I used this:  
X\_jma shape: (85325, 10, 10)

y\_jma shape: (85325, 1)

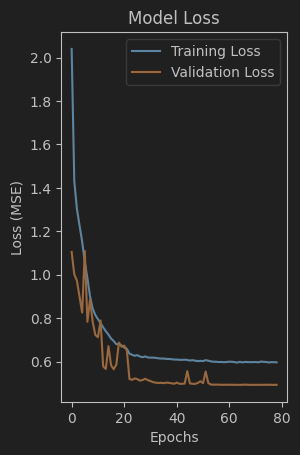
# Define the CNN-GRU model  
def build\_cnn\_gru\_model(input\_shape):  
 model = Sequential()  
  
 # CNN layers  
 model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=input\_shape, padding='same'))  
 model.add(BatchNormalization())  
 model.add(MaxPooling1D(pool\_size=2, padding='same')) # Use padding='same' to preserve dimensions  
  
 model.add(Conv1D(filters=128, kernel\_size=3, activation='relu', padding='same'))  
 model.add(BatchNormalization())  
 model.add(MaxPooling1D(pool\_size=2, padding='same')) # Use padding='same' to preserve dimensions  
  
 # GRU layers  
 model.add(GRU(units=256, return\_sequences=True, kernel\_regularizer=l2(0.001)))  
 model.add(Dropout(0.3))  
 model.add(GRU(units=128, return\_sequences=False, kernel\_regularizer=l2(0.001)))  
 model.add(Dropout(0.3))  
  
 # Dense layers  
 model.add(Dense(units=64, activation='relu', kernel\_regularizer=l2(0.001)))  
 model.add(Dropout(0.4))  
 model.add(Dense(units=1, activation='linear')) # Regression output  
  
 # Compile the model  
 model.compile(optimizer=Adam(learning\_rate=0.0005), loss='mse', metrics=['mae'])  
  
 return model

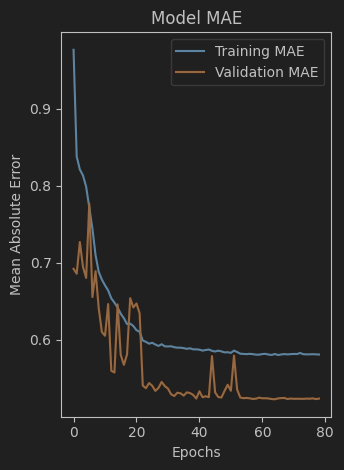
# Adjust the input shape to match the new data  
input\_shape = (X\_jma.shape[1], X\_jma.shape[2]) # (10, 10)

history = model.fit(  
 X\_jma, y\_jma,  
 validation\_split=0.2,  
 epochs=100, # Increased to 100 to allow for more learning  
 batch\_size=128,  
 callbacks=[early\_stopping, reduce\_lr]  
)

I got this:  
  
Training Loss: 0.5643

Training MAE: 0.5533





Epoch 1/100

534/534 [==============================] - 13s 20ms/step - loss: 2.0403 - mae: 0.9763 - val\_loss: 1.1048 - val\_mae: 0.6923 - lr: 5.0000e-04

Epoch 2/100

534/534 [==============================] - 10s 20ms/step - loss: 1.4305 - mae: 0.8379 - val\_loss: 1.0014 - val\_mae: 0.6859 - lr: 5.0000e-04

Epoch 3/100

534/534 [==============================] - 10s 19ms/step - loss: 1.3036 - mae: 0.8211 - val\_loss: 0.9733 - val\_mae: 0.7270 - lr: 5.0000e-04

Epoch 4/100

534/534 [==============================] - 11s 20ms/step - loss: 1.2268 - mae: 0.8133 - val\_loss: 0.8987 - val\_mae: 0.6948 - lr: 5.0000e-04

Epoch 5/100

534/534 [==============================] - 11s 20ms/step - loss: 1.1524 - mae: 0.7988 - val\_loss: 0.8255 - val\_mae: 0.6805 - lr: 5.0000e-04

Epoch 6/100

534/534 [==============================] - 11s 20ms/step - loss: 1.0589 - mae: 0.7719 - val\_loss: 1.1096 - val\_mae: 0.7768 - lr: 5.0000e-04

Epoch 7/100

534/534 [==============================] - 11s 20ms/step - loss: 0.9837 - mae: 0.7443 - val\_loss: 0.7830 - val\_mae: 0.6557 - lr: 5.0000e-04

Epoch 8/100

534/534 [==============================] - 10s 20ms/step - loss: 0.9001 - mae: 0.7099 - val\_loss: 0.8851 - val\_mae: 0.6893 - lr: 5.0000e-04

Epoch 9/100

534/534 [==============================] - 11s 20ms/step - loss: 0.8441 - mae: 0.6883 - val\_loss: 0.7832 - val\_mae: 0.6414 - lr: 5.0000e-04

Epoch 10/100

534/534 [==============================] - 11s 20ms/step - loss: 0.8143 - mae: 0.6783 - val\_loss: 0.7226 - val\_mae: 0.6104 - lr: 5.0000e-04

Epoch 11/100

534/534 [==============================] - 11s 20ms/step - loss: 0.7952 - mae: 0.6709 - val\_loss: 0.7120 - val\_mae: 0.6055 - lr: 5.0000e-04

Epoch 12/100

534/534 [==============================] - 11s 20ms/step - loss: 0.7771 - mae: 0.6643 - val\_loss: 0.7891 - val\_mae: 0.6466 - lr: 5.0000e-04

Epoch 13/100

534/534 [==============================] - 10s 20ms/step - loss: 0.7573 - mae: 0.6540 - val\_loss: 0.5773 - val\_mae: 0.5601 - lr: 5.0000e-04

Epoch 14/100

534/534 [==============================] - 10s 19ms/step - loss: 0.7397 - mae: 0.6484 - val\_loss: 0.5656 - val\_mae: 0.5579 - lr: 5.0000e-04

Epoch 15/100

534/534 [==============================] - 10s 19ms/step - loss: 0.7238 - mae: 0.6421 - val\_loss: 0.6708 - val\_mae: 0.6462 - lr: 5.0000e-04

Epoch 16/100

534/534 [==============================] - 10s 19ms/step - loss: 0.7058 - mae: 0.6341 - val\_loss: 0.5823 - val\_mae: 0.5806 - lr: 5.0000e-04

Epoch 17/100

534/534 [==============================] - 10s 19ms/step - loss: 0.6943 - mae: 0.6282 - val\_loss: 0.5644 - val\_mae: 0.5678 - lr: 5.0000e-04

Epoch 18/100

534/534 [==============================] - 10s 19ms/step - loss: 0.6797 - mae: 0.6207 - val\_loss: 0.5859 - val\_mae: 0.5813 - lr: 5.0000e-04

Epoch 19/100

534/534 [==============================] - 10s 20ms/step - loss: 0.6795 - mae: 0.6213 - val\_loss: 0.6871 - val\_mae: 0.6543 - lr: 5.0000e-04

Epoch 20/100

534/534 [==============================] - 10s 19ms/step - loss: 0.6738 - mae: 0.6181 - val\_loss: 0.6681 - val\_mae: 0.6422 - lr: 5.0000e-04

Epoch 21/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6646 - mae: 0.6127 - val\_loss: 0.6731 - val\_mae: 0.6473 - lr: 5.0000e-04

Epoch 22/100

534/534 [==============================] - 10s 20ms/step - loss: 0.6585 - mae: 0.6107 - val\_loss: 0.6518 - val\_mae: 0.6345 - lr: 5.0000e-04

Epoch 23/100

534/534 [==============================] - 10s 20ms/step - loss: 0.6364 - mae: 0.5994 - val\_loss: 0.5194 - val\_mae: 0.5409 - lr: 5.0000e-05

Epoch 24/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6309 - mae: 0.5976 - val\_loss: 0.5154 - val\_mae: 0.5375 - lr: 5.0000e-05

Epoch 25/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6263 - mae: 0.5952 - val\_loss: 0.5220 - val\_mae: 0.5442 - lr: 5.0000e-05

Epoch 26/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6293 - mae: 0.5964 - val\_loss: 0.5189 - val\_mae: 0.5406 - lr: 5.0000e-05

Epoch 27/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6231 - mae: 0.5941 - val\_loss: 0.5116 - val\_mae: 0.5340 - lr: 5.0000e-05

Epoch 28/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6197 - mae: 0.5923 - val\_loss: 0.5149 - val\_mae: 0.5380 - lr: 5.0000e-05

Epoch 29/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6237 - mae: 0.5945 - val\_loss: 0.5207 - val\_mae: 0.5457 - lr: 5.0000e-05

Epoch 30/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6185 - mae: 0.5918 - val\_loss: 0.5141 - val\_mae: 0.5403 - lr: 5.0000e-05

Epoch 31/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6178 - mae: 0.5916 - val\_loss: 0.5099 - val\_mae: 0.5370 - lr: 5.0000e-05

Epoch 32/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6180 - mae: 0.5919 - val\_loss: 0.5047 - val\_mae: 0.5297 - lr: 5.0000e-05

Epoch 33/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6166 - mae: 0.5907 - val\_loss: 0.5026 - val\_mae: 0.5273 - lr: 5.0000e-05

Epoch 34/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6146 - mae: 0.5900 - val\_loss: 0.5008 - val\_mae: 0.5317 - lr: 5.0000e-05

Epoch 35/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6135 - mae: 0.5901 - val\_loss: 0.5019 - val\_mae: 0.5309 - lr: 5.0000e-05

Epoch 36/100

534/534 [==============================] - 10s 20ms/step - loss: 0.6137 - mae: 0.5895 - val\_loss: 0.5003 - val\_mae: 0.5279 - lr: 5.0000e-05

Epoch 37/100

534/534 [==============================] - 10s 19ms/step - loss: 0.6119 - mae: 0.5885 - val\_loss: 0.5027 - val\_mae: 0.5321 - lr: 5.0000e-05

Epoch 38/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6118 - mae: 0.5892 - val\_loss: 0.5017 - val\_mae: 0.5313 - lr: 5.0000e-05

Epoch 39/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6105 - mae: 0.5879 - val\_loss: 0.4997 - val\_mae: 0.5289 - lr: 5.0000e-05

Epoch 40/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6090 - mae: 0.5879 - val\_loss: 0.4974 - val\_mae: 0.5241 - lr: 5.0000e-05

Epoch 41/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6090 - mae: 0.5875 - val\_loss: 0.5028 - val\_mae: 0.5335 - lr: 5.0000e-05

Epoch 42/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6078 - mae: 0.5862 - val\_loss: 0.4975 - val\_mae: 0.5258 - lr: 5.0000e-05

Epoch 43/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6076 - mae: 0.5870 - val\_loss: 0.4973 - val\_mae: 0.5271 - lr: 5.0000e-05

Epoch 44/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6086 - mae: 0.5877 - val\_loss: 0.4982 - val\_mae: 0.5259 - lr: 5.0000e-05

Epoch 45/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6070 - mae: 0.5860 - val\_loss: 0.5555 - val\_mae: 0.5792 - lr: 5.0000e-05

Epoch 46/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6045 - mae: 0.5851 - val\_loss: 0.4992 - val\_mae: 0.5320 - lr: 5.0000e-05

Epoch 47/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6061 - mae: 0.5862 - val\_loss: 0.4972 - val\_mae: 0.5260 - lr: 5.0000e-05

Epoch 48/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6039 - mae: 0.5852 - val\_loss: 0.4969 - val\_mae: 0.5254 - lr: 5.0000e-05

Epoch 49/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6016 - mae: 0.5840 - val\_loss: 0.5014 - val\_mae: 0.5341 - lr: 5.0000e-05

Epoch 50/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6030 - mae: 0.5841 - val\_loss: 0.5088 - val\_mae: 0.5419 - lr: 5.0000e-05

Epoch 51/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6019 - mae: 0.5833 - val\_loss: 0.5005 - val\_mae: 0.5342 - lr: 5.0000e-05

Epoch 52/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6062 - mae: 0.5862 - val\_loss: 0.5535 - val\_mae: 0.5797 - lr: 5.0000e-05

Epoch 53/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6037 - mae: 0.5844 - val\_loss: 0.5008 - val\_mae: 0.5356 - lr: 5.0000e-05

Epoch 54/100

534/534 [==============================] - 11s 20ms/step - loss: 0.6005 - mae: 0.5822 - val\_loss: 0.4938 - val\_mae: 0.5254 - lr: 5.0000e-06

Epoch 55/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5990 - mae: 0.5820 - val\_loss: 0.4933 - val\_mae: 0.5245 - lr: 5.0000e-06

Epoch 56/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5987 - mae: 0.5816 - val\_loss: 0.4935 - val\_mae: 0.5249 - lr: 5.0000e-06

Epoch 57/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5974 - mae: 0.5821 - val\_loss: 0.4933 - val\_mae: 0.5244 - lr: 5.0000e-06

Epoch 58/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5980 - mae: 0.5816 - val\_loss: 0.4927 - val\_mae: 0.5235 - lr: 5.0000e-06

Epoch 59/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5967 - mae: 0.5810 - val\_loss: 0.4927 - val\_mae: 0.5239 - lr: 5.0000e-06

Epoch 60/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5977 - mae: 0.5809 - val\_loss: 0.4931 - val\_mae: 0.5253 - lr: 5.0000e-06

Epoch 61/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5991 - mae: 0.5818 - val\_loss: 0.4926 - val\_mae: 0.5244 - lr: 5.0000e-06

Epoch 62/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5988 - mae: 0.5821 - val\_loss: 0.4930 - val\_mae: 0.5245 - lr: 5.0000e-06

Epoch 63/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5971 - mae: 0.5811 - val\_loss: 0.4924 - val\_mae: 0.5242 - lr: 5.0000e-06

Epoch 64/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5950 - mae: 0.5806 - val\_loss: 0.4925 - val\_mae: 0.5234 - lr: 5.0000e-06

Epoch 65/100

534/534 [==============================] - 13s 24ms/step - loss: 0.5984 - mae: 0.5819 - val\_loss: 0.4924 - val\_mae: 0.5232 - lr: 5.0000e-06

Epoch 66/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5959 - mae: 0.5805 - val\_loss: 0.4927 - val\_mae: 0.5243 - lr: 5.0000e-06

Epoch 67/100

534/534 [==============================] - 11s 20ms/step - loss: 0.5978 - mae: 0.5813 - val\_loss: 0.4933 - val\_mae: 0.5247 - lr: 5.0000e-06

Epoch 68/100

534/534 [==============================] - 11s 20ms/step - loss: 0.5974 - mae: 0.5817 - val\_loss: 0.4929 - val\_mae: 0.5248 - lr: 5.0000e-06

Epoch 69/100

534/534 [==============================] - 11s 20ms/step - loss: 0.5969 - mae: 0.5813 - val\_loss: 0.4921 - val\_mae: 0.5234 - lr: 1.0000e-06

Epoch 70/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5972 - mae: 0.5817 - val\_loss: 0.4926 - val\_mae: 0.5241 - lr: 1.0000e-06

Epoch 71/100

534/534 [==============================] - 11s 20ms/step - loss: 0.5976 - mae: 0.5820 - val\_loss: 0.4925 - val\_mae: 0.5237 - lr: 1.0000e-06

Epoch 72/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5962 - mae: 0.5818 - val\_loss: 0.4924 - val\_mae: 0.5238 - lr: 1.0000e-06

Epoch 73/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5996 - mae: 0.5832 - val\_loss: 0.4927 - val\_mae: 0.5238 - lr: 1.0000e-06

Epoch 74/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5986 - mae: 0.5816 - val\_loss: 0.4926 - val\_mae: 0.5236 - lr: 1.0000e-06

Epoch 75/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5978 - mae: 0.5814 - val\_loss: 0.4926 - val\_mae: 0.5240 - lr: 1.0000e-06

Epoch 76/100

534/534 [==============================] - 10s 19ms/step - loss: 0.5956 - mae: 0.5814 - val\_loss: 0.4928 - val\_mae: 0.5238 - lr: 1.0000e-06

Epoch 77/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5969 - mae: 0.5816 - val\_loss: 0.4926 - val\_mae: 0.5243 - lr: 1.0000e-06

Epoch 78/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5969 - mae: 0.5814 - val\_loss: 0.4922 - val\_mae: 0.5234 - lr: 1.0000e-06

Epoch 79/100

534/534 [==============================] - 10s 20ms/step - loss: 0.5962 - mae: 0.5812 - val\_loss: 0.4926 - val\_mae: 0.5240 - lr: 1.0000e-06