In [1]:

```
import os

import matplotlib.pyplot as plt
import pandas as pd
from yahoo_fin import stock_info as si

class YahooStockData :
        def __init__(
                        self , company , from_date , to_date , save_folder = "charts" ,
                        result_folder = "results" , interval = '1d' ,
                        stock_df = None
                        ) :
                self.__ticker = company
                self.__start_date = from_date
                self.__end_date = to_date
                self.interval = interval
                self.__result_folder = f"results/{result_folder}"
                self.__stock_df = stock_df
                self.__save_chart_folder = f"{self.__result_folder}/{save_folder}"
                self.__create_folder( self.__save_chart_folder )

        def __create_folder( self , folder ) :
                if not os.path.exists( folder ) :
                        os.makedirs( folder )

        def get_stock_data( self ) :
                __stock_data = si.get_data(
                        self.__ticker , start_date = self.__start_date ,
                        end_date = self.__end_date ,
                        interval = self.interval
                        )
                self.__stock_df = pd.DataFrame( __stock_data.to_records( ) ).rename(
                        columns = { 'index' : 'date' }
                        )
                self.__stock_df = self.__stock_df.set_index( "date" )
                self.__stock_df.sort_index( ascending = True )
                return self.__stock_df

        def plot_stock_data(
                        self , column = 'adjclose' , style = 'seaborn-dark' ,
                        figsize = (10 , 15)
                        ) :
                if self.__stock_df is None :
                        self.get_stock_data( )
                plt.style.use( style )
                self.__stock_df[ column ].plot( cmap = "viridis" , figsize = figsize )
                plt.grid( )
                file_path = os.path.join(
                        self.__save_chart_folder , f'{self.__ticker}_stock_data_.png'
                        )
                plt.savefig( file_path )
                plt.show( )
                plt.close( )

        def save_stock_data_as_pkl( self , file_name , folder = "data_sets" ) :
                file_path = f"{folder}/{file_name}"
                if self.__stock_df is None :
                        self.get_stock_data( )

                if not os.path.exists( os.path.dirname( file_path ) ) :
                        os.mkdir( os.path.dirname( file_path ) )

                self.__stock_df.to_pickle( file_path )
                return file_path
```

```
        def load_stock_data_from_pkl( self , file_path ) :
                self.__stock_df = pd.read_pickle( file_path )
                return self.__stock_df
```

In [2]:
```
import numpy as np

class StockDataPreprocessor :
        def __init__(
                        self , stock_history_length = 50 , split_ratio = 0.8 ,
                        normalise_stock_data = True
                        ) :
                self.__stock_history_length = stock_history_length
                self.__normalise_stock_data = normalise_stock_data
                self.__split_ratio = split_ratio

        def __normalise_data( self , data ) :
                normalised_data = [ ]
                for window in data :
                        normalised_window = [ ((float( p ) / float( window[ 0 ] )) - 1)
                                              p in window ]
                        normalised_data.append( normalised_window )
                return normalised_data

        def __train_test_split( self , data_to_split ) :
                split_index = int( len( data_to_split ) * self.__split_ratio )
                train_data = data_to_split[ :split_index ]
                test_data = data_to_split[ split_index : ]
                return train_data , test_data

        def __extract_y_from_data( self , data ) :
                data = np.array( data )
                inp = data[ : , :-1 ]
                out = data[ : , -1 ]
                inp = np.reshape( inp , (inp.shape[ 0 ] , inp.shape[ 1 ] , 1) )
                return inp , out

        def prepare_data( self , data ) :
                history_length = self.__stock_history_length + 1
                __nomalise_data = [ ]
                for index in range( len( data ) - history_length ) :
                        __nomalise_data.append( data[ index : index + history_length ] )

                if self.__normalise_stock_data :
                        __nomalise_data = self.__normalise_data( __nomalise_data )

                train_data , test_data = self.__train_test_split( __nomalise_data )
                x_train , y_train = self.__extract_y_from_data( train_data )
                x_test , y_test = self.__extract_y_from_data( test_data )

                return x_train , y_train , x_test , y_test
```

In [3]:
```
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_absolute_error , mean_squared_error
from sklearn.model_selection import train_test_split

class RandomForestPredictor :
        def __init__( self , n_estimators = 100 , random_state = 42 ) :
                self.__n_estimators = n_estimators
                self.__random_state = random_state
                self.__model = RandomForestRegressor(
                        n_estimators = self.__n_estimators ,
                        random_state = self.__random_state
                        )
                self.__history = None
```

```
        def train( self , x_train , y_train ) :
                x_train , x_val , y_train , y_val = train_test_split(
                        x_train , y_train , test_size = 0.2 , random_state = 42
                        )

                x_train_2d = x_train.reshape( x_train.shape[ 0 ] , -1 )
                x_val_2d = x_val.reshape( x_val.shape[ 0 ] , -1 )

                history = {
                                'loss' : [ ] , 'val_loss' : [ ] , 'mae' : [ ] , 'mse' :
                                }

                self.__model.fit( x_train_2d , y_train )
                __train_predictions = self.__model.predict( x_train_2d )
                __val_predictions = self.__model.predict( x_val_2d )

                __train_loss = mean_squared_error( y_train , __train_predictions )
                __val_loss = mean_squared_error( y_val , __val_predictions )
                __train_mae = mean_absolute_error( y_train , __train_predictions )

                history[ 'loss' ].append( __train_loss )
                history[ 'val_loss' ].append( __val_loss )
                history[ 'mae' ].append( __train_mae )
                history[ 'mse' ].append( __val_loss )

                self.__history = history
                return history , self.__model
```

In [4]:

```
from keras.layers import LSTM
from keras.layers.core import Activation , Dense , Dropout
from keras.models import Sequential
from keras.optimizers import RMSprop

class LSTMPredictor :
        def __init__(
                        self , layers , learning_rate = 0.0001 , loss = "mse" ,
                        metrics = [ 'mae' , 'mse' ] , batch_size = 512 , epochs = 100 ,
                        validation_split = 0.05
                        ) :
                self.__layers = layers
                self.__metrics = metrics
                self.__learning_rate = learning_rate
                self.__loss = loss
                self.__batch_size = batch_size
                self.__epochs = epochs
                self.__validation_split = validation_split
                self.__model = self.__build_model( )

        def __build_model( self ) :
                lstm_model = Sequential( )
                length = len( self.__layers )
                for layer in self.__layers :
                        length -= 1
                        if length != 0 :
                                lstm_model.add(
                                        LSTM( units = layer , return_sequences = True )
                                        )
                        else :
                                lstm_model.add( LSTM( layer ) )

                        lstm_model.add( Dropout( 0.2 ) )

                lstm_model.add( Dense( units = 1 ) )
                lstm_model.add( Activation( "linear" ) )
```

```
                optimizer = RMSprop( self.__learning_rate )

                lstm_model.compile(
                        loss = self.__loss , optimizer = optimizer ,
                        metrics = self.__metrics
                        )
                return lstm_model

        def train( self , x_train , y_train ) :
                history = self.__model.fit(
                                x_train ,
                                y_train ,
                                batch_size = self.__batch_size ,
                                epochs = self.__epochs ,
                                validation_split = self.__validation_split
                                )
                return history , self.__model
```

In [5]:

```
from keras.layers import GRU
from keras.layers.core import Activation , Dense , Dropout
from keras.models import Sequential
from keras.optimizers import RMSprop

class GRUPredictor :
        def __init__(
                        self , layers , learning_rate = 0.0001 , loss = "mse" ,
                        metrics = [ 'mae' , 'mse' ] , batch_size = 512 , epochs = 100 ,
                        validation_split = 0.05
                        ) :
                self.__layers = layers
                self.__metrics = metrics
                self.__learning_rate = learning_rate
                self.__loss = loss
                self.__batch_size = batch_size
                self.__epochs = epochs
                self.__validation_split = validation_split
                self.__model = self.__build_model( )

        def __build_model( self ) :
                gru_model = Sequential( )

                length = len( self.__layers )
                for layer in self.__layers :
                        length -= 1
                        if length != 0 :
                                gru_model.add( GRU( units = layer , return_sequences = T
                        else :
                                gru_model.add( GRU( layer ) )

                        gru_model.add( Dropout( 0.2 ) )

                gru_model.add( Dense( units = 1 ) )
                gru_model.add( Activation( "linear" ) )

                optimizer = RMSprop( self.__learning_rate )

                gru_model.compile(
                        loss = self.__loss , optimizer = optimizer ,
                        metrics = self.__metrics
                        )
                return gru_model

        def train( self , x_train , y_train ) :
                history = self.__model.fit(
```

```
                                x_train ,
                                y_train ,
                                batch_size = self.__batch_size ,
                                epochs = self.__epochs ,
                                validation_split = self.__validation_split
                                )
                return history , self.__model
```

In [6]:

```
from keras.layers import Conv1D , Flatten , MaxPooling1D
from keras.layers.core import Dense
from keras.models import Sequential
from keras.optimizers import RMSprop

class CNNPredictor :
        def __init__(
                        self , layers , input_shape , learning_rate = 0.0001 ,
                        filters = 64 , kernel_size = 3 , pool_size = 2 , epochs = 100 ,
                        loss = "mse" ,
                        metrics = [ 'mae' , 'mse' ]
                        ) :
                self.__layers = layers
                self.__filters = filters
                self.__kernel_size = kernel_size
                self.__pool_size = pool_size
                self.__input_shape = input_shape
                self.__epochs = epochs
                self.__loss = loss
                self.__metrics = metrics
                self.__learning_rate = learning_rate
                self.__model = self.__build_model( )

        def __build_model( self ) :
                cnn_model = Sequential( )

                cnn_model.add(
                        Conv1D(
                                filters = self.__filters , kernel_size = self.__kernel_s
                                activation = 'relu' ,
                                input_shape = self.__input_shape
                                )
                        )
                cnn_model.add( MaxPooling1D( pool_size = self.__pool_size ) )
                cnn_model.add( Flatten( ) )

                for units in self.__layers[ 1 : ] :
                        cnn_model.add( Dense( units = units , activation = 'relu' ) )
                optimizer = RMSprop( self.__learning_rate )

                cnn_model.compile(
                        optimizer = optimizer , loss = self.__loss ,
                        metrics = self.__metrics
                        )
                return cnn_model

        def train( self , x_train , y_train ) :
                history = self.__model.fit(
                                x_train ,
                                y_train ,
                                epochs = self.__epochs ,
                                validation_split = 0.05
                                )
                return history , self.__model
```

In [7]:

```
import json
import os
```

```
import matplotlib.pyplot as plt
import numpy as np

results_folder = "results"

sub_folders = [ f.path for f in os.scandir( results_folder ) if f.is_dir( ) ]

rmse_values = {
                "Random Forest" : [ ] , "LSTM" : [ ] , "GRU" : [ ] , "CNN" : [ ]
                }
epochs_list = [ ]
seq_lengths_list = [ ]

def get_metrics( ) :
        for sub_folder in sub_folders :
                for file in os.listdir( sub_folder ) :
                        if file.endswith( ".json" ) :
                                results_file = os.path.join( sub_folder , file )
                                with open( results_file , "r" ) as f :
                                        results_data = json.load( f )

                                for model in [ "Random Forest" , "LSTM" , "GRU" , "CNN"
                                        rmse_values[ model ].append(
                                                        results_data[ "all_models" ][ "r
                                                        )

                                epochs = results_data[ "train_metadata" ][ "epochs" ]
                                seq_len = results_data[ "train_metadata" ][ "seq_len" ]
                                epochs_list.append( epochs )
                                seq_lengths_list.append( seq_len )

def plot_and_save_metric_and_save( ) :
        bar_width = 0.15
        x = np.arange( len( epochs_list ) )
        fig , ax = plt.subplots( figsize = (12 , 6) )
        ax.bar(
                        x - 3 * bar_width / 2 , rmse_values[ "Random Forest" ] ,
                        bar_width ,
                        label = "Random Forest"
                        )
        ax.bar(
                        x - bar_width / 2 , rmse_values[ "LSTM" ] , bar_width ,
                        label = "LSTM"
                        )
        ax.bar(
                        x + bar_width / 2 , rmse_values[ "GRU" ] , bar_width , label =
                        "GRU"
                        )
        ax.bar(
                        x + 3 * bar_width / 2 , rmse_values[ "CNN" ] , bar_width , label
                        "CNN"
                        )
        ax.set_ylabel( "RMSE" )
        ax.set_title(
                        "RMSE Comparison for Different Models, Epochs, and Sequence "
                        "Lengths"
                        )
        ax.set_xticks( x )
        ax.set_xticklabels(
                        [ f"E{e}, S{s}" for e , s in
                          zip( epochs_list , seq_lengths_list ) ] , rotation = 45
                        )
        ax.legend( )
        plt.savefig( "rmse_comparison_chart_epochs_seq_lengths_bar.png" )
        plt.show( )
```

```
def get_final_good_model( ) :
        global best_worst_rmse
        best_worst_rmse = {
                        "Random Forest" : { "best" : float( "inf" ) } ,
                        "LSTM"          : { "best" : float( "inf" ) , "worst" : 0 } ,
                        "GRU"           : { "best" : float( "inf" ) , "worst" : 0 } ,
                        "CNN"           : { "best" : float( "inf" ) , "worst" : 0 } ,
                        }

        for model in [ "Random Forest" , "LSTM" , "GRU" , "CNN" ] :
                for i , rmse_value in enumerate( rmse_values[ model ] ) :
                        if model == "Random Forest" :
                                best_worst_rmse[ model ][ "best" ] = rmse_value
                        else :
                                if rmse_value < best_worst_rmse[ model ][ "best" ] :
                                        best_worst_rmse[ model ][ "best" ] = rmse_value
                                        best_worst_rmse[ model ][ "best_seq_len" ] = \
                                                seq_lengths_list[ i ]
                                        best_worst_rmse[ model ][ "best_epochs" ] = epoc
                                                i ]
                                if rmse_value > best_worst_rmse[ model ][ "worst" ] :
                                        best_worst_rmse[ model ][ "worst" ] = rmse_value
                                        best_worst_rmse[ model ][ "worst_seq_len" ] = \
                                                seq_lengths_list[ i ]
                                        best_worst_rmse[ model ][ "worst_epochs" ] = epo
                                                i ]

        final_best_model = min(
                        best_worst_rmse , key = lambda x : best_worst_rmse[ x ][ "best"
                        )
        best_worst_rmse[ "final_best_model" ] = final_best_model

        with open( "best_worst_rmse_final_good_model.json" , "w" ) as f :
                json.dump( best_worst_rmse , f , indent = 2 )
```

In [8]:

```
import json
import os
import pickle

import matplotlib.pyplot as plt
import numpy as np
from sklearn.metrics import mean_absolute_error , mean_squared_error

class PerformanceUtil :
        def __init__(
                        self , histories , all_predictions , y_test , metadata ,
                        save_folder = "charts" , result_folder = "" ,
                        model_folder = 'models'
                        ) :
                self.__histories = histories
                self.__all_predictions = all_predictions
                self.__y_test = y_test
                self.__result_folder = f"results/{result_folder}"
                self.__save_chart_folder = f"{self.__result_folder}/{save_folder}"
                self.__save_model_folder = f"{self.__result_folder}/{model_folder}"
                self.__metadata = metadata
                self.__error_metrics = None
                self.__create_folder( self.__save_model_folder )
                self.__create_folder( self.__save_chart_folder )

        def __create_folder( self , folder ) :
                if not os.path.exists( folder ) :
                        os.makedirs( folder )
```

```
    def __root_absolute_squared_error(
                    self , y_true , y_pred , threshold = 0.5
                    ) :
            return np.sqrt( mean_absolute_error( y_true , y_pred ) )

    def __root_mean_squared_error( self , y_true , y_pred ) :
            return np.sqrt( mean_squared_error( y_true , y_pred ) )

    def __get_error_metrics( self , y_test ) :
            performance_metrics = [ 'rmse' , 'mae' ]
            self.__error_metrics = { metric : { } for metric in
                                     performance_metrics }
            for model_name , predictions in self.__all_predictions.items( ) :
                    self.__error_metrics[ 'rmse' ][
                            model_name ] = self.__root_mean_squared_error(
                            y_test , predictions
                            )
                    self.__error_metrics[ 'mae' ][
                            model_name ] = self.__root_absolute_squared_error(
                            y_test , predictions
                            )

    def __write_result( self , best_model_name ) :
            data = {
                            "train_metadata" : self.__metadata ,
                            "all_models"     : self.__error_metrics ,
                            "best_model"     : best_model_name
                            }
            model_file_path = os.path.join(
                    self.__result_folder , "model_metrics_with_best_models.json"
                    )

            with open( model_file_path , "w" ) as file :
                    json.dump( data , file , indent = 4 )

    def save_models( self , models ) :
            for model_name , model in models.items( ) :
                    model_file_path = os.path.join(
                            self.__save_model_folder , f'{model_name}_model.pkl'
                            )
                    with open( model_file_path , 'wb' ) as f :
                            pickle.dump( model , f )

    def print_and_writebest_model_based_on_rmse( self ) :
            best_model_name = min(
                            self.__error_metrics[ 'rmse' ] ,
                            key = self.__error_metrics[ 'rmse' ].get
                            )
            best_rmse = self.__error_metrics[ 'rmse' ][ best_model_name ]
            print( "All Models and Root Mean Squared Error:" )
            for model_name , rmse in self.__error_metrics[ 'rmse' ].items( ) :
                    print( f"\t{model_name}'s RMSE is {rmse:.4f}" )

            print(
                    f"The best model is {best_model_name} with an RMSE of "
                    f"{best_rmse:.4f}"
                    )
            self.__write_result( best_model_name )

    def plot_loss_curves( self ) :
            num_models = len( self.__histories )
            fig , axs = plt.subplots(
                    num_models , 1 , figsize = (10 , num_models * 5) ,
                    constrained_layout = True
                    )
```

```
            for i , model_history in enumerate( self.__histories ) :
                    for model_name , history in model_history.items( ) :
                            axs[ i ].plot(
                                    history.history[ 'loss' ] , label = 'Tra
                                    )
                            axs[ i ].plot(
                                    history.history[ 'val_loss' ] ,
                                    label = 'Validation Loss'
                                    )
                            axs[ i ].plot( history.history[ 'mse' ] , label = "MSE"
                            axs[ i ].plot( history.history[ 'mae' ] , label = "MAE"
                            axs[ i ].set_title( f'Metrics of {model_name}' )
                            axs[ i ].set_xlabel( 'Epoch' )
                            axs[ i ].set_ylabel( 'Loss' )
                            axs[ i ].legend( loc = 'upper right' )
            file_path = os.path.join(
                    self.__save_chart_folder , 'all_model_loss_curves.png'
                    )
            plt.savefig( file_path )
            plt.show( )
            plt.close( )

    def plot_all_models_performance( self ) :
            for model_history in self.__histories :
                    for model_name , history in model_history.items( ) :
                            plt.plot(
                                    history.history[ 'val_loss' ] ,
                                    label = f"{model_name} Validation"
                                    )
            plt.title( 'All Models Validation Loss' )
            plt.xlabel( 'Epoch' )
            plt.ylabel( 'Loss' )
            plt.legend( loc = 'upper right' )
            file_path = os.path.join(
                    self.__save_chart_folder , 'all_model_validation_loss_curves.png
                    )
            plt.savefig( file_path )
            plt.show( )
            plt.close( )

    def plot_all_predictions( self ) :
            plt.plot( self.__y_test , label = 'True Values' )
            for model_name , predictions in self.__all_predictions.items( ) :
                    plt.plot( predictions , label = f'{model_name} Predictions' )
            plt.title( 'All Models Predictions vs True Values' )
            plt.legend( loc = 'upper right' )
            plt.show( )
            plt.close( )

            n_models = len( self.__all_predictions )
            fig , axes = plt.subplots(
                    n_models , 1 , figsize = (10 , n_models * 5) , sharex = True
                    )

            for i , (model_name , predictions) in enumerate(
                            self.__all_predictions.items( )
                            ) :
                    axes[ i ].plot(
                            self.__y_test , label = 'True Values' , alpha = 0.6
                            )
                    axes[ i ].plot(
                            predictions , label = f'{model_name} Predictions' , alph
                            )
                    axes[ i ].set_title( f'{model_name} Predictions vs True Values'
                    axes[ i ].legend( loc = 'upper right' )
```

```
                plt.xlabel( 'Time Steps' )
                plt.tight_layout( )
                file_path = os.path.join(
                        self.__save_chart_folder ,
                        'all_model_predictions_vs_true_values.png'
                        )
                plt.savefig( file_path )
                plt.show( )
                plt.close( )

        def plot_error_metric_comparison( self ) :
                self.__get_error_metrics( self.__y_test )

                fig , axs = plt.subplots( 1 , 2 , figsize = (15 , 5) )

                for idx , (metric , model_results) in enumerate(
                                self.__error_metrics.items( )
                                ) :
                        model_names = list( model_results.keys( ) )
                        metric_values = list( model_results.values( ) )

                        axs[ idx ].bar( model_names , metric_values )
                        axs[ idx ].set_title( f'{metric.upper( )} Comparison' )
                        axs[ idx ].set_xlabel( 'Models' )
                        axs[ idx ].set_ylabel( metric.upper( ) )

                file_path = os.path.join(
                        self.__save_chart_folder , 'all_model_error_metric_comparison.pn
                        )
                plt.savefig( file_path )
                plt.show( )
                plt.close( )
```

In [10]:

```
def train_and_evaluate_models(
                x_train , y_train , x_test , y_test , layers , epochs
                ) :
        model_histories = [ ]

        rf_predictor = RandomForestPredictor( )
        rf_history , rf_model = rf_predictor.train( x_train , y_train )

        lstm_predictor = LSTMPredictor( layers , epochs = epochs )
        lstm_history , lstm_model = lstm_predictor.train( x_train , y_train )
        model_histories.append( { "LSTM" : lstm_history } )

        gru_predictor = GRUPredictor( layers , epochs = epochs )
        gru_history , gru_model = gru_predictor.train( x_train , y_train )
        model_histories.append( { "GRU" : gru_history } )

        cnn_predictor = CNNPredictor(
                layers , input_shape = (x_train.shape[ 1 ] , 1) , epochs = epochs
                )
        cnn_history , cnn_model = cnn_predictor.train( x_train , y_train )
        model_histories.append( { "CNN" : cnn_history } )

        all_predictions = {
                        "Random Forest" : rf_model.predict(
                                x_test.reshape( x_test.shape[ 0 ] , -1 )
                                ) ,
                        "LSTM"          : lstm_model.predict( x_test ) ,
                        "GRU"           : gru_model.predict( x_test ) ,
                        "CNN"           : cnn_model.predict( x_test )
                        }

        all_models = {
```

```
                        "Random Forest" : rf_model ,
                        "LSTM"          : lstm_model ,
                        "GRU"           : gru_model ,
                        "CNN"           : cnn_model
                        }

        return model_histories , all_predictions , all_models

def get_and_save_yahoo_stock_data(
                ticker , start_date , end_date , result_folder , file_name
                ) :
        yahoo_stock_data = YahooStockData(
                ticker , start_date , end_date , result_folder = result_folder
                )
        stock_df = yahoo_stock_data.get_stock_data( )
        yahoo_stock_data.plot_stock_data( )
        file_path = yahoo_stock_data.save_stock_data_as_pkl( file_name )
        stock_df_loaded = yahoo_stock_data.load_stock_data_from_pkl( file_path )
        return stock_df_loaded

def main( ) :
        start_date = '1875-02-01 00:00:00'
        end_date = '2023-04-01 23:59:59'
        ticker = "AAPL"
        file_name = "apple.pkl"

        seq_len = 15
        epochs = 200
        layers = [ seq_len , 50 , 100 , 1 ]

        current_time = datetime.datetime.now( )
        time_stamp = current_time.strftime( "%d_%H-%M-%S" )

        result_folder = f"Ticker_{ticker}_{time_stamp}_layers" + "_".join(
                        [ str( i ) for i in layers ]
                        ) + f"_epochs_{epochs}"

        stock_df_loaded = get_and_save_yahoo_stock_data(
                ticker , start_date , end_date , result_folder , file_name
                )

        data_preprocessing = StockDataPreprocessor( seq_len )
        stock_data = stock_df_loaded[ 'adjclose' ].values
        x_train , y_train , x_test , y_test = data_preprocessing.prepare_data(
                stock_data
                )

        model_histories , all_predictions , all_models = train_and_evaluate_models(
                x_train , y_train , x_test , y_test , layers ,
                epochs
                )

        metadata = {
                        "trained_at" : time_stamp ,
                        "seq_len"    : seq_len ,
                        "epochs"     : epochs ,
                        "layers"     : layers ,
                        "data"       : {
                                        "ticker" : ticker , "start_date" : start_date ,
                                        "end_date" : end_date ,
                                        "count" : {
                                                        "x_train" : len( x_train ) ,
                                                        "y_train" : len( y_train ) ,
                                                        "x_test"  : len( x_test ) ,
                                                        "y_test"  : len( y_test )
                                                        }
```

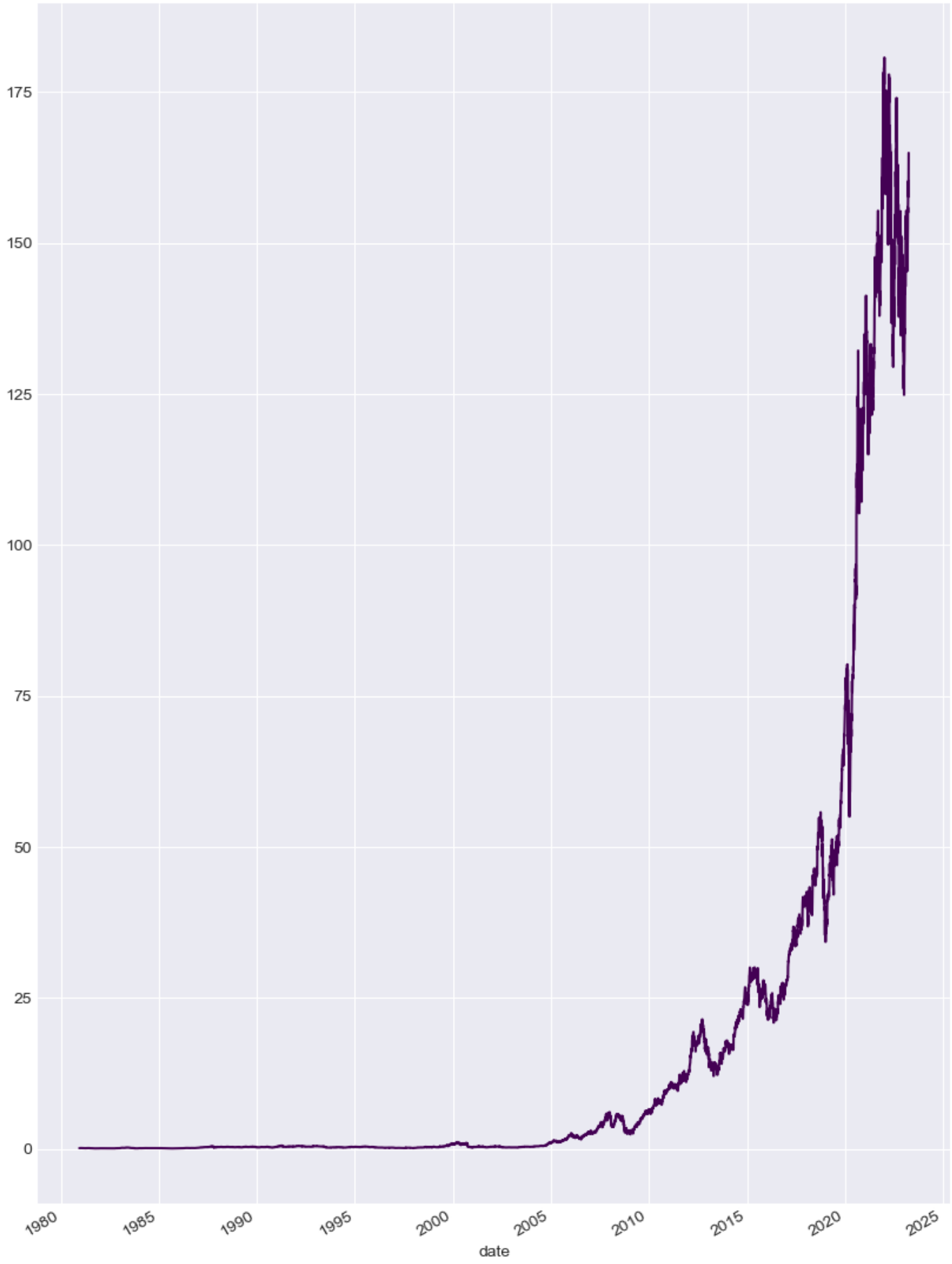
```
                                        }
                    }

        performance_util = PerformanceUtil(
                model_histories , all_predictions , y_test ,
                result_folder = result_folder ,
                metadata = metadata
                )
        performance_util.save_models( all_models )
        performance_util.plot_loss_curves( )
        performance_util.plot_all_models_performance( )
        performance_util.plot_all_predictions( )
        performance_util.plot_error_metric_comparison( )
        performance_util.print_and_writebest_model_based_on_rmse( )
```

In [12]:

```
if __name__ == "__main__" :
        main( )
        get_metrics( )
        plot_and_save_metric_and_save( )
        get_final_good_model( )
```

```
/var/folders/ms/2f084nvx1n5b5wq69jt8j3cc0000gn/T/ipykernel_86416/49938427.py:45: Matplot
libDeprecationWarning: The seaborn styles shipped by Matplotlib are deprecated since 3.
6, as they no longer correspond to the styles shipped by seaborn. However, they will rem
ain available as 'seaborn-v0_8-<style>'. Alternatively, directly use the seaborn API ins
tead.
  plt.style.use( style )
```




```
Metal device set to: Apple M1 Max
Epoch 1/200
```

```
2023-05-09 18:19:51.644425: I tensorflow/core/common_runtime/pluggable_device/pluggable_
device_factory.cc:306] Could not identify NUMA node of platform GPU ID 0, defaulting to
0. Your kernel may not have been built with NUMA support.
2023-05-09 18:19:51.644543: I tensorflow/core/common_runtime/pluggable_device/pluggable_
device_factory.cc:272] Created TensorFlow device (/job:localhost/replica:0/task:0/devic
e:GPU:0 with 0 MB memory) -> physical PluggableDevice (device: 0, name: METAL, pci bus i
```

```
d: <undefined>)
2023-05-09 18:19:51.740737: W tensorflow/core/platform/profile_utils/cpu_utils.cc:128] F
ailed to get CPU frequency: 0 Hz
2023-05-09 18:19:53.717652: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.015720: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.134512: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.230866: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.318433: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.515596: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.662493: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.833315: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:54.970530: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
16/16 [==============================] - ETA: 0s - loss: 0.0134 - mae: 0.0873 - mse: 0.0
134
2023-05-09 18:19:56.568293: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:56.667115: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:56.727730: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
16/16 [==============================] - 5s 122ms/step - loss: 0.0134 - mae: 0.0873 - ms
e: 0.0134 - val_loss: 0.0029 - val_mae: 0.0417 - val_mse: 0.0029
Epoch 2/200
2023-05-09 18:19:56.794079: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:19:56.884656: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
16/16 [==============================] - 1s 45ms/step - loss: 0.0121 - mae: 0.0832 - ms
e: 0.0121 - val_loss: 0.0026 - val_mae: 0.0397 - val_mse: 0.0026
Epoch 3/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0109 - mae: 0.0787 - ms
e: 0.0109 - val_loss: 0.0023 - val_mae: 0.0374 - val_mse: 0.0023
Epoch 4/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0097 - mae: 0.0740 - ms
e: 0.0097 - val_loss: 0.0022 - val_mae: 0.0355 - val_mse: 0.0022
Epoch 5/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0090 - mae: 0.0706 - ms
e: 0.0090 - val_loss: 0.0020 - val_mae: 0.0351 - val_mse: 0.0020
Epoch 6/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0087 - mae: 0.0690 - ms
e: 0.0087 - val_loss: 0.0020 - val_mae: 0.0348 - val_mse: 0.0020
Epoch 7/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0084 - mae: 0.0682 - ms
e: 0.0084 - val_loss: 0.0019 - val_mae: 0.0345 - val_mse: 0.0019
Epoch 8/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0082 - mae: 0.0674 - ms
e: 0.0082 - val_loss: 0.0019 - val_mae: 0.0342 - val_mse: 0.0019
Epoch 9/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0082 - mae: 0.0672 - ms
e: 0.0082 - val_loss: 0.0018 - val_mae: 0.0338 - val_mse: 0.0018
Epoch 10/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0080 - mae: 0.0661 - ms
e: 0.0080 - val_loss: 0.0018 - val_mae: 0.0335 - val_mse: 0.0018
Epoch 11/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0078 - mae: 0.0653 - ms
e: 0.0078 - val_loss: 0.0018 - val_mae: 0.0331 - val_mse: 0.0018
```

```
Epoch 12/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0077 - mae: 0.0649 - ms
e: 0.0077 - val_loss: 0.0018 - val_mae: 0.0328 - val_mse: 0.0018
Epoch 13/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0075 - mae: 0.0642 - ms
e: 0.0075 - val_loss: 0.0018 - val_mae: 0.0327 - val_mse: 0.0018
Epoch 14/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0075 - mae: 0.0635 - ms
e: 0.0075 - val_loss: 0.0016 - val_mae: 0.0317 - val_mse: 0.0016
Epoch 15/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0072 - mae: 0.0619 - ms
e: 0.0072 - val_loss: 0.0016 - val_mae: 0.0312 - val_mse: 0.0016
Epoch 16/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0070 - mae: 0.0615 - ms
e: 0.0070 - val_loss: 0.0016 - val_mae: 0.0309 - val_mse: 0.0016
Epoch 17/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0068 - mae: 0.0604 - ms
e: 0.0068 - val_loss: 0.0015 - val_mae: 0.0302 - val_mse: 0.0015
Epoch 18/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0066 - mae: 0.0595 - ms
e: 0.0066 - val_loss: 0.0014 - val_mae: 0.0297 - val_mse: 0.0014
Epoch 19/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0066 - mae: 0.0591 - ms
e: 0.0066 - val_loss: 0.0014 - val_mae: 0.0289 - val_mse: 0.0014
Epoch 20/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0067 - mae: 0.0589 - ms
e: 0.0067 - val_loss: 0.0014 - val_mae: 0.0284 - val_mse: 0.0014
Epoch 21/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0064 - mae: 0.0578 - ms
e: 0.0064 - val_loss: 0.0013 - val_mae: 0.0278 - val_mse: 0.0013
Epoch 22/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0064 - mae: 0.0574 - ms
e: 0.0064 - val_loss: 0.0013 - val_mae: 0.0273 - val_mse: 0.0013
Epoch 23/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0062 - mae: 0.0564 - ms
e: 0.0062 - val_loss: 0.0012 - val_mae: 0.0268 - val_mse: 0.0012
Epoch 24/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0061 - mae: 0.0563 - ms
e: 0.0061 - val_loss: 0.0012 - val_mae: 0.0265 - val_mse: 0.0012
Epoch 25/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0060 - mae: 0.0556 - ms
e: 0.0060 - val_loss: 0.0012 - val_mae: 0.0263 - val_mse: 0.0012
Epoch 26/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0059 - mae: 0.0556 - ms
e: 0.0059 - val_loss: 0.0012 - val_mae: 0.0260 - val_mse: 0.0012
Epoch 27/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0058 - mae: 0.0549 - ms
e: 0.0058 - val_loss: 0.0012 - val_mae: 0.0258 - val_mse: 0.0012
Epoch 28/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0058 - mae: 0.0548 - ms
e: 0.0058 - val_loss: 0.0012 - val_mae: 0.0259 - val_mse: 0.0012
Epoch 29/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0059 - mae: 0.0552 - ms
e: 0.0059 - val_loss: 0.0011 - val_mae: 0.0254 - val_mse: 0.0011
Epoch 30/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0057 - mae: 0.0546 - ms
e: 0.0057 - val_loss: 0.0011 - val_mae: 0.0258 - val_mse: 0.0011
Epoch 31/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0059 - mae: 0.0543 - ms
e: 0.0059 - val_loss: 0.0011 - val_mae: 0.0250 - val_mse: 0.0011
Epoch 32/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0059 - mae: 0.0538 - ms
e: 0.0059 - val_loss: 0.0011 - val_mae: 0.0246 - val_mse: 0.0011
Epoch 33/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0056 - mae: 0.0535 - ms
e: 0.0056 - val_loss: 0.0011 - val_mae: 0.0245 - val_mse: 0.0011
```

```
Epoch 34/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0056 - mae: 0.0534 - ms
e: 0.0056 - val_loss: 0.0011 - val_mae: 0.0247 - val_mse: 0.0011
Epoch 35/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0056 - mae: 0.0529 - ms
e: 0.0056 - val_loss: 0.0010 - val_mae: 0.0240 - val_mse: 0.0010
Epoch 36/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0056 - mae: 0.0525 - ms
e: 0.0056 - val_loss: 9.9940e-04 - val_mae: 0.0238 - val_mse: 9.9940e-04
Epoch 37/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0055 - mae: 0.0524 - ms
e: 0.0055 - val_loss: 9.9410e-04 - val_mae: 0.0237 - val_mse: 9.9410e-04
Epoch 38/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0054 - mae: 0.0522 - ms
e: 0.0054 - val_loss: 9.9141e-04 - val_mae: 0.0237 - val_mse: 9.9141e-04
Epoch 39/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0056 - mae: 0.0523 - ms
e: 0.0056 - val_loss: 9.6017e-04 - val_mae: 0.0232 - val_mse: 9.6017e-04
Epoch 40/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0054 - mae: 0.0518 - ms
e: 0.0054 - val_loss: 9.3382e-04 - val_mae: 0.0229 - val_mse: 9.3382e-04
Epoch 41/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0052 - mae: 0.0508 - ms
e: 0.0052 - val_loss: 9.1400e-04 - val_mae: 0.0226 - val_mse: 9.1400e-04
Epoch 42/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0053 - mae: 0.0513 - ms
e: 0.0053 - val_loss: 9.0442e-04 - val_mae: 0.0224 - val_mse: 9.0442e-04
Epoch 43/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0053 - mae: 0.0510 - ms
e: 0.0053 - val_loss: 8.8410e-04 - val_mae: 0.0223 - val_mse: 8.8410e-04
Epoch 44/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0052 - mae: 0.0507 - ms
e: 0.0052 - val_loss: 8.7978e-04 - val_mae: 0.0221 - val_mse: 8.7978e-04
Epoch 45/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0052 - mae: 0.0505 - ms
e: 0.0052 - val_loss: 8.8932e-04 - val_mae: 0.0224 - val_mse: 8.8932e-04
Epoch 46/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0050 - mae: 0.0498 - ms
e: 0.0050 - val_loss: 8.4935e-04 - val_mae: 0.0217 - val_mse: 8.4935e-04
Epoch 47/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0053 - mae: 0.0502 - ms
e: 0.0053 - val_loss: 8.2921e-04 - val_mae: 0.0215 - val_mse: 8.2921e-04
Epoch 48/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0050 - mae: 0.0496 - ms
e: 0.0050 - val_loss: 8.0150e-04 - val_mae: 0.0211 - val_mse: 8.0150e-04
Epoch 49/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0049 - mae: 0.0492 - ms
e: 0.0049 - val_loss: 7.9289e-04 - val_mae: 0.0210 - val_mse: 7.9289e-04
Epoch 50/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0050 - mae: 0.0492 - ms
e: 0.0050 - val_loss: 7.7968e-04 - val_mae: 0.0208 - val_mse: 7.7968e-04
Epoch 51/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0050 - mae: 0.0486 - ms
e: 0.0050 - val_loss: 7.7005e-04 - val_mae: 0.0207 - val_mse: 7.7005e-04
Epoch 52/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0049 - mae: 0.0489 - ms
e: 0.0049 - val_loss: 7.6227e-04 - val_mae: 0.0205 - val_mse: 7.6227e-04
Epoch 53/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0050 - mae: 0.0485 - ms
e: 0.0050 - val_loss: 7.3821e-04 - val_mae: 0.0203 - val_mse: 7.3821e-04
Epoch 54/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0484 - ms
e: 0.0049 - val_loss: 7.2992e-04 - val_mae: 0.0202 - val_mse: 7.2992e-04
Epoch 55/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0480 - ms
e: 0.0050 - val_loss: 7.2690e-04 - val_mae: 0.0201 - val_mse: 7.2690e-04
```

```
Epoch 56/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0480 - ms
e: 0.0048 - val_loss: 7.0269e-04 - val_mae: 0.0199 - val_mse: 7.0269e-04
Epoch 57/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0049 - mae: 0.0477 - ms
e: 0.0049 - val_loss: 7.0419e-04 - val_mae: 0.0198 - val_mse: 7.0419e-04
Epoch 58/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0047 - mae: 0.0475 - ms
e: 0.0047 - val_loss: 6.8384e-04 - val_mae: 0.0196 - val_mse: 6.8384e-04
Epoch 59/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0048 - mae: 0.0476 - ms
e: 0.0048 - val_loss: 6.8906e-04 - val_mae: 0.0196 - val_mse: 6.8906e-04
Epoch 60/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0048 - mae: 0.0471 - ms
e: 0.0048 - val_loss: 6.8280e-04 - val_mae: 0.0197 - val_mse: 6.8280e-04
Epoch 61/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0465 - ms
e: 0.0044 - val_loss: 6.6882e-04 - val_mae: 0.0194 - val_mse: 6.6882e-04
Epoch 62/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0051 - mae: 0.0476 - ms
e: 0.0051 - val_loss: 6.6675e-04 - val_mae: 0.0194 - val_mse: 6.6675e-04
Epoch 63/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0046 - mae: 0.0465 - ms
e: 0.0046 - val_loss: 6.6514e-04 - val_mae: 0.0195 - val_mse: 6.6514e-04
Epoch 64/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0047 - mae: 0.0467 - ms
e: 0.0047 - val_loss: 6.7575e-04 - val_mae: 0.0193 - val_mse: 6.7575e-04
Epoch 65/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0048 - mae: 0.0469 - ms
e: 0.0048 - val_loss: 6.4104e-04 - val_mae: 0.0191 - val_mse: 6.4104e-04
Epoch 66/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0046 - mae: 0.0465 - ms
e: 0.0046 - val_loss: 6.3209e-04 - val_mae: 0.0189 - val_mse: 6.3209e-04
Epoch 67/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0045 - mae: 0.0459 - ms
e: 0.0045 - val_loss: 6.3556e-04 - val_mae: 0.0188 - val_mse: 6.3556e-04
Epoch 68/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0047 - mae: 0.0464 - ms
e: 0.0047 - val_loss: 6.2673e-04 - val_mae: 0.0187 - val_mse: 6.2673e-04
Epoch 69/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0045 - mae: 0.0458 - ms
e: 0.0045 - val_loss: 6.1586e-04 - val_mae: 0.0187 - val_mse: 6.1586e-04
Epoch 70/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0046 - mae: 0.0459 - ms
e: 0.0046 - val_loss: 6.3506e-04 - val_mae: 0.0187 - val_mse: 6.3506e-04
Epoch 71/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0045 - mae: 0.0457 - ms
e: 0.0045 - val_loss: 6.1962e-04 - val_mae: 0.0188 - val_mse: 6.1962e-04
Epoch 72/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0046 - mae: 0.0456 - ms
e: 0.0046 - val_loss: 5.9767e-04 - val_mae: 0.0184 - val_mse: 5.9767e-04
Epoch 73/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0045 - mae: 0.0453 - ms
e: 0.0045 - val_loss: 5.9305e-04 - val_mae: 0.0183 - val_mse: 5.9305e-04
Epoch 74/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0452 - ms
e: 0.0044 - val_loss: 5.9717e-04 - val_mae: 0.0184 - val_mse: 5.9717e-04
Epoch 75/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0045 - mae: 0.0453 - ms
e: 0.0045 - val_loss: 5.8988e-04 - val_mae: 0.0183 - val_mse: 5.8988e-04
Epoch 76/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0450 - ms
e: 0.0044 - val_loss: 5.8297e-04 - val_mae: 0.0180 - val_mse: 5.8297e-04
Epoch 77/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0449 - ms
e: 0.0044 - val_loss: 5.8346e-04 - val_mae: 0.0180 - val_mse: 5.8346e-04
```

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Epoch 78/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0046 - mae: 0.0452 - ms
e: 0.0046 - val_loss: 5.7137e-04 - val_mae: 0.0179 - val_mse: 5.7137e-04
Epoch 79/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0446 - ms
e: 0.0044 - val_loss: 5.7516e-04 - val_mae: 0.0178 - val_mse: 5.7516e-04
Epoch 80/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0045 - mae: 0.0449 - ms
e: 0.0045 - val_loss: 5.6992e-04 - val_mae: 0.0178 - val_mse: 5.6992e-04
Epoch 81/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0045 - mae: 0.0450 - ms
e: 0.0045 - val_loss: 5.5249e-04 - val_mae: 0.0175 - val_mse: 5.5249e-04
Epoch 82/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0045 - mae: 0.0445 - ms
e: 0.0045 - val_loss: 5.5981e-04 - val_mae: 0.0176 - val_mse: 5.5981e-04
Epoch 83/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0045 - mae: 0.0444 - ms
e: 0.0045 - val_loss: 5.6937e-04 - val_mae: 0.0179 - val_mse: 5.6937e-04
Epoch 84/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0043 - mae: 0.0440 - ms
e: 0.0043 - val_loss: 5.4663e-04 - val_mae: 0.0174 - val_mse: 5.4663e-04
Epoch 85/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0048 - mae: 0.0449 - ms
e: 0.0048 - val_loss: 5.5983e-04 - val_mae: 0.0177 - val_mse: 5.5983e-04
Epoch 86/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0447 - ms
e: 0.0044 - val_loss: 5.4608e-04 - val_mae: 0.0173 - val_mse: 5.4608e-04
Epoch 87/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0441 - ms
e: 0.0044 - val_loss: 5.4746e-04 - val_mae: 0.0174 - val_mse: 5.4746e-04
Epoch 88/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0439 - ms
e: 0.0044 - val_loss: 5.3776e-04 - val_mae: 0.0174 - val_mse: 5.3776e-04
Epoch 89/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0043 - mae: 0.0440 - ms
e: 0.0043 - val_loss: 5.3567e-04 - val_mae: 0.0172 - val_mse: 5.3567e-04
Epoch 90/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0439 - ms
e: 0.0043 - val_loss: 5.2640e-04 - val_mae: 0.0172 - val_mse: 5.2640e-04
Epoch 91/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0436 - ms
e: 0.0043 - val_loss: 5.2310e-04 - val_mae: 0.0170 - val_mse: 5.2310e-04
Epoch 92/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0043 - mae: 0.0437 - ms
e: 0.0043 - val_loss: 5.2252e-04 - val_mae: 0.0169 - val_mse: 5.2252e-04
Epoch 93/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0440 - ms
e: 0.0043 - val_loss: 5.2780e-04 - val_mae: 0.0171 - val_mse: 5.2780e-04
Epoch 94/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0042 - mae: 0.0434 - ms
e: 0.0042 - val_loss: 5.4014e-04 - val_mae: 0.0171 - val_mse: 5.4014e-04
Epoch 95/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0044 - mae: 0.0435 - ms
e: 0.0044 - val_loss: 5.2448e-04 - val_mae: 0.0170 - val_mse: 5.2448e-04
Epoch 96/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0043 - mae: 0.0434 - ms
e: 0.0043 - val_loss: 5.1874e-04 - val_mae: 0.0168 - val_mse: 5.1874e-04
Epoch 97/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0041 - mae: 0.0431 - ms
e: 0.0041 - val_loss: 5.0376e-04 - val_mae: 0.0166 - val_mse: 5.0376e-04
Epoch 98/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0043 - mae: 0.0432 - ms
e: 0.0043 - val_loss: 5.1234e-04 - val_mae: 0.0167 - val_mse: 5.1234e-04
Epoch 99/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0432 - ms
e: 0.0044 - val_loss: 5.0290e-04 - val_mae: 0.0165 - val_mse: 5.0290e-04
```

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Epoch 100/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0432 - ms
e: 0.0043 - val_loss: 5.0134e-04 - val_mae: 0.0165 - val_mse: 5.0134e-04
Epoch 101/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0041 - mae: 0.0427 - ms
e: 0.0041 - val_loss: 4.8738e-04 - val_mae: 0.0163 - val_mse: 4.8738e-04
Epoch 102/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0042 - mae: 0.0427 - ms
e: 0.0042 - val_loss: 4.9741e-04 - val_mae: 0.0165 - val_mse: 4.9741e-04
Epoch 103/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0045 - mae: 0.0431 - ms
e: 0.0045 - val_loss: 5.0834e-04 - val_mae: 0.0166 - val_mse: 5.0834e-04
Epoch 104/200
16/16 [==============================] - 1s 38ms/step - loss: 0.0040 - mae: 0.0424 - ms
e: 0.0040 - val_loss: 4.8503e-04 - val_mae: 0.0164 - val_mse: 4.8503e-04
Epoch 105/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0043 - mae: 0.0425 - ms
e: 0.0043 - val_loss: 4.9818e-04 - val_mae: 0.0165 - val_mse: 4.9818e-04
Epoch 106/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0040 - mae: 0.0416 - ms
e: 0.0040 - val_loss: 4.8166e-04 - val_mae: 0.0162 - val_mse: 4.8166e-04
Epoch 107/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0043 - mae: 0.0425 - ms
e: 0.0043 - val_loss: 4.9139e-04 - val_mae: 0.0165 - val_mse: 4.9139e-04
Epoch 108/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0042 - mae: 0.0424 - ms
e: 0.0042 - val_loss: 4.7525e-04 - val_mae: 0.0161 - val_mse: 4.7525e-04
Epoch 109/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0428 - ms
e: 0.0043 - val_loss: 4.7916e-04 - val_mae: 0.0162 - val_mse: 4.7916e-04
Epoch 110/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0041 - mae: 0.0423 - ms
e: 0.0041 - val_loss: 4.6966e-04 - val_mae: 0.0161 - val_mse: 4.6966e-04
Epoch 111/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0041 - mae: 0.0420 - ms
e: 0.0041 - val_loss: 4.5843e-04 - val_mae: 0.0158 - val_mse: 4.5843e-04
Epoch 112/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0040 - mae: 0.0420 - ms
e: 0.0040 - val_loss: 4.8154e-04 - val_mae: 0.0161 - val_mse: 4.8154e-04
Epoch 113/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0420 - ms
e: 0.0043 - val_loss: 4.5341e-04 - val_mae: 0.0157 - val_mse: 4.5341e-04
Epoch 114/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0041 - mae: 0.0417 - ms
e: 0.0041 - val_loss: 4.5987e-04 - val_mae: 0.0159 - val_mse: 4.5987e-04
Epoch 115/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0043 - mae: 0.0422 - ms
e: 0.0043 - val_loss: 4.5448e-04 - val_mae: 0.0158 - val_mse: 4.5448e-04
Epoch 116/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0412 - ms
e: 0.0039 - val_loss: 4.6039e-04 - val_mae: 0.0158 - val_mse: 4.6039e-04
Epoch 117/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0042 - mae: 0.0417 - ms
e: 0.0042 - val_loss: 4.6454e-04 - val_mae: 0.0158 - val_mse: 4.6454e-04
Epoch 118/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0042 - mae: 0.0418 - ms
e: 0.0042 - val_loss: 4.4896e-04 - val_mae: 0.0156 - val_mse: 4.4896e-04
Epoch 119/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0041 - mae: 0.0416 - ms
e: 0.0041 - val_loss: 4.5845e-04 - val_mae: 0.0157 - val_mse: 4.5845e-04
Epoch 120/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0043 - mae: 0.0419 - ms
e: 0.0043 - val_loss: 4.5144e-04 - val_mae: 0.0156 - val_mse: 4.5144e-04
Epoch 121/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0041 - mae: 0.0417 - ms
e: 0.0041 - val_loss: 4.3475e-04 - val_mae: 0.0155 - val_mse: 4.3475e-04
```

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Epoch 122/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0409 - ms
e: 0.0039 - val_loss: 4.3185e-04 - val_mae: 0.0152 - val_mse: 4.3185e-04
Epoch 123/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0040 - mae: 0.0411 - ms
e: 0.0040 - val_loss: 4.4098e-04 - val_mae: 0.0155 - val_mse: 4.4098e-04
Epoch 124/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0409 - ms
e: 0.0039 - val_loss: 4.3314e-04 - val_mae: 0.0153 - val_mse: 4.3314e-04
Epoch 125/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0040 - mae: 0.0407 - ms
e: 0.0040 - val_loss: 4.3228e-04 - val_mae: 0.0152 - val_mse: 4.3228e-04
Epoch 126/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0405 - ms
e: 0.0039 - val_loss: 4.2755e-04 - val_mae: 0.0152 - val_mse: 4.2755e-04
Epoch 127/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0044 - mae: 0.0418 - ms
e: 0.0044 - val_loss: 4.2712e-04 - val_mae: 0.0153 - val_mse: 4.2712e-04
Epoch 128/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0042 - mae: 0.0412 - ms
e: 0.0042 - val_loss: 4.3306e-04 - val_mae: 0.0153 - val_mse: 4.3306e-04
Epoch 129/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0406 - ms
e: 0.0039 - val_loss: 4.1441e-04 - val_mae: 0.0149 - val_mse: 4.1441e-04
Epoch 130/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0406 - ms
e: 0.0039 - val_loss: 4.1673e-04 - val_mae: 0.0150 - val_mse: 4.1673e-04
Epoch 131/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0039 - mae: 0.0405 - ms
e: 0.0039 - val_loss: 4.1578e-04 - val_mae: 0.0150 - val_mse: 4.1578e-04
Epoch 132/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0040 - mae: 0.0405 - ms
e: 0.0040 - val_loss: 4.1821e-04 - val_mae: 0.0150 - val_mse: 4.1821e-04
Epoch 133/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0038 - mae: 0.0407 - ms
e: 0.0038 - val_loss: 4.2313e-04 - val_mae: 0.0151 - val_mse: 4.2313e-04
Epoch 134/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0402 - ms
e: 0.0038 - val_loss: 4.1312e-04 - val_mae: 0.0149 - val_mse: 4.1312e-04
Epoch 135/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0040 - mae: 0.0405 - ms
e: 0.0040 - val_loss: 4.3038e-04 - val_mae: 0.0153 - val_mse: 4.3038e-04
Epoch 136/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0040 - mae: 0.0406 - ms
e: 0.0040 - val_loss: 4.2680e-04 - val_mae: 0.0152 - val_mse: 4.2680e-04
Epoch 137/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0038 - mae: 0.0400 - ms
e: 0.0038 - val_loss: 4.2148e-04 - val_mae: 0.0152 - val_mse: 4.2148e-04
Epoch 138/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0040 - mae: 0.0405 - ms
e: 0.0040 - val_loss: 4.0526e-04 - val_mae: 0.0148 - val_mse: 4.0526e-04
Epoch 139/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0401 - ms
e: 0.0039 - val_loss: 4.0082e-04 - val_mae: 0.0147 - val_mse: 4.0082e-04
Epoch 140/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0038 - mae: 0.0400 - ms
e: 0.0038 - val_loss: 4.0953e-04 - val_mae: 0.0149 - val_mse: 4.0953e-04
Epoch 141/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0040 - mae: 0.0402 - ms
e: 0.0040 - val_loss: 4.0911e-04 - val_mae: 0.0149 - val_mse: 4.0911e-04
Epoch 142/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0038 - mae: 0.0397 - ms
e: 0.0038 - val_loss: 3.9823e-04 - val_mae: 0.0146 - val_mse: 3.9823e-04
Epoch 143/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0037 - mae: 0.0395 - ms
e: 0.0037 - val_loss: 3.9698e-04 - val_mae: 0.0148 - val_mse: 3.9698e-04
```

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Epoch 144/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0041 - mae: 0.0406 - ms
e: 0.0041 - val_loss: 3.9362e-04 - val_mae: 0.0146 - val_mse: 3.9362e-04
Epoch 145/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0042 - mae: 0.0406 - ms
e: 0.0042 - val_loss: 4.0671e-04 - val_mae: 0.0149 - val_mse: 4.0671e-04
Epoch 146/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0040 - mae: 0.0402 - ms
e: 0.0040 - val_loss: 4.2407e-04 - val_mae: 0.0151 - val_mse: 4.2407e-04
Epoch 147/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0041 - mae: 0.0403 - ms
e: 0.0041 - val_loss: 3.8897e-04 - val_mae: 0.0145 - val_mse: 3.8897e-04
Epoch 148/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0039 - mae: 0.0396 - ms
e: 0.0039 - val_loss: 3.8152e-04 - val_mae: 0.0143 - val_mse: 3.8152e-04
Epoch 149/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0040 - mae: 0.0399 - ms
e: 0.0040 - val_loss: 4.0871e-04 - val_mae: 0.0148 - val_mse: 4.0871e-04
Epoch 150/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0038 - mae: 0.0394 - ms
e: 0.0038 - val_loss: 3.8049e-04 - val_mae: 0.0143 - val_mse: 3.8049e-04
Epoch 151/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0040 - mae: 0.0397 - ms
e: 0.0040 - val_loss: 3.9043e-04 - val_mae: 0.0146 - val_mse: 3.9043e-04
Epoch 152/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0039 - mae: 0.0394 - ms
e: 0.0039 - val_loss: 3.9486e-04 - val_mae: 0.0146 - val_mse: 3.9486e-04
Epoch 153/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0037 - mae: 0.0391 - ms
e: 0.0037 - val_loss: 3.8918e-04 - val_mae: 0.0146 - val_mse: 3.8918e-04
Epoch 154/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0038 - mae: 0.0394 - ms
e: 0.0038 - val_loss: 3.7201e-04 - val_mae: 0.0142 - val_mse: 3.7201e-04
Epoch 155/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0392 - ms
e: 0.0038 - val_loss: 3.8281e-04 - val_mae: 0.0144 - val_mse: 3.8281e-04
Epoch 156/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0038 - mae: 0.0392 - ms
e: 0.0038 - val_loss: 3.7056e-04 - val_mae: 0.0141 - val_mse: 3.7056e-04
Epoch 157/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0038 - mae: 0.0392 - ms
e: 0.0038 - val_loss: 3.9410e-04 - val_mae: 0.0146 - val_mse: 3.9410e-04
Epoch 158/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0039 - mae: 0.0394 - ms
e: 0.0039 - val_loss: 3.8401e-04 - val_mae: 0.0145 - val_mse: 3.8401e-04
Epoch 159/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0390 - ms
e: 0.0038 - val_loss: 3.6975e-04 - val_mae: 0.0141 - val_mse: 3.6975e-04
Epoch 160/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0040 - mae: 0.0396 - ms
e: 0.0040 - val_loss: 3.6165e-04 - val_mae: 0.0141 - val_mse: 3.6165e-04
Epoch 161/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0038 - mae: 0.0390 - ms
e: 0.0038 - val_loss: 3.7688e-04 - val_mae: 0.0144 - val_mse: 3.7688e-04
Epoch 162/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0038 - mae: 0.0391 - ms
e: 0.0038 - val_loss: 3.9536e-04 - val_mae: 0.0146 - val_mse: 3.9536e-04
Epoch 163/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0389 - ms
e: 0.0039 - val_loss: 3.8389e-04 - val_mae: 0.0144 - val_mse: 3.8389e-04
Epoch 164/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0040 - mae: 0.0394 - ms
e: 0.0040 - val_loss: 3.7857e-04 - val_mae: 0.0143 - val_mse: 3.7857e-04
Epoch 165/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0037 - mae: 0.0389 - ms
e: 0.0037 - val_loss: 3.5651e-04 - val_mae: 0.0139 - val_mse: 3.5651e-04
```

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Epoch 166/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0391 - ms
e: 0.0039 - val_loss: 3.6982e-04 - val_mae: 0.0141 - val_mse: 3.6982e-04
Epoch 167/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0391 - ms
e: 0.0039 - val_loss: 3.7766e-04 - val_mae: 0.0145 - val_mse: 3.7766e-04
Epoch 168/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0036 - mae: 0.0386 - ms
e: 0.0036 - val_loss: 3.5829e-04 - val_mae: 0.0139 - val_mse: 3.5829e-04
Epoch 169/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0389 - ms
e: 0.0039 - val_loss: 3.6265e-04 - val_mae: 0.0140 - val_mse: 3.6265e-04
Epoch 170/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0040 - mae: 0.0391 - ms
e: 0.0040 - val_loss: 3.5820e-04 - val_mae: 0.0140 - val_mse: 3.5820e-04
Epoch 171/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0390 - ms
e: 0.0039 - val_loss: 3.6691e-04 - val_mae: 0.0141 - val_mse: 3.6691e-04
Epoch 172/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0387 - ms
e: 0.0038 - val_loss: 3.7628e-04 - val_mae: 0.0143 - val_mse: 3.7628e-04
Epoch 173/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0038 - mae: 0.0389 - ms
e: 0.0038 - val_loss: 3.5734e-04 - val_mae: 0.0139 - val_mse: 3.5734e-04
Epoch 174/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0384 - ms
e: 0.0038 - val_loss: 3.5051e-04 - val_mae: 0.0138 - val_mse: 3.5051e-04
Epoch 175/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0037 - mae: 0.0385 - ms
e: 0.0037 - val_loss: 3.5973e-04 - val_mae: 0.0139 - val_mse: 3.5973e-04
Epoch 176/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0037 - mae: 0.0381 - ms
e: 0.0037 - val_loss: 3.5883e-04 - val_mae: 0.0139 - val_mse: 3.5883e-04
Epoch 177/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0386 - ms
e: 0.0038 - val_loss: 3.5293e-04 - val_mae: 0.0138 - val_mse: 3.5293e-04
Epoch 178/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0383 - ms
e: 0.0038 - val_loss: 3.5356e-04 - val_mae: 0.0138 - val_mse: 3.5356e-04
Epoch 179/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0384 - ms
e: 0.0038 - val_loss: 3.6419e-04 - val_mae: 0.0140 - val_mse: 3.6419e-04
Epoch 180/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0036 - mae: 0.0380 - ms
e: 0.0036 - val_loss: 3.5491e-04 - val_mae: 0.0138 - val_mse: 3.5491e-04
Epoch 181/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0038 - mae: 0.0382 - ms
e: 0.0038 - val_loss: 3.5188e-04 - val_mae: 0.0138 - val_mse: 3.5188e-04
Epoch 182/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0387 - ms
e: 0.0038 - val_loss: 3.6648e-04 - val_mae: 0.0141 - val_mse: 3.6648e-04
Epoch 183/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0038 - mae: 0.0384 - ms
e: 0.0038 - val_loss: 3.3706e-04 - val_mae: 0.0136 - val_mse: 3.3706e-04
Epoch 184/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0037 - mae: 0.0380 - ms
e: 0.0037 - val_loss: 3.5051e-04 - val_mae: 0.0137 - val_mse: 3.5051e-04
Epoch 185/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0038 - mae: 0.0385 - ms
e: 0.0038 - val_loss: 3.3681e-04 - val_mae: 0.0134 - val_mse: 3.3681e-04
Epoch 186/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0036 - mae: 0.0377 - ms
e: 0.0036 - val_loss: 4.0160e-04 - val_mae: 0.0149 - val_mse: 4.0160e-04
Epoch 187/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0037 - mae: 0.0383 - ms
e: 0.0037 - val_loss: 3.4327e-04 - val_mae: 0.0136 - val_mse: 3.4327e-04
```

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Epoch 188/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0037 - mae: 0.0380 - ms
e: 0.0037 - val_loss: 3.4056e-04 - val_mae: 0.0136 - val_mse: 3.4056e-04
Epoch 189/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0386 - ms
e: 0.0039 - val_loss: 3.3286e-04 - val_mae: 0.0135 - val_mse: 3.3286e-04
Epoch 190/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0038 - mae: 0.0381 - ms
e: 0.0038 - val_loss: 3.4527e-04 - val_mae: 0.0136 - val_mse: 3.4527e-04
Epoch 191/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0383 - ms
e: 0.0039 - val_loss: 3.5288e-04 - val_mae: 0.0141 - val_mse: 3.5288e-04
Epoch 192/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0382 - ms
e: 0.0039 - val_loss: 3.2529e-04 - val_mae: 0.0132 - val_mse: 3.2529e-04
Epoch 193/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0037 - mae: 0.0382 - ms
e: 0.0037 - val_loss: 3.3470e-04 - val_mae: 0.0134 - val_mse: 3.3470e-04
Epoch 194/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0036 - mae: 0.0377 - ms
e: 0.0036 - val_loss: 3.3858e-04 - val_mae: 0.0136 - val_mse: 3.3858e-04
Epoch 195/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0038 - mae: 0.0378 - ms
e: 0.0038 - val_loss: 3.3438e-04 - val_mae: 0.0134 - val_mse: 3.3438e-04
Epoch 196/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0039 - mae: 0.0382 - ms
e: 0.0039 - val_loss: 3.4048e-04 - val_mae: 0.0135 - val_mse: 3.4048e-04
Epoch 197/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0036 - mae: 0.0379 - ms
e: 0.0036 - val_loss: 3.5022e-04 - val_mae: 0.0138 - val_mse: 3.5022e-04
Epoch 198/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0039 - mae: 0.0384 - ms
e: 0.0039 - val_loss: 3.3582e-04 - val_mae: 0.0134 - val_mse: 3.3582e-04
Epoch 199/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0036 - mae: 0.0375 - ms
e: 0.0036 - val_loss: 3.4151e-04 - val_mae: 0.0135 - val_mse: 3.4151e-04
Epoch 200/200
16/16 [==============================] - 1s 39ms/step - loss: 0.0037 - mae: 0.0378 - ms
e: 0.0037 - val_loss: 3.5051e-04 - val_mae: 0.0139 - val_mse: 3.5051e-04
Epoch 1/200
2023-05-09 18:22:07.890320: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.159680: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.254535: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.339405: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.424328: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.558784: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.693577: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:08.846095: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
 1/16 [>.............................] - ETA: 46s - loss: 0.0146 - mae: 0.0919 - mse: 0.
0146
2023-05-09 18:22:08.999646: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
16/16 [==============================] - ETA: 0s - loss: 0.0134 - mae: 0.0875 - mse: 0.0
134
2023-05-09 18:22:10.727939: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:10.813257: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
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_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:10.883434: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
16/16 [==============================] - 5s 130ms/step - loss: 0.0134 - mae: 0.0875 - ms
e: 0.0134 - val_loss: 0.0028 - val_mae: 0.0411 - val_mse: 0.0028
Epoch 2/200
2023-05-09 18:22:10.955338: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:22:11.031929: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
16/16 [==============================] - 1s 46ms/step - loss: 0.0115 - mae: 0.0810 - ms
e: 0.0115 - val_loss: 0.0024 - val_mae: 0.0379 - val_mse: 0.0024
Epoch 3/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0100 - mae: 0.0752 - ms
e: 0.0100 - val_loss: 0.0020 - val_mae: 0.0347 - val_mse: 0.0020
Epoch 4/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0086 - mae: 0.0695 - ms
e: 0.0086 - val_loss: 0.0017 - val_mae: 0.0316 - val_mse: 0.0017
Epoch 5/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0074 - mae: 0.0637 - ms
e: 0.0074 - val_loss: 0.0015 - val_mae: 0.0290 - val_mse: 0.0015
Epoch 6/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0067 - mae: 0.0592 - ms
e: 0.0067 - val_loss: 0.0013 - val_mae: 0.0274 - val_mse: 0.0013
Epoch 7/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0062 - mae: 0.0570 - ms
e: 0.0062 - val_loss: 0.0012 - val_mae: 0.0270 - val_mse: 0.0012
Epoch 8/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0060 - mae: 0.0559 - ms
e: 0.0060 - val_loss: 0.0012 - val_mae: 0.0270 - val_mse: 0.0012
Epoch 9/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0061 - mae: 0.0560 - ms
e: 0.0061 - val_loss: 0.0012 - val_mae: 0.0270 - val_mse: 0.0012
Epoch 10/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0061 - mae: 0.0559 - ms
e: 0.0061 - val_loss: 0.0012 - val_mae: 0.0270 - val_mse: 0.0012
Epoch 11/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0060 - mae: 0.0557 - ms
e: 0.0060 - val_loss: 0.0013 - val_mae: 0.0273 - val_mse: 0.0013
Epoch 12/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0061 - mae: 0.0558 - ms
e: 0.0061 - val_loss: 0.0012 - val_mae: 0.0271 - val_mse: 0.0012
Epoch 13/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0060 - mae: 0.0561 - ms
e: 0.0060 - val_loss: 0.0013 - val_mae: 0.0272 - val_mse: 0.0013
Epoch 14/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0062 - mae: 0.0565 - ms
e: 0.0062 - val_loss: 0.0013 - val_mae: 0.0273 - val_mse: 0.0013
Epoch 15/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0062 - mae: 0.0564 - ms
e: 0.0062 - val_loss: 0.0013 - val_mae: 0.0273 - val_mse: 0.0013
Epoch 16/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0062 - mae: 0.0570 - ms
e: 0.0062 - val_loss: 0.0013 - val_mae: 0.0275 - val_mse: 0.0013
Epoch 17/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0063 - mae: 0.0572 - ms
e: 0.0063 - val_loss: 0.0013 - val_mae: 0.0277 - val_mse: 0.0013
Epoch 18/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0062 - mae: 0.0575 - ms
e: 0.0062 - val_loss: 0.0013 - val_mae: 0.0277 - val_mse: 0.0013
Epoch 19/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0061 - mae: 0.0571 - ms
e: 0.0061 - val_loss: 0.0013 - val_mae: 0.0278 - val_mse: 0.0013
Epoch 20/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0063 - mae: 0.0575 - ms
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e: 0.0063 - val_loss: 0.0013 - val_mae: 0.0281 - val_mse: 0.0013
Epoch 21/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0062 - mae: 0.0570 - ms
e: 0.0062 - val_loss: 0.0013 - val_mae: 0.0281 - val_mse: 0.0013
Epoch 22/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0063 - mae: 0.0578 - ms
e: 0.0063 - val_loss: 0.0014 - val_mae: 0.0283 - val_mse: 0.0014
Epoch 23/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0067 - mae: 0.0590 - ms
e: 0.0067 - val_loss: 0.0014 - val_mae: 0.0289 - val_mse: 0.0014
Epoch 24/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0065 - mae: 0.0584 - ms
e: 0.0065 - val_loss: 0.0014 - val_mae: 0.0287 - val_mse: 0.0014
Epoch 25/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0065 - mae: 0.0584 - ms
e: 0.0065 - val_loss: 0.0014 - val_mae: 0.0288 - val_mse: 0.0014
Epoch 26/200
16/16 [==============================] - 1s 46ms/step - loss: 0.0066 - mae: 0.0589 - ms
e: 0.0066 - val_loss: 0.0014 - val_mae: 0.0289 - val_mse: 0.0014
Epoch 27/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0070 - mae: 0.0603 - ms
e: 0.0070 - val_loss: 0.0014 - val_mae: 0.0292 - val_mse: 0.0014
Epoch 28/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0067 - mae: 0.0594 - ms
e: 0.0067 - val_loss: 0.0014 - val_mae: 0.0292 - val_mse: 0.0014
Epoch 29/200
16/16 [==============================] - 1s 46ms/step - loss: 0.0067 - mae: 0.0598 - ms
e: 0.0067 - val_loss: 0.0015 - val_mae: 0.0294 - val_mse: 0.0015
Epoch 30/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0069 - mae: 0.0607 - ms
e: 0.0069 - val_loss: 0.0015 - val_mae: 0.0296 - val_mse: 0.0015
Epoch 31/200
16/16 [==============================] - 1s 46ms/step - loss: 0.0068 - mae: 0.0607 - ms
e: 0.0068 - val_loss: 0.0015 - val_mae: 0.0297 - val_mse: 0.0015
Epoch 32/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0071 - mae: 0.0616 - ms
e: 0.0071 - val_loss: 0.0015 - val_mae: 0.0296 - val_mse: 0.0015
Epoch 33/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0072 - mae: 0.0615 - ms
e: 0.0072 - val_loss: 0.0015 - val_mae: 0.0298 - val_mse: 0.0015
Epoch 34/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0071 - mae: 0.0615 - ms
e: 0.0071 - val_loss: 0.0015 - val_mae: 0.0300 - val_mse: 0.0015
Epoch 35/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0072 - mae: 0.0617 - ms
e: 0.0072 - val_loss: 0.0015 - val_mae: 0.0300 - val_mse: 0.0015
Epoch 36/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0073 - mae: 0.0624 - ms
e: 0.0073 - val_loss: 0.0015 - val_mae: 0.0300 - val_mse: 0.0015
Epoch 37/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0074 - mae: 0.0627 - ms
e: 0.0074 - val_loss: 0.0015 - val_mae: 0.0301 - val_mse: 0.0015
Epoch 38/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0075 - mae: 0.0633 - ms
e: 0.0075 - val_loss: 0.0015 - val_mae: 0.0302 - val_mse: 0.0015
Epoch 39/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0075 - mae: 0.0634 - ms
e: 0.0075 - val_loss: 0.0015 - val_mae: 0.0302 - val_mse: 0.0015
Epoch 40/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0075 - mae: 0.0636 - ms
e: 0.0075 - val_loss: 0.0016 - val_mae: 0.0304 - val_mse: 0.0016
Epoch 41/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0075 - mae: 0.0636 - ms
e: 0.0075 - val_loss: 0.0016 - val_mae: 0.0313 - val_mse: 0.0016
Epoch 42/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0076 - mae: 0.0638 - ms
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e: 0.0076 - val_loss: 0.0015 - val_mae: 0.0303 - val_mse: 0.0015
Epoch 43/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0073 - mae: 0.0628 - ms
e: 0.0073 - val_loss: 0.0015 - val_mae: 0.0303 - val_mse: 0.0015
Epoch 44/200
16/16 [==============================] - 1s 47ms/step - loss: 0.0074 - mae: 0.0628 - ms
e: 0.0074 - val_loss: 0.0015 - val_mae: 0.0303 - val_mse: 0.0015
Epoch 45/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0075 - mae: 0.0636 - ms
e: 0.0075 - val_loss: 0.0015 - val_mae: 0.0304 - val_mse: 0.0015
Epoch 46/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0074 - mae: 0.0631 - ms
e: 0.0074 - val_loss: 0.0015 - val_mae: 0.0305 - val_mse: 0.0015
Epoch 47/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0073 - mae: 0.0629 - ms
e: 0.0073 - val_loss: 0.0015 - val_mae: 0.0301 - val_mse: 0.0015
Epoch 48/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0072 - mae: 0.0629 - ms
e: 0.0072 - val_loss: 0.0015 - val_mae: 0.0303 - val_mse: 0.0015
Epoch 49/200
16/16 [==============================] - 1s 47ms/step - loss: 0.0073 - mae: 0.0622 - ms
e: 0.0073 - val_loss: 0.0015 - val_mae: 0.0303 - val_mse: 0.0015
Epoch 50/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0074 - mae: 0.0633 - ms
e: 0.0074 - val_loss: 0.0015 - val_mae: 0.0300 - val_mse: 0.0015
Epoch 51/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0072 - mae: 0.0630 - ms
e: 0.0072 - val_loss: 0.0015 - val_mae: 0.0299 - val_mse: 0.0015
Epoch 52/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0072 - mae: 0.0624 - ms
e: 0.0072 - val_loss: 0.0015 - val_mae: 0.0302 - val_mse: 0.0015
Epoch 53/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0073 - mae: 0.0623 - ms
e: 0.0073 - val_loss: 0.0015 - val_mae: 0.0298 - val_mse: 0.0015
Epoch 54/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0074 - mae: 0.0629 - ms
e: 0.0074 - val_loss: 0.0015 - val_mae: 0.0296 - val_mse: 0.0015
Epoch 55/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0072 - mae: 0.0623 - ms
e: 0.0072 - val_loss: 0.0015 - val_mae: 0.0295 - val_mse: 0.0015
Epoch 56/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0071 - mae: 0.0619 - ms
e: 0.0071 - val_loss: 0.0014 - val_mae: 0.0293 - val_mse: 0.0014
Epoch 57/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0071 - mae: 0.0616 - ms
e: 0.0071 - val_loss: 0.0014 - val_mae: 0.0290 - val_mse: 0.0014
Epoch 58/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0070 - mae: 0.0612 - ms
e: 0.0070 - val_loss: 0.0014 - val_mae: 0.0295 - val_mse: 0.0014
Epoch 59/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0071 - mae: 0.0612 - ms
e: 0.0071 - val_loss: 0.0014 - val_mae: 0.0288 - val_mse: 0.0014
Epoch 60/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0069 - mae: 0.0604 - ms
e: 0.0069 - val_loss: 0.0014 - val_mae: 0.0287 - val_mse: 0.0014
Epoch 61/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0068 - mae: 0.0597 - ms
e: 0.0068 - val_loss: 0.0013 - val_mae: 0.0281 - val_mse: 0.0013
Epoch 62/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0065 - mae: 0.0585 - ms
e: 0.0065 - val_loss: 0.0013 - val_mae: 0.0279 - val_mse: 0.0013
Epoch 63/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0068 - mae: 0.0597 - ms
e: 0.0068 - val_loss: 0.0013 - val_mae: 0.0276 - val_mse: 0.0013
Epoch 64/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0066 - mae: 0.0589 - ms
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e: 0.0066 - val_loss: 0.0013 - val_mae: 0.0274 - val_mse: 0.0013
Epoch 65/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0063 - mae: 0.0581 - ms
e: 0.0063 - val_loss: 0.0013 - val_mae: 0.0271 - val_mse: 0.0013
Epoch 66/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0063 - mae: 0.0571 - ms
e: 0.0063 - val_loss: 0.0012 - val_mae: 0.0267 - val_mse: 0.0012
Epoch 67/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0063 - mae: 0.0578 - ms
e: 0.0063 - val_loss: 0.0012 - val_mae: 0.0264 - val_mse: 0.0012
Epoch 68/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0061 - mae: 0.0565 - ms
e: 0.0061 - val_loss: 0.0012 - val_mae: 0.0259 - val_mse: 0.0012
Epoch 69/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0060 - mae: 0.0560 - ms
e: 0.0060 - val_loss: 0.0011 - val_mae: 0.0256 - val_mse: 0.0011
Epoch 70/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0060 - mae: 0.0555 - ms
e: 0.0060 - val_loss: 0.0011 - val_mae: 0.0251 - val_mse: 0.0011
Epoch 71/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0059 - mae: 0.0545 - ms
e: 0.0059 - val_loss: 0.0011 - val_mae: 0.0248 - val_mse: 0.0011
Epoch 72/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0059 - mae: 0.0547 - ms
e: 0.0059 - val_loss: 0.0010 - val_mae: 0.0244 - val_mse: 0.0010
Epoch 73/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0057 - mae: 0.0539 - ms
e: 0.0057 - val_loss: 0.0010 - val_mae: 0.0240 - val_mse: 0.0010
Epoch 74/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0056 - mae: 0.0536 - ms
e: 0.0056 - val_loss: 9.8473e-04 - val_mae: 0.0236 - val_mse: 9.8473e-04
Epoch 75/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0056 - mae: 0.0533 - ms
e: 0.0056 - val_loss: 9.6353e-04 - val_mae: 0.0233 - val_mse: 9.6353e-04
Epoch 76/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0054 - mae: 0.0526 - ms
e: 0.0054 - val_loss: 9.3353e-04 - val_mae: 0.0229 - val_mse: 9.3353e-04
Epoch 77/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0054 - mae: 0.0522 - ms
e: 0.0054 - val_loss: 9.0779e-04 - val_mae: 0.0226 - val_mse: 9.0779e-04
Epoch 78/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0054 - mae: 0.0514 - ms
e: 0.0054 - val_loss: 8.9245e-04 - val_mae: 0.0224 - val_mse: 8.9245e-04
Epoch 79/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0056 - mae: 0.0520 - ms
e: 0.0056 - val_loss: 8.5858e-04 - val_mae: 0.0219 - val_mse: 8.5858e-04
Epoch 80/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0053 - mae: 0.0512 - ms
e: 0.0053 - val_loss: 8.6052e-04 - val_mae: 0.0218 - val_mse: 8.6052e-04
Epoch 81/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0053 - mae: 0.0508 - ms
e: 0.0053 - val_loss: 8.1474e-04 - val_mae: 0.0213 - val_mse: 8.1474e-04
Epoch 82/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0503 - ms
e: 0.0051 - val_loss: 7.9858e-04 - val_mae: 0.0211 - val_mse: 7.9858e-04
Epoch 83/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0496 - ms
e: 0.0050 - val_loss: 7.7896e-04 - val_mae: 0.0208 - val_mse: 7.7896e-04
Epoch 84/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0495 - ms
e: 0.0051 - val_loss: 7.9226e-04 - val_mae: 0.0209 - val_mse: 7.9226e-04
Epoch 85/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0492 - ms
e: 0.0051 - val_loss: 7.9997e-04 - val_mae: 0.0211 - val_mse: 7.9997e-04
Epoch 86/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0055 - mae: 0.0505 - ms
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e: 0.0055 - val_loss: 7.7131e-04 - val_mae: 0.0208 - val_mse: 7.7131e-04
Epoch 87/200
16/16 [==============================] - 1s 45ms/step - loss: 0.0054 - mae: 0.0501 - ms
e: 0.0054 - val_loss: 7.6371e-04 - val_mae: 0.0207 - val_mse: 7.6371e-04
Epoch 88/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0048 - mae: 0.0483 - ms
e: 0.0048 - val_loss: 7.5996e-04 - val_mae: 0.0206 - val_mse: 7.5996e-04
Epoch 89/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0048 - mae: 0.0487 - ms
e: 0.0048 - val_loss: 7.7082e-04 - val_mae: 0.0208 - val_mse: 7.7082e-04
Epoch 90/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0489 - ms
e: 0.0051 - val_loss: 7.7719e-04 - val_mae: 0.0209 - val_mse: 7.7719e-04
Epoch 91/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0484 - ms
e: 0.0049 - val_loss: 7.6215e-04 - val_mae: 0.0206 - val_mse: 7.6215e-04
Epoch 92/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0486 - ms
e: 0.0049 - val_loss: 7.6698e-04 - val_mae: 0.0207 - val_mse: 7.6698e-04
Epoch 93/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0052 - mae: 0.0493 - ms
e: 0.0052 - val_loss: 7.5454e-04 - val_mae: 0.0207 - val_mse: 7.5454e-04
Epoch 94/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0053 - mae: 0.0490 - ms
e: 0.0053 - val_loss: 7.6844e-04 - val_mae: 0.0207 - val_mse: 7.6844e-04
Epoch 95/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0049 - mae: 0.0484 - ms
e: 0.0049 - val_loss: 7.8014e-04 - val_mae: 0.0209 - val_mse: 7.8014e-04
Epoch 96/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0051 - mae: 0.0490 - ms
e: 0.0051 - val_loss: 7.8461e-04 - val_mae: 0.0209 - val_mse: 7.8461e-04
Epoch 97/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0488 - ms
e: 0.0050 - val_loss: 7.9508e-04 - val_mae: 0.0213 - val_mse: 7.9508e-04
Epoch 98/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0481 - ms
e: 0.0049 - val_loss: 7.5906e-04 - val_mae: 0.0206 - val_mse: 7.5906e-04
Epoch 99/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0049 - mae: 0.0489 - ms
e: 0.0049 - val_loss: 7.5795e-04 - val_mae: 0.0206 - val_mse: 7.5795e-04
Epoch 100/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0052 - mae: 0.0493 - ms
e: 0.0052 - val_loss: 7.6526e-04 - val_mae: 0.0207 - val_mse: 7.6526e-04
Epoch 101/200
16/16 [==============================] - 1s 48ms/step - loss: 0.0050 - mae: 0.0490 - ms
e: 0.0050 - val_loss: 7.4885e-04 - val_mae: 0.0205 - val_mse: 7.4885e-04
Epoch 102/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0050 - mae: 0.0490 - ms
e: 0.0050 - val_loss: 7.7252e-04 - val_mae: 0.0208 - val_mse: 7.7252e-04
Epoch 103/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0050 - mae: 0.0487 - ms
e: 0.0050 - val_loss: 7.6310e-04 - val_mae: 0.0206 - val_mse: 7.6310e-04
Epoch 104/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0048 - mae: 0.0483 - ms
e: 0.0048 - val_loss: 7.8179e-04 - val_mae: 0.0211 - val_mse: 7.8179e-04
Epoch 105/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0480 - ms
e: 0.0047 - val_loss: 7.6483e-04 - val_mae: 0.0207 - val_mse: 7.6483e-04
Epoch 106/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0486 - ms
e: 0.0050 - val_loss: 7.6217e-04 - val_mae: 0.0207 - val_mse: 7.6217e-04
Epoch 107/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0049 - mae: 0.0485 - ms
e: 0.0049 - val_loss: 7.5007e-04 - val_mae: 0.0205 - val_mse: 7.5007e-04
Epoch 108/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0478 - ms
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e: 0.0047 - val_loss: 7.6349e-04 - val_mae: 0.0207 - val_mse: 7.6349e-04
Epoch 109/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0051 - mae: 0.0488 - ms
e: 0.0051 - val_loss: 7.7402e-04 - val_mae: 0.0208 - val_mse: 7.7402e-04
Epoch 110/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0051 - mae: 0.0491 - ms
e: 0.0051 - val_loss: 7.6060e-04 - val_mae: 0.0206 - val_mse: 7.6060e-04
Epoch 111/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0051 - mae: 0.0491 - ms
e: 0.0051 - val_loss: 7.5548e-04 - val_mae: 0.0206 - val_mse: 7.5548e-04
Epoch 112/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0490 - ms
e: 0.0050 - val_loss: 7.6999e-04 - val_mae: 0.0209 - val_mse: 7.6999e-04
Epoch 113/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0052 - mae: 0.0492 - ms
e: 0.0052 - val_loss: 7.8769e-04 - val_mae: 0.0211 - val_mse: 7.8769e-04
Epoch 114/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0049 - mae: 0.0484 - ms
e: 0.0049 - val_loss: 7.4975e-04 - val_mae: 0.0205 - val_mse: 7.4975e-04
Epoch 115/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0050 - mae: 0.0486 - ms
e: 0.0050 - val_loss: 7.6021e-04 - val_mae: 0.0206 - val_mse: 7.6021e-04
Epoch 116/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0483 - ms
e: 0.0049 - val_loss: 7.4371e-04 - val_mae: 0.0205 - val_mse: 7.4371e-04
Epoch 117/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0050 - mae: 0.0487 - ms
e: 0.0050 - val_loss: 7.4051e-04 - val_mae: 0.0204 - val_mse: 7.4051e-04
Epoch 118/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0479 - ms
e: 0.0048 - val_loss: 7.3505e-04 - val_mae: 0.0204 - val_mse: 7.3505e-04
Epoch 119/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0052 - mae: 0.0489 - ms
e: 0.0052 - val_loss: 7.4252e-04 - val_mae: 0.0204 - val_mse: 7.4252e-04
Epoch 120/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0488 - ms
e: 0.0051 - val_loss: 7.6077e-04 - val_mae: 0.0207 - val_mse: 7.6077e-04
Epoch 121/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0482 - ms
e: 0.0050 - val_loss: 7.3975e-04 - val_mae: 0.0204 - val_mse: 7.3975e-04
Epoch 122/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0487 - ms
e: 0.0050 - val_loss: 7.5046e-04 - val_mae: 0.0206 - val_mse: 7.5046e-04
Epoch 123/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0484 - ms
e: 0.0050 - val_loss: 7.3125e-04 - val_mae: 0.0202 - val_mse: 7.3125e-04
Epoch 124/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0482 - ms
e: 0.0049 - val_loss: 7.4103e-04 - val_mae: 0.0203 - val_mse: 7.4103e-04
Epoch 125/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0482 - ms
e: 0.0049 - val_loss: 7.5188e-04 - val_mae: 0.0205 - val_mse: 7.5188e-04
Epoch 126/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0484 - ms
e: 0.0050 - val_loss: 7.3117e-04 - val_mae: 0.0202 - val_mse: 7.3117e-04
Epoch 127/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0484 - ms
e: 0.0050 - val_loss: 7.4953e-04 - val_mae: 0.0204 - val_mse: 7.4953e-04
Epoch 128/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0483 - ms
e: 0.0048 - val_loss: 7.3555e-04 - val_mae: 0.0204 - val_mse: 7.3555e-04
Epoch 129/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0486 - ms
e: 0.0050 - val_loss: 7.4275e-04 - val_mae: 0.0205 - val_mse: 7.4275e-04
Epoch 130/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0049 - mae: 0.0481 - ms
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e: 0.0049 - val_loss: 7.2343e-04 - val_mae: 0.0201 - val_mse: 7.2343e-04
Epoch 131/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0049 - mae: 0.0487 - ms
e: 0.0049 - val_loss: 7.4931e-04 - val_mae: 0.0204 - val_mse: 7.4931e-04
Epoch 132/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0482 - ms
e: 0.0049 - val_loss: 7.4925e-04 - val_mae: 0.0207 - val_mse: 7.4925e-04
Epoch 133/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0049 - mae: 0.0484 - ms
e: 0.0049 - val_loss: 7.3238e-04 - val_mae: 0.0202 - val_mse: 7.3238e-04
Epoch 134/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0489 - ms
e: 0.0050 - val_loss: 7.3123e-04 - val_mae: 0.0203 - val_mse: 7.3123e-04
Epoch 135/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0485 - ms
e: 0.0050 - val_loss: 7.2965e-04 - val_mae: 0.0202 - val_mse: 7.2965e-04
Epoch 136/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0483 - ms
e: 0.0049 - val_loss: 7.5771e-04 - val_mae: 0.0208 - val_mse: 7.5771e-04
Epoch 137/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0047 - mae: 0.0480 - ms
e: 0.0047 - val_loss: 7.4517e-04 - val_mae: 0.0206 - val_mse: 7.4517e-04
Epoch 138/200
16/16 [==============================] - 1s 46ms/step - loss: 0.0050 - mae: 0.0483 - ms
e: 0.0050 - val_loss: 7.6153e-04 - val_mae: 0.0208 - val_mse: 7.6153e-04
Epoch 139/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0050 - mae: 0.0485 - ms
e: 0.0050 - val_loss: 7.2636e-04 - val_mae: 0.0203 - val_mse: 7.2636e-04
Epoch 140/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0481 - ms
e: 0.0049 - val_loss: 7.2065e-04 - val_mae: 0.0201 - val_mse: 7.2065e-04
Epoch 141/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0477 - ms
e: 0.0049 - val_loss: 7.3066e-04 - val_mae: 0.0202 - val_mse: 7.3066e-04
Epoch 142/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0482 - ms
e: 0.0049 - val_loss: 7.2388e-04 - val_mae: 0.0202 - val_mse: 7.2388e-04
Epoch 143/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0052 - mae: 0.0486 - ms
e: 0.0052 - val_loss: 7.1761e-04 - val_mae: 0.0200 - val_mse: 7.1761e-04
Epoch 144/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0481 - ms
e: 0.0049 - val_loss: 7.1904e-04 - val_mae: 0.0201 - val_mse: 7.1904e-04
Epoch 145/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0482 - ms
e: 0.0050 - val_loss: 7.0351e-04 - val_mae: 0.0198 - val_mse: 7.0351e-04
Epoch 146/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0486 - ms
e: 0.0049 - val_loss: 7.1711e-04 - val_mae: 0.0201 - val_mse: 7.1711e-04
Epoch 147/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0481 - ms
e: 0.0049 - val_loss: 7.0249e-04 - val_mae: 0.0198 - val_mse: 7.0249e-04
Epoch 148/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0476 - ms
e: 0.0047 - val_loss: 6.8814e-04 - val_mae: 0.0197 - val_mse: 6.8814e-04
Epoch 149/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0478 - ms
e: 0.0049 - val_loss: 6.8521e-04 - val_mae: 0.0196 - val_mse: 6.8521e-04
Epoch 150/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0489 - ms
e: 0.0051 - val_loss: 7.0208e-04 - val_mae: 0.0200 - val_mse: 7.0208e-04
Epoch 151/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0483 - ms
e: 0.0050 - val_loss: 7.0968e-04 - val_mae: 0.0200 - val_mse: 7.0968e-04
Epoch 152/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0478 - ms
```

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e: 0.0047 - val_loss: 6.8023e-04 - val_mae: 0.0195 - val_mse: 6.8023e-04
Epoch 153/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0477 - ms
e: 0.0047 - val_loss: 6.9174e-04 - val_mae: 0.0199 - val_mse: 6.9174e-04
Epoch 154/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0478 - ms
e: 0.0048 - val_loss: 6.7397e-04 - val_mae: 0.0193 - val_mse: 6.7397e-04
Epoch 155/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0480 - ms
e: 0.0048 - val_loss: 6.7311e-04 - val_mae: 0.0195 - val_mse: 6.7311e-04
Epoch 156/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0472 - ms
e: 0.0047 - val_loss: 6.4565e-04 - val_mae: 0.0189 - val_mse: 6.4565e-04
Epoch 157/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0048 - mae: 0.0479 - ms
e: 0.0048 - val_loss: 6.3509e-04 - val_mae: 0.0188 - val_mse: 6.3509e-04
Epoch 158/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0477 - ms
e: 0.0047 - val_loss: 6.6497e-04 - val_mae: 0.0192 - val_mse: 6.6497e-04
Epoch 159/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0480 - ms
e: 0.0049 - val_loss: 6.1370e-04 - val_mae: 0.0184 - val_mse: 6.1370e-04
Epoch 160/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0477 - ms
e: 0.0048 - val_loss: 6.1786e-04 - val_mae: 0.0184 - val_mse: 6.1786e-04
Epoch 161/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0048 - mae: 0.0473 - ms
e: 0.0048 - val_loss: 6.0880e-04 - val_mae: 0.0184 - val_mse: 6.0880e-04
Epoch 162/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0048 - mae: 0.0478 - ms
e: 0.0048 - val_loss: 5.9276e-04 - val_mae: 0.0180 - val_mse: 5.9276e-04
Epoch 163/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0049 - mae: 0.0479 - ms
e: 0.0049 - val_loss: 5.9120e-04 - val_mae: 0.0181 - val_mse: 5.9120e-04
Epoch 164/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0478 - ms
e: 0.0048 - val_loss: 5.7537e-04 - val_mae: 0.0178 - val_mse: 5.7537e-04
Epoch 165/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0477 - ms
e: 0.0047 - val_loss: 5.6398e-04 - val_mae: 0.0175 - val_mse: 5.6398e-04
Epoch 166/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0050 - mae: 0.0480 - ms
e: 0.0050 - val_loss: 5.5439e-04 - val_mae: 0.0173 - val_mse: 5.5439e-04
Epoch 167/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0046 - mae: 0.0471 - ms
e: 0.0046 - val_loss: 5.6850e-04 - val_mae: 0.0179 - val_mse: 5.6850e-04
Epoch 168/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0481 - ms
e: 0.0048 - val_loss: 5.4716e-04 - val_mae: 0.0174 - val_mse: 5.4716e-04
Epoch 169/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0047 - mae: 0.0476 - ms
e: 0.0047 - val_loss: 5.2309e-04 - val_mae: 0.0168 - val_mse: 5.2309e-04
Epoch 170/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0046 - mae: 0.0471 - ms
e: 0.0046 - val_loss: 5.2418e-04 - val_mae: 0.0167 - val_mse: 5.2418e-04
Epoch 171/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0474 - ms
e: 0.0048 - val_loss: 5.6044e-04 - val_mae: 0.0178 - val_mse: 5.6044e-04
Epoch 172/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0476 - ms
e: 0.0049 - val_loss: 5.2321e-04 - val_mae: 0.0169 - val_mse: 5.2321e-04
Epoch 173/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0047 - mae: 0.0471 - ms
e: 0.0047 - val_loss: 5.0845e-04 - val_mae: 0.0164 - val_mse: 5.0845e-04
Epoch 174/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0048 - mae: 0.0475 - ms
```

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e: 0.0048 - val_loss: 5.1269e-04 - val_mae: 0.0164 - val_mse: 5.1269e-04
Epoch 175/200
16/16 [==============================] - 1s 46ms/step - loss: 0.0049 - mae: 0.0482 - ms
e: 0.0049 - val_loss: 4.9508e-04 - val_mae: 0.0162 - val_mse: 4.9508e-04
Epoch 176/200
16/16 [==============================] - 1s 44ms/step - loss: 0.0046 - mae: 0.0476 - ms
e: 0.0046 - val_loss: 5.7598e-04 - val_mae: 0.0183 - val_mse: 5.7598e-04
Epoch 177/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0046 - mae: 0.0470 - ms
e: 0.0046 - val_loss: 5.0896e-04 - val_mae: 0.0166 - val_mse: 5.0896e-04
Epoch 178/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0047 - mae: 0.0476 - ms
e: 0.0047 - val_loss: 5.0297e-04 - val_mae: 0.0163 - val_mse: 5.0297e-04
Epoch 179/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0478 - ms
e: 0.0048 - val_loss: 4.9947e-04 - val_mae: 0.0164 - val_mse: 4.9947e-04
Epoch 180/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0480 - ms
e: 0.0048 - val_loss: 5.3818e-04 - val_mae: 0.0170 - val_mse: 5.3818e-04
Epoch 181/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0479 - ms
e: 0.0048 - val_loss: 5.5608e-04 - val_mae: 0.0179 - val_mse: 5.5608e-04
Epoch 182/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0049 - mae: 0.0486 - ms
e: 0.0049 - val_loss: 4.9256e-04 - val_mae: 0.0163 - val_mse: 4.9256e-04
Epoch 183/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0051 - mae: 0.0487 - ms
e: 0.0051 - val_loss: 5.0714e-04 - val_mae: 0.0164 - val_mse: 5.0714e-04
Epoch 184/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0047 - mae: 0.0483 - ms
e: 0.0047 - val_loss: 4.8675e-04 - val_mae: 0.0162 - val_mse: 4.8675e-04
Epoch 185/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0493 - ms
e: 0.0051 - val_loss: 5.1350e-04 - val_mae: 0.0165 - val_mse: 5.1350e-04
Epoch 186/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0049 - mae: 0.0495 - ms
e: 0.0049 - val_loss: 4.9000e-04 - val_mae: 0.0161 - val_mse: 4.9000e-04
Epoch 187/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0050 - mae: 0.0497 - ms
e: 0.0050 - val_loss: 4.8720e-04 - val_mae: 0.0161 - val_mse: 4.8720e-04
Epoch 188/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0051 - mae: 0.0503 - ms
e: 0.0051 - val_loss: 5.1187e-04 - val_mae: 0.0170 - val_mse: 5.1187e-04
Epoch 189/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0048 - mae: 0.0495 - ms
e: 0.0048 - val_loss: 4.6892e-04 - val_mae: 0.0159 - val_mse: 4.6892e-04
Epoch 190/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0051 - mae: 0.0513 - ms
e: 0.0051 - val_loss: 4.7418e-04 - val_mae: 0.0158 - val_mse: 4.7418e-04
Epoch 191/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0052 - mae: 0.0514 - ms
e: 0.0052 - val_loss: 4.6930e-04 - val_mae: 0.0161 - val_mse: 4.6930e-04
Epoch 192/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0054 - mae: 0.0530 - ms
e: 0.0054 - val_loss: 4.9739e-04 - val_mae: 0.0169 - val_mse: 4.9739e-04
Epoch 193/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0055 - mae: 0.0534 - ms
e: 0.0055 - val_loss: 4.6189e-04 - val_mae: 0.0160 - val_mse: 4.6189e-04
Epoch 194/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0058 - mae: 0.0552 - ms
e: 0.0058 - val_loss: 4.3510e-04 - val_mae: 0.0151 - val_mse: 4.3510e-04
Epoch 195/200
16/16 [==============================] - 1s 40ms/step - loss: 0.0056 - mae: 0.0553 - ms
e: 0.0056 - val_loss: 4.5851e-04 - val_mae: 0.0161 - val_mse: 4.5851e-04
Epoch 196/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0061 - mae: 0.0577 - ms
```

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e: 0.0061 - val_loss: 4.3285e-04 - val_mae: 0.0154 - val_mse: 4.3285e-04
Epoch 197/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0063 - mae: 0.0587 - ms
e: 0.0063 - val_loss: 4.4770e-04 - val_mae: 0.0153 - val_mse: 4.4770e-04
Epoch 198/200
16/16 [==============================] - 1s 41ms/step - loss: 0.0065 - mae: 0.0600 - ms
e: 0.0065 - val_loss: 4.3596e-04 - val_mae: 0.0156 - val_mse: 4.3596e-04
Epoch 199/200
16/16 [==============================] - 1s 43ms/step - loss: 0.0066 - mae: 0.0612 - ms
e: 0.0066 - val_loss: 4.4807e-04 - val_mae: 0.0154 - val_mse: 4.4807e-04
Epoch 200/200
16/16 [==============================] - 1s 42ms/step - loss: 0.0070 - mae: 0.0632 - ms
e: 0.0070 - val_loss: 5.1170e-04 - val_mae: 0.0175 - val_mse: 5.1170e-04
Epoch 1/200
2023-05-09 18:24:27.105774: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
253/253 [==============================] - 4s 12ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 2/200
  1/253 [..............................] - ETA: 2s - loss: 0.0130 - mae: 0.0883 - mse:
0.0130
2023-05-09 18:24:30.274883: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 3/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 4/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 5/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 6/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 7/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 8/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 9/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 10/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 11/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 12/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 13/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 14/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 15/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 16/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 17/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 18/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 19/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 20/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 21/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 22/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 23/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 24/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 25/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 26/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 27/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 28/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 29/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 30/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 31/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 32/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 33/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 34/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 35/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 36/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 37/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 38/200
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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 39/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 40/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 41/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 42/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 43/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 44/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 45/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 46/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 47/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 48/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 49/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 50/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 51/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 52/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 53/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 54/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 55/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 56/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 57/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 58/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 59/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 60/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 61/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 62/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 63/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 64/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 65/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 66/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 67/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 68/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 69/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 70/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 71/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 72/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 73/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 74/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 75/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 76/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 77/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 78/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 79/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 80/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 81/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 82/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 83/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 84/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 85/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 86/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 87/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 88/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 89/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 90/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 91/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 92/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 93/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 94/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 95/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 96/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 97/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 98/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 99/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 100/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 101/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 102/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 103/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 104/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 105/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 106/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 107/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 108/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 109/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 110/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 111/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 112/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 113/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 114/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 115/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 116/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 117/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 118/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 119/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 120/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 121/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 122/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 123/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 124/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 125/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 126/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 127/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 128/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 129/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 130/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 131/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 132/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 133/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 134/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 135/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 136/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 137/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 138/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 139/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 140/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 141/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 142/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 143/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 144/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 145/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 146/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 147/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 148/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 149/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 150/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 151/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 152/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 153/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 154/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 155/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 156/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 157/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 158/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 159/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 160/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 161/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 162/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 163/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 164/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 165/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 166/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 167/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 168/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 169/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 170/200
```

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253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 171/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 172/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 173/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 174/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 175/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 176/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 177/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 178/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 179/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 180/200
253/253 [==============================] - 3s 11ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 181/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 182/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 183/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 184/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 185/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 186/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 187/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 188/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 189/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 190/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 191/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 192/200
```
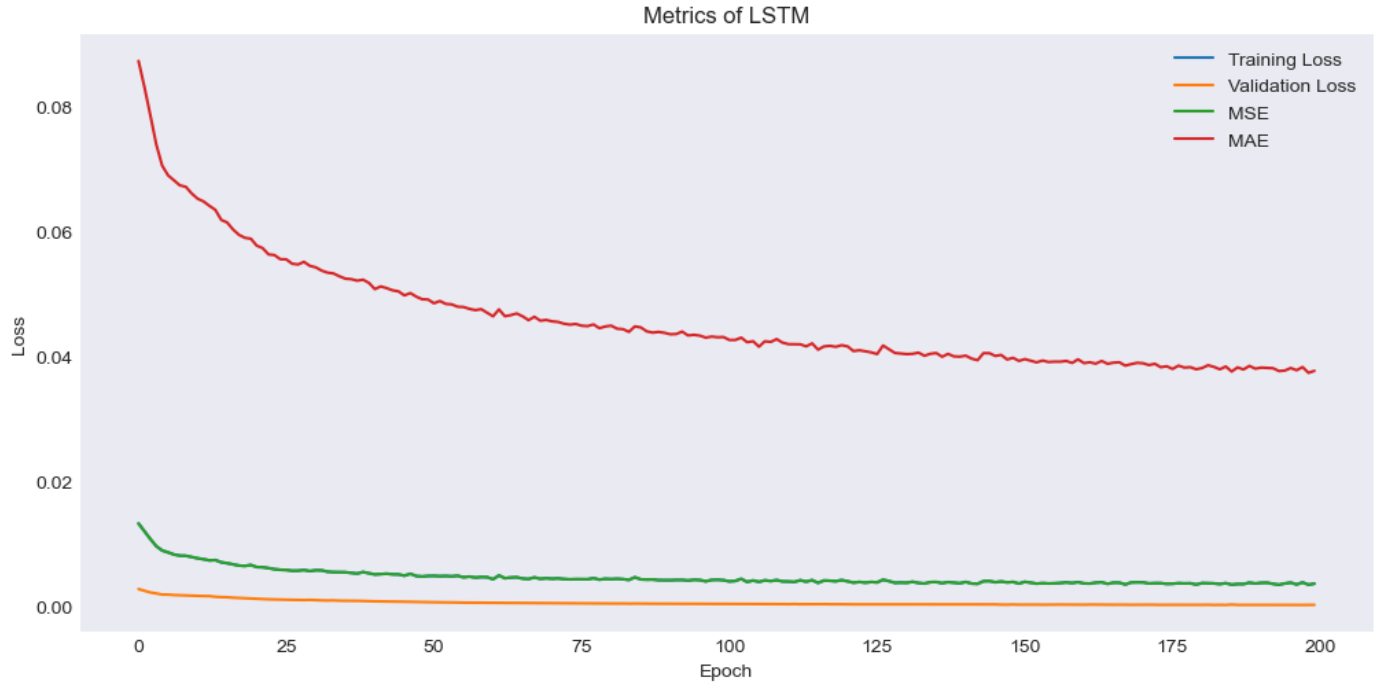
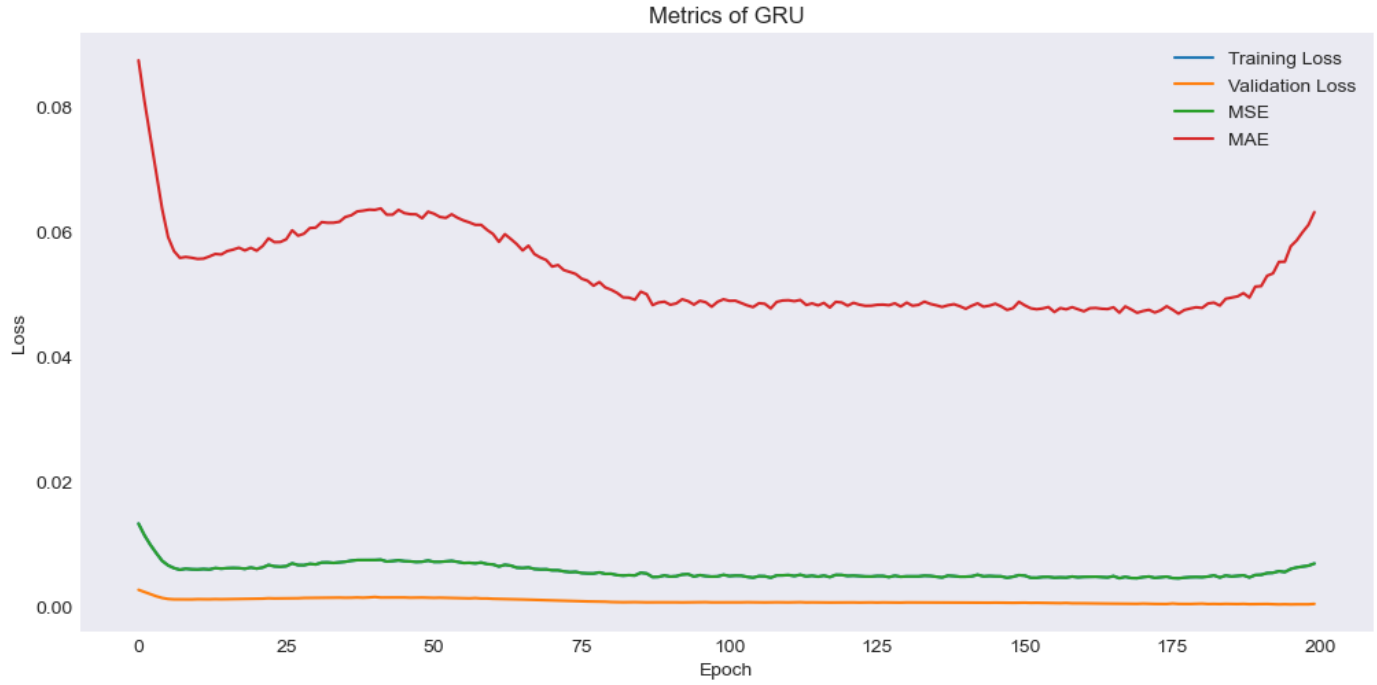
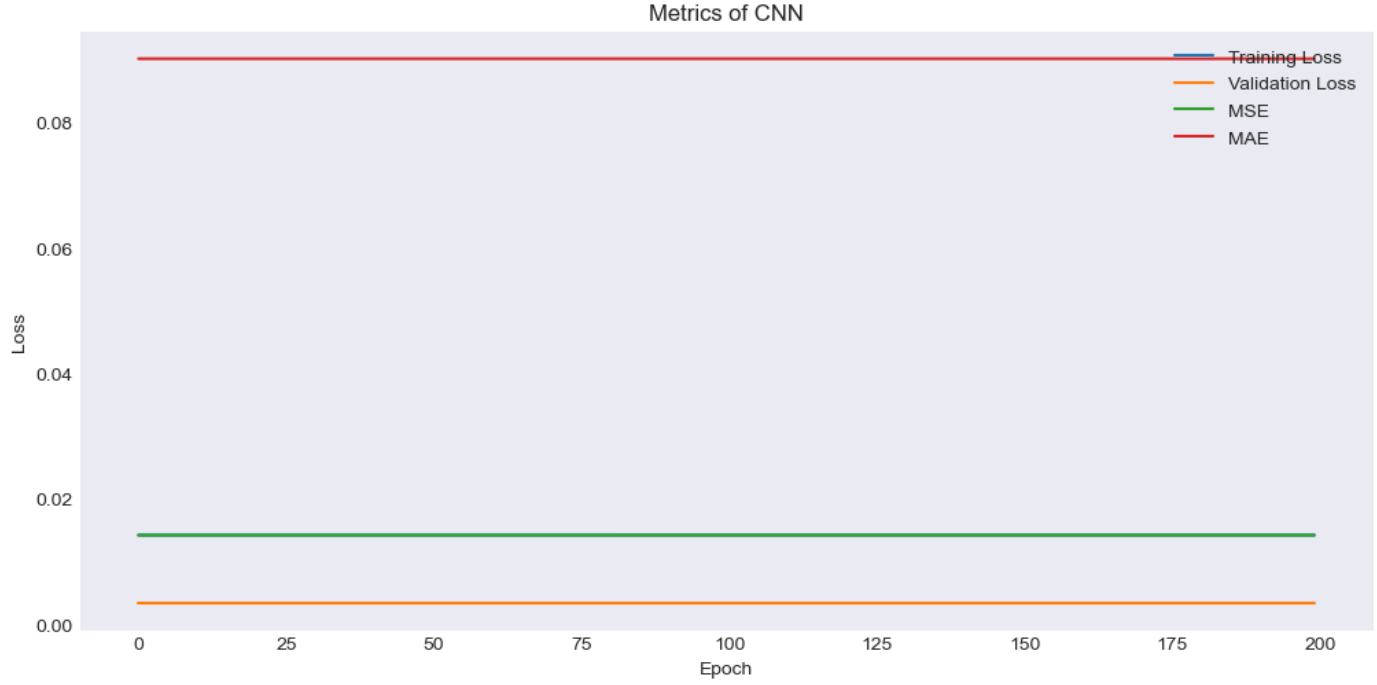
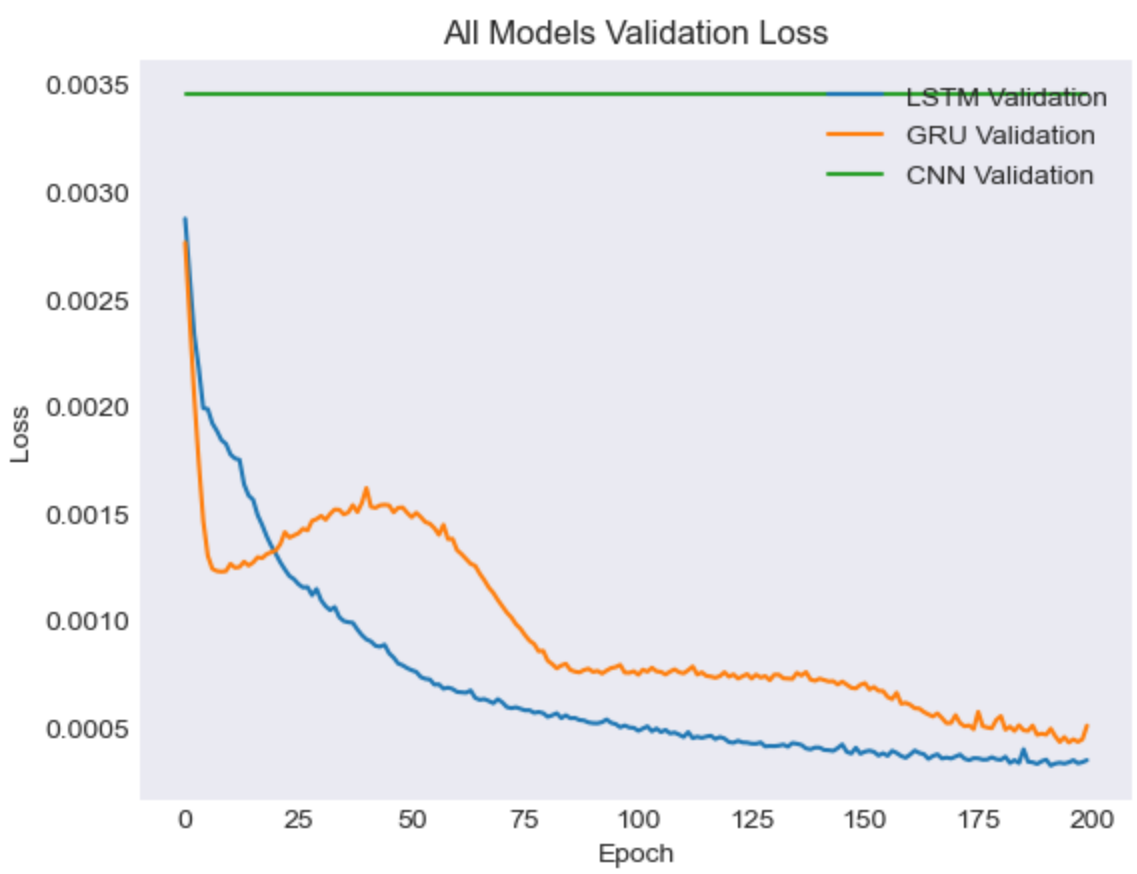

```
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 193/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 194/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 195/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 196/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 197/200
253/253 [==============================] - 2s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 198/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 199/200
253/253 [==============================] - 2s 9ms/step - loss: 0.0142 - mae: 0.0902 - ms
e: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
Epoch 200/200
253/253 [==============================] - 3s 10ms/step - loss: 0.0142 - mae: 0.0902 - m
se: 0.0142 - val_loss: 0.0035 - val_mae: 0.0453 - val_mse: 0.0035
2023-05-09 18:32:24.332344: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:32:24.421896: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:32:24.494004: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
 1/67 [..............................] - ETA: 45s
2023-05-09 18:32:24.579274: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:32:24.663975: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
67/67 [==============================] - 2s 16ms/step
2023-05-09 18:32:26.192911: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:32:26.273908: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:32:26.344204: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
 1/67 [..............................] - ETA: 49s
2023-05-09 18:32:26.426423: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
2023-05-09 18:32:26.506756: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
67/67 [==============================] - 2s 16ms/step
55/67 [=====================>......] - ETA: 0s
2023-05-09 18:32:27.703537: I tensorflow/core/grappler/optimizers/custom_graph_optimizer
_registry.cc:114] Plugin optimizer for device_type GPU is enabled.
67/67 [==============================] - 0s 3ms/step
WARNING:absl:Found untraced functions such as lstm_cell_layer_call_fn, lstm_cell_layer_c
all_and_return_conditional_losses, lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and
_return_conditional_losses, lstm_cell_2_layer_call_fn while saving (showing 5 of 8). The
se functions will not be directly callable after loading.
INFO:tensorflow:Assets written to: ram://7e360b68-b942-4d3f-8f45-f07f955817ec/assets
INFO:tensorflow:Assets written to: ram://7e360b68-b942-4d3f-8f45-f07f955817ec/assets
WARNING:absl:Found untraced functions such as gru_cell_layer_call_fn, gru_cell_layer_cal
l_and_return_conditional_losses, gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_ret
```

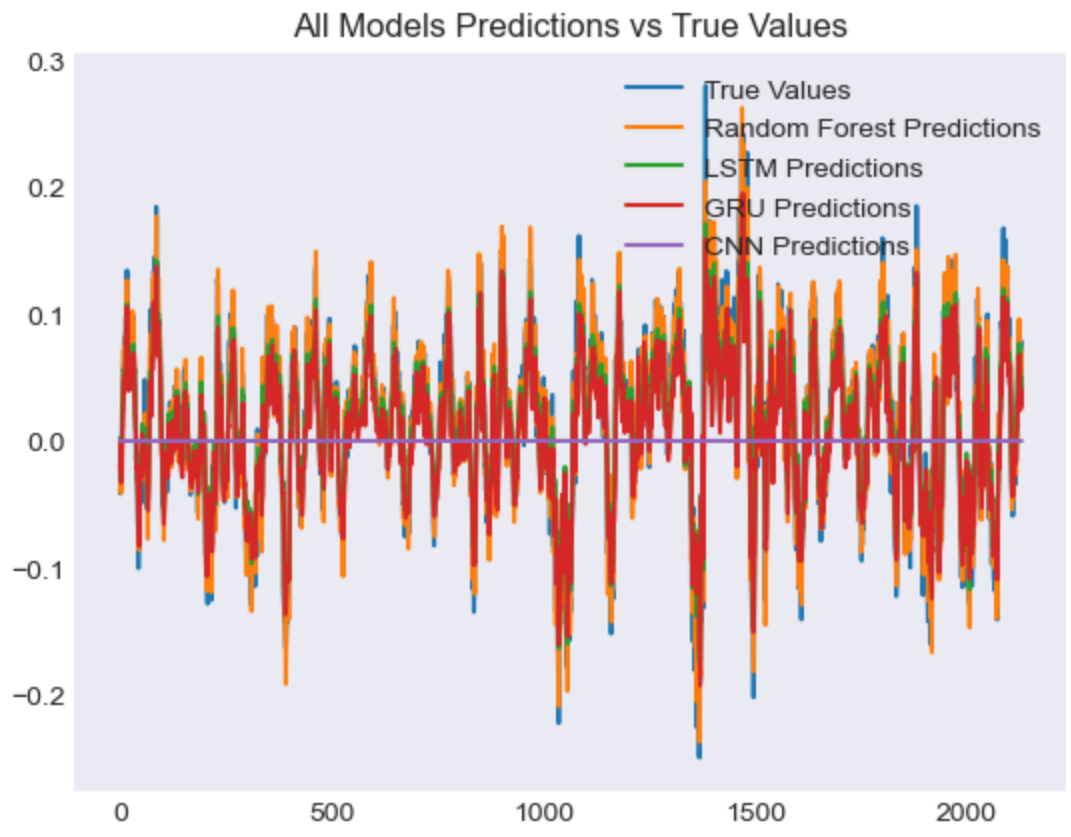
```
urn_conditional_losses, gru_cell_2_layer_call_fn while saving (showing 5 of 8). These fu
nctions will not be directly callable after loading.
INFO:tensorflow:Assets written to: ram://0174d3c0-e587-4dbd-8e92-ae9e0739a841/assets
INFO:tensorflow:Assets written to: ram://0174d3c0-e587-4dbd-8e92-ae9e0739a841/assets
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while saving
(showing 1 of 1). These functions will not be directly callable after loading.
INFO:tensorflow:Assets written to: ram://4d2df547-0da4-4927-8da5-514dc93ad451/assets
INFO:tensorflow:Assets written to: ram://4d2df547-0da4-4927-8da5-514dc93ad451/assets
```

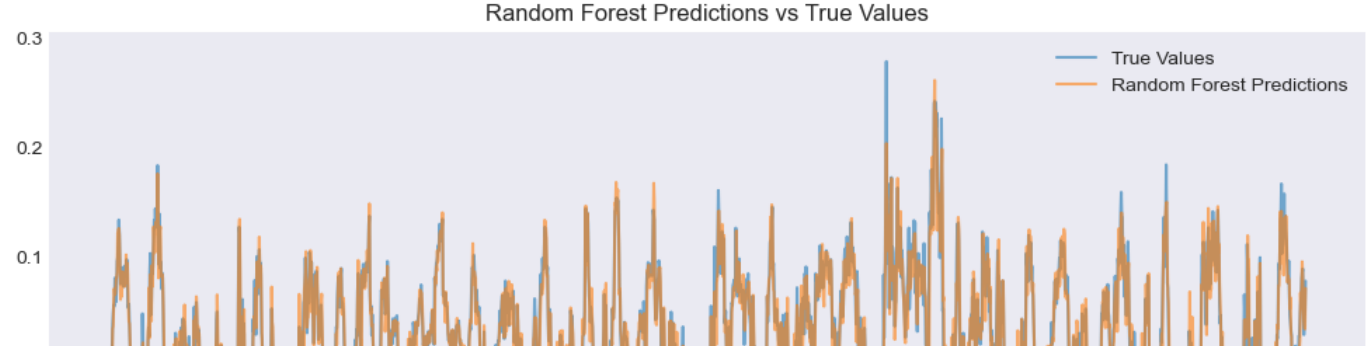

Metrics of LSTM
Training Loss
Validation Loss
MSE
MAE
Loss
0.00
0.02
0.04
0.06
0.08
0
25
50
75
100
125
150
175
200
Epoch

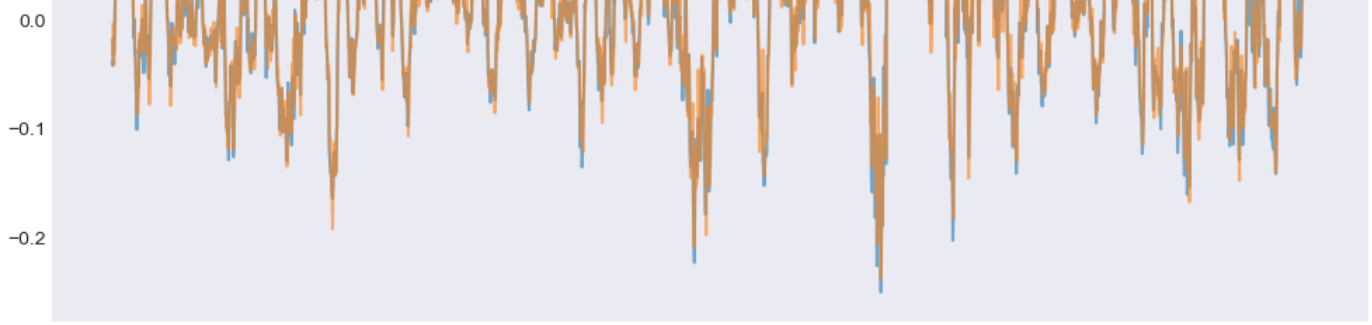

Metrics of GRU
Training Loss
Validation Loss
MSE
MAE
Loss
0.00
0.02
0.04
0.06
0.08
0
25
50
75
100
125
150
175
200
Epoch


Metrics of CNN
Training Loss
Validation Loss
MSE
MAE
Loss
0.00
0.02
0.04
0.06
0.08
0
25
50
75
100
125
150
175
200
Epoch

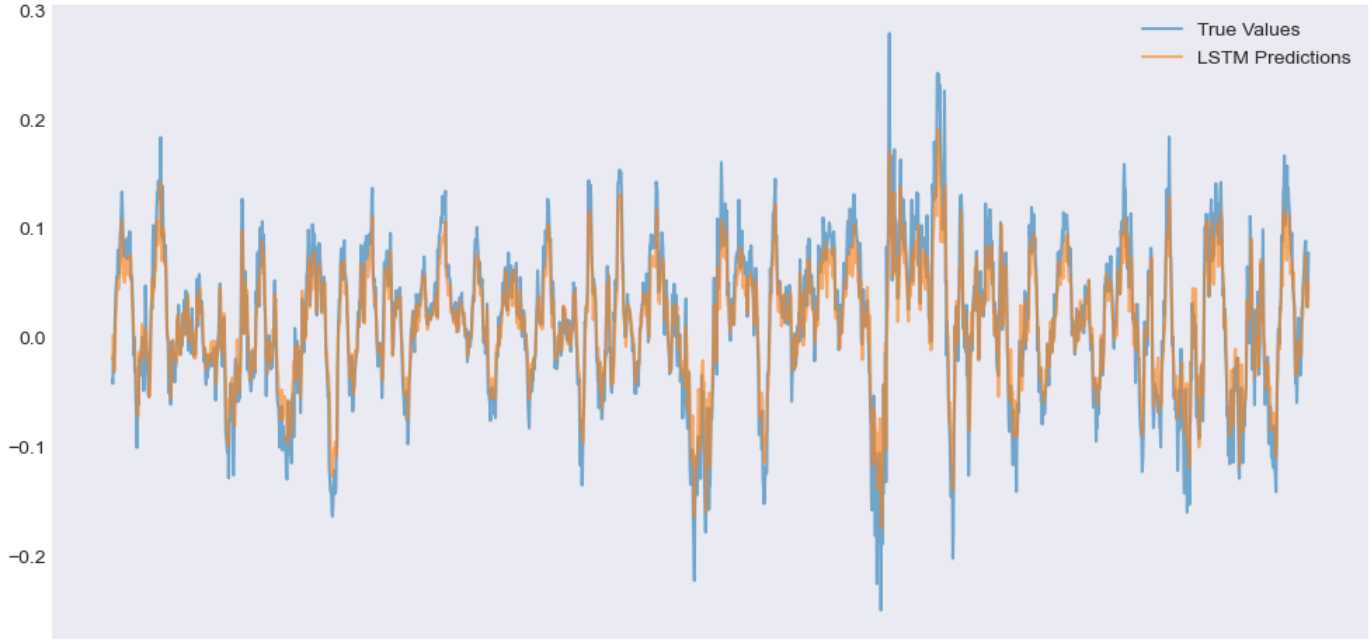

All Models Validation Loss
LSTM Validation
GRU Validation
CNN Validation
Loss
Epoch
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0
25
50
75
100
125
150
175
200


All Models Predictions vs True Values
True Values
Random Forest Predictions
LSTM Predictions
GRU Predictions
CNN Predictions
0.3
0.2
0.1
0.0
−0.1
−0.2
0
500
1000
1500
2000

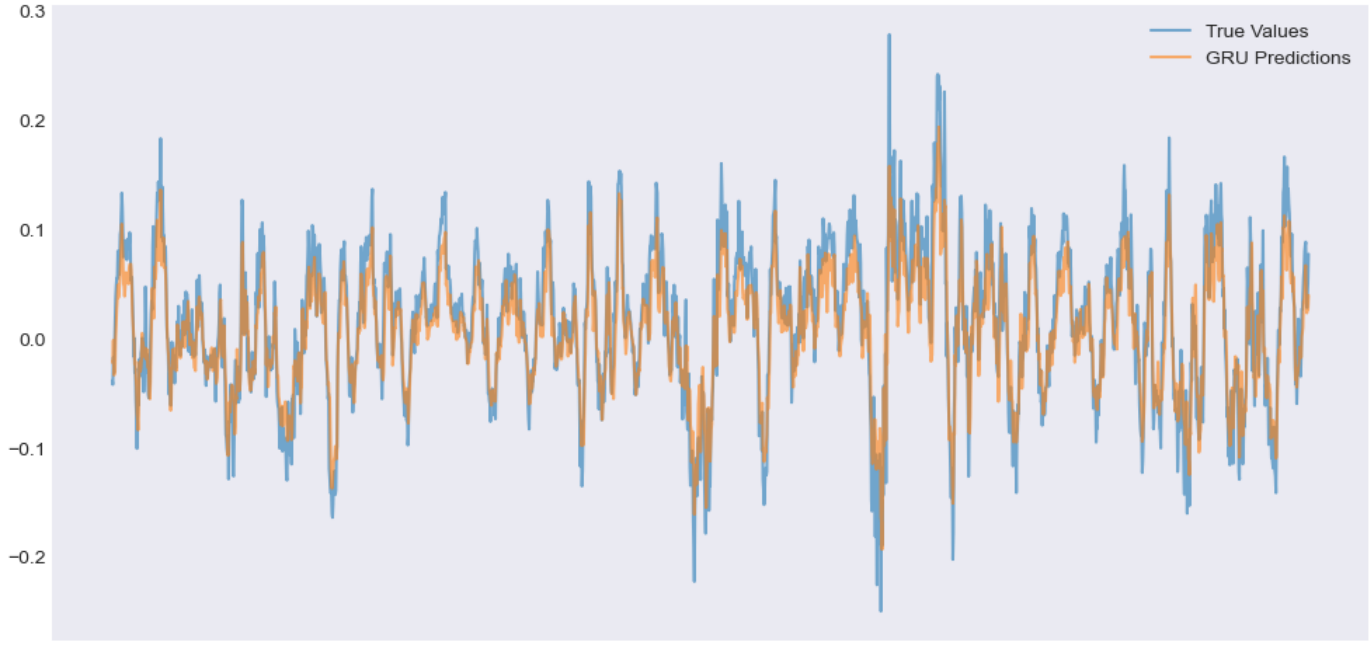

Random Forest Predictions vs True Values
True Values
Random Forest Predictions
0.3
0.2
0.1



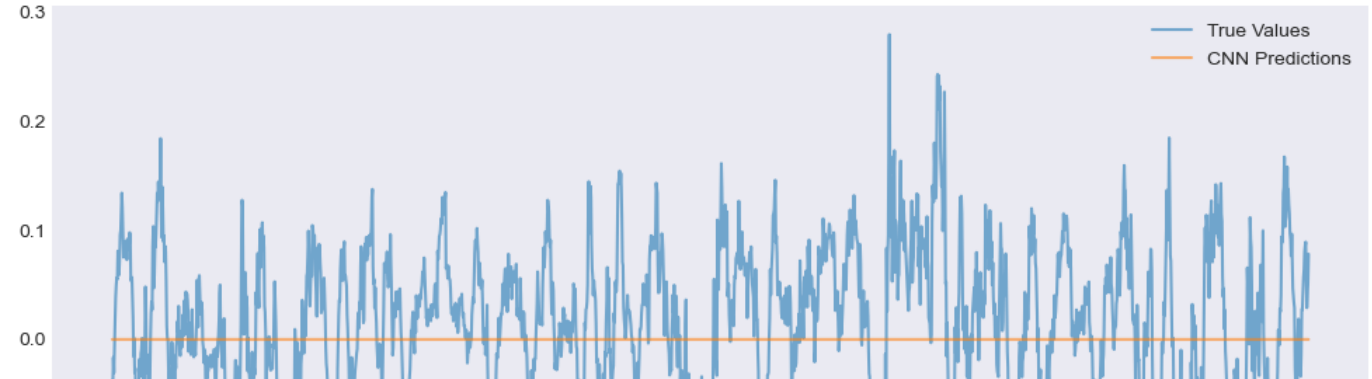
LSTM Predictions vs True Values

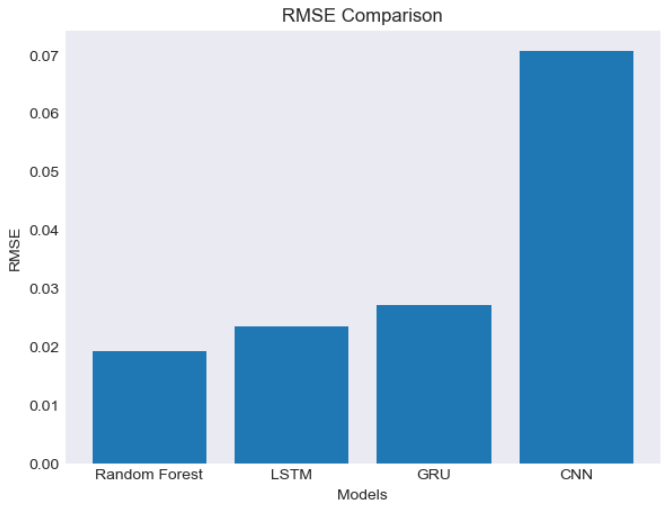


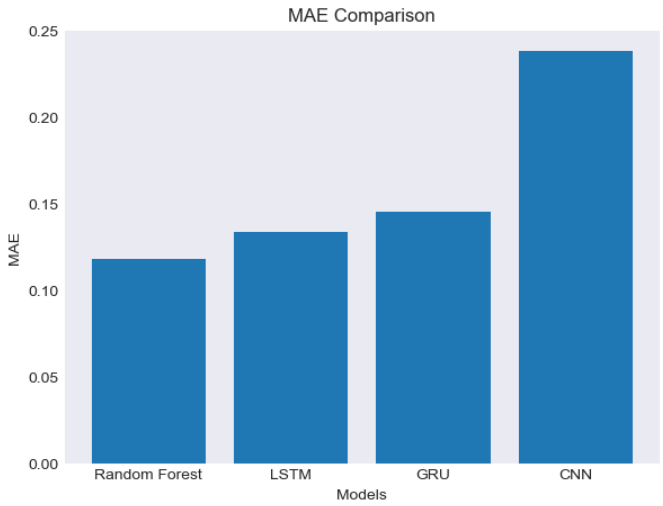
GRU Predictions vs True Values



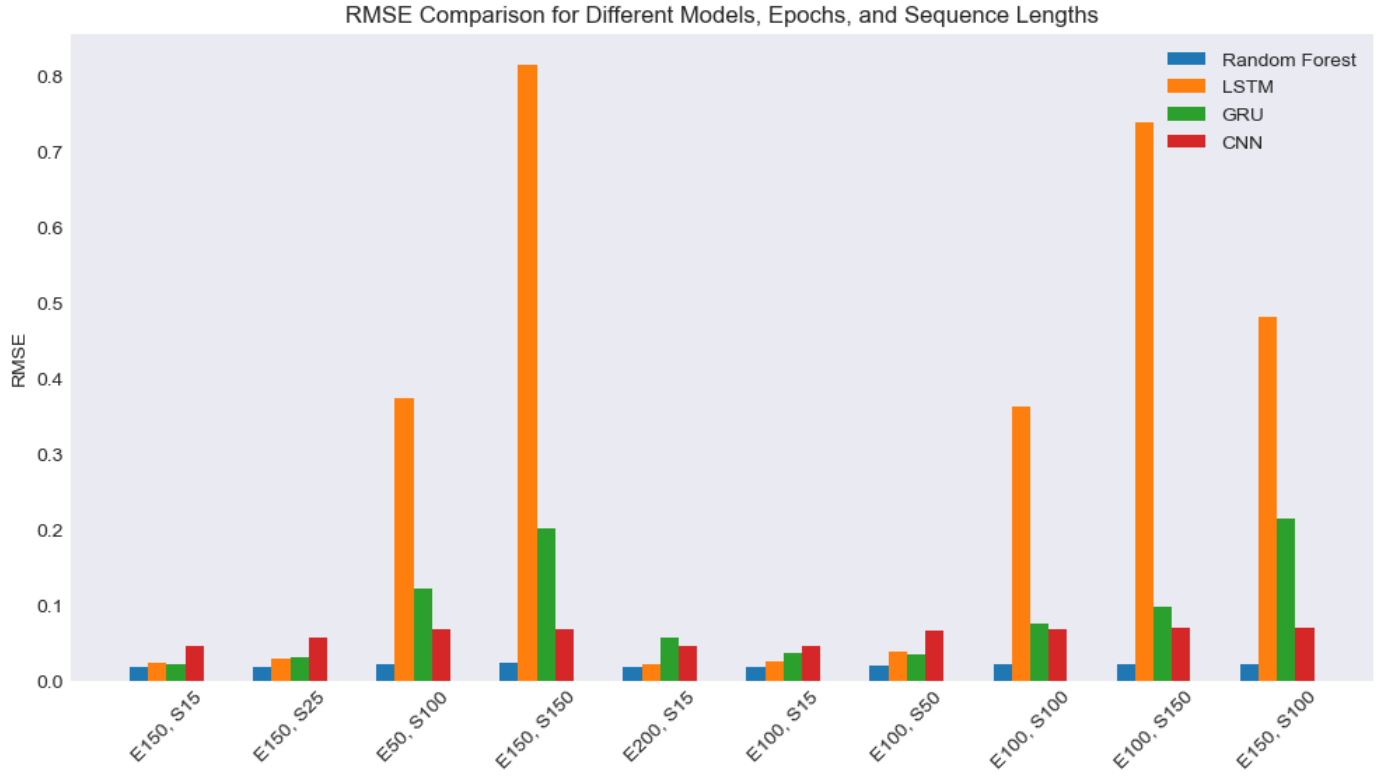
CNN Predictions vs True Values








```
All Models and Root Mean Squared Error:
        Random Forest's RMSE is 0.0192
        LSTM's RMSE is 0.0235
        GRU's RMSE is 0.0270
        CNN's RMSE is 0.0707
The best model is Random Forest with an RMSE of 0.0192
```



In [ ]: