

# DSC680\_CPJP\_Prediction\_Model

January 8, 2022

```
[1]: from ipynb.fs.full.DSC680_CPJP_EDA import *
```

\*\*\*\*\* November 2000 data\*\*\*\*\*

	transaction_dt	customer_id	age_group	pin_code	product_subclass	product_id	
							↳amount asset sales_price
1	2000-11-01	00046855	D	E	110411	4710085120468	↳
	↳ 3	51	57				
2	2000-11-01	00539166	E	E	130315	4714981010038	↳
	↳ 2	56	48				
3	2000-11-01	00663373	F	E	110217	4710265847666	↳
	↳ 1	180	135				

\*\*\*\*\* December 2000 data\*\*\*\*\*

	transaction_dt	customer_id	age_group	pin_code	product_subclass	product_id	
							↳amount asset sales_price
1	2000-12-01	00207423	C	E	530101	4710054134403	↳
	↳ 1	92	99				
2	2000-12-01	00329002	F	E	590514	4710049000973	↳
	↳ 1	41	49				
3	2000-12-01	01657951	E	E	120103	4710011401135	↳
	↳ 1	23	29				

\*\*\*\*\* January 2021 data\*\*\*\*\*

	transaction_dt	customer_id	age_group	pin_code	product_subclass	product_id	
							↳amount asset sales_price

1	2001-01-01	00141833	F	F	130207	4710105011011
↪ 2	44	52				
2	2001-01-01	01376753	E	E	110217	4710265849066
↪ 1	150	129				
3	2001-01-01	01603071	E	G	100201	4712019100607
↪ 1	35	39				

\*\*\*\*\* Feb 2021 data\*\*\*\*\*

	transaction_dt	customer_id	age_group	pin_code	product_subclass	product_id
↪	amount	asset	sales_price			
1	2001-02-01	00557818	H	E	500210	4710114105046
↪ 1	123	135				
2	2001-02-01	01677683	C	B	711310	4902520163103
↪ 6	840	894				
3	2001-02-01	01900910	A	D	500206	4710036003598
↪ 1	26	33				

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 817741 entries, 0 to 817740
Data columns (total 12 columns):
```

#	Column	Non-Null Count	Dtype
0	transaction_dt	817741 non-null	datetime64[ns]
1	customer_id	817741 non-null	object
2	age_group	817741 non-null	object
3	pin_code	817741 non-null	object
4	product_subclass	817741 non-null	object
5	product_id	817741 non-null	object
6	amount	817741 non-null	object
7	asset	817741 non-null	object
8	sales_price	817741 non-null	object
9	age_label	817741 non-null	object
10	age_int	817741 non-null	int64
11	pin_code_int	817741 non-null	int64

```
dtypes: datetime64[ns](1), int64(2), object(9)
memory usage: 74.9+ MB
```

None

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 817741 entries, 0 to 817740
Data columns (total 29 columns):
```

#	Column	Non-Null Count	Dtype
0	transaction_dt	817741 non-null	datetime64[ns]

1	customer_id	817741	non-null	object
2	product_subclass	817741	non-null	int64
3	product_id	817741	non-null	int64
4	amount	817741	non-null	int64
5	asset	817741	non-null	int64
6	sales_price	817741	non-null	int64
7	age_label	817741	non-null	object
8	age_int	817741	non-null	int64
9	pin_code_int	817741	non-null	int64
10	age_group_A	817741	non-null	int32
11	age_group_B	817741	non-null	int32
12	age_group_C	817741	non-null	int32
13	age_group_D	817741	non-null	int32
14	age_group_E	817741	non-null	int32
15	age_group_F	817741	non-null	int32
16	age_group_G	817741	non-null	int32
17	age_group_H	817741	non-null	int32
18	age_group_I	817741	non-null	int32
19	age_group_J	817741	non-null	int32
20	age_group_K	817741	non-null	int32
21	pin_code_A	817741	non-null	int32
22	pin_code_B	817741	non-null	int32
23	pin_code_C	817741	non-null	int32
24	pin_code_D	817741	non-null	int32
25	pin_code_E	817741	non-null	int32
26	pin_code_F	817741	non-null	int32
27	pin_code_G	817741	non-null	int32
28	pin_code_H	817741	non-null	int32

dtypes: datetime64[ns](1), int32(19), int64(7), object(2)

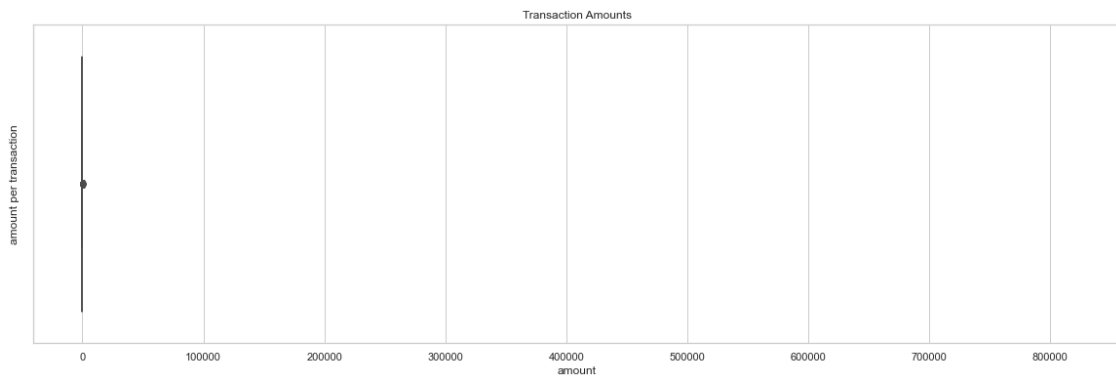
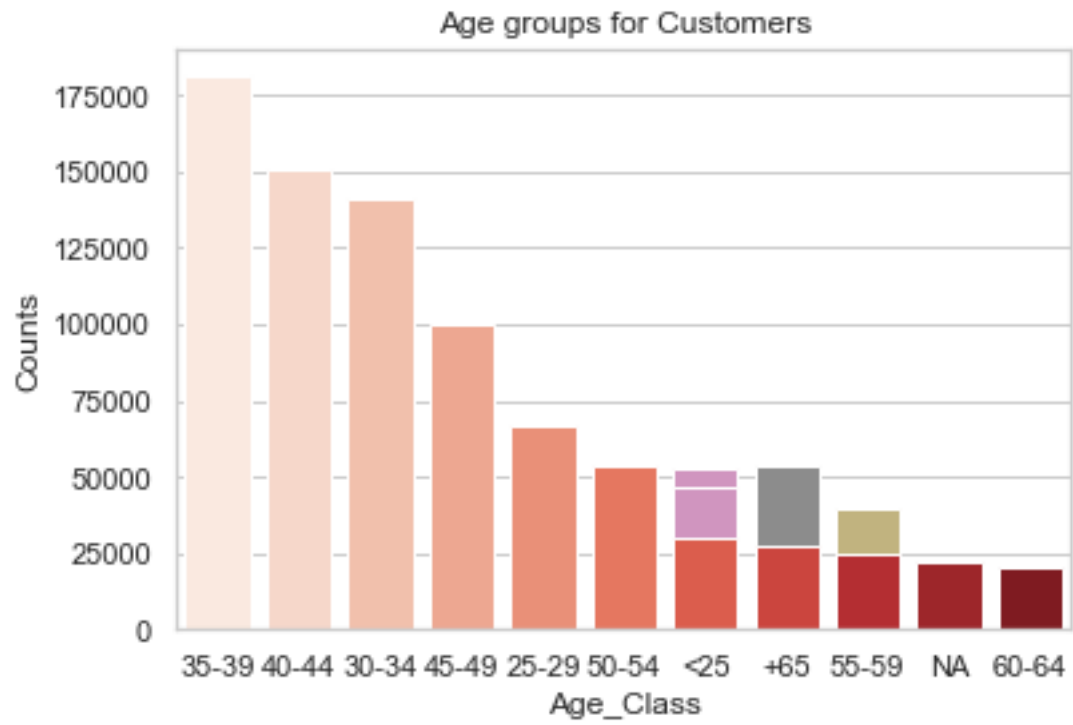
memory usage: 121.7+ MB

None

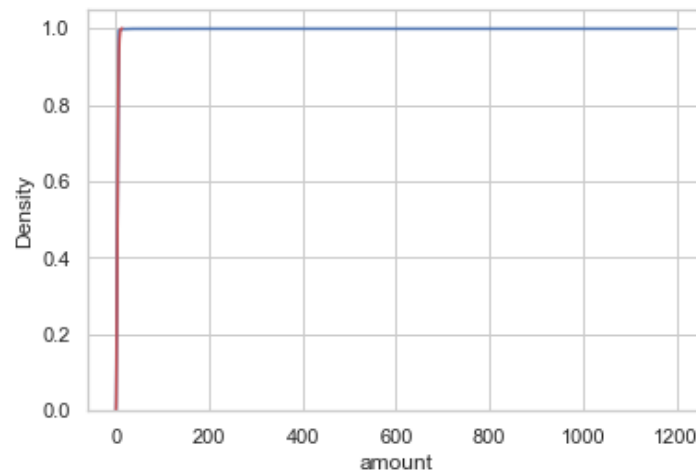
<pandas.io.formats.style.Styler at 0x1860aad87c0>

<pandas.io.formats.style.Styler at 0x1860ab25ee0>

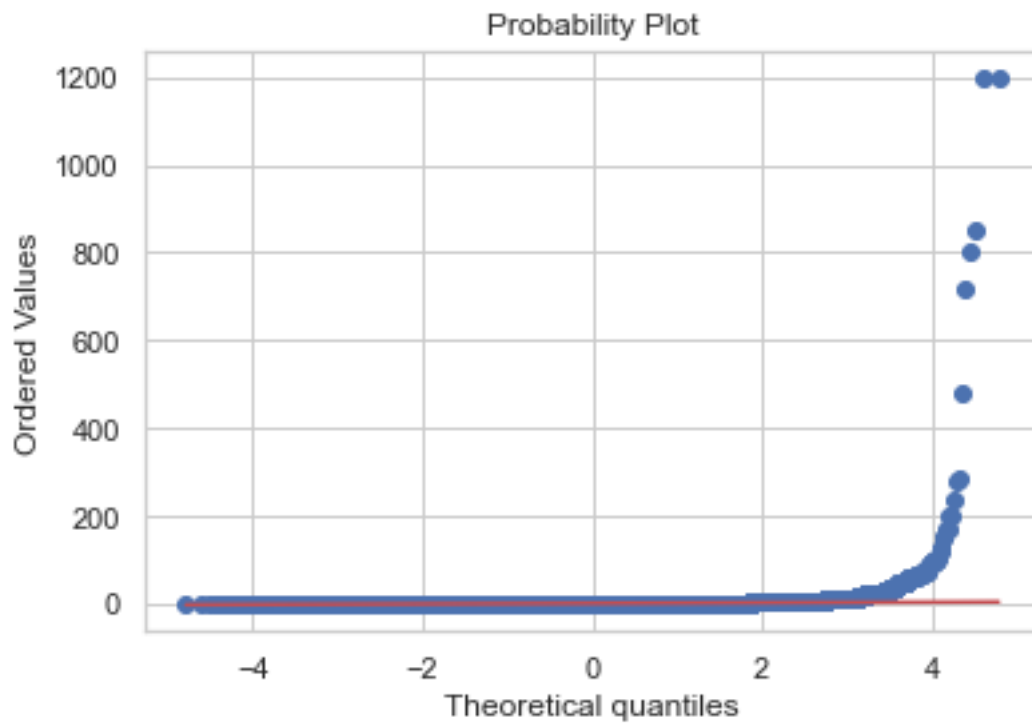
Number of Large Orders 23

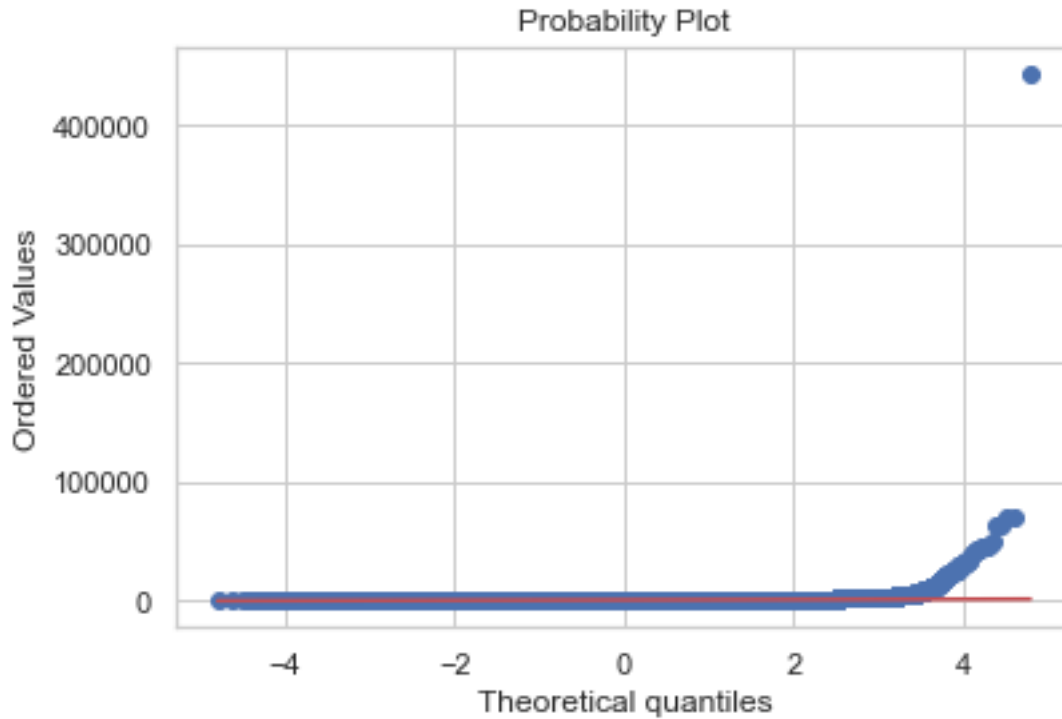


Cumulative Distribution Frequency of purchase amount Against Normal Gaussian distribution.



<Figure size 432x288 with 0 Axes>





```
test statistic: 4963437.687618293
P-value: 0.0
Conclusion: Not a normal distribution.
test statistic: 4310127.30717614
P-value: 0.0
Conclusion: Not a normal distribution.
Median: 1.0
Outer Fence: -228.0 & 402.0
Number of Strong Outliers: 34788
Median: 1.0
Inner Fence: -93.0 & 267.0
Number of Mild Outliers: 69184
```

	Recency	Frequency	Monetary	
	mean	mean	mean	count
RMF_Segment				
First segment customers	15.7	37.4	4906.3	18796
Second segment customers	59.9	9.8	1364.5	10647
Third segment customers	97.6	3.6	387.6	2823

```
[8]: #For real-valued input data types, log always returns real output
cust_data_subset['Log_Unit_Price']=np.log(cust_data_subset['unit_price'])
```

```
[9]: cust_data_subset.head()
```

```
[9]:      transaction_dt customer_id age_int product_subclass product_id
pin_code_int asset amount sales_price year month week day unit_price
Log_Unit_Price
753166 2000-11-01 02101750 3 130315 4714981010038
5 28 1 24 2000 11 44 1 24.0
3.178
787527 2000-11-01 02144511 1 110401 4710088410382
5 44 1 55 2000 11 44 1 55.0
4.007
787526 2000-11-01 02144511 1 100312 37000445111
5 38 1 47 2000 11 44 1 47.0
3.850
787525 2000-11-01 02144511 1 100205 4711372660094
5 58 1 76 2000 11 44 1 76.0
4.331
787524 2000-11-01 02144511 1 110401 4710008290032
5 46 1 57 2000 11 44 1 57.0
4.043
```

```
[10]: temp_df=cust_data_subset[['transaction_dt','customer_id','amount','unit_price','Log_Unit_Price']
temp_df['total_sum']=temp_df['amount']*temp_df['unit_price']
rmf_df=temp_df.groupby(['customer_id','transaction_dt']).sum()
# initializing frequency,recency,monetary
rmf_df['frequency']=1
rmf_df['recency']=1
rmf_df['monetary']=1
rmf_df.head(5)
```

```
[10]:      amount unit_price Log_Unit_Price total_sum
frequency recency monetary
customer_id transaction_dt
00001069 2000-11-13 2 187.000 9.074 187.0 1
1 1
2001-01-21 3 971.000 17.193 971.0 1
1 1
2001-02-03 9 283.000 19.490 496.0 1
1 1
2001-02-10 2 145.000 4.977 290.0 1
1 1
00001113 2000-11-12 5 144.833 7.544 420.0 1
1 1
```

```
[11]: #Identify lower transaction date
transaction_dt_min=cust_data.transaction_dt.min()

#function to calculate difference in days
def diff_days(start_day,end_day):
```

```

delta = start_day - end_day
return delta.days

```

```

[12]: counter_idx=[0]
recency=[]
frequency=[]
monetary=[]
summer_mt=0
counter=0

for i in range(len(rmf_df.index)):
    customer_id=rmf_df.index[i][0]
    transaction_dt=rmf_df.index[i][1].date()
    counter_idx.append(customer_id)
    counter+=1
    summer_mt+=rmf_df.total_sum.values[i]
    if counter_idx[-2]!=customer_id:
        counter=1
        frequency.append(counter)
        start_date=transaction_dt_min.date()
        end_date=transaction_dt
        recency.append(diff_days(start_date,end_date))
        summer_mt=rmf_df.total_sum.values[i]
        monetary.append(summer_mt)
    else:
        start_date=rmf_df.index[i-1][1].date()
        end_date=transaction_dt
        recency.append(diff_days(start_date,end_date))
        frequency.append(counter)
        monetary.append(summer_mt)

rmf_df['recency']=recency
rmf_df['monetary']=monetary
rmf_df['frequency']=frequency
rmf_df_reset=rmf_df.reset_index()
rmf_df_reset.head(10)

```

```

[12]:  customer_id transaction_dt  amount  unit_price  Log_Unit_Price  total_sum
frequency recency  monetary
0  00001069  2000-11-13      2      187.000      9.074      187.0
1      -12      187.0
1  00001069  2001-01-21      3      971.000     17.193     971.0
2      -69     1158.0
2  00001069  2001-02-03      9      283.000     19.490     496.0
3      -13     1654.0
3  00001069  2001-02-10      2      145.000      4.977     290.0
4      -7     1944.0

```



4	00001113	2000-11-12	5	144.833	7.544	420.0
1	-11	420.0				
5	00001113	2000-11-26	3	558.000	15.488	558.0
2	-14	978.0				
6	00001113	2000-11-27	6	624.000	26.221	624.0
3	-1	1602.0				
7	00001113	2001-01-06	9	544.000	28.356	628.0
4	-40	2230.0				
8	00001250	2001-02-04	5	685.000	19.810	734.0
1	-95	734.0				
9	00001250	2001-02-10	13	792.000	38.402	849.0
2	-6	1583.0				

```
[13]: rmf_df_reset['year'],rmf_df_reset['month'],rmf_df_reset['week'],rmf_df_reset['day']=get_date_i
```

```
[14]: #This dictionary codes the weeks from week of the year (52 weeks) to the week
      ↪from entry into the dataset to end
      wk_dict_int = {44:0, 45:1, 46:2, 47:3, 48:4, \
                     49:5, 50:6, 51:7, 52:8, 1:9, 2:10 , 3:11 , 4:12, 5:13 ,6:14 ,7:15,8:
      ↪16,9:17}
```

```
[15]: rmf_df_reset=rmf_df_reset.sort_values(by=['transaction_dt','customer_id']).
      ↪reset_index(drop=True)
      rmf_df_reset['week_number'] = rmf_df_reset['week'].apply(lambda x:
      ↪wk_dict_int[x])
      rmf_df_reset=rmf_df_reset.drop('week',axis=1)
      rmf_df_reset=rmf_df_reset.sort_values(by=['customer_id','week_number'])
      rmf_df_reset['age_int'] = rmf_df_reset['customer_id'].apply(lambda x:
      ↪age_map[x])
      rmf_df_reset['pin_code_int'] = rmf_df_reset['customer_id'].apply(lambda x:
      ↪pin_map[x])
```

```
[16]: final_rmf_df=rmf_df_reset[['transaction_dt','customer_id','week_number','amount','total_sum',
      comp_fr=(final_rmf_df['frequency']>1)
      print('Average Frequency:',round(final_rmf_df[comp_fr].frequency.mean()))
      print('Average Week Number:',round(final_rmf_df[comp_fr].week_number.mean()))
      round(final_rmf_df[comp_fr].week_number.value_counts())
```

Average Frequency: 7

Average Week Number: 10

```
[16]: 16      8084
      11      7827
      15      6363
      14      6339
      13      6024
      6      5981
```

```

12    5677
10    5601
5     5183
4     5135
8     5108
3     4885
9     3526
2     3463
1     3167
17    2834
7     1329
0      786
Name: week_number, dtype: int64

```

observation: We can see weeks 16 and 11 have the most transactions; also most customers have made around 6 purchases in the 4 month period of time

Next steps: I will be restricting the independent features to values prior to week 16 and the dependant features to weeks 16 or 17. The intention is to use the transactions in the first 15 weeks to predict transactions within the last two weeks.

```
[17]: final_rmf_df.head(5)
```

```

[17]:      transaction_dt customer_id week_number amount total_sum frequency
recency  monetary  age_int  pin_code_int unit_price  Log_Unit_Price
13176    2000-11-13      00001069         2         2        187.0         1
-12      187.0      11          5        187.000         9.074
77139    2001-01-21      00001069        11         3        971.0         2
-69      1158.0     11          5        971.000        17.193
90033    2001-02-03      00001069        13         9        496.0         3
-13      1654.0     11          5        283.000        19.490
97470    2001-02-10      00001069        14         2        290.0         4
-7       1944.0     11          5        145.000         4.977
11523    2000-11-12      00001113         1         5        420.0         1
-11       420.0     11          6        144.833         7.544

```

```

[18]: #Fetch final week data based on the observation that this week contains more
      ↳ transactions
feature_df=((final_rmf_df['week_number']<=15) & (final_rmf_df['frequency']>1))
X_set=final_rmf_df[feature_df]
#Fetch previous transactions for dependent features
feature_df=((final_rmf_df['week_number']==16) |
      ↳ (final_rmf_df['week_number']==17) & (final_rmf_df['frequency']>1))
y_set=final_rmf_df[feature_df]

```

```

[19]: #for regression the independent values need to have a matching customer ID in
      ↳ the dependent values.
y_id_list=sorted(list(y_set.customer_id.unique()))

```

```
[20]: X_set=X_set.loc[X_set['customer_id'].isin(y_id_list)]#have to be represented in
      ↪final week
X_set=X_set[X_set.groupby('customer_id')['transaction_dt'].rank() == 1].
      ↪reset_index()
X_set.head(5)
ind=X_set.index
num_rows=len(ind)
print(num_rows)
print(X_set.head(5))
```

6670

	index	transaction_dt	customer_id	week_number	amount	total_sum	frequency
recency	monetary	age_int	pin_code_int	unit_price	Log_Unit_Price		
0	62438	2001-01-07	00005241	9	19	931.0	2
-22	1256.0	4	6	616.0	37.835		
1	24296	2000-11-25	00006668	3	11	873.0	2
-14	1305.0	4	5	835.0	33.562		
2	5116	2000-11-06	00010801	1	5	574.0	2
-2	663.0	4	5	574.0	23.360		
3	20945	2000-11-22	00011235	3	6	425.0	2
-8	1331.0	11	6	425.0	24.638		
4	42565	2000-12-11	00011914	6	13	1266.0	2
-8	1723.0	4	1	1113.0	44.232		

```
[21]: X_set=X_set.sort_values(by=['customer_id'])#sort by id
X_set=X_set.reset_index(drop=True)
print('number of unique customer ids:',len(set(list(X_set.
      ↪customer_id))),'\nlength of the dataset:',len(X_set))
X_set.head()
```

number of unique customer ids: 6670

length of the dataset: 6670

```
[21]: index transaction_dt customer_id week_number amount total_sum frequency
recency monetary age_int pin_code_int unit_price Log_Unit_Price
```

0	62438	2001-01-07	00005241	9	19	931.0	2
-22	1256.0	4	6	616.0	37.835		
1	24296	2000-11-25	00006668	3	11	873.0	2
-14	1305.0	4	5	835.0	33.562		
2	5116	2000-11-06	00010801	1	5	574.0	2
-2	663.0	4	5	574.0	23.360		
3	20945	2000-11-22	00011235	3	6	425.0	2
-8	1331.0	11	6	425.0	24.638		
4	42565	2000-12-11	00011914	6	13	1266.0	2
-8	1723.0	4	1	1113.0	44.232		

```
[22]: X_set_list=sorted(list(X_set.customer_id.unique()))#get list of unique ids from
      ↪those represented in the last month
```

```
y_set=y_set.loc[y_set['customer_id'].isin(X_set_list)]#return only individuals
↳who made a purchase in the prior month
```

```
[23]: y_set=y_set[y_set.groupby('customer_id')['transaction_dt'].rank() == 1].
↳reset_index()
y_set=y_set.sort_values(by=['customer_id'])
y_set=y_set.reset_index(drop=True)
print('number of unique customer ids:',len(set(list(y_set.
↳customer_id))),'\nlength of the dataset:',len(y_set))
y_set.head()
```

```
number of unique customer ids: 6670
length of the dataset: 6670
```

```
[23]:      index transaction_dt customer_id week_number amount total_sum frequency
recency monetary age_int pin_code_int unit_price Log_Unit_Price
0  107300  2001-02-19      00005241      16          6        315.0          4
-34      3396.0      4          6      267.0      19.792
1  111018  2001-02-22      00006668      16          2        193.0         10
-5      5099.0      4          5      193.0      9.102
2  107301  2001-02-19      00010801      16          4        161.0         15
-7      7045.0      4          5      161.0     14.655
3  117403  2001-02-27      00011235      17          7       1157.0          5
-10     4209.0     11          6      972.0     29.231
4  118286  2001-02-28      00011914      17          4        276.0          5
-53     2616.0      4          1      138.0      8.380
```

```
[24]: X_set_df=X_set[['customer_id', 'week_number', 'amount', 'total_sum',
↳'age_int', 'pin_code_int', 'unit_price', 'Log_Unit_Price', 'frequency',
↳'recency', 'monetary']]#reduce Xset
y_set_df=y_set[['customer_id', 'frequency', 'recency', 'monetary']]#reduce yset
```

```
[25]: X_set_df.head(3)
```

```
[25]:      customer_id week_number amount total_sum age_int pin_code_int unit_price
Log_Unit_Price frequency recency monetary
0  00005241      9      19      931.0      4          6        616.0
37.835      2     -22     1256.0
1  00006668      3      11      873.0      4          5        835.0
33.562      2     -14     1305.0
2  00010801      1          5      574.0      4          5        574.0
23.360      2     -2      663.0
```

```
[26]: # Splits the records into two parts part 1 contains Customer ID all other
↳fields in part 2
def return_pair(df,indexer=0):
    data=df.iloc[indexer]
    x=[]
```

```

part1=list(map(int,list(data.iloc[0])))
part2=list(data.iloc[1:])
x.extend(part1)
x.extend(part2)
x=np.array(x)
return x
X_set=np.array([return_pair(X_set_df,i) for i in range(0,len(X_set_df))])

```

```
[27]: y_set=np.array([return_pair(y_set_df,i) for i in range(0,len(y_set_df))])
```

```
[28]: n_orig_size=len(X_set)
n_train_percent = round(n_orig_size*.2)
print('Original size:',n_orig_size,'\n20 Percent of size:',n_train_percent)
```

```

Original size: 6670
20 Percent of size: 1334

```

```
[29]: train_X=X_set[n_train_percent:,:]
train_y=y_set[n_train_percent:,:]
test_X=X_set[:n_train_percent, :]
test_y=y_set[:n_train_percent, :]
```

```
[30]: train_X.shape,test_X.shape
```

```
[30]: ((5336, 18), (1334, 18))
```

```
[31]: train_y.shape,test_y.shape
```

```
[31]: ((5336, 11), (1334, 11))
```

```
[32]: from sklearn.preprocessing import MinMaxScaler
scaler_y = MinMaxScaler(feature_range=(0, 1))
train_y = scaler_y.fit_transform(train_y)
test_y = scaler_y.fit_transform(test_y)
```

```
[33]: scaler_x = MinMaxScaler(feature_range=(0, 1))
rescaled_x_train = scaler_x.fit_transform(train_X)
rescaled_x_test = scaler_x.fit_transform(test_X)
```

```
[34]: # reshape input to be 3D [samples, timesteps, features]
train_X = rescaled_x_train.reshape((rescaled_x_train.shape[0], 1,
    ↳rescaled_x_train.shape[1]))
test_X = rescaled_x_test.reshape((rescaled_x_test.shape[0], 1, rescaled_x_test.
    ↳shape[1]))
print('train_X',train_X.shape,'\ntrain_y', train_y.shape,'\ntest_X', test_X.
    ↳shape,'\ntest_y', test_y.shape)
```

```

train_X (5336, 1, 18)
train_y (5336, 11)

```

```
test_X (1334, 1, 18)
test_y (1334, 11)
```

```
[35]: from keras.models import Sequential
      from keras.layers import SimpleRNN
      from keras.layers import Input, Dense, Dropout, LSTM
      from keras import regularizers
      epochs = 1000
      learning_rate = 0.001
      model = Sequential()
      model.add(SimpleRNN(11,activation='relu',input_shape=(train_X.shape[1], train_X.
        ↳shape[2])))
      model.add(Dense(250,kernel_initializer='random_uniform',
        ↳activity_regularizer=regularizers.l1(0.0001)))
      model.add(Dense(11))
      model.compile(loss='mse', optimizer='adam', metrics=['mae', 'acc'])
      model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
simple_rnn (SimpleRNN)	(None, 11)	330
dense (Dense)	(None, 250)	3000
dense_1 (Dense)	(None, 11)	2761

```
=====
Total params: 6,091
Trainable params: 6,091
Non-trainable params: 0
=====
```

```
[36]: # fit network
      RNN_classifier = model.fit(train_X, train_y, epochs=epochs, batch_size=120,
        ↳validation_data=(test_X, test_y), validation_split=0.3, verbose=1,
        ↳shuffle=True)
```

```
Epoch 1/1000
32/32 [=====] - 1s 8ms/step - loss: 0.1059 - mae:
0.2305 - acc: 0.2967 - val_loss: 0.0914 - val_mae: 0.2178 - val_acc: 0.0000e+00
Epoch 2/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0407 - mae:
0.1449 - acc: 0.3261 - val_loss: 0.0638 - val_mae: 0.1762 - val_acc: 6.2461e-04
Epoch 3/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0250 - mae:
0.1081 - acc: 0.4316 - val_loss: 0.0407 - val_mae: 0.1364 - val_acc: 0.0194
```

Epoch 4/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0163 - mae: 0.0823 - acc: 0.5269 - val\_loss: 0.0257 - val\_mae: 0.1064 - val\_acc: 0.2005  
Epoch 5/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0122 - mae: 0.0674 - acc: 0.5874 - val\_loss: 0.0182 - val\_mae: 0.0851 - val\_acc: 0.4016  
Epoch 6/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0099 - mae: 0.0577 - acc: 0.6295 - val\_loss: 0.0142 - val\_mae: 0.0729 - val\_acc: 0.5016  
Epoch 7/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0085 - mae: 0.0514 - acc: 0.6514 - val\_loss: 0.0127 - val\_mae: 0.0654 - val\_acc: 0.4747  
Epoch 8/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0075 - mae: 0.0467 - acc: 0.6632 - val\_loss: 0.0110 - val\_mae: 0.0603 - val\_acc: 0.5640  
Epoch 9/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0069 - mae: 0.0430 - acc: 0.6771 - val\_loss: 0.0103 - val\_mae: 0.0543 - val\_acc: 0.5946  
Epoch 10/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0064 - mae: 0.0398 - acc: 0.6846 - val\_loss: 0.0095 - val\_mae: 0.0515 - val\_acc: 0.6521  
Epoch 11/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0060 - mae: 0.0369 - acc: 0.6908 - val\_loss: 0.0089 - val\_mae: 0.0501 - val\_acc: 0.6814  
Epoch 12/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0058 - mae: 0.0351 - acc: 0.6964 - val\_loss: 0.0083 - val\_mae: 0.0456 - val\_acc: 0.7196  
Epoch 13/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0056 - mae: 0.0331 - acc: 0.7063 - val\_loss: 0.0081 - val\_mae: 0.0437 - val\_acc: 0.6877  
Epoch 14/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0055 - mae: 0.0316 - acc: 0.7041 - val\_loss: 0.0081 - val\_mae: 0.0419 - val\_acc: 0.6827  
Epoch 15/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0053 - mae: 0.0303 - acc: 0.7036 - val\_loss: 0.0077 - val\_mae: 0.0410 - val\_acc: 0.6821  
Epoch 16/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0052 - mae: 0.0296 - acc: 0.7092 - val\_loss: 0.0075 - val\_mae: 0.0393 - val\_acc: 0.7789  
Epoch 17/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0051 - mae: 0.0283 - acc: 0.7100 - val\_loss: 0.0074 - val\_mae: 0.0392 - val\_acc: 0.7014  
Epoch 18/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0051 - mae: 0.0281 - acc: 0.7076 - val\_loss: 0.0073 - val\_mae: 0.0383 - val\_acc: 0.6515  
Epoch 19/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0051 - mae: 0.0276 - acc: 0.7074 - val\_loss: 0.0071 - val\_mae: 0.0367 - val\_acc: 0.7402

Epoch 20/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0050 - mae: 0.0268 - acc: 0.7100 - val\_loss: 0.0071 - val\_mae: 0.0351 - val\_acc: 0.6621  
Epoch 21/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0049 - mae: 0.0263 - acc: 0.7178 - val\_loss: 0.0071 - val\_mae: 0.0363 - val\_acc: 0.7764  
Epoch 22/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0049 - mae: 0.0258 - acc: 0.7178 - val\_loss: 0.0069 - val\_mae: 0.0346 - val\_acc: 0.6877  
Epoch 23/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0048 - mae: 0.0253 - acc: 0.7114 - val\_loss: 0.0068 - val\_mae: 0.0339 - val\_acc: 0.7427  
Epoch 24/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0048 - mae: 0.0247 - acc: 0.7162 - val\_loss: 0.0068 - val\_mae: 0.0344 - val\_acc: 0.6827  
Epoch 25/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0048 - mae: 0.0252 - acc: 0.7084 - val\_loss: 0.0071 - val\_mae: 0.0348 - val\_acc: 0.7845  
Epoch 26/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0047 - mae: 0.0242 - acc: 0.7162 - val\_loss: 0.0068 - val\_mae: 0.0349 - val\_acc: 0.7264  
Epoch 27/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0047 - mae: 0.0245 - acc: 0.7151 - val\_loss: 0.0068 - val\_mae: 0.0343 - val\_acc: 0.7233  
Epoch 28/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0048 - mae: 0.0248 - acc: 0.7071 - val\_loss: 0.0068 - val\_mae: 0.0320 - val\_acc: 0.6921  
Epoch 29/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0047 - mae: 0.0239 - acc: 0.7186 - val\_loss: 0.0068 - val\_mae: 0.0312 - val\_acc: 0.6452  
Epoch 30/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0047 - mae: 0.0237 - acc: 0.7205 - val\_loss: 0.0065 - val\_mae: 0.0314 - val\_acc: 0.7089  
Epoch 31/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0046 - mae: 0.0238 - acc: 0.7154 - val\_loss: 0.0065 - val\_mae: 0.0299 - val\_acc: 0.7570  
Epoch 32/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0046 - mae: 0.0233 - acc: 0.7234 - val\_loss: 0.0064 - val\_mae: 0.0300 - val\_acc: 0.7820  
Epoch 33/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0046 - mae: 0.0226 - acc: 0.7159 - val\_loss: 0.0066 - val\_mae: 0.0291 - val\_acc: 0.7914  
Epoch 34/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0047 - mae: 0.0234 - acc: 0.7237 - val\_loss: 0.0067 - val\_mae: 0.0310 - val\_acc: 0.7589  
Epoch 35/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0047 - mae: 0.0240 - acc: 0.7141 - val\_loss: 0.0064 - val\_mae: 0.0307 - val\_acc: 0.7233



Epoch 36/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0046 - mae:  
0.0228 - acc: 0.7178 - val\_loss: 0.0063 - val\_mae: 0.0313 - val\_acc: 0.7102  
Epoch 37/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0235 - acc: 0.7229 - val\_loss: 0.0067 - val\_mae: 0.0301 - val\_acc: 0.7533  
Epoch 38/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0223 - acc: 0.7229 - val\_loss: 0.0064 - val\_mae: 0.0295 - val\_acc: 0.8007  
Epoch 39/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0226 - acc: 0.7221 - val\_loss: 0.0063 - val\_mae: 0.0314 - val\_acc: 0.6565  
Epoch 40/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0232 - acc: 0.7178 - val\_loss: 0.0063 - val\_mae: 0.0300 - val\_acc: 0.8426  
Epoch 41/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0231 - acc: 0.7149 - val\_loss: 0.0062 - val\_mae: 0.0299 - val\_acc: 0.8164  
Epoch 42/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0222 - acc: 0.7186 - val\_loss: 0.0064 - val\_mae: 0.0311 - val\_acc: 0.8688  
Epoch 43/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0046 - mae:  
0.0236 - acc: 0.7122 - val\_loss: 0.0062 - val\_mae: 0.0297 - val\_acc: 0.6721  
Epoch 44/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0236 - acc: 0.7114 - val\_loss: 0.0062 - val\_mae: 0.0297 - val\_acc: 0.8470  
Epoch 45/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0046 - mae:  
0.0236 - acc: 0.7189 - val\_loss: 0.0061 - val\_mae: 0.0298 - val\_acc: 0.7102  
Epoch 46/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0238 - acc: 0.7127 - val\_loss: 0.0064 - val\_mae: 0.0351 - val\_acc: 0.6889  
Epoch 47/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0247 - acc: 0.7157 - val\_loss: 0.0062 - val\_mae: 0.0309 - val\_acc: 0.7314  
Epoch 48/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae:  
0.0228 - acc: 0.7242 - val\_loss: 0.0061 - val\_mae: 0.0286 - val\_acc: 0.7127  
Epoch 49/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae:  
0.0221 - acc: 0.7226 - val\_loss: 0.0062 - val\_mae: 0.0278 - val\_acc: 0.6334  
Epoch 50/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae:  
0.0233 - acc: 0.7237 - val\_loss: 0.0062 - val\_mae: 0.0301 - val\_acc: 0.8032  
Epoch 51/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae:  
0.0235 - acc: 0.7189 - val\_loss: 0.0061 - val\_mae: 0.0296 - val\_acc: 0.8082

Epoch 52/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0226 - acc: 0.7157 - val\_loss: 0.0061 - val\_mae: 0.0298 - val\_acc: 0.6596  
Epoch 53/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0221 - acc: 0.7258 - val\_loss: 0.0062 - val\_mae: 0.0291 - val\_acc: 0.7533  
Epoch 54/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae: 0.0251 - acc: 0.7170 - val\_loss: 0.0061 - val\_mae: 0.0306 - val\_acc: 0.6615  
Epoch 55/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0045 - mae: 0.0244 - acc: 0.7213 - val\_loss: 0.0060 - val\_mae: 0.0282 - val\_acc: 0.6246  
Epoch 56/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0215 - acc: 0.7234 - val\_loss: 0.0062 - val\_mae: 0.0285 - val\_acc: 0.7171  
Epoch 57/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0230 - acc: 0.7234 - val\_loss: 0.0060 - val\_mae: 0.0289 - val\_acc: 0.9300  
Epoch 58/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0227 - acc: 0.7197 - val\_loss: 0.0061 - val\_mae: 0.0292 - val\_acc: 0.7264  
Epoch 59/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0224 - acc: 0.7175 - val\_loss: 0.0064 - val\_mae: 0.0289 - val\_acc: 0.7295  
Epoch 60/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0235 - acc: 0.7151 - val\_loss: 0.0061 - val\_mae: 0.0322 - val\_acc: 0.7270  
Epoch 61/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0238 - acc: 0.7258 - val\_loss: 0.0060 - val\_mae: 0.0276 - val\_acc: 0.6102  
Epoch 62/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0215 - acc: 0.7213 - val\_loss: 0.0060 - val\_mae: 0.0274 - val\_acc: 0.8082  
Epoch 63/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0240 - acc: 0.7266 - val\_loss: 0.0062 - val\_mae: 0.0289 - val\_acc: 0.7489  
Epoch 64/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0235 - acc: 0.7106 - val\_loss: 0.0063 - val\_mae: 0.0269 - val\_acc: 0.8089  
Epoch 65/1000  
32/32 [=====] - 0s 3ms/step - loss: 0.0043 - mae: 0.0223 - acc: 0.7199 - val\_loss: 0.0060 - val\_mae: 0.0266 - val\_acc: 0.7951  
Epoch 66/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0215 - acc: 0.7253 - val\_loss: 0.0064 - val\_mae: 0.0280 - val\_acc: 0.7608  
Epoch 67/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0237 - acc: 0.7170 - val\_loss: 0.0059 - val\_mae: 0.0279 - val\_acc: 0.8451

Epoch 68/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0243 - acc: 0.7242 - val\_loss: 0.0060 - val\_mae: 0.0312 - val\_acc: 0.8095  
Epoch 69/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0222 - acc: 0.7240 - val\_loss: 0.0058 - val\_mae: 0.0265 - val\_acc: 0.7964  
Epoch 70/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0220 - acc: 0.7277 - val\_loss: 0.0060 - val\_mae: 0.0294 - val\_acc: 0.7908  
Epoch 71/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0227 - acc: 0.7154 - val\_loss: 0.0059 - val\_mae: 0.0305 - val\_acc: 0.7701  
Epoch 72/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0227 - acc: 0.7173 - val\_loss: 0.0060 - val\_mae: 0.0268 - val\_acc: 0.8526  
Epoch 73/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0044 - mae: 0.0230 - acc: 0.7124 - val\_loss: 0.0059 - val\_mae: 0.0273 - val\_acc: 0.7914  
Epoch 74/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0222 - acc: 0.7237 - val\_loss: 0.0059 - val\_mae: 0.0269 - val\_acc: 0.7339  
Epoch 75/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0234 - acc: 0.7130 - val\_loss: 0.0063 - val\_mae: 0.0333 - val\_acc: 0.6977  
Epoch 76/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0250 - acc: 0.7133 - val\_loss: 0.0061 - val\_mae: 0.0260 - val\_acc: 0.7620  
Epoch 77/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0227 - acc: 0.7178 - val\_loss: 0.0060 - val\_mae: 0.0274 - val\_acc: 0.7933  
Epoch 78/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0216 - acc: 0.7226 - val\_loss: 0.0059 - val\_mae: 0.0289 - val\_acc: 0.7620  
Epoch 79/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0217 - acc: 0.7234 - val\_loss: 0.0059 - val\_mae: 0.0306 - val\_acc: 0.8014  
Epoch 80/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0216 - acc: 0.7197 - val\_loss: 0.0059 - val\_mae: 0.0298 - val\_acc: 0.7858  
Epoch 81/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0231 - acc: 0.7226 - val\_loss: 0.0059 - val\_mae: 0.0265 - val\_acc: 0.7464  
Epoch 82/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0228 - acc: 0.7183 - val\_loss: 0.0060 - val\_mae: 0.0268 - val\_acc: 0.7733  
Epoch 83/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0215 - acc: 0.7202 - val\_loss: 0.0059 - val\_mae: 0.0288 - val\_acc: 0.7520

Epoch 84/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0216 - acc: 0.7216 - val\_loss: 0.0060 - val\_mae: 0.0269 - val\_acc: 0.7452  
Epoch 85/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0227 - acc: 0.7191 - val\_loss: 0.0058 - val\_mae: 0.0292 - val\_acc: 0.7389  
Epoch 86/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0219 - acc: 0.7253 - val\_loss: 0.0058 - val\_mae: 0.0299 - val\_acc: 0.7027  
Epoch 87/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0223 - acc: 0.7199 - val\_loss: 0.0058 - val\_mae: 0.0285 - val\_acc: 0.7770  
Epoch 88/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0043 - mae: 0.0226 - acc: 0.7210 - val\_loss: 0.0059 - val\_mae: 0.0290 - val\_acc: 0.6565  
Epoch 89/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0227 - acc: 0.7175 - val\_loss: 0.0059 - val\_mae: 0.0321 - val\_acc: 0.8151  
Epoch 90/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0230 - acc: 0.7232 - val\_loss: 0.0057 - val\_mae: 0.0282 - val\_acc: 0.7508  
Epoch 91/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0220 - acc: 0.7213 - val\_loss: 0.0057 - val\_mae: 0.0278 - val\_acc: 0.7133  
Epoch 92/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0226 - acc: 0.7194 - val\_loss: 0.0057 - val\_mae: 0.0291 - val\_acc: 0.7726  
Epoch 93/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0222 - acc: 0.7146 - val\_loss: 0.0058 - val\_mae: 0.0262 - val\_acc: 0.7583  
Epoch 94/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0215 - acc: 0.7213 - val\_loss: 0.0057 - val\_mae: 0.0279 - val\_acc: 0.6833  
Epoch 95/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0211 - acc: 0.7253 - val\_loss: 0.0057 - val\_mae: 0.0282 - val\_acc: 0.7795  
Epoch 96/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0225 - acc: 0.7127 - val\_loss: 0.0057 - val\_mae: 0.0278 - val\_acc: 0.7027  
Epoch 97/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0219 - acc: 0.7234 - val\_loss: 0.0057 - val\_mae: 0.0288 - val\_acc: 0.8189  
Epoch 98/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0227 - acc: 0.7154 - val\_loss: 0.0058 - val\_mae: 0.0269 - val\_acc: 0.7920  
Epoch 99/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0215 - acc: 0.7213 - val\_loss: 0.0059 - val\_mae: 0.0288 - val\_acc: 0.6640

Epoch 100/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0237 - acc: 0.7256 - val\_loss: 0.0058 - val\_mae: 0.0302 - val\_acc: 0.6490  
Epoch 101/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0234 - acc: 0.7232 - val\_loss: 0.0059 - val\_mae: 0.0279 - val\_acc: 0.7708  
Epoch 102/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0225 - acc: 0.7269 - val\_loss: 0.0057 - val\_mae: 0.0314 - val\_acc: 0.7445  
Epoch 103/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0228 - acc: 0.7175 - val\_loss: 0.0057 - val\_mae: 0.0279 - val\_acc: 0.7658  
Epoch 104/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0227 - acc: 0.7167 - val\_loss: 0.0057 - val\_mae: 0.0270 - val\_acc: 0.6927  
Epoch 105/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0218 - acc: 0.7266 - val\_loss: 0.0057 - val\_mae: 0.0277 - val\_acc: 0.8089  
Epoch 106/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0218 - acc: 0.7253 - val\_loss: 0.0057 - val\_mae: 0.0267 - val\_acc: 0.7302  
Epoch 107/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0216 - acc: 0.7264 - val\_loss: 0.0057 - val\_mae: 0.0308 - val\_acc: 0.7264  
Epoch 108/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0246 - acc: 0.7250 - val\_loss: 0.0059 - val\_mae: 0.0343 - val\_acc: 0.8695  
Epoch 109/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0241 - acc: 0.7162 - val\_loss: 0.0057 - val\_mae: 0.0282 - val\_acc: 0.7945  
Epoch 110/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0227 - acc: 0.7245 - val\_loss: 0.0058 - val\_mae: 0.0270 - val\_acc: 0.5878  
Epoch 111/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0226 - acc: 0.7248 - val\_loss: 0.0057 - val\_mae: 0.0286 - val\_acc: 0.7283  
Epoch 112/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0224 - acc: 0.7181 - val\_loss: 0.0063 - val\_mae: 0.0293 - val\_acc: 0.7283  
Epoch 113/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0042 - mae: 0.0225 - acc: 0.7221 - val\_loss: 0.0057 - val\_mae: 0.0309 - val\_acc: 0.7520  
Epoch 114/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0220 - acc: 0.7218 - val\_loss: 0.0059 - val\_mae: 0.0299 - val\_acc: 0.7539  
Epoch 115/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0227 - acc: 0.7210 - val\_loss: 0.0057 - val\_mae: 0.0281 - val\_acc: 0.6939

Epoch 116/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0229 - acc: 0.7178 - val\_loss: 0.0060 - val\_mae: 0.0277 - val\_acc: 0.8470  
Epoch 117/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0224 - acc: 0.7248 - val\_loss: 0.0056 - val\_mae: 0.0285 - val\_acc: 0.7820  
Epoch 118/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0216 - acc: 0.7226 - val\_loss: 0.0059 - val\_mae: 0.0361 - val\_acc: 0.7177  
Epoch 119/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0242 - acc: 0.7068 - val\_loss: 0.0058 - val\_mae: 0.0280 - val\_acc: 0.6783  
Epoch 120/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0219 - acc: 0.7202 - val\_loss: 0.0057 - val\_mae: 0.0281 - val\_acc: 0.8101  
Epoch 121/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0213 - acc: 0.7296 - val\_loss: 0.0057 - val\_mae: 0.0320 - val\_acc: 0.7639  
Epoch 122/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0233 - acc: 0.7178 - val\_loss: 0.0058 - val\_mae: 0.0275 - val\_acc: 0.6896  
Epoch 123/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0225 - acc: 0.7202 - val\_loss: 0.0057 - val\_mae: 0.0318 - val\_acc: 0.7414  
Epoch 124/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0238 - acc: 0.7216 - val\_loss: 0.0057 - val\_mae: 0.0303 - val\_acc: 0.6671  
Epoch 125/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0221 - acc: 0.7210 - val\_loss: 0.0057 - val\_mae: 0.0272 - val\_acc: 0.7601  
Epoch 126/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0222 - acc: 0.7224 - val\_loss: 0.0056 - val\_mae: 0.0292 - val\_acc: 0.6571  
Epoch 127/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0234 - acc: 0.7146 - val\_loss: 0.0056 - val\_mae: 0.0264 - val\_acc: 0.5909  
Epoch 128/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0231 - acc: 0.7133 - val\_loss: 0.0057 - val\_mae: 0.0315 - val\_acc: 0.5884  
Epoch 129/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0228 - acc: 0.7232 - val\_loss: 0.0056 - val\_mae: 0.0275 - val\_acc: 0.7127  
Epoch 130/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0222 - acc: 0.7229 - val\_loss: 0.0056 - val\_mae: 0.0277 - val\_acc: 0.7601  
Epoch 131/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0221 - acc: 0.7240 - val\_loss: 0.0055 - val\_mae: 0.0287 - val\_acc: 0.8551

Epoch 132/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0237 - acc: 0.7175 - val\_loss: 0.0057 - val\_mae: 0.0265 - val\_acc: 0.7258  
Epoch 133/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0220 - acc: 0.7242 - val\_loss: 0.0060 - val\_mae: 0.0315 - val\_acc: 0.8176  
Epoch 134/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0243 - acc: 0.7138 - val\_loss: 0.0058 - val\_mae: 0.0336 - val\_acc: 0.7683  
Epoch 135/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0235 - acc: 0.7090 - val\_loss: 0.0056 - val\_mae: 0.0284 - val\_acc: 0.5871  
Epoch 136/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0224 - acc: 0.7221 - val\_loss: 0.0057 - val\_mae: 0.0329 - val\_acc: 0.7152  
Epoch 137/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0235 - acc: 0.7207 - val\_loss: 0.0056 - val\_mae: 0.0287 - val\_acc: 0.7164  
Epoch 138/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0225 - acc: 0.7234 - val\_loss: 0.0055 - val\_mae: 0.0271 - val\_acc: 0.6221  
Epoch 139/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0221 - acc: 0.7170 - val\_loss: 0.0056 - val\_mae: 0.0303 - val\_acc: 0.6977  
Epoch 140/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0225 - acc: 0.7237 - val\_loss: 0.0055 - val\_mae: 0.0278 - val\_acc: 0.7477  
Epoch 141/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0217 - acc: 0.7173 - val\_loss: 0.0056 - val\_mae: 0.0277 - val\_acc: 0.7414  
Epoch 142/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0222 - acc: 0.7170 - val\_loss: 0.0057 - val\_mae: 0.0278 - val\_acc: 0.7277  
Epoch 143/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0220 - acc: 0.7272 - val\_loss: 0.0057 - val\_mae: 0.0321 - val\_acc: 0.8064  
Epoch 144/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0231 - acc: 0.7256 - val\_loss: 0.0056 - val\_mae: 0.0282 - val\_acc: 0.7139  
Epoch 145/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0220 - acc: 0.7210 - val\_loss: 0.0055 - val\_mae: 0.0292 - val\_acc: 0.7845  
Epoch 146/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0227 - acc: 0.7146 - val\_loss: 0.0056 - val\_mae: 0.0281 - val\_acc: 0.8089  
Epoch 147/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0228 - acc: 0.7266 - val\_loss: 0.0056 - val\_mae: 0.0283 - val\_acc: 0.8757

Epoch 148/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0216 - acc: 0.7269 - val\_loss: 0.0055 - val\_mae: 0.0289 - val\_acc: 0.7377  
Epoch 149/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0221 - acc: 0.7133 - val\_loss: 0.0055 - val\_mae: 0.0280 - val\_acc: 0.6996  
Epoch 150/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0216 - acc: 0.7189 - val\_loss: 0.0056 - val\_mae: 0.0282 - val\_acc: 0.7202  
Epoch 151/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0219 - acc: 0.7205 - val\_loss: 0.0056 - val\_mae: 0.0280 - val\_acc: 0.6627  
Epoch 152/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0217 - acc: 0.7090 - val\_loss: 0.0058 - val\_mae: 0.0347 - val\_acc: 0.7158  
Epoch 153/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0041 - mae: 0.0254 - acc: 0.7173 - val\_loss: 0.0055 - val\_mae: 0.0299 - val\_acc: 0.7064  
Epoch 154/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0221 - acc: 0.7341 - val\_loss: 0.0055 - val\_mae: 0.0276 - val\_acc: 0.7939  
Epoch 155/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0215 - acc: 0.7232 - val\_loss: 0.0055 - val\_mae: 0.0275 - val\_acc: 0.8057  
Epoch 156/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0223 - acc: 0.7191 - val\_loss: 0.0055 - val\_mae: 0.0281 - val\_acc: 0.6996  
Epoch 157/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0219 - acc: 0.7224 - val\_loss: 0.0055 - val\_mae: 0.0301 - val\_acc: 0.7664  
Epoch 158/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0223 - acc: 0.7162 - val\_loss: 0.0055 - val\_mae: 0.0282 - val\_acc: 0.7146  
Epoch 159/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0218 - acc: 0.7205 - val\_loss: 0.0054 - val\_mae: 0.0264 - val\_acc: 0.6640  
Epoch 160/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0210 - acc: 0.7162 - val\_loss: 0.0056 - val\_mae: 0.0271 - val\_acc: 0.7352  
Epoch 161/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0232 - acc: 0.7207 - val\_loss: 0.0056 - val\_mae: 0.0290 - val\_acc: 0.8282  
Epoch 162/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0229 - acc: 0.7197 - val\_loss: 0.0056 - val\_mae: 0.0300 - val\_acc: 0.7345  
Epoch 163/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0232 - acc: 0.7232 - val\_loss: 0.0055 - val\_mae: 0.0282 - val\_acc: 0.7926



Epoch 164/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0215 - acc: 0.7229 - val\_loss: 0.0055 - val\_mae: 0.0309 - val\_acc: 0.7183  
Epoch 165/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0232 - acc: 0.7130 - val\_loss: 0.0057 - val\_mae: 0.0268 - val\_acc: 0.7245  
Epoch 166/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0220 - acc: 0.7175 - val\_loss: 0.0056 - val\_mae: 0.0278 - val\_acc: 0.7720  
Epoch 167/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0234 - acc: 0.7207 - val\_loss: 0.0055 - val\_mae: 0.0306 - val\_acc: 0.6527  
Epoch 168/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0232 - acc: 0.7202 - val\_loss: 0.0055 - val\_mae: 0.0268 - val\_acc: 0.8926  
Epoch 169/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0215 - acc: 0.7207 - val\_loss: 0.0055 - val\_mae: 0.0290 - val\_acc: 0.7883  
Epoch 170/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0225 - acc: 0.7210 - val\_loss: 0.0056 - val\_mae: 0.0311 - val\_acc: 0.6902  
Epoch 171/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0218 - acc: 0.7194 - val\_loss: 0.0055 - val\_mae: 0.0297 - val\_acc: 0.7008  
Epoch 172/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0222 - acc: 0.7191 - val\_loss: 0.0056 - val\_mae: 0.0300 - val\_acc: 0.7601  
Epoch 173/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0229 - acc: 0.7221 - val\_loss: 0.0054 - val\_mae: 0.0269 - val\_acc: 0.6715  
Epoch 174/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0221 - acc: 0.7207 - val\_loss: 0.0055 - val\_mae: 0.0287 - val\_acc: 0.8182  
Epoch 175/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0219 - acc: 0.7207 - val\_loss: 0.0054 - val\_mae: 0.0270 - val\_acc: 0.7389  
Epoch 176/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0214 - acc: 0.7221 - val\_loss: 0.0055 - val\_mae: 0.0278 - val\_acc: 0.6814  
Epoch 177/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0222 - acc: 0.7159 - val\_loss: 0.0054 - val\_mae: 0.0270 - val\_acc: 0.6939  
Epoch 178/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0219 - acc: 0.7301 - val\_loss: 0.0054 - val\_mae: 0.0270 - val\_acc: 0.8170  
Epoch 179/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0219 - acc: 0.7189 - val\_loss: 0.0054 - val\_mae: 0.0284 - val\_acc: 0.6490

Epoch 180/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0218 - acc: 0.7167 - val\_loss: 0.0054 - val\_mae: 0.0293 - val\_acc: 0.7908  
Epoch 181/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0222 - acc: 0.7151 - val\_loss: 0.0055 - val\_mae: 0.0267 - val\_acc: 0.6627  
Epoch 182/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0214 - acc: 0.7122 - val\_loss: 0.0056 - val\_mae: 0.0314 - val\_acc: 0.7295  
Epoch 183/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0231 - acc: 0.7226 - val\_loss: 0.0055 - val\_mae: 0.0306 - val\_acc: 0.7889  
Epoch 184/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0223 - acc: 0.7186 - val\_loss: 0.0054 - val\_mae: 0.0283 - val\_acc: 0.7289  
Epoch 185/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0219 - acc: 0.7245 - val\_loss: 0.0054 - val\_mae: 0.0260 - val\_acc: 0.5978  
Epoch 186/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0212 - acc: 0.7183 - val\_loss: 0.0055 - val\_mae: 0.0328 - val\_acc: 0.6908  
Epoch 187/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0239 - acc: 0.7178 - val\_loss: 0.0055 - val\_mae: 0.0308 - val\_acc: 0.6821  
Epoch 188/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0226 - acc: 0.7165 - val\_loss: 0.0054 - val\_mae: 0.0256 - val\_acc: 0.8382  
Epoch 189/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0208 - acc: 0.7207 - val\_loss: 0.0054 - val\_mae: 0.0287 - val\_acc: 0.8239  
Epoch 190/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0213 - acc: 0.7202 - val\_loss: 0.0055 - val\_mae: 0.0262 - val\_acc: 0.7489  
Epoch 191/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0209 - acc: 0.7205 - val\_loss: 0.0055 - val\_mae: 0.0308 - val\_acc: 0.8232  
Epoch 192/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0223 - acc: 0.7149 - val\_loss: 0.0056 - val\_mae: 0.0279 - val\_acc: 0.7601  
Epoch 193/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0229 - acc: 0.7194 - val\_loss: 0.0056 - val\_mae: 0.0323 - val\_acc: 0.8482  
Epoch 194/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0239 - acc: 0.7237 - val\_loss: 0.0055 - val\_mae: 0.0313 - val\_acc: 0.6396  
Epoch 195/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0237 - acc: 0.7170 - val\_loss: 0.0054 - val\_mae: 0.0277 - val\_acc: 0.7277

Epoch 196/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0219 - acc: 0.7154 - val\_loss: 0.0055 - val\_mae: 0.0298 - val\_acc: 0.6396  
Epoch 197/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0233 - acc: 0.7194 - val\_loss: 0.0056 - val\_mae: 0.0273 - val\_acc: 0.6384  
Epoch 198/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0235 - acc: 0.7154 - val\_loss: 0.0055 - val\_mae: 0.0277 - val\_acc: 0.7639  
Epoch 199/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0218 - acc: 0.7197 - val\_loss: 0.0055 - val\_mae: 0.0324 - val\_acc: 0.7121  
Epoch 200/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0223 - acc: 0.7170 - val\_loss: 0.0055 - val\_mae: 0.0264 - val\_acc: 0.8407  
Epoch 201/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0218 - acc: 0.7216 - val\_loss: 0.0055 - val\_mae: 0.0266 - val\_acc: 0.6690  
Epoch 202/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0218 - acc: 0.7095 - val\_loss: 0.0055 - val\_mae: 0.0273 - val\_acc: 0.7676  
Epoch 203/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0223 - acc: 0.7245 - val\_loss: 0.0055 - val\_mae: 0.0305 - val\_acc: 0.7895  
Epoch 204/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0228 - acc: 0.7197 - val\_loss: 0.0057 - val\_mae: 0.0352 - val\_acc: 0.7683  
Epoch 205/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0040 - mae: 0.0239 - acc: 0.7135 - val\_loss: 0.0054 - val\_mae: 0.0271 - val\_acc: 0.8888  
Epoch 206/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0226 - acc: 0.7280 - val\_loss: 0.0055 - val\_mae: 0.0277 - val\_acc: 0.6515  
Epoch 207/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0221 - acc: 0.7240 - val\_loss: 0.0054 - val\_mae: 0.0283 - val\_acc: 0.7058  
Epoch 208/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0219 - acc: 0.7253 - val\_loss: 0.0054 - val\_mae: 0.0265 - val\_acc: 0.6396  
Epoch 209/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0209 - acc: 0.7194 - val\_loss: 0.0055 - val\_mae: 0.0298 - val\_acc: 0.6889  
Epoch 210/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0226 - acc: 0.7229 - val\_loss: 0.0053 - val\_mae: 0.0269 - val\_acc: 0.7533  
Epoch 211/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0212 - acc: 0.7183 - val\_loss: 0.0054 - val\_mae: 0.0276 - val\_acc: 0.7096

Epoch 212/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0216 - acc: 0.7199 - val\_loss: 0.0054 - val\_mae: 0.0276 - val\_acc: 0.6996  
Epoch 213/1000  
32/32 [=====] - ETA: 0s - loss: 0.0035 - mae: 0.0221 - acc: 0.716 - 0s 2ms/step - loss: 0.0039 - mae: 0.0221 - acc: 0.7277 - val\_loss: 0.0053 - val\_mae: 0.0270 - val\_acc: 0.6952  
Epoch 214/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0212 - acc: 0.7221 - val\_loss: 0.0054 - val\_mae: 0.0269 - val\_acc: 0.7908  
Epoch 215/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0214 - acc: 0.7138 - val\_loss: 0.0053 - val\_mae: 0.0268 - val\_acc: 0.7489  
Epoch 216/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0213 - acc: 0.7253 - val\_loss: 0.0054 - val\_mae: 0.0282 - val\_acc: 0.7202  
Epoch 217/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0223 - acc: 0.7205 - val\_loss: 0.0055 - val\_mae: 0.0304 - val\_acc: 0.7676  
Epoch 218/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0223 - acc: 0.7261 - val\_loss: 0.0055 - val\_mae: 0.0286 - val\_acc: 0.5965  
Epoch 219/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0227 - acc: 0.7199 - val\_loss: 0.0054 - val\_mae: 0.0294 - val\_acc: 0.6983  
Epoch 220/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0218 - acc: 0.7234 - val\_loss: 0.0054 - val\_mae: 0.0303 - val\_acc: 0.7308  
Epoch 221/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae: 0.0230 - acc: 0.7170 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.7814  
Epoch 222/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0220 - acc: 0.7167 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.8545  
Epoch 223/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0226 - acc: 0.7237 - val\_loss: 0.0054 - val\_mae: 0.0285 - val\_acc: 0.7289  
Epoch 224/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0215 - acc: 0.7221 - val\_loss: 0.0053 - val\_mae: 0.0270 - val\_acc: 0.7039  
Epoch 225/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0213 - acc: 0.7162 - val\_loss: 0.0054 - val\_mae: 0.0262 - val\_acc: 0.9275  
Epoch 226/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae: 0.0219 - acc: 0.7189 - val\_loss: 0.0055 - val\_mae: 0.0262 - val\_acc: 0.8239  
Epoch 227/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:

0.0218 - acc: 0.7261 - val\_loss: 0.0053 - val\_mae: 0.0277 - val\_acc: 0.7133  
Epoch 228/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0225 - acc: 0.7248 - val\_loss: 0.0054 - val\_mae: 0.0302 - val\_acc: 0.7939  
Epoch 229/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0229 - acc: 0.7191 - val\_loss: 0.0054 - val\_mae: 0.0288 - val\_acc: 0.7164  
Epoch 230/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0222 - acc: 0.7199 - val\_loss: 0.0053 - val\_mae: 0.0261 - val\_acc: 0.8057  
Epoch 231/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0207 - acc: 0.7213 - val\_loss: 0.0054 - val\_mae: 0.0289 - val\_acc: 0.7926  
Epoch 232/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0221 - acc: 0.7232 - val\_loss: 0.0056 - val\_mae: 0.0357 - val\_acc: 0.7283  
Epoch 233/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0240 - acc: 0.7242 - val\_loss: 0.0054 - val\_mae: 0.0308 - val\_acc: 0.7539  
Epoch 234/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0237 - acc: 0.7133 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.7114  
Epoch 235/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0223 - acc: 0.7242 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.9126  
Epoch 236/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0214 - acc: 0.7191 - val\_loss: 0.0054 - val\_mae: 0.0268 - val\_acc: 0.7633  
Epoch 237/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0221 - acc: 0.7274 - val\_loss: 0.0053 - val\_mae: 0.0282 - val\_acc: 0.8095  
Epoch 238/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0211 - acc: 0.7226 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.7377  
Epoch 239/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0213 - acc: 0.7216 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.7539  
Epoch 240/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0219 - acc: 0.7237 - val\_loss: 0.0055 - val\_mae: 0.0341 - val\_acc: 0.6746  
Epoch 241/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
0.0235 - acc: 0.7143 - val\_loss: 0.0054 - val\_mae: 0.0268 - val\_acc: 0.8370  
Epoch 242/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0219 - acc: 0.7256 - val\_loss: 0.0054 - val\_mae: 0.0285 - val\_acc: 0.8957  
Epoch 243/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:

0.0225 - acc: 0.7245 - val\_loss: 0.0056 - val\_mae: 0.0281 - val\_acc: 0.8026  
 Epoch 244/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0226 - acc: 0.7207 - val\_loss: 0.0055 - val\_mae: 0.0346 - val\_acc: 0.6665  
 Epoch 245/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0039 - mae:  
 0.0233 - acc: 0.7269 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.8007  
 Epoch 246/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0212 - acc: 0.7173 - val\_loss: 0.0053 - val\_mae: 0.0265 - val\_acc: 0.8114  
 Epoch 247/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0210 - acc: 0.7173 - val\_loss: 0.0053 - val\_mae: 0.0264 - val\_acc: 0.6908  
 Epoch 248/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0210 - acc: 0.7216 - val\_loss: 0.0053 - val\_mae: 0.0268 - val\_acc: 0.7408  
 Epoch 249/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0212 - acc: 0.7216 - val\_loss: 0.0053 - val\_mae: 0.0266 - val\_acc: 0.7108  
 Epoch 250/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0213 - acc: 0.7191 - val\_loss: 0.0053 - val\_mae: 0.0275 - val\_acc: 0.6758  
 Epoch 251/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0212 - acc: 0.7199 - val\_loss: 0.0054 - val\_mae: 0.0292 - val\_acc: 0.7339  
 Epoch 252/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0224 - acc: 0.7159 - val\_loss: 0.0053 - val\_mae: 0.0284 - val\_acc: 0.7064  
 Epoch 253/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0218 - acc: 0.7159 - val\_loss: 0.0054 - val\_mae: 0.0291 - val\_acc: 0.7951  
 Epoch 254/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0228 - acc: 0.7224 - val\_loss: 0.0054 - val\_mae: 0.0328 - val\_acc: 0.7801  
 Epoch 255/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0225 - acc: 0.7194 - val\_loss: 0.0053 - val\_mae: 0.0272 - val\_acc: 0.8270  
 Epoch 256/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0205 - acc: 0.7194 - val\_loss: 0.0053 - val\_mae: 0.0283 - val\_acc: 0.6396  
 Epoch 257/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0220 - acc: 0.7199 - val\_loss: 0.0053 - val\_mae: 0.0259 - val\_acc: 0.7808  
 Epoch 258/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0221 - acc: 0.7253 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.5946  
 Epoch 259/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:

0.0218 - acc: 0.7181 - val\_loss: 0.0054 - val\_mae: 0.0312 - val\_acc: 0.8014  
 Epoch 260/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0219 - acc: 0.7133 - val\_loss: 0.0053 - val\_mae: 0.0277 - val\_acc: 0.7808  
 Epoch 261/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0217 - acc: 0.7207 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.7789  
 Epoch 262/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0213 - acc: 0.7159 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.7071  
 Epoch 263/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0218 - acc: 0.7175 - val\_loss: 0.0054 - val\_mae: 0.0314 - val\_acc: 0.8182  
 Epoch 264/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0229 - acc: 0.7205 - val\_loss: 0.0053 - val\_mae: 0.0283 - val\_acc: 0.8788  
 Epoch 265/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0216 - acc: 0.7087 - val\_loss: 0.0054 - val\_mae: 0.0286 - val\_acc: 0.6071  
 Epoch 266/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0212 - acc: 0.7253 - val\_loss: 0.0053 - val\_mae: 0.0287 - val\_acc: 0.6902  
 Epoch 267/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0224 - acc: 0.7226 - val\_loss: 0.0054 - val\_mae: 0.0314 - val\_acc: 0.7801  
 Epoch 268/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0222 - acc: 0.7210 - val\_loss: 0.0054 - val\_mae: 0.0279 - val\_acc: 0.8332  
 Epoch 269/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0216 - acc: 0.7261 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.7014  
 Epoch 270/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0217 - acc: 0.7141 - val\_loss: 0.0053 - val\_mae: 0.0272 - val\_acc: 0.7133  
 Epoch 271/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0225 - acc: 0.7135 - val\_loss: 0.0054 - val\_mae: 0.0306 - val\_acc: 0.7508  
 Epoch 272/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0229 - acc: 0.7159 - val\_loss: 0.0053 - val\_mae: 0.0264 - val\_acc: 0.7889  
 Epoch 273/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0209 - acc: 0.7285 - val\_loss: 0.0053 - val\_mae: 0.0270 - val\_acc: 0.8851  
 Epoch 274/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0215 - acc: 0.7191 - val\_loss: 0.0054 - val\_mae: 0.0285 - val\_acc: 0.7283  
 Epoch 275/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:

0.0216 - acc: 0.7210 - val\_loss: 0.0053 - val\_mae: 0.0299 - val\_acc: 0.8089  
Epoch 276/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0226 - acc: 0.7173 - val\_loss: 0.0053 - val\_mae: 0.0261 - val\_acc: 0.8220  
Epoch 277/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0217 - acc: 0.7221 - val\_loss: 0.0055 - val\_mae: 0.0292 - val\_acc: 0.6977  
Epoch 278/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0222 - acc: 0.7224 - val\_loss: 0.0054 - val\_mae: 0.0313 - val\_acc: 0.6814  
Epoch 279/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0224 - acc: 0.7258 - val\_loss: 0.0053 - val\_mae: 0.0280 - val\_acc: 0.6265  
Epoch 280/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0214 - acc: 0.7210 - val\_loss: 0.0054 - val\_mae: 0.0266 - val\_acc: 0.8076  
Epoch 281/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0218 - acc: 0.7237 - val\_loss: 0.0053 - val\_mae: 0.0268 - val\_acc: 0.6996  
Epoch 282/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0213 - acc: 0.7202 - val\_loss: 0.0054 - val\_mae: 0.0278 - val\_acc: 0.7601  
Epoch 283/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0211 - acc: 0.7216 - val\_loss: 0.0055 - val\_mae: 0.0279 - val\_acc: 0.6877  
Epoch 284/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0214 - acc: 0.7264 - val\_loss: 0.0053 - val\_mae: 0.0272 - val\_acc: 0.7377  
Epoch 285/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0214 - acc: 0.7232 - val\_loss: 0.0053 - val\_mae: 0.0281 - val\_acc: 0.7133  
Epoch 286/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0212 - acc: 0.7253 - val\_loss: 0.0053 - val\_mae: 0.0268 - val\_acc: 0.6877  
Epoch 287/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0216 - acc: 0.7266 - val\_loss: 0.0054 - val\_mae: 0.0282 - val\_acc: 0.7064  
Epoch 288/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0223 - acc: 0.7194 - val\_loss: 0.0053 - val\_mae: 0.0268 - val\_acc: 0.8613  
Epoch 289/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0216 - acc: 0.7173 - val\_loss: 0.0053 - val\_mae: 0.0272 - val\_acc: 0.8314  
Epoch 290/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0216 - acc: 0.7186 - val\_loss: 0.0054 - val\_mae: 0.0323 - val\_acc: 0.6690  
Epoch 291/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:



0.0230 - acc: 0.7261 - val\_loss: 0.0053 - val\_mae: 0.0274 - val\_acc: 0.6796  
Epoch 292/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0217 - acc: 0.7151 - val\_loss: 0.0053 - val\_mae: 0.0265 - val\_acc: 0.6796  
Epoch 293/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0210 - acc: 0.7191 - val\_loss: 0.0053 - val\_mae: 0.0270 - val\_acc: 0.8413  
Epoch 294/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0215 - acc: 0.7199 - val\_loss: 0.0053 - val\_mae: 0.0273 - val\_acc: 0.6477  
Epoch 295/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0224 - acc: 0.7205 - val\_loss: 0.0054 - val\_mae: 0.0294 - val\_acc: 0.7845  
Epoch 296/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0220 - acc: 0.7205 - val\_loss: 0.0053 - val\_mae: 0.0274 - val\_acc: 0.7970  
Epoch 297/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0225 - acc: 0.7224 - val\_loss: 0.0053 - val\_mae: 0.0294 - val\_acc: 0.7570  
Epoch 298/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0222 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.7370  
Epoch 299/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0222 - acc: 0.7269 - val\_loss: 0.0053 - val\_mae: 0.0303 - val\_acc: 0.8051  
Epoch 300/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0222 - acc: 0.7226 - val\_loss: 0.0053 - val\_mae: 0.0284 - val\_acc: 0.6602  
Epoch 301/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
0.0221 - acc: 0.7146 - val\_loss: 0.0053 - val\_mae: 0.0265 - val\_acc: 0.7489  
Epoch 302/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0210 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.8495  
Epoch 303/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0209 - acc: 0.7272 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.8788  
Epoch 304/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0220 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.8801  
Epoch 305/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0212 - acc: 0.7194 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.7158  
Epoch 306/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0217 - acc: 0.7285 - val\_loss: 0.0053 - val\_mae: 0.0282 - val\_acc: 0.6902  
Epoch 307/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:

0.0212 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.8326  
 Epoch 308/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0213 - acc: 0.7189 - val\_loss: 0.0053 - val\_mae: 0.0295 - val\_acc: 0.6602  
 Epoch 309/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0212 - acc: 0.7127 - val\_loss: 0.0053 - val\_mae: 0.0285 - val\_acc: 0.7577  
 Epoch 310/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0222 - acc: 0.7272 - val\_loss: 0.0054 - val\_mae: 0.0334 - val\_acc: 0.7258  
 Epoch 311/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0038 - mae:  
 0.0232 - acc: 0.7277 - val\_loss: 0.0053 - val\_mae: 0.0290 - val\_acc: 0.7327  
 Epoch 312/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0216 - acc: 0.7202 - val\_loss: 0.0053 - val\_mae: 0.0274 - val\_acc: 0.7939  
 Epoch 313/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0209 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7402  
 Epoch 314/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0213 - acc: 0.7280 - val\_loss: 0.0053 - val\_mae: 0.0321 - val\_acc: 0.7739  
 Epoch 315/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0226 - acc: 0.7216 - val\_loss: 0.0054 - val\_mae: 0.0291 - val\_acc: 0.6839  
 Epoch 316/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0217 - acc: 0.7197 - val\_loss: 0.0053 - val\_mae: 0.0289 - val\_acc: 0.6452  
 Epoch 317/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0205 - acc: 0.7178 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8032  
 Epoch 318/1000  
 32/32 [=====] - ETA: 0s - loss: 0.0030 - mae: 0.0193 -  
 acc: 0.741 - 0s 2ms/step - loss: 0.0037 - mae: 0.0205 - acc: 0.7191 - val\_loss:  
 0.0053 - val\_mae: 0.0265 - val\_acc: 0.6727  
 Epoch 319/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0206 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7389  
 Epoch 320/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0215 - acc: 0.7194 - val\_loss: 0.0053 - val\_mae: 0.0290 - val\_acc: 0.6227  
 Epoch 321/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0221 - acc: 0.7296 - val\_loss: 0.0053 - val\_mae: 0.0281 - val\_acc: 0.6683  
 Epoch 322/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
 0.0213 - acc: 0.7159 - val\_loss: 0.0053 - val\_mae: 0.0294 - val\_acc: 0.7783  
 Epoch 323/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0222 - acc: 0.7210 - val\_loss: 0.0053 - val\_mae: 0.0285 - val\_acc: 0.7289  
Epoch 324/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7352 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.8176  
Epoch 325/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7312 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.7220  
Epoch 326/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7288 - val\_loss: 0.0053 - val\_mae: 0.0263 - val\_acc: 0.6946  
Epoch 327/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7127 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7389  
Epoch 328/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8520  
Epoch 329/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.6140  
Epoch 330/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7167 - val\_loss: 0.0053 - val\_mae: 0.0273 - val\_acc: 0.8888  
Epoch 331/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7502  
Epoch 332/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0208 - acc: 0.7213 - val\_loss: 0.0053 - val\_mae: 0.0252 - val\_acc: 0.7808  
Epoch 333/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0208 - acc: 0.7143 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7645  
Epoch 334/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0220 - acc: 0.7154 - val\_loss: 0.0053 - val\_mae: 0.0274 - val\_acc: 0.6908  
Epoch 335/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0208 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6883  
Epoch 336/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7234 - val\_loss: 0.0053 - val\_mae: 0.0266 - val\_acc: 0.7626  
Epoch 337/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.8751  
Epoch 338/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0206 - acc: 0.7232 - val\_loss: 0.0053 - val\_mae: 0.0282 - val\_acc: 0.6902  
Epoch 339/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0211 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.7645  
Epoch 340/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0221 - acc: 0.7264 - val\_loss: 0.0052 - val\_mae: 0.0301 - val\_acc: 0.7989  
Epoch 341/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0222 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7995  
Epoch 342/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0205 - acc: 0.7191 - val\_loss: 0.0053 - val\_mae: 0.0283 - val\_acc: 0.7364  
Epoch 343/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0220 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7589  
Epoch 344/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0223 - acc: 0.7320 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.7764  
Epoch 345/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7248 - val\_loss: 0.0053 - val\_mae: 0.0296 - val\_acc: 0.6583  
Epoch 346/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7170 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.6852  
Epoch 347/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0295 - val\_acc: 0.7839  
Epoch 348/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0219 - acc: 0.7116 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.6683  
Epoch 349/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7280 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.6902  
Epoch 350/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7102  
Epoch 351/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.6221  
Epoch 352/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0219 - acc: 0.7138 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.8045  
Epoch 353/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0289 - val\_acc: 0.7895  
Epoch 354/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0219 - acc: 0.7234 - val\_loss: 0.0053 - val\_mae: 0.0304 - val\_acc: 0.6296  
Epoch 355/1000

32/32 [=====] - 0s 3ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7173 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.9307  
Epoch 356/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.6540  
Epoch 357/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7127 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.7901  
Epoch 358/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7186 - val\_loss: 0.0054 - val\_mae: 0.0326 - val\_acc: 0.7483  
Epoch 359/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0230 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0286 - val\_acc: 0.7670  
Epoch 360/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0221 - acc: 0.7167 - val\_loss: 0.0054 - val\_mae: 0.0293 - val\_acc: 0.7708  
Epoch 361/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0222 - acc: 0.7312 - val\_loss: 0.0052 - val\_mae: 0.0295 - val\_acc: 0.7814  
Epoch 362/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7245 - val\_loss: 0.0053 - val\_mae: 0.0291 - val\_acc: 0.7508  
Epoch 363/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7178 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7558  
Epoch 364/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0205 - acc: 0.7277 - val\_loss: 0.0052 - val\_mae: 0.0281 - val\_acc: 0.8201  
Epoch 365/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7269 - val\_loss: 0.0053 - val\_mae: 0.0305 - val\_acc: 0.7146  
Epoch 366/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0221 - acc: 0.7167 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6846  
Epoch 367/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0205 - acc: 0.7229 - val\_loss: 0.0053 - val\_mae: 0.0262 - val\_acc: 0.8157  
Epoch 368/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0211 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.6658  
Epoch 369/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0208 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.7639  
Epoch 370/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0206 - acc: 0.7173 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.6852  
Epoch 371/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0205 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6390  
Epoch 372/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7745  
Epoch 373/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0208 - acc: 0.7159 - val\_loss: 0.0053 - val\_mae: 0.0277 - val\_acc: 0.6933  
Epoch 374/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7315 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7108  
Epoch 375/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.6889  
Epoch 376/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.6234  
Epoch 377/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0206 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6415  
Epoch 378/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0206 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.8420  
Epoch 379/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0211 - acc: 0.7277 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.6146  
Epoch 380/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0210 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6583  
Epoch 381/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7076 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7127  
Epoch 382/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.9219  
Epoch 383/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0211 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.8663  
Epoch 384/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0219 - acc: 0.7167 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.8507  
Epoch 385/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.7783  
Epoch 386/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0206 - acc: 0.7288 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.6677  
Epoch 387/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0201 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.7970  
Epoch 388/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0227 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.6077  
Epoch 389/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.8164  
Epoch 390/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0207 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0256 - val\_acc: 0.7814  
Epoch 391/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0207 - acc: 0.7183 - val\_loss: 0.0051 - val\_mae: 0.0260 - val\_acc: 0.9250  
Epoch 392/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.6027  
Epoch 393/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7170 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.8688  
Epoch 394/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.9157  
Epoch 395/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0210 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.6458  
Epoch 396/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6771  
Epoch 397/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7071  
Epoch 398/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0292 - val\_acc: 0.8014  
Epoch 399/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0223 - acc: 0.7167 - val\_loss: 0.0052 - val\_mae: 0.0289 - val\_acc: 0.7327  
Epoch 400/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7162 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.6996  
Epoch 401/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0210 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.6658  
Epoch 402/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7277 - val\_loss: 0.0053 - val\_mae: 0.0300 - val\_acc: 0.6908  
Epoch 403/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0218 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8282  
Epoch 404/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7170 - val\_loss: 0.0053 - val\_mae: 0.0265 - val\_acc: 0.7527  
Epoch 405/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.7470  
Epoch 406/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7119 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.7052  
Epoch 407/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0211 - acc: 0.7162 - val\_loss: 0.0053 - val\_mae: 0.0281 - val\_acc: 0.7233  
Epoch 408/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7141 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7327  
Epoch 409/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0294 - val\_acc: 0.6921  
Epoch 410/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0212 - acc: 0.7189 - val\_loss: 0.0054 - val\_mae: 0.0274 - val\_acc: 0.7664  
Epoch 411/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0217 - acc: 0.7202 - val\_loss: 0.0051 - val\_mae: 0.0270 - val\_acc: 0.7995  
Epoch 412/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7162 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.8488  
Epoch 413/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.6802  
Epoch 414/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0210 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0315 - val\_acc: 0.7733  
Epoch 415/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0222 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6946  
Epoch 416/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0289 - val\_acc: 0.7339  
Epoch 417/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.6346  
Epoch 418/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0204 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0256 - val\_acc: 0.7933  
Epoch 419/1000



32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.7039  
Epoch 420/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.7327  
Epoch 421/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7539  
Epoch 422/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7207 - val\_loss: 0.0051 - val\_mae: 0.0254 - val\_acc: 0.8045  
Epoch 423/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7162 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.7289  
Epoch 424/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7191 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.8132  
Epoch 425/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0204 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7489  
Epoch 426/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.8101  
Epoch 427/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7795  
Epoch 428/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7138 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.7308  
Epoch 429/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0297 - val\_acc: 0.8707  
Epoch 430/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7162 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.7114  
Epoch 431/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7165 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.8451  
Epoch 432/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7282 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.6683  
Epoch 433/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7189 - val\_loss: 0.0053 - val\_mae: 0.0286 - val\_acc: 0.6640  
Epoch 434/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0217 - acc: 0.7216 - val\_loss: 0.0051 - val\_mae: 0.0273 - val\_acc: 0.8107  
Epoch 435/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0219 - acc: 0.7178 - val\_loss: 0.0051 - val\_mae: 0.0276 - val\_acc: 0.8351  
Epoch 436/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0209 - acc: 0.7165 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.9151  
Epoch 437/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7776  
Epoch 438/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7293 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.6921  
Epoch 439/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7197 - val\_loss: 0.0051 - val\_mae: 0.0257 - val\_acc: 0.8407  
Epoch 440/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.5784  
Epoch 441/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6315  
Epoch 442/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7272 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.6921  
Epoch 443/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7242 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.5803  
Epoch 444/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7213 - val\_loss: 0.0053 - val\_mae: 0.0282 - val\_acc: 0.7420  
Epoch 445/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0215 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.5796  
Epoch 446/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0217 - acc: 0.7288 - val\_loss: 0.0052 - val\_mae: 0.0292 - val\_acc: 0.7820  
Epoch 447/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0221 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0286 - val\_acc: 0.8551  
Epoch 448/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7261 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.6721  
Epoch 449/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7252  
Epoch 450/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.6240  
Epoch 451/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0219 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.8014  
Epoch 452/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7008  
Epoch 453/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0211 - acc: 0.7141 - val\_loss: 0.0051 - val\_mae: 0.0274 - val\_acc: 0.7883  
Epoch 454/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7327  
Epoch 455/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.5859  
Epoch 456/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0204 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6908  
Epoch 457/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0292 - val\_acc: 0.7820  
Epoch 458/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0216 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7189  
Epoch 459/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7296 - val\_loss: 0.0051 - val\_mae: 0.0281 - val\_acc: 0.6234  
Epoch 460/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7124 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.6939  
Epoch 461/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7232 - val\_loss: 0.0053 - val\_mae: 0.0320 - val\_acc: 0.7951  
Epoch 462/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0225 - acc: 0.7157 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.7352  
Epoch 463/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7224 - val\_loss: 0.0051 - val\_mae: 0.0260 - val\_acc: 0.7795  
Epoch 464/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0207 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6671  
Epoch 465/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0253 - val\_acc: 0.7676  
Epoch 466/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7229 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.6402  
Epoch 467/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7272 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6352  
Epoch 468/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6833  
Epoch 469/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0287 - val\_acc: 0.6727  
Epoch 470/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0223 - acc: 0.7181 - val\_loss: 0.0053 - val\_mae: 0.0266 - val\_acc: 0.8051  
Epoch 471/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7514  
Epoch 472/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7213 - val\_loss: 0.0053 - val\_mae: 0.0288 - val\_acc: 0.7202  
Epoch 473/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8089  
Epoch 474/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8314  
Epoch 475/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7199 - val\_loss: 0.0053 - val\_mae: 0.0273 - val\_acc: 0.8245  
Epoch 476/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0207 - acc: 0.7253 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.6702  
Epoch 477/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6852  
Epoch 478/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.8170  
Epoch 479/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7234 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.7233  
Epoch 480/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7159 - val\_loss: 0.0051 - val\_mae: 0.0279 - val\_acc: 0.7458  
Epoch 481/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7237 - val\_loss: 0.0051 - val\_mae: 0.0269 - val\_acc: 0.7277  
Epoch 482/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7234 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.6971  
Epoch 483/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0210 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.7883  
Epoch 484/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0211 - acc: 0.7299 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.7864  
Epoch 485/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae:  
0.0210 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.8057  
Epoch 486/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0209 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.7108  
Epoch 487/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0216 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.7196  
Epoch 488/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0222 - acc: 0.7266 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.7046  
Epoch 489/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7191 - val\_loss: 0.0051 - val\_mae: 0.0284 - val\_acc: 0.7452  
Epoch 490/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0213 - acc: 0.7143 - val\_loss: 0.0051 - val\_mae: 0.0253 - val\_acc: 0.7945  
Epoch 491/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0211 - acc: 0.7221 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.7739  
Epoch 492/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0203 - acc: 0.7162 - val\_loss: 0.0053 - val\_mae: 0.0262 - val\_acc: 0.7314  
Epoch 493/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7783  
Epoch 494/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7154 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.6371  
Epoch 495/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7264 - val\_loss: 0.0052 - val\_mae: 0.0293 - val\_acc: 0.8126  
Epoch 496/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0214 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6808  
Epoch 497/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.6958  
Epoch 498/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7293 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.8345  
Epoch 499/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.7527  
Epoch 500/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7280 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7502  
Epoch 501/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0218 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6377  
Epoch 502/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7293 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7570  
Epoch 503/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7221 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.7701  
Epoch 504/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7194 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.8114  
Epoch 505/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0250 - val\_acc: 0.7751  
Epoch 506/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0196 - acc: 0.7277 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7364  
Epoch 507/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7224 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.6671  
Epoch 508/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0213 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7858  
Epoch 509/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7317 - val\_loss: 0.0051 - val\_mae: 0.0273 - val\_acc: 0.6933  
Epoch 510/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7165 - val\_loss: 0.0051 - val\_mae: 0.0280 - val\_acc: 0.7164  
Epoch 511/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7216 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.7701  
Epoch 512/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7248 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6502  
Epoch 513/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.7146  
Epoch 514/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8770  
Epoch 515/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.8682  
Epoch 516/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6552  
Epoch 517/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.6796  
Epoch 518/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7127 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7683  
Epoch 519/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.7071  
Epoch 520/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7183 - val\_loss: 0.0051 - val\_mae: 0.0260 - val\_acc: 0.7127  
Epoch 521/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.6621  
Epoch 522/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0274 - val\_acc: 0.6796  
Epoch 523/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.7196  
Epoch 524/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.6864  
Epoch 525/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7232 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.7402  
Epoch 526/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7100 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.6846  
Epoch 527/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0290 - val\_acc: 0.8157  
Epoch 528/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0214 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.6602  
Epoch 529/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0215 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.6790  
Epoch 530/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7205 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.6621  
Epoch 531/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7229 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.7270  
Epoch 532/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7154 - val\_loss: 0.0052 - val\_mae: 0.0255 - val\_acc: 0.7801  
Epoch 533/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7242 - val\_loss: 0.0053 - val\_mae: 0.0296 - val\_acc: 0.7108  
Epoch 534/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7194 - val\_loss: 0.0051 - val\_mae: 0.0279 - val\_acc: 0.6271  
Epoch 535/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7162 - val\_loss: 0.0053 - val\_mae: 0.0267 - val\_acc: 0.6727  
Epoch 536/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7039  
Epoch 537/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7202 - val\_loss: 0.0051 - val\_mae: 0.0273 - val\_acc: 0.8045  
Epoch 538/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.8164  
Epoch 539/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7202 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.9294  
Epoch 540/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7277  
Epoch 541/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0217 - acc: 0.7256 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.6390  
Epoch 542/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.6134  
Epoch 543/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7167 - val\_loss: 0.0051 - val\_mae: 0.0260 - val\_acc: 0.6908  
Epoch 544/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7146 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.7033  
Epoch 545/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.6340  
Epoch 546/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.6858  
Epoch 547/1000



32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7218 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.6590  
Epoch 548/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7258 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.7464  
Epoch 549/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7232 - val\_loss: 0.0051 - val\_mae: 0.0268 - val\_acc: 0.7202  
Epoch 550/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7248 - val\_loss: 0.0051 - val\_mae: 0.0289 - val\_acc: 0.9232  
Epoch 551/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7266 - val\_loss: 0.0051 - val\_mae: 0.0268 - val\_acc: 0.6458  
Epoch 552/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7159 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7845  
Epoch 553/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7234 - val\_loss: 0.0051 - val\_mae: 0.0257 - val\_acc: 0.7158  
Epoch 554/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0199 - acc: 0.7183 - val\_loss: 0.0051 - val\_mae: 0.0269 - val\_acc: 0.8057  
Epoch 555/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7226 - val\_loss: 0.0051 - val\_mae: 0.0285 - val\_acc: 0.8457  
Epoch 556/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0212 - acc: 0.7143 - val\_loss: 0.0051 - val\_mae: 0.0255 - val\_acc: 0.6021  
Epoch 557/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7304 - val\_loss: 0.0051 - val\_mae: 0.0274 - val\_acc: 0.7645  
Epoch 558/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7207 - val\_loss: 0.0051 - val\_mae: 0.0277 - val\_acc: 0.8314  
Epoch 559/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7299 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.8376  
Epoch 560/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7277 - val\_loss: 0.0051 - val\_mae: 0.0255 - val\_acc: 0.8064  
Epoch 561/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.7789  
Epoch 562/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7216 - val\_loss: 0.0051 - val\_mae: 0.0257 - val\_acc: 0.6490  
Epoch 563/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7143 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7964  
Epoch 564/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7248 - val\_loss: 0.0052 - val\_mae: 0.0291 - val\_acc: 0.7758  
Epoch 565/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0219 - acc: 0.7234 - val\_loss: 0.0051 - val\_mae: 0.0285 - val\_acc: 0.7633  
Epoch 566/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7285 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.6340  
Epoch 567/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7171  
Epoch 568/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.8051  
Epoch 569/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0297 - val\_acc: 0.7651  
Epoch 570/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7620  
Epoch 571/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7218 - val\_loss: 0.0051 - val\_mae: 0.0267 - val\_acc: 0.6996  
Epoch 572/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7021  
Epoch 573/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7194 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.6883  
Epoch 574/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7250 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.7477  
Epoch 575/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.8064  
Epoch 576/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7202 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.6821  
Epoch 577/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.6265  
Epoch 578/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6027  
Epoch 579/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.6546  
Epoch 580/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7167 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.8969  
Epoch 581/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7199 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.6777  
Epoch 582/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7213 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.8426  
Epoch 583/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.6359  
Epoch 584/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0267 - val\_acc: 0.7121  
Epoch 585/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7183 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.6540  
Epoch 586/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0314 - val\_acc: 0.8645  
Epoch 587/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0037 - mae: 0.0231 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0293 - val\_acc: 0.7470  
Epoch 588/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.6690  
Epoch 589/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0288 - val\_acc: 0.6896  
Epoch 590/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7226 - val\_loss: 0.0053 - val\_mae: 0.0268 - val\_acc: 0.8051  
Epoch 591/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.7183  
Epoch 592/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7218 - val\_loss: 0.0051 - val\_mae: 0.0267 - val\_acc: 0.8320  
Epoch 593/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7242 - val\_loss: 0.0051 - val\_mae: 0.0256 - val\_acc: 0.6321  
Epoch 594/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7258 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.7458  
Epoch 595/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0293 - val\_acc: 0.7783  
Epoch 596/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.6196  
Epoch 597/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6408  
Epoch 598/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7870  
Epoch 599/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6084  
Epoch 600/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0255 - val\_acc: 0.7452  
Epoch 601/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7237 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.6952  
Epoch 602/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0294 - val\_acc: 0.8120  
Epoch 603/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7207 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.7676  
Epoch 604/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7285 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6952  
Epoch 605/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7146 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.7014  
Epoch 606/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7234 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.7102  
Epoch 607/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7151 - val\_loss: 0.0051 - val\_mae: 0.0267 - val\_acc: 0.8395  
Epoch 608/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7258 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.9169  
Epoch 609/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7272 - val\_loss: 0.0051 - val\_mae: 0.0256 - val\_acc: 0.6827  
Epoch 610/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7258 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.8576  
Epoch 611/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7293 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7177  
Epoch 612/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8176  
Epoch 613/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7234 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.7502  
Epoch 614/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7151 - val\_loss: 0.0051 - val\_mae: 0.0268 - val\_acc: 0.7458  
Epoch 615/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7170 - val\_loss: 0.0051 - val\_mae: 0.0272 - val\_acc: 0.7033  
Epoch 616/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7213 - val\_loss: 0.0051 - val\_mae: 0.0255 - val\_acc: 0.6733  
Epoch 617/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7189  
Epoch 618/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7173 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.6633  
Epoch 619/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7301 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.7502  
Epoch 620/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0198 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.6215  
Epoch 621/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7170 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.7495  
Epoch 622/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7248 - val\_loss: 0.0051 - val\_mae: 0.0254 - val\_acc: 0.7102  
Epoch 623/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.5790  
Epoch 624/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6733  
Epoch 625/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7191 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.7408  
Epoch 626/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7288 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.6908  
Epoch 627/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0198 - acc: 0.7210 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.7820  
Epoch 628/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.6540  
Epoch 629/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0206 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7758  
Epoch 630/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0206 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.6140  
Epoch 631/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0206 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0313 - val\_acc: 0.7658  
Epoch 632/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0225 - acc: 0.7250 - val\_loss: 0.0051 - val\_mae: 0.0275 - val\_acc: 0.7320  
Epoch 633/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.7577  
Epoch 634/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7149 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.6721  
Epoch 635/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0207 - acc: 0.7274 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.9369  
Epoch 636/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0199 - acc: 0.7232 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.7083  
Epoch 637/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7027  
Epoch 638/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0204 - acc: 0.7274 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.8894  
Epoch 639/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0201 - acc: 0.7167 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.8413  
Epoch 640/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7157 - val\_loss: 0.0051 - val\_mae: 0.0270 - val\_acc: 0.6209  
Epoch 641/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7205 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.7014  
Epoch 642/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0203 - acc: 0.7288 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.8445  
Epoch 643/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7533  
Epoch 644/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7199 - val\_loss: 0.0051 - val\_mae: 0.0270 - val\_acc: 0.6640  
Epoch 645/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.7064  
Epoch 646/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6665  
Epoch 647/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7826  
Epoch 648/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7181 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.7695  
Epoch 649/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7218 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.6671  
Epoch 650/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7170 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.6496  
Epoch 651/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7221 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.8413  
Epoch 652/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7157 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.7626  
Epoch 653/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7248 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.6446  
Epoch 654/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.7408  
Epoch 655/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7820  
Epoch 656/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.7083  
Epoch 657/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.7146  
Epoch 658/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0197 - acc: 0.7205 - val\_loss: 0.0051 - val\_mae: 0.0255 - val\_acc: 0.6633  
Epoch 659/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0198 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7895  
Epoch 660/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.7383  
Epoch 661/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7256 - val\_loss: 0.0051 - val\_mae: 0.0276 - val\_acc: 0.7776  
Epoch 662/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0215 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.7577  
Epoch 663/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0213 - acc: 0.7266 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.7152  
Epoch 664/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0289 - val\_acc: 0.7052  
Epoch 665/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7210 - val\_loss: 0.0051 - val\_mae: 0.0274 - val\_acc: 0.7552  
Epoch 666/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.7601  
Epoch 667/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.7614  
Epoch 668/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7162 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6302  
Epoch 669/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7245 - val\_loss: 0.0051 - val\_mae: 0.0269 - val\_acc: 0.7483  
Epoch 670/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.7577  
Epoch 671/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0214 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.6852  
Epoch 672/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7645  
Epoch 673/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.8051  
Epoch 674/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.8470  
Epoch 675/1000



32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0207 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7133  
Epoch 676/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7245 - val\_loss: 0.0051 - val\_mae: 0.0267 - val\_acc: 0.8289  
Epoch 677/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0201 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6996  
Epoch 678/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0206 - acc: 0.7154 - val\_loss: 0.0051 - val\_mae: 0.0255 - val\_acc: 0.6059  
Epoch 679/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0202 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.8032  
Epoch 680/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0201 - acc: 0.7170 - val\_loss: 0.0051 - val\_mae: 0.0278 - val\_acc: 0.6577  
Epoch 681/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7154 - val\_loss: 0.0051 - val\_mae: 0.0259 - val\_acc: 0.8276  
Epoch 682/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0204 - acc: 0.7296 - val\_loss: 0.0051 - val\_mae: 0.0260 - val\_acc: 0.6477  
Epoch 683/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0208 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0303 - val\_acc: 0.7908  
Epoch 684/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0223 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.8232  
Epoch 685/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0208 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.7933  
Epoch 686/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0201 - acc: 0.7213 - val\_loss: 0.0051 - val\_mae: 0.0275 - val\_acc: 0.6259  
Epoch 687/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0207 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.8819  
Epoch 688/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0218 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7658  
Epoch 689/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0199 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.7920  
Epoch 690/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0205 - acc: 0.7341 - val\_loss: 0.0051 - val\_mae: 0.0268 - val\_acc: 0.7046  
Epoch 691/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.8026  
Epoch 692/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8695  
Epoch 693/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7183 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.6352  
Epoch 694/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0197 - acc: 0.7157 - val\_loss: 0.0051 - val\_mae: 0.0268 - val\_acc: 0.6733  
Epoch 695/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0197 - acc: 0.7199 - val\_loss: 0.0053 - val\_mae: 0.0333 - val\_acc: 0.7958  
Epoch 696/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0221 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7439  
Epoch 697/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.7027  
Epoch 698/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0292 - val\_acc: 0.7564  
Epoch 699/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.7295  
Epoch 700/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7162 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.7958  
Epoch 701/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0196 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.8688  
Epoch 702/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0195 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7864  
Epoch 703/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6902  
Epoch 704/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7269 - val\_loss: 0.0053 - val\_mae: 0.0281 - val\_acc: 0.7833  
Epoch 705/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0211 - acc: 0.7325 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6490  
Epoch 706/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6677  
Epoch 707/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.7552  
Epoch 708/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.8301  
Epoch 709/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.8382  
Epoch 710/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0199 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0255 - val\_acc: 0.5965  
Epoch 711/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0195 - acc: 0.7170 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.7864  
Epoch 712/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7173 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6964  
Epoch 713/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8426  
Epoch 714/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0198 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.7958  
Epoch 715/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.8620  
Epoch 716/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7483  
Epoch 717/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0197 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.7776  
Epoch 718/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0200 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.6871  
Epoch 719/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0290 - val\_acc: 0.7214  
Epoch 720/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6621  
Epoch 721/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7191 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.7308  
Epoch 722/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.6733  
Epoch 723/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7165 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.7108  
Epoch 724/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7191 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.7945  
Epoch 725/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7052  
Epoch 726/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0273 - val\_acc: 0.8451  
Epoch 727/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7564  
Epoch 728/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.7227  
Epoch 729/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0226 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6546  
Epoch 730/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.6783  
Epoch 731/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6727  
Epoch 732/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7282 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.7245  
Epoch 733/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7191 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.8170  
Epoch 734/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0281 - val\_acc: 0.7445  
Epoch 735/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0257 - val\_acc: 0.7358  
Epoch 736/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7258 - val\_loss: 0.0053 - val\_mae: 0.0286 - val\_acc: 0.7139  
Epoch 737/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.6971  
Epoch 738/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7218 - val\_loss: 0.0053 - val\_mae: 0.0287 - val\_acc: 0.7114  
Epoch 739/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.6309  
Epoch 740/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7218 - val\_loss: 0.0051 - val\_mae: 0.0254 - val\_acc: 0.6771  
Epoch 741/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.7427  
Epoch 742/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6240  
Epoch 743/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.9394  
Epoch 744/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7296 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.6721  
Epoch 745/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7213 - val\_loss: 0.0051 - val\_mae: 0.0255 - val\_acc: 0.7108  
Epoch 746/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0295 - val\_acc: 0.8713  
Epoch 747/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0219 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0281 - val\_acc: 0.8576  
Epoch 748/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7058  
Epoch 749/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0210 - acc: 0.7293 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6808  
Epoch 750/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0290 - val\_acc: 0.7689  
Epoch 751/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.7227  
Epoch 752/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7152  
Epoch 753/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7264 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6889  
Epoch 754/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7186 - val\_loss: 0.0051 - val\_mae: 0.0252 - val\_acc: 0.8501  
Epoch 755/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0198 - acc: 0.7264 - val\_loss: 0.0053 - val\_mae: 0.0291 - val\_acc: 0.8301  
Epoch 756/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6721  
Epoch 757/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7664  
Epoch 758/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7154 - val\_loss: 0.0052 - val\_mae: 0.0256 - val\_acc: 0.7339  
Epoch 759/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7175 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.7027  
Epoch 760/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0196 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.8545  
Epoch 761/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7119 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.6933  
Epoch 762/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0215 - acc: 0.7186 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.6571  
Epoch 763/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8389  
Epoch 764/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6783  
Epoch 765/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0204 - acc: 0.7178 - val\_loss: 0.0052 - val\_mae: 0.0281 - val\_acc: 0.6227  
Epoch 766/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0206 - acc: 0.7146 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7639  
Epoch 767/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0288 - val\_acc: 0.7064  
Epoch 768/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.7639  
Epoch 769/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0289 - val\_acc: 0.6159  
Epoch 770/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7162 - val\_loss: 0.0051 - val\_mae: 0.0265 - val\_acc: 0.7083  
Epoch 771/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0198 - acc: 0.7258 - val\_loss: 0.0051 - val\_mae: 0.0266 - val\_acc: 0.6658  
Epoch 772/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0197 - acc: 0.7175 - val\_loss: 0.0051 - val\_mae: 0.0271 - val\_acc: 0.7420  
Epoch 773/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7248 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6721  
Epoch 774/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7194 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.7608  
Epoch 775/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0203 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6939  
Epoch 776/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0215 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6846  
Epoch 777/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.6521  
Epoch 778/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7197 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.8682  
Epoch 779/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.8732  
Epoch 780/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7157 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6327  
Epoch 781/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0208 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.6721  
Epoch 782/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.6177  
Epoch 783/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.8195  
Epoch 784/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6209  
Epoch 785/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.9375  
Epoch 786/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0209 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6821  
Epoch 787/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7277 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6227  
Epoch 788/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.8020  
Epoch 789/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7280 - val\_loss: 0.0051 - val\_mae: 0.0258 - val\_acc: 0.8264  
Epoch 790/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0288 - val\_acc: 0.7489  
Epoch 791/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0210 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6721  
Epoch 792/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0206 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.7820  
Epoch 793/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0253 - val\_acc: 0.8114  
Epoch 794/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0198 - acc: 0.7133 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.6833  
Epoch 795/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7245 - val\_loss: 0.0051 - val\_mae: 0.0269 - val\_acc: 0.8357  
Epoch 796/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7639  
Epoch 797/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7116 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.6858  
Epoch 798/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0284 - val\_acc: 0.7458  
Epoch 799/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.8751  
Epoch 800/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7269 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.9413  
Epoch 801/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7301 - val\_loss: 0.0051 - val\_mae: 0.0261 - val\_acc: 0.8339  
Epoch 802/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.7358  
Epoch 803/1000



32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.7039  
Epoch 804/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.7171  
Epoch 805/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0210 - acc: 0.7237 - val\_loss: 0.0051 - val\_mae: 0.0280 - val\_acc: 0.7989  
Epoch 806/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7274 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.9076  
Epoch 807/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7183 - val\_loss: 0.0053 - val\_mae: 0.0283 - val\_acc: 0.6633  
Epoch 808/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.6402  
Epoch 809/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7141 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.8232  
Epoch 810/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7178 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.8364  
Epoch 811/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7165 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7676  
Epoch 812/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0197 - acc: 0.7154 - val\_loss: 0.0053 - val\_mae: 0.0318 - val\_acc: 0.7320  
Epoch 813/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0219 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.6827  
Epoch 814/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0207 - acc: 0.7151 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.7277  
Epoch 815/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0252 - val\_acc: 0.7758  
Epoch 816/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6802  
Epoch 817/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0259 - val\_acc: 0.8838  
Epoch 818/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.8214  
Epoch 819/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7183  
Epoch 820/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7833  
Epoch 821/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.7601  
Epoch 822/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.6864  
Epoch 823/1000

32/32 [=====] - 0s 3ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.6309  
Epoch 824/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.7683  
Epoch 825/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7170 - val\_loss: 0.0051 - val\_mae: 0.0269 - val\_acc: 0.7433  
Epoch 826/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0293 - val\_acc: 0.8307  
Epoch 827/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0211 - acc: 0.7100 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.6889  
Epoch 828/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7558  
Epoch 829/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.8195  
Epoch 830/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0201 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0262 - val\_acc: 0.8657  
Epoch 831/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.6896  
Epoch 832/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0256 - val\_acc: 0.6477  
Epoch 833/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.8488  
Epoch 834/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7138 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.8501  
Epoch 835/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.8039  
Epoch 836/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.8301  
Epoch 837/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0212 - acc: 0.7237 - val\_loss: 0.0053 - val\_mae: 0.0293 - val\_acc: 0.6608  
Epoch 838/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0209 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.6946  
Epoch 839/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6608  
Epoch 840/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0205 - acc: 0.7119 - val\_loss: 0.0053 - val\_mae: 0.0274 - val\_acc: 0.7077  
Epoch 841/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0206 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0256 - val\_acc: 0.5946  
Epoch 842/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.6209  
Epoch 843/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0197 - acc: 0.7293 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.6715  
Epoch 844/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0209 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7545  
Epoch 845/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.6315  
Epoch 846/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7689  
Epoch 847/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0207 - acc: 0.7221 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.7958  
Epoch 848/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0208 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.7083  
Epoch 849/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7149 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.6977  
Epoch 850/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7089  
Epoch 851/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0198 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.6877  
Epoch 852/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.7789  
Epoch 853/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0206 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.8513  
Epoch 854/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7210 - val\_loss: 0.0051 - val\_mae: 0.0264 - val\_acc: 0.8239  
Epoch 855/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0195 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7502  
Epoch 856/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.7433  
Epoch 857/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0207 - acc: 0.7248 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7152  
Epoch 858/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7274 - val\_loss: 0.0051 - val\_mae: 0.0262 - val\_acc: 0.8032  
Epoch 859/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8476  
Epoch 860/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.8101  
Epoch 861/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7138 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7951  
Epoch 862/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8157  
Epoch 863/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0285 - val\_acc: 0.7620  
Epoch 864/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0208 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6521  
Epoch 865/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7240 - val\_loss: 0.0053 - val\_mae: 0.0262 - val\_acc: 0.6196  
Epoch 866/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6271  
Epoch 867/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.8126  
Epoch 868/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7216 - val\_loss: 0.0053 - val\_mae: 0.0304 - val\_acc: 0.6889  
Epoch 869/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0215 - acc: 0.7282 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.7527  
Epoch 870/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.8926  
Epoch 871/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0207 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.6202  
Epoch 872/1000

32/32 [=====] - 0s 3ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6184  
Epoch 873/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7218 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.7439  
Epoch 874/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7272 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.6196  
Epoch 875/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7197 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.8588  
Epoch 876/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0209 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8557  
Epoch 877/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7240 - val\_loss: 0.0051 - val\_mae: 0.0272 - val\_acc: 0.8963  
Epoch 878/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.8432  
Epoch 879/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7266 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.6540  
Epoch 880/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7149 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.5834  
Epoch 881/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6802  
Epoch 882/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0211 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8276  
Epoch 883/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7269 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.6989  
Epoch 884/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7266 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.7258  
Epoch 885/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0206 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8907  
Epoch 886/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0202 - acc: 0.7256 - val\_loss: 0.0053 - val\_mae: 0.0275 - val\_acc: 0.7851  
Epoch 887/1000

32/32 [=====] - ETA: 0s - loss: 0.0029 - mae: 0.0193 - acc: 0.766 - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.6627  
Epoch 888/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0197 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6983  
Epoch 889/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.8132  
Epoch 890/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0196 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.8251  
Epoch 891/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae: 0.0207 - acc: 0.7178 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.6102  
Epoch 892/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0206 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7096  
Epoch 893/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.5753  
Epoch 894/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0276 - val\_acc: 0.7502  
Epoch 895/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7248 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.8164  
Epoch 896/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.7608  
Epoch 897/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7245  
Epoch 898/1000

32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7389

Epoch 899/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7272 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.9338  
Epoch 900/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.6683  
Epoch 901/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7995  
Epoch 902/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0205 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0273 - val\_acc: 0.6452  
Epoch 903/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0210 - acc: 0.7167 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8607  
Epoch 904/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7130 - val\_loss: 0.0053 - val\_mae: 0.0292 - val\_acc: 0.9063  
Epoch 905/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0208 - acc: 0.7213 - val\_loss: 0.0051 - val\_mae: 0.0263 - val\_acc: 0.7227  
Epoch 906/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6552  
Epoch 907/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7002  
Epoch 908/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7194 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.7389  
Epoch 909/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.8432  
Epoch 910/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7226 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8413  
Epoch 911/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7253 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7733  
Epoch 912/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7207 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.7227  
Epoch 913/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.7545  
Epoch 914/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7218 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7171

Epoch 915/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7154 - val\_loss: 0.0052 - val\_mae: 0.0290 - val\_acc: 0.7489  
Epoch 916/1000  
32/32 [=====] - ETA: 0s - loss: 0.0037 - mae: 0.0235 - acc: 0.691 - 0s 2ms/step - loss: 0.0035 - mae: 0.0213 - acc: 0.7269 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.5971  
Epoch 917/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0207 - acc: 0.7202 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.5921  
Epoch 918/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7282 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7858  
Epoch 919/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.9200  
Epoch 920/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0201 - acc: 0.7154 - val\_loss: 0.0053 - val\_mae: 0.0271 - val\_acc: 0.9257  
Epoch 921/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0198 - acc: 0.7264 - val\_loss: 0.0052 - val\_mae: 0.0257 - val\_acc: 0.7433  
Epoch 922/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0200 - acc: 0.7175 - val\_loss: 0.0053 - val\_mae: 0.0276 - val\_acc: 0.6821  
Epoch 923/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0203 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0281 - val\_acc: 0.7514  
Epoch 924/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0210 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.8720  
Epoch 925/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0204 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.6071  
Epoch 926/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0207 - acc: 0.7218 - val\_loss: 0.0053 - val\_mae: 0.0266 - val\_acc: 0.6302  
Epoch 927/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0199 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7239  
Epoch 928/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0202 - acc: 0.7299 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.6646  
Epoch 929/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae: 0.0208 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.7320  
Epoch 930/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:



0.0201 - acc: 0.7181 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.7408  
Epoch 931/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0204 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0260 - val\_acc: 0.7189  
Epoch 932/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0195 - acc: 0.7317 - val\_loss: 0.0052 - val\_mae: 0.0272 - val\_acc: 0.6433  
Epoch 933/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7234 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.6265  
Epoch 934/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0210 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.8588  
Epoch 935/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0202 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.6927  
Epoch 936/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0204 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.7108  
Epoch 937/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0203 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0261 - val\_acc: 0.8014  
Epoch 938/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0200 - acc: 0.7178 - val\_loss: 0.0052 - val\_mae: 0.0279 - val\_acc: 0.6983  
Epoch 939/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7159 - val\_loss: 0.0053 - val\_mae: 0.0275 - val\_acc: 0.7127  
Epoch 940/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8076  
Epoch 941/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0200 - acc: 0.7258 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7083  
Epoch 942/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0194 - acc: 0.7242 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6796  
Epoch 943/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7186 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.5796  
Epoch 944/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0202 - acc: 0.7229 - val\_loss: 0.0052 - val\_mae: 0.0266 - val\_acc: 0.8389  
Epoch 945/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7149 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7983  
Epoch 946/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:

0.0205 - acc: 0.7240 - val\_loss: 0.0052 - val\_mae: 0.0271 - val\_acc: 0.8476  
Epoch 947/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
0.0213 - acc: 0.7143 - val\_loss: 0.0053 - val\_mae: 0.0276 - val\_acc: 0.6571  
Epoch 948/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0203 - acc: 0.7282 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.7876  
Epoch 949/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7213 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.7689  
Epoch 950/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.6477  
Epoch 951/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0203 - acc: 0.7170 - val\_loss: 0.0052 - val\_mae: 0.0265 - val\_acc: 0.6377  
Epoch 952/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0204 - acc: 0.7237 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.8488  
Epoch 953/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7194 - val\_loss: 0.0053 - val\_mae: 0.0302 - val\_acc: 0.8245  
Epoch 954/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0212 - acc: 0.7154 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.7789  
Epoch 955/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.6196  
Epoch 956/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0202 - acc: 0.7245 - val\_loss: 0.0052 - val\_mae: 0.0277 - val\_acc: 0.6827  
Epoch 957/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0207 - acc: 0.7205 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.6721  
Epoch 958/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0206 - acc: 0.7232 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.6502  
Epoch 959/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0280 - val\_acc: 0.7614  
Epoch 960/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0200 - acc: 0.7183 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7458  
Epoch 961/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0203 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.8095  
Epoch 962/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:

0.0201 - acc: 0.7213 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.8676  
 Epoch 963/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0202 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7989  
 Epoch 964/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0198 - acc: 0.7250 - val\_loss: 0.0052 - val\_mae: 0.0264 - val\_acc: 0.7083  
 Epoch 965/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0198 - acc: 0.7143 - val\_loss: 0.0052 - val\_mae: 0.0270 - val\_acc: 0.6252  
 Epoch 966/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0201 - acc: 0.7256 - val\_loss: 0.0052 - val\_mae: 0.0278 - val\_acc: 0.7701  
 Epoch 967/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0211 - acc: 0.7237 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.6983  
 Epoch 968/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0205 - acc: 0.7264 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.6746  
 Epoch 969/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0205 - acc: 0.7274 - val\_loss: 0.0052 - val\_mae: 0.0287 - val\_acc: 0.8239  
 Epoch 970/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0210 - acc: 0.7261 - val\_loss: 0.0052 - val\_mae: 0.0283 - val\_acc: 0.7733  
 Epoch 971/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0209 - acc: 0.7189 - val\_loss: 0.0053 - val\_mae: 0.0276 - val\_acc: 0.5896  
 Epoch 972/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0205 - acc: 0.7301 - val\_loss: 0.0052 - val\_mae: 0.0275 - val\_acc: 0.8582  
 Epoch 973/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0200 - acc: 0.7277 - val\_loss: 0.0053 - val\_mae: 0.0286 - val\_acc: 0.6571  
 Epoch 974/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0205 - acc: 0.7256 - val\_loss: 0.0053 - val\_mae: 0.0295 - val\_acc: 0.8039  
 Epoch 975/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0036 - mae:  
 0.0205 - acc: 0.7224 - val\_loss: 0.0053 - val\_mae: 0.0280 - val\_acc: 0.7389  
 Epoch 976/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0200 - acc: 0.7199 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.7239  
 Epoch 977/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
 0.0203 - acc: 0.7240 - val\_loss: 0.0053 - val\_mae: 0.0285 - val\_acc: 0.6352  
 Epoch 978/1000  
 32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:

0.0204 - acc: 0.7224 - val\_loss: 0.0052 - val\_mae: 0.0282 - val\_acc: 0.6134  
Epoch 979/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0206 - acc: 0.7170 - val\_loss: 0.0052 - val\_mae: 0.0267 - val\_acc: 0.7745  
Epoch 980/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0203 - acc: 0.7272 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6877  
Epoch 981/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0274 - val\_acc: 0.8676  
Epoch 982/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7189 - val\_loss: 0.0052 - val\_mae: 0.0268 - val\_acc: 0.6352  
Epoch 983/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0197 - acc: 0.7216 - val\_loss: 0.0052 - val\_mae: 0.0269 - val\_acc: 0.6196  
Epoch 984/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7197 - val\_loss: 0.0053 - val\_mae: 0.0259 - val\_acc: 0.7245  
Epoch 985/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0197 - acc: 0.7210 - val\_loss: 0.0052 - val\_mae: 0.0258 - val\_acc: 0.6946  
Epoch 986/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0198 - acc: 0.7363 - val\_loss: 0.0052 - val\_mae: 0.0263 - val\_acc: 0.8326  
Epoch 987/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0197 - acc: 0.7221 - val\_loss: 0.0053 - val\_mae: 0.0285 - val\_acc: 0.7783  
Epoch 988/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7216 - val\_loss: 0.0053 - val\_mae: 0.0279 - val\_acc: 0.7720  
Epoch 989/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0201 - acc: 0.7178 - val\_loss: 0.0053 - val\_mae: 0.0280 - val\_acc: 0.7577  
Epoch 990/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0207 - acc: 0.7237 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.7114  
Epoch 991/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0199 - acc: 0.7237 - val\_loss: 0.0053 - val\_mae: 0.0278 - val\_acc: 0.8982  
Epoch 992/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0205 - acc: 0.7253 - val\_loss: 0.0053 - val\_mae: 0.0275 - val\_acc: 0.6983  
Epoch 993/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:  
0.0203 - acc: 0.7261 - val\_loss: 0.0053 - val\_mae: 0.0275 - val\_acc: 0.6621  
Epoch 994/1000  
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:

```

0.0206 - acc: 0.7250 - val_loss: 0.0052 - val_mae: 0.0270 - val_acc: 0.8357
Epoch 995/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:
0.0205 - acc: 0.7189 - val_loss: 0.0052 - val_mae: 0.0265 - val_acc: 0.6259
Epoch 996/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:
0.0199 - acc: 0.7178 - val_loss: 0.0052 - val_mae: 0.0270 - val_acc: 0.7395
Epoch 997/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:
0.0207 - acc: 0.7261 - val_loss: 0.0053 - val_mae: 0.0265 - val_acc: 0.8226
Epoch 998/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:
0.0202 - acc: 0.7221 - val_loss: 0.0053 - val_mae: 0.0262 - val_acc: 0.7352
Epoch 999/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:
0.0202 - acc: 0.7237 - val_loss: 0.0053 - val_mae: 0.0268 - val_acc: 0.7726
Epoch 1000/1000
32/32 [=====] - 0s 2ms/step - loss: 0.0035 - mae:
0.0203 - acc: 0.7194 - val_loss: 0.0053 - val_mae: 0.0277 - val_acc: 0.6246

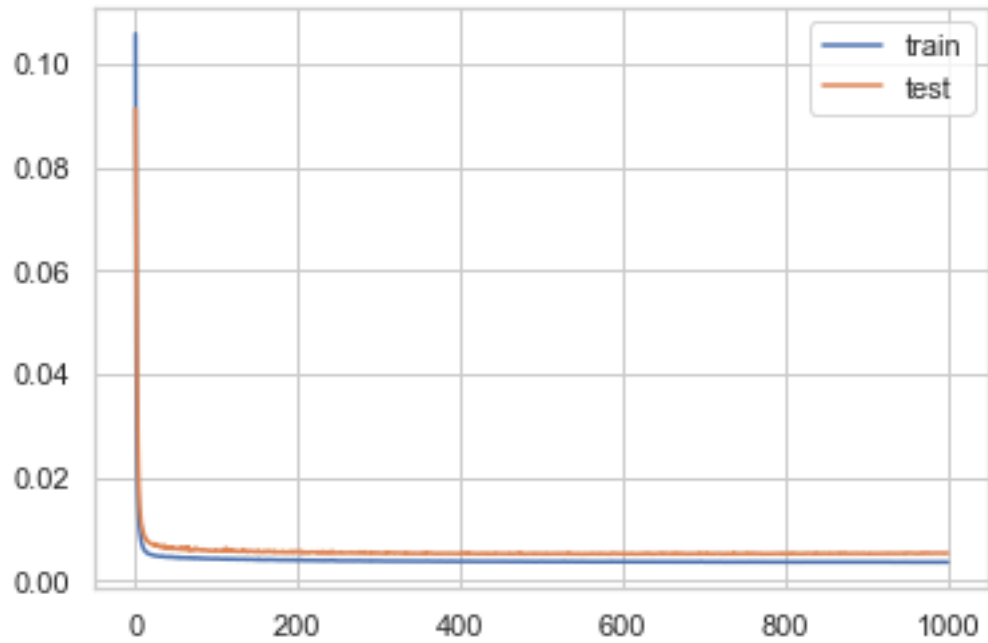
```

From the above log it is evident that the accuracy is consistently above 70%. The inclusion of all the additional features (Week\_number, Amount, Total\_sum, Age\_group, Pin\_code, Unit\_price, Log\_unit\_price) have resulted in significant impact in accuracy and it's good sign.

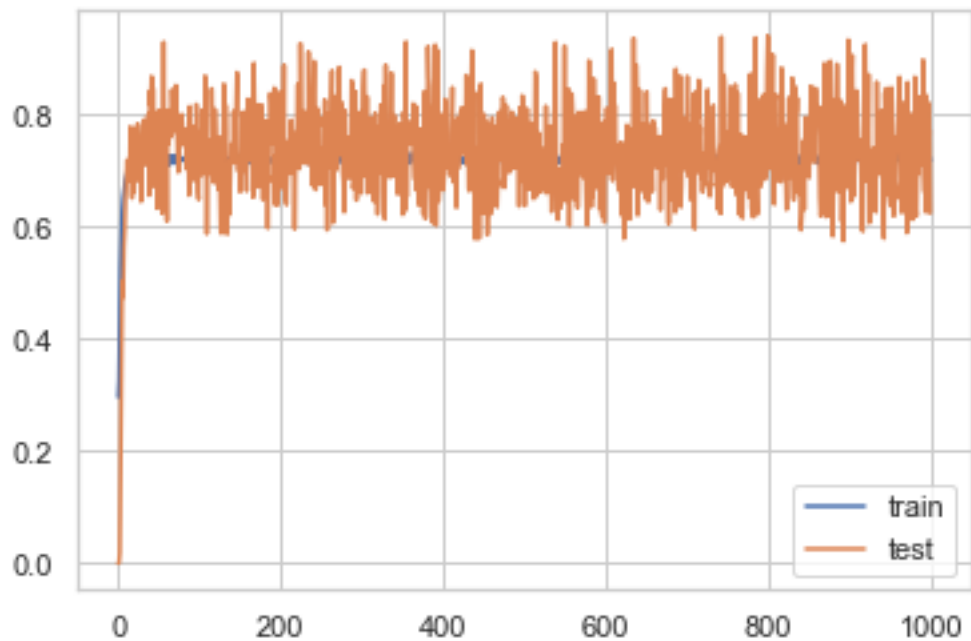
```

[37]: # plot history
from matplotlib import pyplot
pyplot.plot(RNN_classifier.history['loss'], label='train')
pyplot.plot(RNN_classifier.history['val_loss'], label='test')
pyplot.legend()
pyplot.show()

```



```
[38]: # plot history
from matplotlib import pyplot
pyplot.plot(RNN_classifier.history['acc'], label='train')
pyplot.plot(RNN_classifier.history['val_acc'], label='test')
pyplot.legend()
pyplot.show()
```



```
[39]: from numpy import concatenate
      Y_Pred = model.predict(test_X)
      Y_Pred.shape
```

```
[39]: (1334, 11)
```

```
[40]: test_X = test_X.reshape(test_X.shape[0], test_X.shape[2])
      test_X.shape
```

```
[40]: (1334, 18)
```

```
[41]: inv_Y_Pred = concatenate((scaler_x.inverse_transform(test_X), scaler_y.
      ↪inverse_transform(Y_Pred)),axis=1)
      inv_y = concatenate((scaler_x.inverse_transform(test_X),scaler_y.
      ↪inverse_transform(test_y)), axis=1)
```

```
[42]: # calculate RMSE
      from math import sqrt
      from sklearn.metrics import mean_squared_error
      rmse = sqrt(mean_squared_error(inv_y[0], inv_Y_Pred[0]))
      print('Test RMSE (Prediction): %.3f' % rmse)
```

```
Test RMSE (Prediction): 2822.107
```

```
[43]: indexer=10
      transformed_id=[''.join(list(map(str,list(map(int,list(scaler_x.
      ↪inverse_transform(test_X)[indexer][:-10])))))))]
      week_number=[scaler_x.inverse_transform(test_X)[indexer][-10]]
      amount=[scaler_x.inverse_transform(test_X)[indexer][-9]]
      total_sum=[scaler_x.inverse_transform(test_X)[indexer][-8]]
      age=[scaler_x.inverse_transform(test_X)[indexer][-7]]
      pin=[scaler_x.inverse_transform(test_X)[indexer][-6]]
      unit_price=[scaler_x.inverse_transform(test_X)[indexer][-5]]
      log_unit_price=[scaler_x.inverse_transform(test_X)[indexer][-4]]
```

```
[44]: prediction=list(scaler_y.inverse_transform(Y_Pred)[:,-3:][indexer])
```

```
[45]: #Prediction
      output=pd.
      ↪DataFrame((transformed_id+week_number+amount+total_sum+pin+age+unit_price+log_unit_price)).
      ↪T.copy()
      output.
      ↪columns=['Predicted_cust_id','Week_number','Amount','Total_sum','Age_group','Pin_code','Uni
      output
```

```
[45]: Predicted_cust_id Week_number Amount Total_sum Age_group Pin_code Unit_price
Log_unit_price
0      00020220          1.0      29.0      1444.0      6.0      5.0      1388.0
101.706
```

```
[46]: # Training
outputID=output['Predicted_cust_id'][0]
feature_df=X_set_df['customer_id']==outputID
X_set_df[feature_df][['customer_id','frequency','recency','monetary']]
```

```
[46]: customer_id frequency recency monetary
10      00020220          2         -2      4023.0
```

```
[47]: # true value
feature_df=y_set_df['customer_id']==outputID
y_set_df[feature_df][['customer_id','frequency','recency','monetary']]
```

```
[47]: customer_id frequency recency monetary
10      00020220         17        -13      22605.0
```