COS30018 Assignment B – Task 4

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This week I created a function which takes in the desired type of deep learning network (LSTM, GRU, RNN), amount of layers, layer size and dropout amount. It will create a new model of n layers and compile it to use for training. See screenshot of code for how the program works line by line. Output results for a variety of settings have also been included.

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CreateCustomModel.py > ...

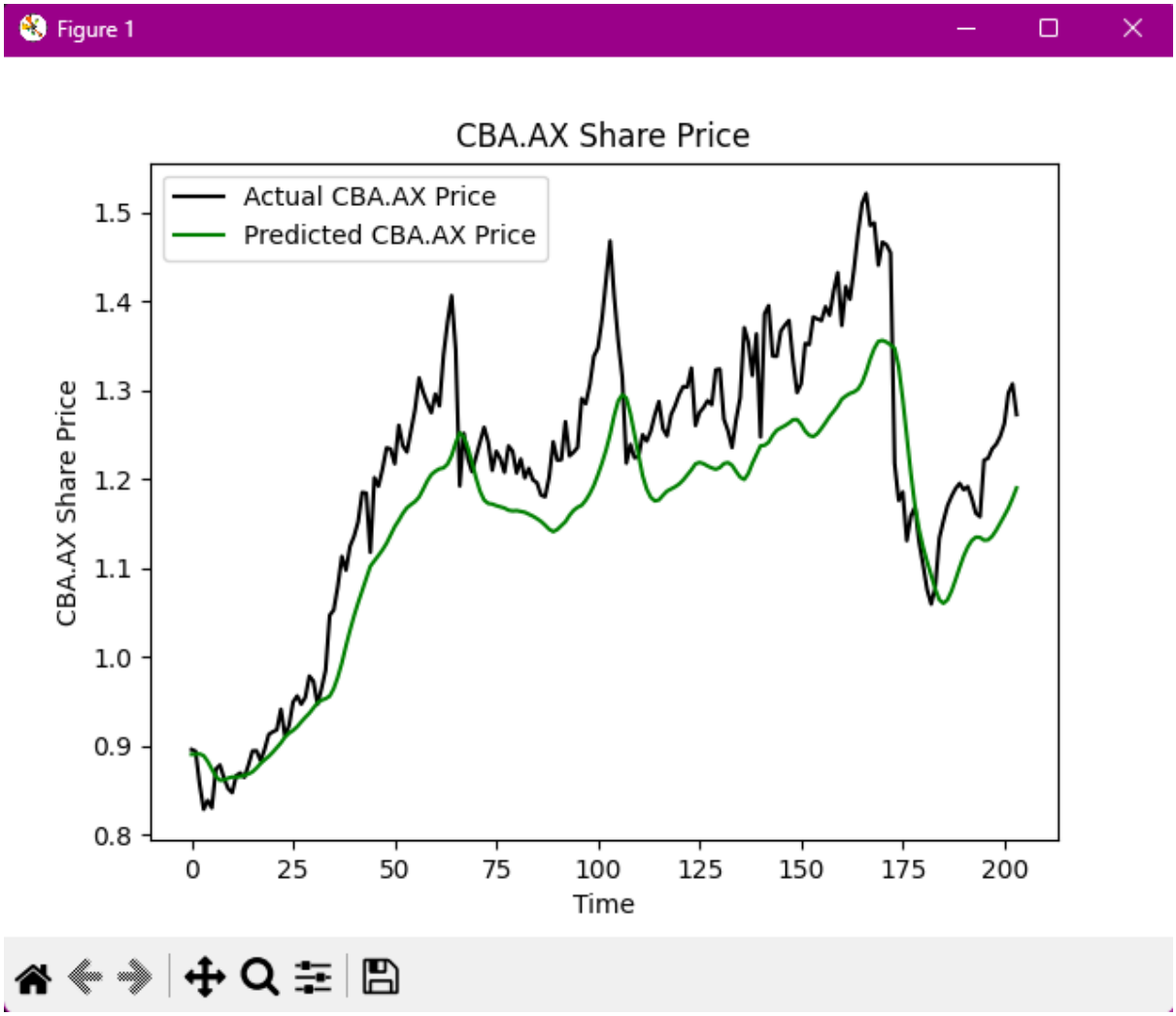
```python
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout, LSTM, SimpleRNN, GRU

def MakeCustomModel(model_type, input_data, n_layers, units, dropout):

    #dictionary to map model_type to the appropriate Keras class
    model_layer_dict = {
        'LSTM': LSTM,
        'RNN': SimpleRNN,
        'GRU': GRU
    }

    #if not valid model type is parsed, select LSTM as default
    if (model_type not in model_layer_dict):
        model_type = LSTM


    #create a blank sequential model that we will add layers to
    model = Sequential()

    for i in range(n_layers - 1):
        if (i == 0):
            #Add first layer, specify input shape which is not needed in future layers
            model.add(model_layer_dict[model_type](units, return_sequences=True, input_shape = input_data))
        else:
            #add the rest of the layers
            model.add(model_layer_dict[model_type](units, return_sequences=True))

        # add dropout on each layer, prevents overfitting by randomly dropping some neurons
        model.add(Dropout(dropout))


    # add final layer, dont need to return sequences as this is the output layer
    model.add(model_layer_dict[model_type](units, return_sequences=False))

    #specify loss function, mean absolute error punishes severe miscalculations
    loss = "mean_absolute_error"
    #optimizer minimizes the loss and updates the weights
    optimizer="rmsprop"
    # add output layer
    model.add(Dense(1, activation="linear"))
    #compile the model and specify the loss, optimizer and metrics to track
    model.compile(loss=loss, metrics = [loss], optimizer = optimizer)
    return model #return complete model
```

```
x_train = np.reshape(x_train, (x_train.shape[0], x_train.shape[1], 1))
# We now reshape x_train into a 3D array(p, q, 1); Note that x_train
# is an array of p inputs with each input being a 2D array

input_shape=(x_train.shape[1], 1)

model = MakeCustomModel('LSTM', input_shape, 2, 256, 0.3)
```

LSTM, 3 layers, 256 units, 0.3 dropout, 25 epochs

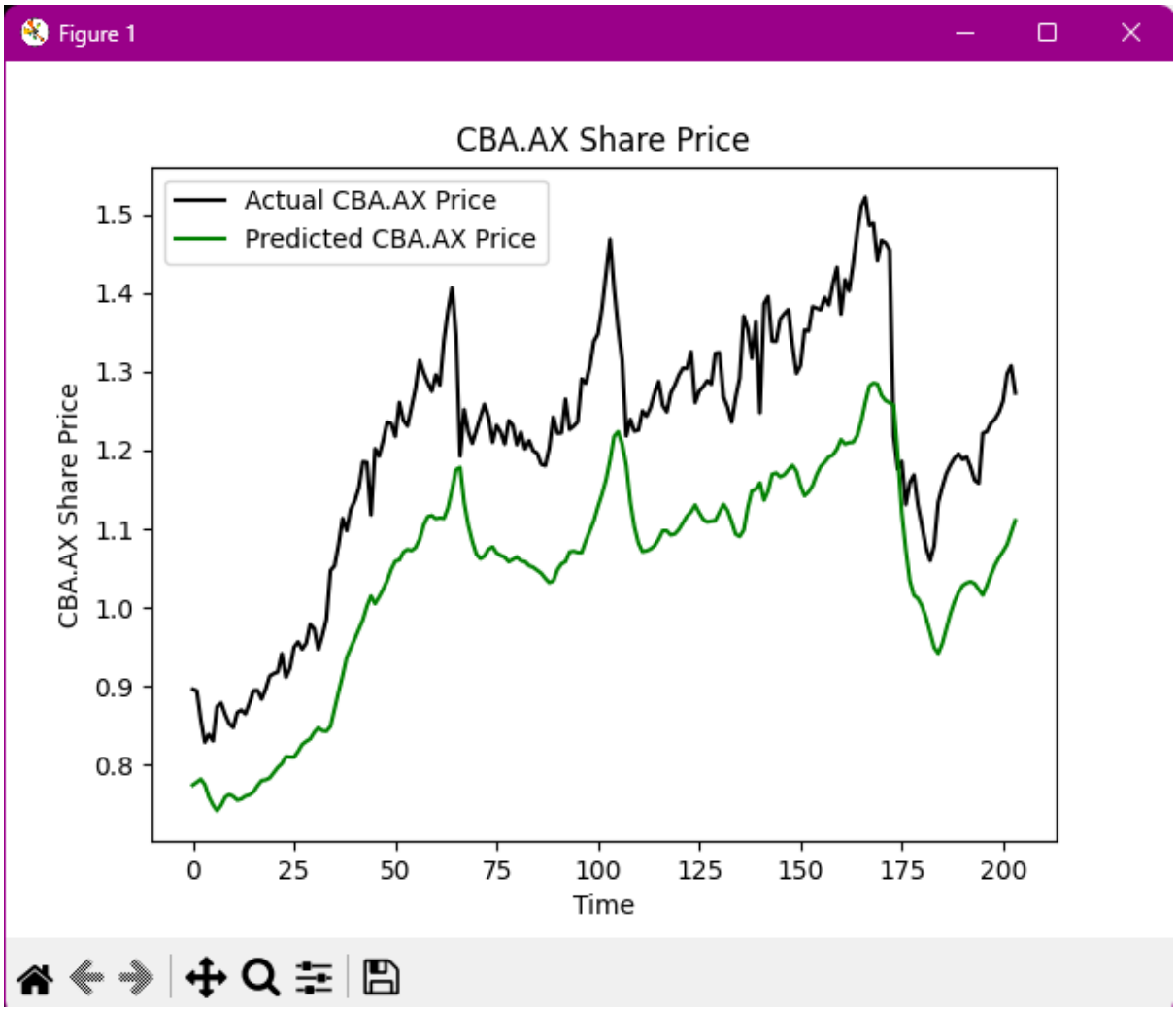
These settings were relatively accurate, but undershooting most of the time.

LSTM, 3 layers, 0.3 dropout, 30 epochs:



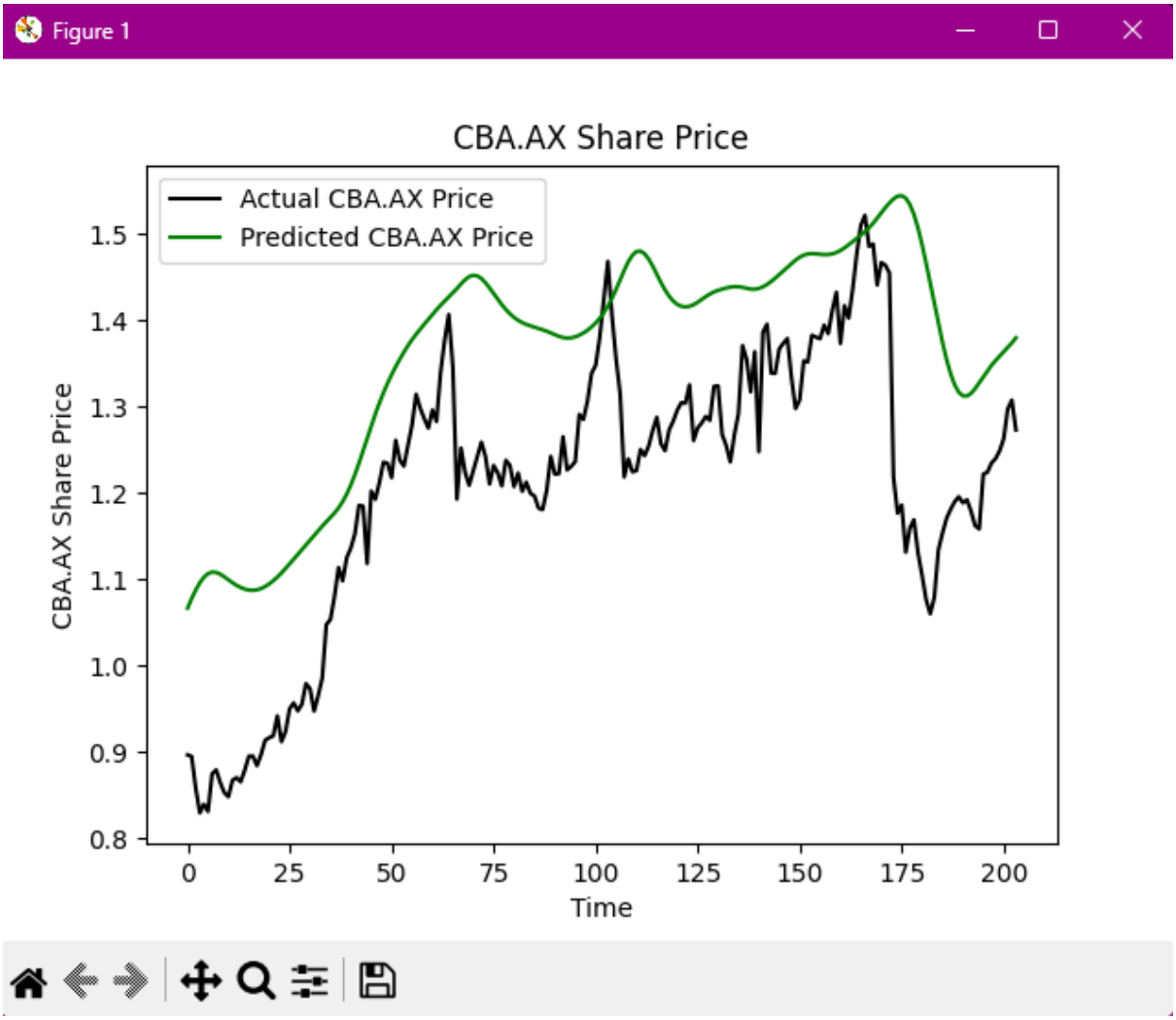
Adding 5 epochs did not have a positive effect.

GRU, 3 layers, 256 units, 0.3 dropout, 25 epochs



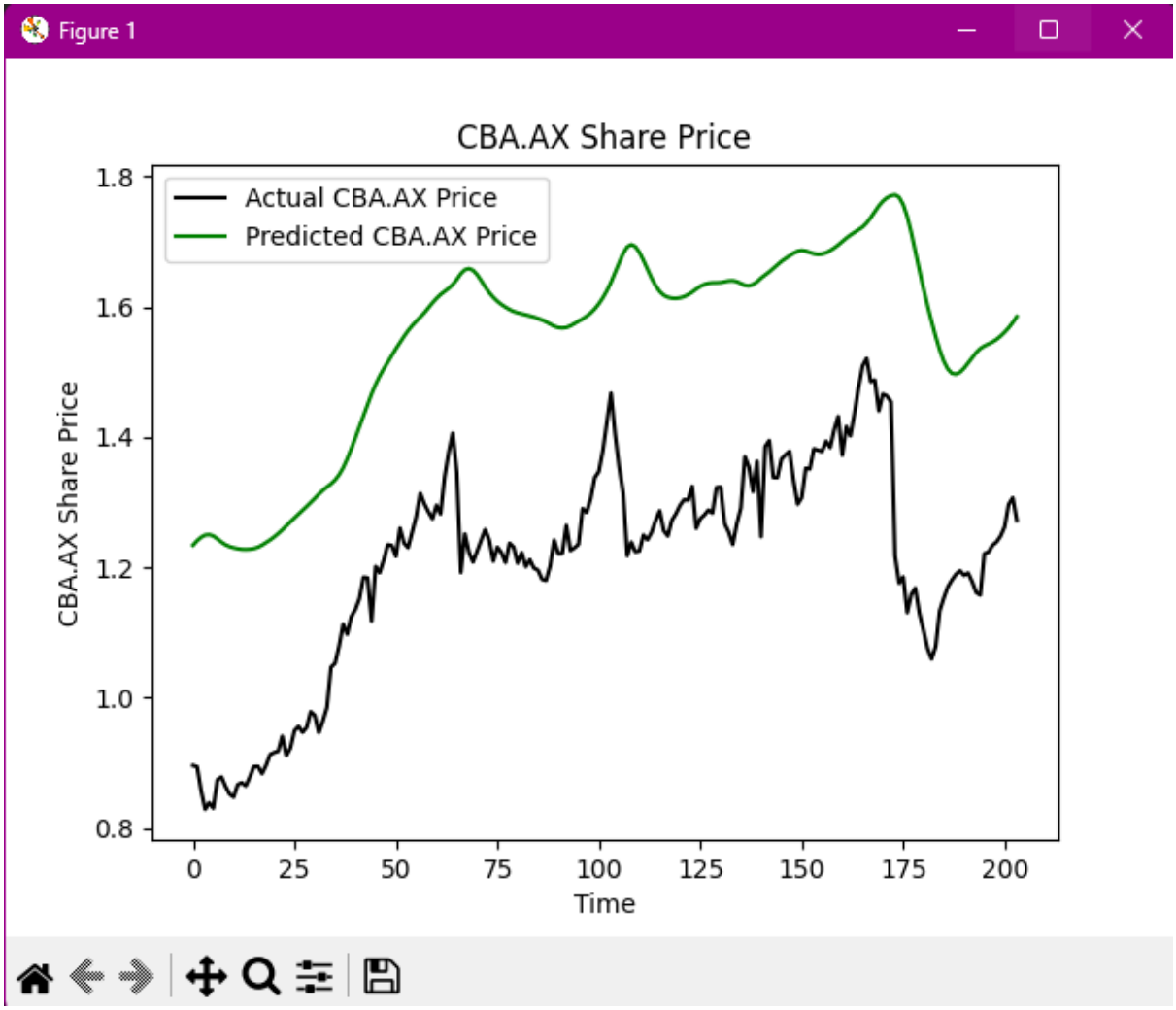
GRU seemed to be less accurate than LSTM.

LSTM, 6 layers, 256 units, 0.3 dropout, 25 epochs



LSTM 6 layers seemed much less accurate than 3 before.

LSTM, 4 layers, 256 units, 0.3 dropout, 25 epochs

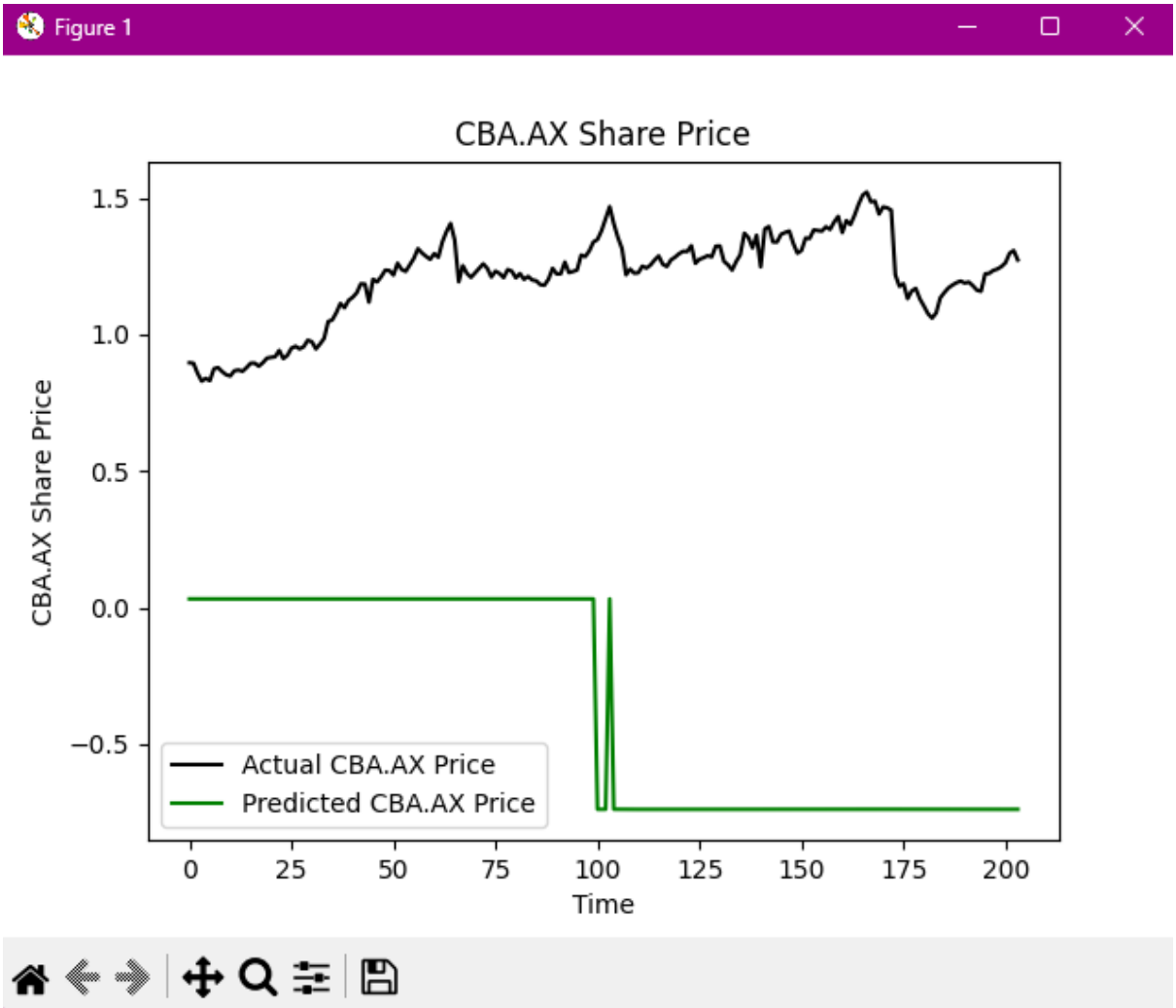


LSTM 4 layers seemed even worse than 6 which is interesting. Not sure why it would get worse after 3 and better at 6.

LSTM, 2 layers, 256 units, 0.3 dropout, 25 epochs

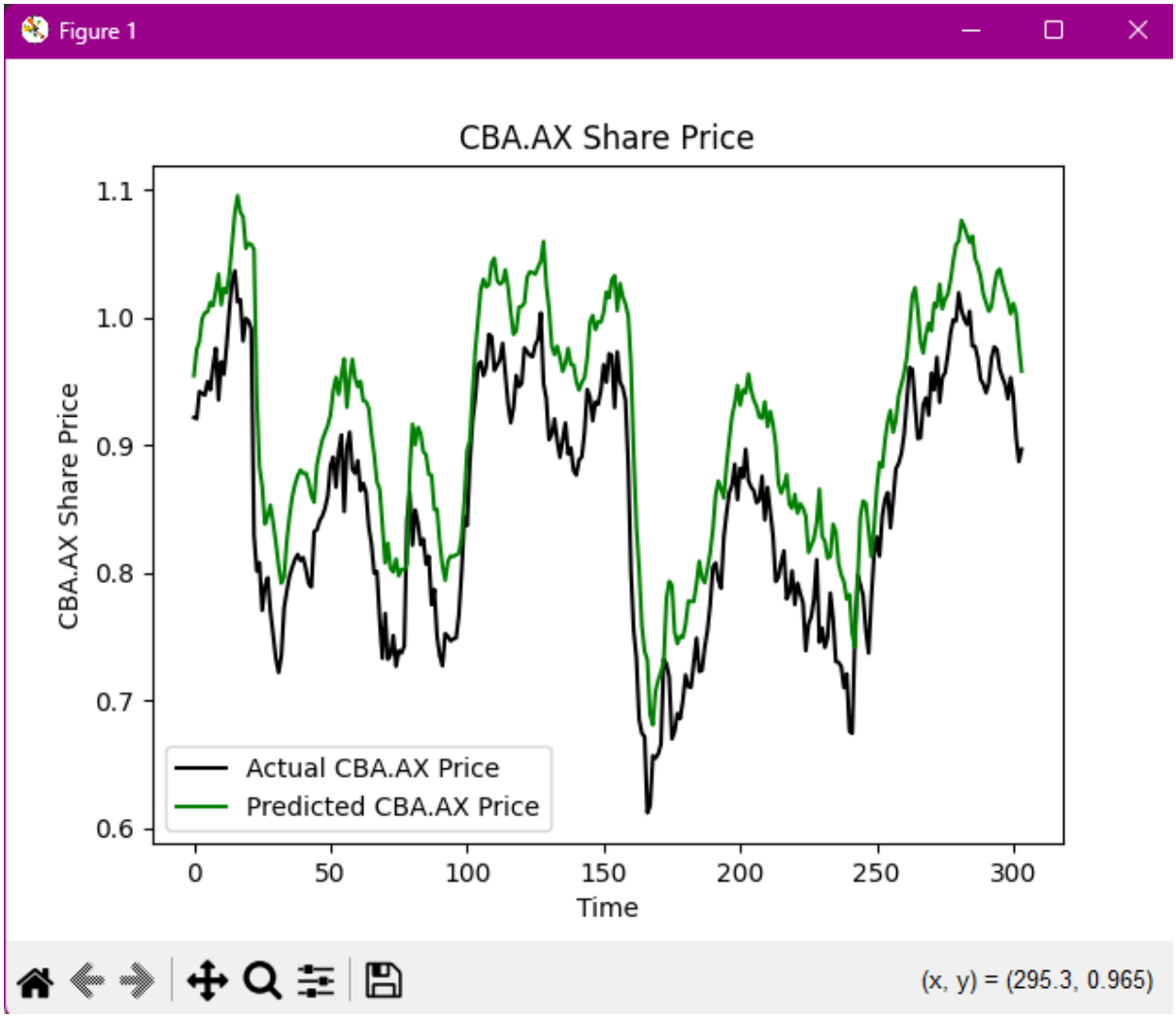
This was by far the best result, with 2 layers and 25 epochs.

RNN, 2 layers, 1024 units, 0.3 dropout, 50 epochs



RNN networks did not seem to be very effective, even with a large layer size and amount of epochs.

LSTM, 2 layers, 1024 units, 0.3 dropout and 50 epochs



LSTM with 2 large layers and 50 epochs was good but not as good as the 2 layer LSTM from before.