [==============================] - 0s 84us/step - loss: 0.0298 - mse:
0.0298 - val_loss: 0.0236 - val_mse: 0.0236
Epoch 295/350
560/560 [==============================] - 0s 119us/step - loss: 0.0315 - mse:
0.0315 - val_loss: 0.0236 - val_mse: 0.0236
Epoch 296/350
560/560 [==============================] - 0s 95us/step - loss: 0.0303 - mse:
0.0303 - val_loss: 0.0236 - val_mse: 0.0236
Epoch 297/350
560/560 [==============================] - 0s 109us/step - loss: 0.0305 - mse:
0.0305 - val_loss: 0.0235 - val_mse: 0.0235
Epoch 298/350
560/560 [==============================] - 0s 100us/step - loss: 0.0306 - mse:
0.0306 - val_loss: 0.0235 - val_mse: 0.0235
Epoch 299/350
560/560 [==============================] - 0s 88us/step - loss: 0.0293 - mse:
0.0293 - val_loss: 0.0234 - val_mse: 0.0234
Epoch 300/350
560/560 [==============================] - 0s 81us/step - loss: 0.0296 - mse:
0.0296 - val_loss: 0.0234 - val_mse: 0.0234
Epoch 301/350
560/560 [==============================] - 0s 83us/step - loss: 0.0296 - mse:
0.0296 - val_loss: 0.0233 - val_mse: 0.0233
Epoch 302/350
560/560 [==============================] - 0s 86us/step - loss: 0.0297 - mse:
0.0297 - val_loss: 0.0233 - val_mse: 0.0233
```

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Epoch 303/350
560/560 [==============================] - 0s 81us/step - loss: 0.0312 - mse:
0.0312 - val_loss: 0.0233 - val_mse: 0.0233
Epoch 304/350
560/560 [==============================] - 0s 83us/step - loss: 0.0295 - mse:
0.0295 - val_loss: 0.0233 - val_mse: 0.0233
Epoch 305/350
560/560 [==============================] - 0s 84us/step - loss: 0.0295 - mse:
0.0295 - val_loss: 0.0233 - val_mse: 0.0233
Epoch 306/350
560/560 [==============================] - 0s 81us/step - loss: 0.0308 - mse:
0.0308 - val_loss: 0.0232 - val_mse: 0.0232
Epoch 307/350
560/560 [==============================] - 0s 85us/step - loss: 0.0304 - mse:
0.0304 - val_loss: 0.0232 - val_mse: 0.0232
Epoch 308/350
560/560 [==============================] - 0s 86us/step - loss: 0.0292 - mse:
0.0292 - val_loss: 0.0231 - val_mse: 0.0231
Epoch 309/350
560/560 [==============================] - 0s 113us/step - loss: 0.0294 - mse:
0.0294 - val_loss: 0.0231 - val_mse: 0.0231
Epoch 310/350
560/560 [==============================] - 0s 93us/step - loss: 0.0294 - mse:
0.0294 - val_loss: 0.0231 - val_mse: 0.0231
Epoch 311/350
560/560 [==============================] - 0s 89us/step - loss: 0.0292 - mse:
0.0292 - val_loss: 0.0230 - val_mse: 0.0230
Epoch 312/350
560/560 [==============================] - 0s 91us/step - loss: 0.0293 - mse:
0.0293 - val_loss: 0.0230 - val_mse: 0.0230
Epoch 313/350
560/560 [==============================] - 0s 84us/step - loss: 0.0290 - mse:
0.0290 - val_loss: 0.0230 - val_mse: 0.0230
Epoch 314/350
560/560 [==============================] - 0s 83us/step - loss: 0.0297 - mse:
0.0297 - val_loss: 0.0230 - val_mse: 0.0230
Epoch 315/350
560/560 [==============================] - 0s 85us/step - loss: 0.0298 - mse:
0.0298 - val_loss: 0.0229 - val_mse: 0.0229
Epoch 316/350
560/560 [==============================] - 0s 83us/step - loss: 0.0293 - mse:
0.0293 - val_loss: 0.0229 - val_mse: 0.0229
Epoch 317/350
560/560 [==============================] - 0s 81us/step - loss: 0.0290 - mse:
0.0290 - val_loss: 0.0228 - val_mse: 0.0228
Epoch 318/350
560/560 [==============================] - 0s 84us/step - loss: 0.0292 - mse:
0.0292 - val_loss: 0.0228 - val_mse: 0.0228
```

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Epoch 319/350
560/560 [==============================] - 0s 83us/step - loss: 0.0288 - mse:
0.0288 - val_loss: 0.0228 - val_mse: 0.0228
Epoch 320/350
560/560 [==============================] - 0s 83us/step - loss: 0.0301 - mse:
0.0301 - val_loss: 0.0228 - val_mse: 0.0228
Epoch 321/350
560/560 [==============================] - 0s 82us/step - loss: 0.0281 - mse:
0.0281 - val_loss: 0.0227 - val_mse: 0.0227
Epoch 322/350
560/560 [==============================] - 0s 83us/step - loss: 0.0288 - mse:
0.0288 - val_loss: 0.0227 - val_mse: 0.0227
Epoch 323/350
560/560 [==============================] - 0s 85us/step - loss: 0.0285 - mse:
0.0285 - val_loss: 0.0227 - val_mse: 0.0227
Epoch 324/350
560/560 [==============================] - 0s 84us/step - loss: 0.0289 - mse:
0.0289 - val_loss: 0.0227 - val_mse: 0.0227
Epoch 325/350
560/560 [==============================] - 0s 83us/step - loss: 0.0294 - mse:
0.0294 - val_loss: 0.0227 - val_mse: 0.0227
Epoch 326/350
560/560 [==============================] - 0s 83us/step - loss: 0.0282 - mse:
0.0282 - val_loss: 0.0226 - val_mse: 0.0226
Epoch 327/350
560/560 [==============================] - 0s 85us/step - loss: 0.0288 - mse:
0.0288 - val_loss: 0.0226 - val_mse: 0.0226
Epoch 328/350
560/560 [==============================] - 0s 85us/step - loss: 0.0290 - mse:
0.0290 - val_loss: 0.0226 - val_mse: 0.0226
Epoch 329/350
560/560 [==============================] - 0s 86us/step - loss: 0.0293 - mse:
0.0293 - val_loss: 0.0226 - val_mse: 0.0226
Epoch 330/350
560/560 [==============================] - 0s 81us/step - loss: 0.0291 - mse:
0.0291 - val_loss: 0.0225 - val_mse: 0.0225
Epoch 331/350
560/560 [==============================] - 0s 86us/step - loss: 0.0281 - mse:
0.0281 - val_loss: 0.0225 - val_mse: 0.0225
Epoch 332/350
560/560 [==============================] - 0s 82us/step - loss: 0.0273 - mse:
0.0273 - val_loss: 0.0225 - val_mse: 0.0225
Epoch 333/350
560/560 [==============================] - 0s 84us/step - loss: 0.0274 - mse:
0.0274 - val_loss: 0.0225 - val_mse: 0.0225
Epoch 334/350
560/560 [==============================] - 0s 88us/step - loss: 0.0286 - mse:
0.0286 - val_loss: 0.0224 - val_mse: 0.0224
```

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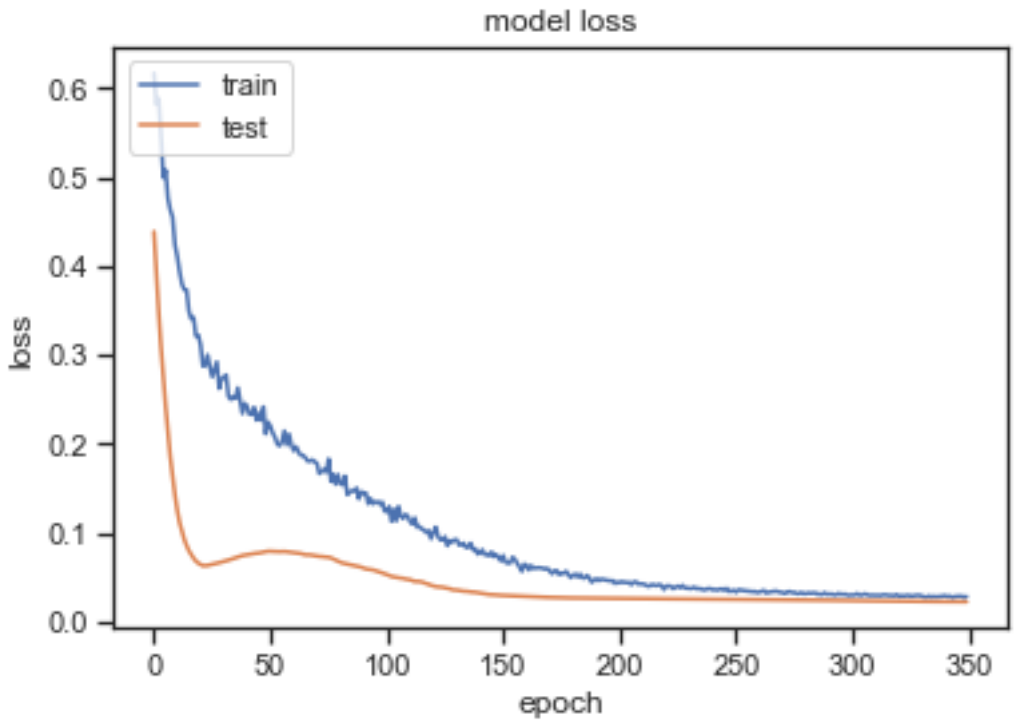
Epoch 335/350
560/560 [==============================] - 0s 91us/step - loss: 0.0272 - mse:
0.0272 - val_loss: 0.0224 - val_mse: 0.0224
Epoch 336/350
560/560 [==============================] - 0s 101us/step - loss: 0.0281 - mse:
0.0281 - val_loss: 0.0223 - val_mse: 0.0223
Epoch 337/350
560/560 [==============================] - 0s 92us/step - loss: 0.0276 - mse:
0.0276 - val_loss: 0.0223 - val_mse: 0.0223
Epoch 338/350
560/560 [==============================] - 0s 103us/step - loss: 0.0280 - mse:
0.0280 - val_loss: 0.0223 - val_mse: 0.0223
Epoch 339/350
560/560 [==============================] - 0s 112us/step - loss: 0.0279 - mse:
0.0279 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 340/350
560/560 [==============================] - 0s 97us/step - loss: 0.0288 - mse:
0.0288 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 341/350
560/560 [==============================] - 0s 86us/step - loss: 0.0286 - mse:
0.0286 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 342/350
560/560 [==============================] - 0s 90us/step - loss: 0.0278 - mse:
0.0278 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 343/350
560/560 [==============================] - 0s 82us/step - loss: 0.0284 - mse:
0.0284 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 344/350
560/560 [==============================] - 0s 82us/step - loss: 0.0266 - mse:
0.0266 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 345/350
560/560 [==============================] - 0s 84us/step - loss: 0.0279 - mse:
0.0279 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 346/350
560/560 [==============================] - 0s 83us/step - loss: 0.0282 - mse:
0.0282 - val_loss: 0.0221 - val_mse: 0.0221
Epoch 347/350
560/560 [==============================] - 0s 93us/step - loss: 0.0281 - mse:
0.0281 - val_loss: 0.0221 - val_mse: 0.0221
Epoch 348/350
560/560 [==============================] - 0s 91us/step - loss: 0.0285 - mse:
0.0285 - val_loss: 0.0222 - val_mse: 0.0222
Epoch 349/350
560/560 [==============================] - 0s 84us/step - loss: 0.0267 - mse:
0.0267 - val_loss: 0.0221 - val_mse: 0.0221
Epoch 350/350
560/560 [==============================] - 0s 85us/step - loss: 0.0281 - mse:
0.0281 - val_loss: 0.0221 - val_mse: 0.0221
```



[15]: <keras.engine.sequential.Sequential at 0x1a4e5c3f90>

<Figure size 432x288 with 0 Axes>

[16]:
```
model_evaluate()
```

```
Training MSE 0.02214636629100351
Test MSE 0.03738510960200408
Predicted Value
  [[0.45825717 0.36276236 0.45468357]
 [0.44970927 0.37574098 0.5617138 ]
 [0.45400682 0.3859441  0.6457234 ]
 [0.46637297 0.37219366 0.54889303]
 [0.46843284 0.3897151  0.68541914]
 [0.46133143 0.36919218 0.5188998 ]
 [0.45226154 0.39028257 0.67983615]
 [0.4659887  0.36698747 0.51225173]
 [0.4804495  0.36861908 0.5425379 ]
 [0.45529848 0.39377534 0.70569414]
 [0.46486276 0.36654976 0.50105697]
 [0.44872546 0.38585615 0.641141  ]
 [0.47625268 0.3616365  0.468539  ]
 [0.4692869  0.3495501  0.34522012]
```

```
[0.47233602 0.35434395 0.39321515]
[0.4565397  0.37255105 0.54805183]
[0.45972744 0.3959928  0.7141448 ]
[0.46873546 0.35237667 0.36783683]
[0.45130762 0.3655014  0.4824731 ]
[0.45431906 0.34432182 0.27330568]
[0.47832492 0.36838862 0.53694457]
[0.45695215 0.3730551  0.5516625 ]
[0.47611097 0.37806365 0.6141787 ]
[0.45465812 0.3762433  0.5728033 ]
[0.47048354 0.37616068 0.59485114]
[0.47611886 0.34940323 0.3591377 ]
[0.4868082  0.371192   0.55970496]
[0.4726376  0.35240176 0.3728461 ]
[0.48145384 0.3670055  0.5196091 ]
[0.46588638 0.37671924 0.5896188 ]
[0.4593263  0.37584993 0.57104623]
[0.48183462 0.3754884  0.5953983 ]
[0.44663602 0.38376573 0.63518643]
[0.46118155 0.38869214 0.68032324]
[0.47730455 0.35155597 0.37306783]
[0.45795503 0.365951   0.48768413]
[0.44500756 0.371369   0.534937  ]
[0.43535998 0.35860446 0.40381074]
[0.4488701  0.35593688 0.39549586]
[0.453137   0.3581293  0.4196219 ]
[0.4410578  0.36094955 0.43164018]
[0.44796392 0.3618741  0.44572505]
[0.47067186 0.35935974 0.43968296]
[0.45930874 0.37074295 0.5299451 ]
[0.46599433 0.36845374 0.52552044]
[0.46466875 0.3671195  0.50989956]
[0.45831198 0.35127243 0.33586538]
[0.46882614 0.3527707  0.37709534]
[0.48357114 0.35903403 0.45075846]
[0.48607948 0.37415507 0.5938761 ]
[0.45833808 0.3841105  0.6333846 ]
[0.48095942 0.36286497 0.4860085 ]
[0.46888277 0.36586535 0.49821666]
[0.44770947 0.36818427 0.50684685]
[0.4552603  0.37257397 0.5520928 ]
[0.4617037  0.3766064  0.5842338 ]
[0.45139748 0.3520683  0.3450806 ]
[0.453503   0.3508453  0.34384185]
[0.45854387 0.36008668 0.43901077]
[0.46405676 0.36550474 0.5011895 ]
[0.47441646 0.37117657 0.5554399 ]
[0.4743245  0.36176267 0.47173288]
```

```
[0.45521718 0.3667125  0.49207827]
[0.4441004  0.3556635  0.3756917 ]
[0.4570637  0.3662463  0.4977626 ]
[0.46749112 0.36276105 0.47126058]
[0.467015   0.36885667 0.51835114]
[0.4609187  0.36933088 0.51595026]
[0.43755382 0.37634504 0.5587986 ]
[0.43628448 0.37699407 0.56395566]
[0.46176198 0.37928006 0.6154727 ]
[0.48592094 0.35057408 0.37064013]
[0.4793336  0.35406047 0.39910173]
[0.47270072 0.36168262 0.46947777]
[0.47045782 0.36526725 0.49863017]
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[0.48946598 0.3485306  0.35542932]
[0.47490656 0.3503704  0.3593047 ]
[0.45435753 0.35762447 0.40701795]
[0.45321697 0.35684115 0.39959723]
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[0.4369641  0.3682305  0.50155807]
[0.43042517 0.36803898 0.49255192]
[0.42607155 0.37063935 0.5151575 ]
[0.44534057 0.36178967 0.443305  ]
[0.4628999  0.3626643  0.47753933]
[0.4461395  0.36287826 0.4492683 ]
[0.46542963 0.35985783 0.45354   ]
[0.454839   0.36613163 0.5038065 ]
[0.45756337 0.36583596 0.5017364 ]
[0.44122386 0.36156613 0.44297853]
[0.43574747 0.36466277 0.46639395]
[0.4396357  0.3677699  0.51041985]
[0.42136002 0.36542916 0.45861244]
[0.4214183  0.36365408 0.43923986]
[0.45285454 0.36948478 0.53040844]
[0.42621642 0.37303028 0.53330576]
[0.41037124 0.37312952 0.52511233]
[0.40590852 0.3736994  0.5235113 ]
[0.41196036 0.373662   0.5259867 ]
[0.448417   0.378318   0.5930083 ]
[0.46893203 0.3765061  0.59518856]
[0.45704025 0.37715724 0.58787435]
[0.46308956 0.3783569  0.60753226]
[0.44398353 0.37527382 0.56475866]
[0.4647759  0.37538034 0.58460116]
[0.44879058 0.37326452 0.551781  ]
[0.4712941  0.37574637 0.5885616 ]
[0.47322756 0.37721673 0.6055176 ]
[0.4608382  0.3763632  0.57985324]
```

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[0.49574846 0.37309945 0.5835116 ]
[0.4958539  0.37616834 0.61212546]
[0.49391782 0.37249246 0.5782116 ]
[0.49906072 0.3721339  0.58100134]
[0.46742576 0.358976   0.43368575]
[0.46166903 0.35580924 0.39421648]
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[0.4601048  0.39426064 0.7138054 ]
[0.44009116 0.3897261  0.6658021 ]
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[0.46247485 0.39337218 0.7098284 ]
```

```
[0.45525238 0.3915616  0.6969077 ]
[0.4458375  0.39360628 0.6999382 ]
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[0.45380893 0.39469522 0.70637083]
[0.4530338  0.39505723 0.7148258 ]]
Denormalized Value
 [[-2.7  3.4 -7.1]
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[-2.8  3.5 -5.6]
[-2.6  3.4 -6.4]
[-2.6  3.6 -5.3]
```

```
[-2.7  3.4 -6.6]
[-2.8  3.6 -5.4]
[-2.6  3.4 -6.7]
[-2.4  3.4 -6.4]
[-2.8  3.6 -5.2]
[-2.6  3.4 -6.7]
[-2.9  3.5 -5.7]
[-2.4  3.4 -7. ]
[-2.5  3.3 -7.9]
[-2.5  3.3 -7.6]
[-2.7  3.4 -6.4]
[-2.7  3.6 -5.1]
[-2.6  3.3 -7.8]
[-2.8  3.4 -6.9]
[-2.8  3.3 -8.5]
[-2.4  3.4 -6.5]
[-2.7  3.5 -6.4]
[-2.4  3.5 -5.9]
[-2.8  3.5 -6.2]
[-2.5  3.5 -6. ]
[-2.4  3.3 -7.8]
[-2.3  3.4 -6.3]
[-2.5  3.3 -7.7]
[-2.3  3.4 -6.6]
[-2.6  3.5 -6.1]
[-2.7  3.5 -6.2]
[-2.3  3.5 -6. ]
[-2.9  3.5 -5.7]
[-2.7  3.5 -5.4]
[-2.4  3.3 -7.7]
[-2.7  3.4 -6.8]
[-2.9  3.4 -6.5]
[-3.1  3.4 -7.5]
[-2.9  3.3 -7.6]
[-2.8  3.4 -7.4]
[-3.   3.4 -7.3]
[-2.9  3.4 -7.2]
[-2.5  3.4 -7.2]
[-2.7  3.4 -6.5]
[-2.6  3.4 -6.6]
[-2.6  3.4 -6.7]
[-2.7  3.3 -8. ]
[-2.6  3.3 -7.7]
[-2.3  3.4 -7.1]
[-2.3  3.5 -6. ]
[-2.7  3.5 -5.7]
[-2.4  3.4 -6.9]
[-2.6  3.4 -6.8]
```

```
[-2.9  3.4 -6.7]
[-2.8  3.4 -6.3]
[-2.7  3.5 -6.1]
[-2.8  3.3 -7.9]
[-2.8  3.3 -8. ]
[-2.7  3.4 -7.2]
[-2.6  3.4 -6.7]
[-2.5  3.4 -6.3]
[-2.5  3.4 -7. ]
[-2.8  3.4 -6.8]
[-2.9  3.3 -7.7]
[-2.7  3.4 -6.8]
[-2.6  3.4 -7. ]
[-2.6  3.4 -6.6]
[-2.7  3.4 -6.6]
[-3.1  3.5 -6.3]
[-3.1  3.5 -6.3]
[-2.7  3.5 -5.9]
[-2.3  3.3 -7.7]
[-2.4  3.3 -7.5]
[-2.5  3.4 -7. ]
[-2.5  3.4 -6.8]
[-2.5  3.4 -6.7]
[-2.2  3.3 -7.9]
[-2.5  3.3 -7.8]
[-2.8  3.4 -7.5]
[-2.8  3.3 -7.5]
[-2.6  3.3 -7.5]
[-3.1  3.4 -6.7]
[-3.2  3.4 -6.8]
[-3.2  3.4 -6.6]
[-2.9  3.4 -7.2]
[-2.6  3.4 -6.9]
[-2.9  3.4 -7.1]
[-2.6  3.4 -7.1]
[-2.8  3.4 -6.7]
[-2.7  3.4 -6.7]
[-3.   3.4 -7.2]
[-3.1  3.4 -7. ]
[-3.   3.4 -6.7]
[-3.3  3.4 -7.1]
[-3.3  3.4 -7.2]
[-2.8  3.4 -6.5]
[-3.2  3.5 -6.5]
[-3.5  3.5 -6.6]
[-3.6  3.5 -6.6]
[-3.5  3.5 -6.5]
[-2.9  3.5 -6. ]
```

```
[-2.6  3.5 -6. ]
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[-2.6  3.5 -6.2]
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[-2.1  3.5 -5.9]
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[-2.6  3.4 -7.2]
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[-2.7  3.4 -6.3]
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[-2.7  3.4 -6.6]
[-2.3  3.5 -6. ]
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[-2.5  3.5 -6. ]
[-3.   3.5 -6.1]
[-2.8  3.5 -5.9]
[-2.6  3.5 -6.1]
[-2.7  3.5 -6. ]
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[-2.5  3.5 -5.5]
[-3.   3.6 -5.3]
[-2.7  3.5 -5.3]
[-2.9  3.6 -5.4]
[-3.   3.6 -5.5]
[-2.3  3.6 -5.2]
[-2.9  3.6 -5.4]
[-2.8  3.6 -5.1]
[-2.8  3.6 -5.3]
```

```
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[-3.   3.6 -5.3]
[-2.7  3.6 -5.1]
[-3.   3.6 -5.5]
[-3.   3.6 -5.4]
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[-2.8  3.6 -5.2]
[-2.9  3.6 -5.2]
[-2.7  3.6 -5.3]
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[-2.2  3.3 -7.2]
[-2.6  3.4 -6.8]
[-2.5  3.4 -6.6]
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[-2.7  3.5 -5.9]
[-2.7  3.5 -5.8]
[-2.9  3.5 -5.8]
[-2.8  3.5 -5.5]
[-2.5  3.5 -5.3]
[-3.   3.6 -5.3]
[-2.5  3.6 -5.3]
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[-2.6  3.6 -5.2]
[-2.3  3.6 -5. ]
[-2.5  3.6 -5. ]
[-2.8  3.6 -5.3]
[-2.7  3.6 -5.1]
[-2.7  3.6 -5.1]
[-2.7  3.6 -5. ]
[-2.6  3.6 -5.1]
```

```
[-2.8  3.6 -5.1]
[-2.8  3.6 -5.2]
[-2.8  3.6 -5.1]]
```