```
'''
*    Author: Olufemi Onimole
*    Date: 2019
*    Code version: 0.1

Dataset Source:
Dua, D. and Graff, C. (2019). UCI Machine Learning Repository [http://archive.ics.uci.edu/ml]

@misc{Dua:2019 ,
author = "Dua, Dheeru and Graff, Casey",
year = "2017",
title = "{UCI} Machine Learning Repository",
url = "http://archive.ics.uci.edu/ml",
institution = "University of California, Irvine, School of Information and Computer Sciences"
'''

!pip install --upgrade tensorflow

from __future__ import absolute_import, division, print_function, unicode_literals

import pandas as pd
import tensorflow as tf
```

Read csv file

```
csv_file = "/content/drive/My Drive/Colab Notebooks/Projects/Abalone/abalone.csv"
df = pd.read_csv(csv_file)
```

examine data

```
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

examine data types

```
df.dtypes
```

```
Sex                object
Length            float64
Diameter          float64
Height            float64
Whole weight      float64
Shucked weight    float64
Viscera weight    float64
Shell weight      float64
Rings               int64
dtype: object
```

convert category to numerical

```
df['Sex'] = pd.Categorical(df['Sex'])
df['Sex'] = df['Sex'].cat.codes
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	2	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	2	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	2	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

shuffle data

```
df = df.sample(frac=1).reset_index(drop=True)
```

Count unique category values

```
category_count = df['Rings'].max() + 1
```

split data into train, validation and test dataframes

```
# create test dataframe
dflen = len(df.index)
split_amount = int(dflen * .8)
df_train = df[:split_amount]
df_test = df[split_amount:]

# create train dataframe
dflen = len(df_train.index)
split_amount = int(dflen * .8)
```

```
df_train = df_train[:split_amount]

# create validation dataframe
df_val = df_train[split_amount:]
```

separate target

```
train_target = df_train.pop('Rings')
val_target = df_val.pop('Rings')
test_target = df_test.pop('Rings')
```

move dataframe to dataset

```
# create train dataset
train_dataset = tf.data.Dataset.from_tensor_slices((df_train.values, train_target.values))

# create validation dataset
val_dataset = tf.data.Dataset.from_tensor_slices((df_val.values, val_target.values))

# create test dataset
test_dataset = tf.data.Dataset.from_tensor_slices((df_test.values, test_target.values))
```

examine dataset

```
for feat, targ in train_dataset.take(5):
  print ('Features: {}, Target: {}:'.format(feat, targ))
```

```
Features: [1.     0.42   0.325  0.11   0.325  0.1245 0.0755 0.1025], Target: 7:
Features: [0.    0.51  0.385 0.135 0.632 0.282 0.145 0.17 ], Target: 8:
Features: [0.     0.7    0.525  0.19   1.6465 0.8545 0.307  0.3995], Target: 9:
Features: [0.     0.53   0.435  0.17   0.8155 0.2985 0.155  0.275 ], Target: 13:
Features: [1.     0.345  0.255  0.095  0.183  0.075  0.0385 0.06  ], Target: 6:
```

shuffle and batch datasets

```
train_dataset = train_dataset.shuffle(len(df)).batch(16, drop_remainder=True)
val_dataset = train_dataset.batch(16, drop_remainder=True)
test_dataset = train_dataset.batch(16, drop_remainder=True)
```

Create and train a model

```
def get_compiled_model():
  model = tf.keras.Sequential([
                               tf.keras.layers.Dense(1000, activation='relu'),
                               tf.keras.layers.Dense(1000, activation='relu'),
```

```
                                    tf.keras.layers.Dense(1000, activation='relu'),
                                    tf.keras.layers.Dense(1000, activation='relu'),
                                    tf.keras.layers.Dropout(0.2),
                                    tf.keras.layers.Dense(category_count, activation='softmax')
    ])

      model.compile(optimizer='adam',
                    loss='sparse_categorical_crossentropy',
                    metrics=['accuracy'])
      return model


    callback = tf.keras.callbacks.EarlyStopping(monitor='val_loss', patience=20)

    model = get_compiled_model()
    model.fit(train_dataset, validation_data=val_dataset, epochs=1000, verbose=2, callbacks=[call

    model.save('/content/drive/My Drive/Colab Notebooks/Projects/Abalone/my_model.h5')
```

```
WARNING:tensorflow:Layer sequential_7 is casting an input tensor from dtype float64 to t

If you intended to run this layer in float32, you can safely ignore this warning. If in

To change all layers to have dtype float64 by default, call `tf.keras.backend.set_floatx

Epoch 1/1000
167/167 - 5s - loss: 2.3714 - accuracy: 0.2058 - val_loss: 0.0000e+00 - val_accuracy: 0.
Epoch 2/1000
167/167 - 4s - loss: 2.1327 - accuracy: 0.2410 - val_loss: 2.0857 - val_accuracy: 0.2441
Epoch 3/1000
167/167 - 4s - loss: 2.0538 - accuracy: 0.2519 - val_loss: 1.9986 - val_accuracy: 0.2559
Epoch 4/1000
167/167 - 4s - loss: 2.0139 - accuracy: 0.2556 - val_loss: 1.9391 - val_accuracy: 0.2809
Epoch 5/1000
167/167 - 4s - loss: 2.0007 - accuracy: 0.2571 - val_loss: 1.9583 - val_accuracy: 0.2570
Epoch 6/1000
167/167 - 4s - loss: 1.9830 - accuracy: 0.2687 - val_loss: 1.9798 - val_accuracy: 0.2699
Epoch 7/1000
167/167 - 4s - loss: 1.9578 - accuracy: 0.2582 - val_loss: 1.8971 - val_accuracy: 0.2793
Epoch 8/1000
167/167 - 4s - loss: 1.9708 - accuracy: 0.2702 - val_loss: 1.9326 - val_accuracy: 0.2770
Epoch 9/1000
167/167 - 4s - loss: 1.9515 - accuracy: 0.2706 - val_loss: 1.9686 - val_accuracy: 0.2508
Epoch 10/1000
167/167 - 4s - loss: 1.9551 - accuracy: 0.2803 - val_loss: 1.9049 - val_accuracy: 0.2672
Epoch 11/1000
167/167 - 4s - loss: 1.9444 - accuracy: 0.2624 - val_loss: 1.9053 - val_accuracy: 0.2820
Epoch 12/1000
167/167 - 4s - loss: 1.9427 - accuracy: 0.2702 - val_loss: 1.9391 - val_accuracy: 0.2668
Epoch 13/1000
167/167 - 4s - loss: 1.9338 - accuracy: 0.2683 - val_loss: 1.9029 - val_accuracy: 0.2820
Epoch 14/1000
167/167 - 4s - loss: 1.9379 - accuracy: 0.2773 - val_loss: 1.8928 - val_accuracy: 0.2812
Epoch 15/1000
167/167 - 4s - loss: 1.9257 - accuracy: 0.2762 - val_loss: 1.8883 - val_accuracy: 0.2879
Epoch 16/1000
167/167 - 4s - loss: 1.9157 - accuracy: 0.2781 - val_loss: 1.8637 - val_accuracy: 0.2926
Epoch 17/1000
167/167 - 4s - loss: 1.9141 - accuracy: 0.2777 - val_loss: 1.9008 - val_accuracy: 0.2980
Epoch 18/1000
167/167 - 4s - loss: 1.9184 - accuracy: 0.2822 - val_loss: 1.8892 - val_accuracy: 0.2875
Epoch 19/1000
167/167 - 4s - loss: 1.9195 - accuracy: 0.2766 - val_loss: 1.8737 - val_accuracy: 0.2961
Epoch 20/1000
167/167 - 4s - loss: 1.9092 - accuracy: 0.2837 - val_loss: 1.8653 - val_accuracy: 0.2961
Epoch 21/1000
167/167 - 4s - loss: 1.9207 - accuracy: 0.2695 - val_loss: 1.8806 - val_accuracy: 0.2980
Epoch 22/1000
167/167 - 4s - loss: 1.9048 - accuracy: 0.2844 - val_loss: 1.9158 - val_accuracy: 0.2832
Epoch 23/1000
167/167 - 4s - loss: 1.8903 - accuracy: 0.2859 - val_loss: 1.8718 - val_accuracy: 0.2937
Epoch 24/1000
167/167 - 4s - loss: 1.8946 - accuracy: 0.2792 - val_loss: 1.9042 - val_accuracy: 0.2758
Epoch 25/1000
167/167 - 4s - loss: 1.8961 - accuracy: 0.2769 - val_loss: 1.8774 - val_accuracy: 0.2852
Epoch 26/1000
```

```
167/167 - 4s - loss: 1.8878 - accuracy: 0.2908 - val_loss: 1.8630 - val_accuracy: 0.2926
Epoch 27/1000
167/167 - 4s - loss: 1.8756 - accuracy: 0.2874 - val_loss: 1.8721 - val_accuracy: 0.3027
Epoch 28/1000
167/167 - 4s - loss: 1.8752 - accuracy: 0.2837 - val_loss: 1.8524 - val_accuracy: 0.2996
Epoch 29/1000
167/167 - 4s - loss: 1.8929 - accuracy: 0.2953 - val_loss: 1.9114 - val_accuracy: 0.2969
Epoch 30/1000
167/167 - 4s - loss: 1.8806 - accuracy: 0.2844 - val_loss: 1.8674 - val_accuracy: 0.2961
Epoch 31/1000
167/167 - 4s - loss: 1.8716 - accuracy: 0.2964 - val_loss: 1.8646 - val_accuracy: 0.2973
Epoch 32/1000
167/167 - 4s - loss: 1.8763 - accuracy: 0.2957 - val_loss: 1.8228 - val_accuracy: 0.3000
Epoch 33/1000
167/167 - 4s - loss: 1.8746 - accuracy: 0.2852 - val_loss: 1.8275 - val_accuracy: 0.3066
Epoch 34/1000
167/167 - 4s - loss: 1.8600 - accuracy: 0.2945 - val_loss: 1.8746 - val_accuracy: 0.2945
Epoch 35/1000
167/167 - 4s - loss: 1.8654 - accuracy: 0.2904 - val_loss: 1.8193 - val_accuracy: 0.3043
Epoch 36/1000
167/167 - 4s - loss: 1.8643 - accuracy: 0.2908 - val_loss: 1.8076 - val_accuracy: 0.3168
Epoch 37/1000
167/167 - 4s - loss: 1.8604 - accuracy: 0.2885 - val_loss: 1.8235 - val_accuracy: 0.2941
Epoch 38/1000
167/167 - 4s - loss: 1.8564 - accuracy: 0.2848 - val_loss: 1.8196 - val_accuracy: 0.3137
Epoch 39/1000
167/167 - 4s - loss: 1.8497 - accuracy: 0.3035 - val_loss: 1.8472 - val_accuracy: 0.3012
Epoch 40/1000
167/167 - 4s - loss: 1.8544 - accuracy: 0.2972 - val_loss: 1.8150 - val_accuracy: 0.3121
Epoch 41/1000
167/167 - 4s - loss: 1.8462 - accuracy: 0.3016 - val_loss: 1.8175 - val_accuracy: 0.3059
Epoch 42/1000
167/167 - 4s - loss: 1.8513 - accuracy: 0.3054 - val_loss: 1.8900 - val_accuracy: 0.2852
Epoch 43/1000
167/167 - 4s - loss: 1.8469 - accuracy: 0.3039 - val_loss: 1.7963 - val_accuracy: 0.3145
Epoch 44/1000
167/167 - 4s - loss: 1.8449 - accuracy: 0.2968 - val_loss: 1.8066 - val_accuracy: 0.3133
Epoch 45/1000
167/167 - 4s - loss: 1.8484 - accuracy: 0.2979 - val_loss: 1.8102 - val_accuracy: 0.3211
Epoch 46/1000
167/167 - 4s - loss: 1.8441 - accuracy: 0.3005 - val_loss: 1.8162 - val_accuracy: 0.3168
Epoch 47/1000
167/167 - 4s - loss: 1.8358 - accuracy: 0.3016 - val_loss: 1.8078 - val_accuracy: 0.3121
Epoch 48/1000
167/167 - 4s - loss: 1.8441 - accuracy: 0.3058 - val_loss: 1.8056 - val_accuracy: 0.3074
Epoch 49/1000
167/167 - 4s - loss: 1.8362 - accuracy: 0.3140 - val_loss: 1.8960 - val_accuracy: 0.3023
Epoch 50/1000
167/167 - 4s - loss: 1.8451 - accuracy: 0.2889 - val_loss: 1.8247 - val_accuracy: 0.3059
Epoch 51/1000
167/167 - 4s - loss: 1.8380 - accuracy: 0.3031 - val_loss: 1.7869 - val_accuracy: 0.3230
Epoch 52/1000
167/167 - 4s - loss: 1.8239 - accuracy: 0.3009 - val_loss: 1.8016 - val_accuracy: 0.3074
Epoch 53/1000
167/167 - 4s - loss: 1.8277 - accuracy: 0.3095 - val_loss: 1.8530 - val_accuracy: 0.3035
Epoch 54/1000
167/167 - 4s - loss: 1.8283 - accuracy: 0.3058 - val_loss: 1.7788 - val_accuracy: 0.3191
Epoch 55/1000
```

```
167/167 - 4s - loss: 1.8154 - accuracy: 0.3031 - val_loss: 1.7823 - val_accuracy: 0.3152
Epoch 56/1000
167/167 - 4s - loss: 1.8220 - accuracy: 0.3050 - val_loss: 1.8049 - val_accuracy: 0.3137
Epoch 57/1000
167/167 - 4s - loss: 1.8118 - accuracy: 0.3054 - val_loss: 1.7850 - val_accuracy: 0.3160
Epoch 58/1000
167/167 - 4s - loss: 1.8161 - accuracy: 0.3039 - val_loss: 1.7628 - val_accuracy: 0.3254
Epoch 59/1000
167/167 - 4s - loss: 1.8139 - accuracy: 0.3035 - val_loss: 1.8040 - val_accuracy: 0.3020
Epoch 60/1000
167/167 - 4s - loss: 1.8199 - accuracy: 0.3069 - val_loss: 1.8428 - val_accuracy: 0.3168
Epoch 61/1000
167/167 - 4s - loss: 1.8227 - accuracy: 0.3088 - val_loss: 1.7692 - val_accuracy: 0.3164
Epoch 62/1000
167/167 - 4s - loss: 1.8107 - accuracy: 0.3001 - val_loss: 1.7566 - val_accuracy: 0.3191
Epoch 63/1000
167/167 - 4s - loss: 1.8045 - accuracy: 0.3147 - val_loss: 1.7732 - val_accuracy: 0.3156
Epoch 64/1000
167/167 - 4s - loss: 1.8019 - accuracy: 0.3110 - val_loss: 1.7423 - val_accuracy: 0.3270
Epoch 65/1000
167/167 - 4s - loss: 1.7994 - accuracy: 0.3076 - val_loss: 1.7486 - val_accuracy: 0.3313
Epoch 66/1000
167/167 - 4s - loss: 1.8114 - accuracy: 0.3031 - val_loss: 1.7497 - val_accuracy: 0.3359
Epoch 67/1000
167/167 - 4s - loss: 1.8018 - accuracy: 0.3118 - val_loss: 1.7688 - val_accuracy: 0.3184
Epoch 68/1000
167/167 - 4s - loss: 1.8034 - accuracy: 0.3095 - val_loss: 1.7375 - val_accuracy: 0.3316
Epoch 69/1000
167/167 - 4s - loss: 1.7962 - accuracy: 0.3155 - val_loss: 1.7488 - val_accuracy: 0.3328
Epoch 70/1000
167/167 - 4s - loss: 1.7882 - accuracy: 0.3129 - val_loss: 1.7540 - val_accuracy: 0.3285
Epoch 71/1000
167/167 - 4s - loss: 1.7777 - accuracy: 0.3125 - val_loss: 1.7314 - val_accuracy: 0.3246
Epoch 72/1000
167/167 - 4s - loss: 1.7913 - accuracy: 0.3151 - val_loss: 1.7477 - val_accuracy: 0.3355
Epoch 73/1000
167/167 - 4s - loss: 1.7847 - accuracy: 0.3181 - val_loss: 1.7659 - val_accuracy: 0.3277
Epoch 74/1000
167/167 - 4s - loss: 1.7782 - accuracy: 0.3207 - val_loss: 1.7309 - val_accuracy: 0.3301
Epoch 75/1000
167/167 - 4s - loss: 1.7681 - accuracy: 0.3219 - val_loss: 1.7452 - val_accuracy: 0.3270
Epoch 76/1000
167/167 - 4s - loss: 1.7706 - accuracy: 0.3234 - val_loss: 1.7344 - val_accuracy: 0.3277
Epoch 77/1000
167/167 - 4s - loss: 1.7768 - accuracy: 0.3237 - val_loss: 1.7340 - val_accuracy: 0.3250
Epoch 78/1000
167/167 - 4s - loss: 1.7766 - accuracy: 0.3211 - val_loss: 1.7529 - val_accuracy: 0.3289
Epoch 79/1000
167/167 - 4s - loss: 1.7708 - accuracy: 0.3136 - val_loss: 1.8847 - val_accuracy: 0.2914
Epoch 80/1000
167/167 - 4s - loss: 1.7756 - accuracy: 0.3151 - val_loss: 1.7070 - val_accuracy: 0.3402
Epoch 81/1000
167/167 - 4s - loss: 1.7579 - accuracy: 0.3222 - val_loss: 1.7171 - val_accuracy: 0.3379
Epoch 82/1000
167/167 - 4s - loss: 1.7644 - accuracy: 0.3211 - val_loss: 1.7151 - val_accuracy: 0.3402
Epoch 83/1000
167/167 - 4s - loss: 1.7492 - accuracy: 0.3166 - val_loss: 1.7078 - val_accuracy: 0.3477
Epoch 84/1000
```

```
Epoch 84/1000
167/167 - 4s - loss: 1.7688 - accuracy: 0.3256 - val_loss: 1.7010 - val_accuracy: 0.3336
Epoch 85/1000
167/167 - 4s - loss: 1.7473 - accuracy: 0.3249 - val_loss: 1.6864 - val_accuracy: 0.3477
Epoch 86/1000
167/167 - 4s - loss: 1.7352 - accuracy: 0.3256 - val_loss: 1.6808 - val_accuracy: 0.3500
Epoch 87/1000
167/167 - 4s - loss: 1.7359 - accuracy: 0.3361 - val_loss: 1.6994 - val_accuracy: 0.3320
Epoch 88/1000
167/167 - 4s - loss: 1.7420 - accuracy: 0.3282 - val_loss: 1.6815 - val_accuracy: 0.3555
Epoch 89/1000
167/167 - 4s - loss: 1.7453 - accuracy: 0.3219 - val_loss: 1.7103 - val_accuracy: 0.3387
Epoch 90/1000
167/167 - 4s - loss: 1.7349 - accuracy: 0.3260 - val_loss: 1.6804 - val_accuracy: 0.3480
Epoch 91/1000
167/167 - 4s - loss: 1.7219 - accuracy: 0.3353 - val_loss: 1.6819 - val_accuracy: 0.3500
Epoch 92/1000
167/167 - 4s - loss: 1.7380 - accuracy: 0.3312 - val_loss: 1.6841 - val_accuracy: 0.3410
Epoch 93/1000
167/167 - 4s - loss: 1.7483 - accuracy: 0.3204 - val_loss: 1.6781 - val_accuracy: 0.3551
Epoch 94/1000
167/167 - 4s - loss: 1.7152 - accuracy: 0.3342 - val_loss: 1.6499 - val_accuracy: 0.3582
Epoch 95/1000
167/167 - 4s - loss: 1.7483 - accuracy: 0.3256 - val_loss: 1.6862 - val_accuracy: 0.3422
Epoch 96/1000
167/167 - 4s - loss: 1.7247 - accuracy: 0.3365 - val_loss: 1.6793 - val_accuracy: 0.3426
Epoch 97/1000
167/167 - 4s - loss: 1.7294 - accuracy: 0.3219 - val_loss: 1.6980 - val_accuracy: 0.3422
Epoch 98/1000
167/167 - 4s - loss: 1.7128 - accuracy: 0.3432 - val_loss: 1.6783 - val_accuracy: 0.3449
Epoch 99/1000
167/167 - 4s - loss: 1.7291 - accuracy: 0.3204 - val_loss: 1.6443 - val_accuracy: 0.3625
Epoch 100/1000
167/167 - 4s - loss: 1.7095 - accuracy: 0.3335 - val_loss: 1.6540 - val_accuracy: 0.3512
Epoch 101/1000
167/167 - 4s - loss: 1.6950 - accuracy: 0.3406 - val_loss: 1.6349 - val_accuracy: 0.3648
Epoch 102/1000
167/167 - 4s - loss: 1.7151 - accuracy: 0.3372 - val_loss: 1.6970 - val_accuracy: 0.3484
Epoch 103/1000
167/167 - 4s - loss: 1.7155 - accuracy: 0.3379 - val_loss: 1.6614 - val_accuracy: 0.3480
Epoch 104/1000
167/167 - 4s - loss: 1.7046 - accuracy: 0.3293 - val_loss: 1.6257 - val_accuracy: 0.3691
Epoch 105/1000
167/167 - 4s - loss: 1.6952 - accuracy: 0.3372 - val_loss: 1.6446 - val_accuracy: 0.3574
Epoch 106/1000
167/167 - 4s - loss: 1.6852 - accuracy: 0.3458 - val_loss: 1.6560 - val_accuracy: 0.3566
Epoch 107/1000
167/167 - 4s - loss: 1.6996 - accuracy: 0.3473 - val_loss: 1.6636 - val_accuracy: 0.3582
Epoch 108/1000
167/167 - 4s - loss: 1.6842 - accuracy: 0.3350 - val_loss: 1.6224 - val_accuracy: 0.3582
Epoch 109/1000
167/167 - 4s - loss: 1.6786 - accuracy: 0.3409 - val_loss: 1.6316 - val_accuracy: 0.3688
Epoch 110/1000
167/167 - 4s - loss: 1.6662 - accuracy: 0.3432 - val_loss: 1.6359 - val_accuracy: 0.3605
Epoch 111/1000
167/167 - 4s - loss: 1.6701 - accuracy: 0.3436 - val_loss: 1.6370 - val_accuracy: 0.3598
Epoch 112/1000
167/167 - 4s - loss: 1.6574 - accuracy: 0.3469 - val_loss: 1.6472 - val_accuracy: 0.3586
```

```
Epoch 113/1000
167/167 - 4s - loss: 1.6812 - accuracy: 0.3342 - val_loss: 1.6138 - val_accuracy: 0.3648
Epoch 114/1000
167/167 - 4s - loss: 1.6564 - accuracy: 0.3443 - val_loss: 1.7349 - val_accuracy: 0.3277
Epoch 115/1000
167/167 - 4s - loss: 1.6601 - accuracy: 0.3413 - val_loss: 1.5727 - val_accuracy: 0.3715
Epoch 116/1000
167/167 - 4s - loss: 1.6530 - accuracy: 0.3484 - val_loss: 1.6057 - val_accuracy: 0.3617
Epoch 117/1000
167/167 - 4s - loss: 1.6581 - accuracy: 0.3413 - val_loss: 1.5797 - val_accuracy: 0.3738
Epoch 118/1000
167/167 - 4s - loss: 1.6382 - accuracy: 0.3615 - val_loss: 1.5920 - val_accuracy: 0.3652
Epoch 119/1000
167/167 - 4s - loss: 1.6416 - accuracy: 0.3484 - val_loss: 1.5789 - val_accuracy: 0.3879
Epoch 120/1000
167/167 - 4s - loss: 1.6377 - accuracy: 0.3518 - val_loss: 1.5577 - val_accuracy: 0.3785
Epoch 121/1000
167/167 - 4s - loss: 1.6534 - accuracy: 0.3597 - val_loss: 1.5856 - val_accuracy: 0.3719
Epoch 122/1000
167/167 - 4s - loss: 1.6361 - accuracy: 0.3462 - val_loss: 1.5560 - val_accuracy: 0.3770
Epoch 123/1000
167/167 - 4s - loss: 1.6206 - accuracy: 0.3570 - val_loss: 1.6317 - val_accuracy: 0.3621
Epoch 124/1000
167/167 - 4s - loss: 1.6258 - accuracy: 0.3529 - val_loss: 1.5732 - val_accuracy: 0.3754
Epoch 125/1000
167/167 - 4s - loss: 1.6351 - accuracy: 0.3567 - val_loss: 1.5665 - val_accuracy: 0.3828
Epoch 126/1000
167/167 - 4s - loss: 1.6036 - accuracy: 0.3567 - val_loss: 1.5398 - val_accuracy: 0.3914
Epoch 127/1000
167/167 - 4s - loss: 1.5900 - accuracy: 0.3660 - val_loss: 1.5129 - val_accuracy: 0.4004
Epoch 128/1000
167/167 - 4s - loss: 1.6014 - accuracy: 0.3593 - val_loss: 1.5710 - val_accuracy: 0.3777
Epoch 129/1000
167/167 - 4s - loss: 1.5995 - accuracy: 0.3593 - val_loss: 1.5198 - val_accuracy: 0.3957
Epoch 130/1000
167/167 - 4s - loss: 1.6074 - accuracy: 0.3720 - val_loss: 1.5728 - val_accuracy: 0.3797
Epoch 131/1000
167/167 - 4s - loss: 1.5999 - accuracy: 0.3604 - val_loss: 1.5315 - val_accuracy: 0.3898
Epoch 132/1000
167/167 - 4s - loss: 1.5839 - accuracy: 0.3679 - val_loss: 1.5725 - val_accuracy: 0.3879
Epoch 133/1000
167/167 - 4s - loss: 1.5941 - accuracy: 0.3630 - val_loss: 1.5211 - val_accuracy: 0.3895
Epoch 134/1000
167/167 - 4s - loss: 1.5851 - accuracy: 0.3675 - val_loss: 1.5372 - val_accuracy: 0.3922
Epoch 135/1000
167/167 - 4s - loss: 1.5697 - accuracy: 0.3754 - val_loss: 1.5145 - val_accuracy: 0.3984
Epoch 136/1000
167/167 - 4s - loss: 1.5722 - accuracy: 0.3675 - val_loss: 1.4804 - val_accuracy: 0.4055
Epoch 137/1000
167/167 - 4s - loss: 1.5517 - accuracy: 0.3885 - val_loss: 1.4860 - val_accuracy: 0.4145
Epoch 138/1000
167/167 - 4s - loss: 1.5516 - accuracy: 0.3862 - val_loss: 1.5920 - val_accuracy: 0.3770
Epoch 139/1000
167/167 - 4s - loss: 1.5545 - accuracy: 0.3817 - val_loss: 1.4780 - val_accuracy: 0.4207
Epoch 140/1000
167/167 - 4s - loss: 1.6044 - accuracy: 0.3731 - val_loss: 1.4981 - val_accuracy: 0.4070
Epoch 141/1000
167/167 - 4s - loss: 1.5735 - accuracy: 0.3825 - val_loss: 1.4944 - val_accuracy: 0.4148
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Epoch 142/1000
167/167 - 4s - loss: 1.5426 - accuracy: 0.3859 - val_loss: 1.4895 - val_accuracy: 0.4117
Epoch 143/1000
167/167 - 4s - loss: 1.5202 - accuracy: 0.3933 - val_loss: 1.4846 - val_accuracy: 0.4109
Epoch 144/1000
167/167 - 4s - loss: 1.5227 - accuracy: 0.3829 - val_loss: 1.4967 - val_accuracy: 0.3887
Epoch 145/1000
167/167 - 4s - loss: 1.5658 - accuracy: 0.3761 - val_loss: 1.4986 - val_accuracy: 0.4152
Epoch 146/1000
167/167 - 4s - loss: 1.5305 - accuracy: 0.3877 - val_loss: 1.4521 - val_accuracy: 0.4184
Epoch 147/1000
167/167 - 4s - loss: 1.5270 - accuracy: 0.3907 - val_loss: 1.4226 - val_accuracy: 0.4313
Epoch 148/1000
167/167 - 4s - loss: 1.5192 - accuracy: 0.3922 - val_loss: 1.4061 - val_accuracy: 0.4359
Epoch 149/1000
167/167 - 4s - loss: 1.4974 - accuracy: 0.3945 - val_loss: 1.4324 - val_accuracy: 0.4203
Epoch 150/1000
167/167 - 4s - loss: 1.5266 - accuracy: 0.3855 - val_loss: 1.5795 - val_accuracy: 0.3879
Epoch 151/1000
167/167 - 4s - loss: 1.4840 - accuracy: 0.4113 - val_loss: 1.4215 - val_accuracy: 0.4246
Epoch 152/1000
167/167 - 4s - loss: 1.4900 - accuracy: 0.4072 - val_loss: 1.4673 - val_accuracy: 0.4262
Epoch 153/1000
167/167 - 4s - loss: 1.4922 - accuracy: 0.4001 - val_loss: 1.4460 - val_accuracy: 0.4266
Epoch 154/1000
167/167 - 4s - loss: 1.4779 - accuracy: 0.4038 - val_loss: 1.4096 - val_accuracy: 0.4348
Epoch 155/1000
167/167 - 4s - loss: 1.4675 - accuracy: 0.3993 - val_loss: 1.3696 - val_accuracy: 0.4543
Epoch 156/1000
167/167 - 4s - loss: 1.4674 - accuracy: 0.4083 - val_loss: 1.4258 - val_accuracy: 0.4281
Epoch 157/1000
167/167 - 4s - loss: 1.4525 - accuracy: 0.4154 - val_loss: 1.3782 - val_accuracy: 0.4473
Epoch 158/1000
167/167 - 4s - loss: 1.4558 - accuracy: 0.4068 - val_loss: 1.3576 - val_accuracy: 0.4547
Epoch 159/1000
167/167 - 4s - loss: 1.4529 - accuracy: 0.4162 - val_loss: 1.3286 - val_accuracy: 0.4715
Epoch 160/1000
167/167 - 4s - loss: 1.4483 - accuracy: 0.4121 - val_loss: 1.4039 - val_accuracy: 0.4363
Epoch 161/1000
167/167 - 4s - loss: 1.4471 - accuracy: 0.4094 - val_loss: 1.3642 - val_accuracy: 0.4566
Epoch 162/1000
167/167 - 4s - loss: 1.4436 - accuracy: 0.4158 - val_loss: 1.3172 - val_accuracy: 0.4785
Epoch 163/1000
167/167 - 4s - loss: 1.4218 - accuracy: 0.4150 - val_loss: 1.3468 - val_accuracy: 0.4668
Epoch 164/1000
167/167 - 4s - loss: 1.4088 - accuracy: 0.4326 - val_loss: 1.3079 - val_accuracy: 0.4629
Epoch 165/1000
167/167 - 4s - loss: 1.4000 - accuracy: 0.4296 - val_loss: 1.3411 - val_accuracy: 0.4543
Epoch 166/1000
167/167 - 4s - loss: 1.3918 - accuracy: 0.4338 - val_loss: 1.3285 - val_accuracy: 0.4641
Epoch 167/1000
167/167 - 4s - loss: 1.3883 - accuracy: 0.4412 - val_loss: 1.2819 - val_accuracy: 0.4887
Epoch 168/1000
167/167 - 4s - loss: 1.4048 - accuracy: 0.4368 - val_loss: 1.3277 - val_accuracy: 0.4625
Epoch 169/1000
167/167 - 4s - loss: 1.3840 - accuracy: 0.4401 - val_loss: 1.2652 - val_accuracy: 0.5000
Epoch 170/1000
167/167 - 4s - loss: 1.3650 - accuracy: 0.4461 - val_loss: 1.2612 - val_accuracy: 0.4961
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167/167 - 4s - loss: 1.3650 - accuracy: 0.4461 - val_loss: 1.2612 - val_accuracy: 0.4961
Epoch 171/1000
167/167 - 4s - loss: 1.3579 - accuracy: 0.4499 - val_loss: 1.2251 - val_accuracy: 0.5078
Epoch 172/1000
167/167 - 4s - loss: 1.3682 - accuracy: 0.4435 - val_loss: 1.2460 - val_accuracy: 0.5137
Epoch 173/1000
167/167 - 4s - loss: 1.3614 - accuracy: 0.4547 - val_loss: 1.3575 - val_accuracy: 0.4559
Epoch 174/1000
167/167 - 4s - loss: 1.3666 - accuracy: 0.4304 - val_loss: 1.2073 - val_accuracy: 0.5242
Epoch 175/1000
167/167 - 4s - loss: 1.3317 - accuracy: 0.4562 - val_loss: 1.2496 - val_accuracy: 0.5027
Epoch 176/1000
167/167 - 4s - loss: 1.3336 - accuracy: 0.4491 - val_loss: 1.2660 - val_accuracy: 0.4980
Epoch 177/1000
167/167 - 4s - loss: 1.3224 - accuracy: 0.4633 - val_loss: 1.2398 - val_accuracy: 0.4980
Epoch 178/1000
167/167 - 4s - loss: 1.3063 - accuracy: 0.4760 - val_loss: 1.2396 - val_accuracy: 0.5070
Epoch 179/1000
167/167 - 4s - loss: 1.3246 - accuracy: 0.4686 - val_loss: 1.1860 - val_accuracy: 0.5297
Epoch 180/1000
167/167 - 4s - loss: 1.2849 - accuracy: 0.4764 - val_loss: 1.1957 - val_accuracy: 0.5145
Epoch 181/1000
167/167 - 4s - loss: 1.3054 - accuracy: 0.4731 - val_loss: 1.1680 - val_accuracy: 0.5328
Epoch 182/1000
167/167 - 4s - loss: 1.3249 - accuracy: 0.4697 - val_loss: 1.2196 - val_accuracy: 0.5082
Epoch 183/1000
167/167 - 4s - loss: 1.2655 - accuracy: 0.4847 - val_loss: 1.1450 - val_accuracy: 0.5457
Epoch 184/1000
167/167 - 4s - loss: 1.2678 - accuracy: 0.4828 - val_loss: 1.1812 - val_accuracy: 0.5309
Epoch 185/1000
167/167 - 4s - loss: 1.2742 - accuracy: 0.4787 - val_loss: 1.1594 - val_accuracy: 0.5410
Epoch 186/1000
167/167 - 4s - loss: 1.2872 - accuracy: 0.4802 - val_loss: 1.1800 - val_accuracy: 0.5273
Epoch 187/1000
167/167 - 4s - loss: 1.2338 - accuracy: 0.5004 - val_loss: 1.1231 - val_accuracy: 0.5492
Epoch 188/1000
167/167 - 4s - loss: 1.2872 - accuracy: 0.4738 - val_loss: 1.1356 - val_accuracy: 0.5500
Epoch 189/1000
167/167 - 4s - loss: 1.2632 - accuracy: 0.4880 - val_loss: 1.1727 - val_accuracy: 0.5211
Epoch 190/1000
167/167 - 4s - loss: 1.2162 - accuracy: 0.4985 - val_loss: 1.1228 - val_accuracy: 0.5586
Epoch 191/1000
167/167 - 4s - loss: 1.2230 - accuracy: 0.5041 - val_loss: 1.1179 - val_accuracy: 0.5410
Epoch 192/1000
167/167 - 4s - loss: 1.2170 - accuracy: 0.5049 - val_loss: 1.0454 - val_accuracy: 0.5887
Epoch 193/1000
167/167 - 4s - loss: 1.1849 - accuracy: 0.5045 - val_loss: 1.1166 - val_accuracy: 0.5551
Epoch 194/1000
167/167 - 4s - loss: 1.1913 - accuracy: 0.5172 - val_loss: 1.2707 - val_accuracy: 0.4848
Epoch 195/1000
167/167 - 4s - loss: 1.2173 - accuracy: 0.5082 - val_loss: 1.1102 - val_accuracy: 0.5434
Epoch 196/1000
167/167 - 4s - loss: 1.1967 - accuracy: 0.5150 - val_loss: 1.0997 - val_accuracy: 0.5641
Epoch 197/1000
167/167 - 4s - loss: 1.1958 - accuracy: 0.5064 - val_loss: 1.0403 - val_accuracy: 0.5824
Epoch 198/1000
167/167 - 4s - loss: 1.1742 - accuracy: 0.5153 - val_loss: 1.0470 - val_accuracy: 0.5813
Epoch 199/1000
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167/167 - 4s - loss: 1.1556 - accuracy: 0.5299 - val_loss: 1.0126 - val_accuracy: 0.5918
Epoch 200/1000
167/167 - 4s - loss: 1.1443 - accuracy: 0.5273 - val_loss: 1.0613 - val_accuracy: 0.5707
Epoch 201/1000
167/167 - 4s - loss: 1.1283 - accuracy: 0.5389 - val_loss: 1.0232 - val_accuracy: 0.5891
Epoch 202/1000
167/167 - 4s - loss: 1.1167 - accuracy: 0.5363 - val_loss: 1.0394 - val_accuracy: 0.5848
Epoch 203/1000
167/167 - 4s - loss: 1.1329 - accuracy: 0.5333 - val_loss: 1.0461 - val_accuracy: 0.5738
Epoch 204/1000
167/167 - 4s - loss: 1.1189 - accuracy: 0.5359 - val_loss: 1.0336 - val_accuracy: 0.5852
Epoch 205/1000
167/167 - 4s - loss: 1.1271 - accuracy: 0.5501 - val_loss: 0.9958 - val_accuracy: 0.5918
Epoch 206/1000
167/167 - 4s - loss: 1.1053 - accuracy: 0.5457 - val_loss: 0.9710 - val_accuracy: 0.6160
Epoch 207/1000
167/167 - 4s - loss: 1.1421 - accuracy: 0.5202 - val_loss: 0.9447 - val_accuracy: 0.6277
Epoch 208/1000
167/167 - 4s - loss: 1.0895 - accuracy: 0.5636 - val_loss: 1.0044 - val_accuracy: 0.6020
Epoch 209/1000
167/167 - 4s - loss: 1.1002 - accuracy: 0.5449 - val_loss: 1.1816 - val_accuracy: 0.5215
Epoch 210/1000
167/167 - 4s - loss: 1.0913 - accuracy: 0.5472 - val_loss: 0.9095 - val_accuracy: 0.6523
Epoch 211/1000
167/167 - 4s - loss: 1.0428 - accuracy: 0.5816 - val_loss: 0.9323 - val_accuracy: 0.6324
Epoch 212/1000
167/167 - 4s - loss: 1.0594 - accuracy: 0.5618 - val_loss: 0.9020 - val_accuracy: 0.6488
Epoch 213/1000
167/167 - 4s - loss: 1.0297 - accuracy: 0.5763 - val_loss: 0.9404 - val_accuracy: 0.6371
Epoch 214/1000
167/167 - 4s - loss: 1.0981 - accuracy: 0.5595 - val_loss: 0.9157 - val_accuracy: 0.6422
Epoch 215/1000
167/167 - 4s - loss: 1.0660 - accuracy: 0.5546 - val_loss: 0.9981 - val_accuracy: 0.6039
Epoch 216/1000
167/167 - 4s - loss: 1.0794 - accuracy: 0.5591 - val_loss: 0.9255 - val_accuracy: 0.6359
Epoch 217/1000
167/167 - 4s - loss: 1.0490 - accuracy: 0.5767 - val_loss: 0.9385 - val_accuracy: 0.6297
Epoch 218/1000
167/167 - 4s - loss: 1.0558 - accuracy: 0.5722 - val_loss: 1.0325 - val_accuracy: 0.5820
Epoch 219/1000
167/167 - 4s - loss: 1.0442 - accuracy: 0.5707 - val_loss: 0.8620 - val_accuracy: 0.6660
Epoch 220/1000
167/167 - 4s - loss: 1.0051 - accuracy: 0.5894 - val_loss: 0.8814 - val_accuracy: 0.6609
Epoch 221/1000
167/167 - 4s - loss: 1.0426 - accuracy: 0.5647 - val_loss: 0.9447 - val_accuracy: 0.6238
Epoch 222/1000
167/167 - 4s - loss: 1.0589 - accuracy: 0.5696 - val_loss: 0.9117 - val_accuracy: 0.6461
Epoch 223/1000
167/167 - 4s - loss: 1.0261 - accuracy: 0.5808 - val_loss: 0.8648 - val_accuracy: 0.6621
Epoch 224/1000
167/167 - 4s - loss: 0.9756 - accuracy: 0.5962 - val_loss: 0.9331 - val_accuracy: 0.6195
Epoch 225/1000
167/167 - 4s - loss: 0.9896 - accuracy: 0.5868 - val_loss: 0.8747 - val_accuracy: 0.6523
Epoch 226/1000
167/167 - 4s - loss: 0.9717 - accuracy: 0.5928 - val_loss: 1.0135 - val_accuracy: 0.5797
Epoch 227/1000
167/167 - 4s - loss: 1.0241 - accuracy: 0.5827 - val_loss: 0.8201 - val_accuracy: 0.6715
Epoch 228/1000
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167/167 - 4s - loss: 0.9488 - accuracy: 0.6052 - val_loss: 0.8118 - val_accuracy: 0.6867
Epoch 229/1000
167/167 - 4s - loss: 0.9587 - accuracy: 0.6093 - val_loss: 0.8643 - val_accuracy: 0.6551
Epoch 230/1000
167/167 - 4s - loss: 0.9806 - accuracy: 0.5951 - val_loss: 0.8410 - val_accuracy: 0.6641
Epoch 231/1000
167/167 - 4s - loss: 0.9407 - accuracy: 0.6160 - val_loss: 0.7934 - val_accuracy: 0.6934
Epoch 232/1000
167/167 - 4s - loss: 0.9521 - accuracy: 0.6029 - val_loss: 0.7921 - val_accuracy: 0.6980
Epoch 233/1000
167/167 - 4s - loss: 0.9606 - accuracy: 0.6052 - val_loss: 0.7609 - val_accuracy: 0.7105
Epoch 234/1000
167/167 - 4s - loss: 0.9285 - accuracy: 0.6168 - val_loss: 0.7790 - val_accuracy: 0.6941
Epoch 235/1000
167/167 - 4s - loss: 0.8971 - accuracy: 0.6224 - val_loss: 0.7598 - val_accuracy: 0.7023
Epoch 236/1000
167/167 - 4s - loss: 0.9051 - accuracy: 0.6295 - val_loss: 0.7499 - val_accuracy: 0.7055
Epoch 237/1000
167/167 - 4s - loss: 0.9263 - accuracy: 0.6205 - val_loss: 0.8907 - val_accuracy: 0.6406
Epoch 238/1000
167/167 - 4s - loss: 0.9198 - accuracy: 0.6291 - val_loss: 0.8076 - val_accuracy: 0.6898
Epoch 239/1000
167/167 - 4s - loss: 0.9329 - accuracy: 0.6257 - val_loss: 0.7882 - val_accuracy: 0.6969
Epoch 240/1000
167/167 - 4s - loss: 0.8879 - accuracy: 0.6310 - val_loss: 0.7489 - val_accuracy: 0.7066
Epoch 241/1000
167/167 - 4s - loss: 0.8681 - accuracy: 0.6403 - val_loss: 0.7392 - val_accuracy: 0.7098
Epoch 242/1000
167/167 - 4s - loss: 0.8900 - accuracy: 0.6243 - val_loss: 0.7364 - val_accuracy: 0.7188
Epoch 243/1000
167/167 - 4s - loss: 0.8770 - accuracy: 0.6437 - val_loss: 0.8392 - val_accuracy: 0.6699
Epoch 244/1000
167/167 - 4s - loss: 0.8856 - accuracy: 0.6366 - val_loss: 0.6849 - val_accuracy: 0.7324
Epoch 245/1000
167/167 - 4s - loss: 0.8508 - accuracy: 0.6583 - val_loss: 0.6990 - val_accuracy: 0.7320
Epoch 246/1000
167/167 - 4s - loss: 0.8694 - accuracy: 0.6411 - val_loss: 0.8485 - val_accuracy: 0.6586
Epoch 247/1000
167/167 - 4s - loss: 0.8958 - accuracy: 0.6400 - val_loss: 0.6920 - val_accuracy: 0.7305
Epoch 248/1000
167/167 - 4s - loss: 0.9086 - accuracy: 0.6205 - val_loss: 0.8901 - val_accuracy: 0.6457
Epoch 249/1000
167/167 - 4s - loss: 0.8562 - accuracy: 0.6396 - val_loss: 0.6831 - val_accuracy: 0.7422
Epoch 250/1000
167/167 - 4s - loss: 0.8274 - accuracy: 0.6591 - val_loss: 0.6855 - val_accuracy: 0.7387
Epoch 251/1000
167/167 - 4s - loss: 0.7862 - accuracy: 0.6774 - val_loss: 0.6135 - val_accuracy: 0.7695
Epoch 252/1000
167/167 - 4s - loss: 0.8893 - accuracy: 0.6235 - val_loss: 0.6896 - val_accuracy: 0.7328
Epoch 253/1000
167/167 - 4s - loss: 0.8764 - accuracy: 0.6441 - val_loss: 0.7725 - val_accuracy: 0.6926
Epoch 254/1000
167/167 - 4s - loss: 0.8015 - accuracy: 0.6808 - val_loss: 0.6536 - val_accuracy: 0.7539
Epoch 255/1000
167/167 - 4s - loss: 0.7836 - accuracy: 0.6725 - val_loss: 0.7593 - val_accuracy: 0.6910
Epoch 256/1000
167/167 - 4s - loss: 0.7961 - accuracy: 0.6819 - val_loss: 0.6995 - val_accuracy: 0.7277
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Epoch 257/1000
167/167 - 4s - loss: 0.7582 - accuracy: 0.6882 - val_loss: 0.6238 - val_accuracy: 0.7625
Epoch 258/1000
167/167 - 4s - loss: 0.7569 - accuracy: 0.6871 - val_loss: 0.6445 - val_accuracy: 0.7508
Epoch 259/1000
167/167 - 4s - loss: 0.8592 - accuracy: 0.6538 - val_loss: 0.8192 - val_accuracy: 0.6547
Epoch 260/1000
167/167 - 4s - loss: 0.8427 - accuracy: 0.6654 - val_loss: 0.6143 - val_accuracy: 0.7723
Epoch 261/1000
167/167 - 4s - loss: 0.7857 - accuracy: 0.6849 - val_loss: 0.5931 - val_accuracy: 0.7789
Epoch 262/1000
167/167 - 4s - loss: 0.7370 - accuracy: 0.7043 - val_loss: 0.5743 - val_accuracy: 0.7816
Epoch 263/1000
167/167 - 4s - loss: 0.7707 - accuracy: 0.6853 - val_loss: 0.7611 - val_accuracy: 0.7020
Epoch 264/1000
167/167 - 4s - loss: 0.7942 - accuracy: 0.6718 - val_loss: 0.7306 - val_accuracy: 0.6941
Epoch 265/1000
167/167 - 4s - loss: 0.7355 - accuracy: 0.6987 - val_loss: 0.5968 - val_accuracy: 0.7738
Epoch 266/1000
167/167 - 4s - loss: 0.7767 - accuracy: 0.6853 - val_loss: 0.6129 - val_accuracy: 0.7598
Epoch 267/1000
167/167 - 4s - loss: 0.7235 - accuracy: 0.7115 - val_loss: 0.5447 - val_accuracy: 0.8008
Epoch 268/1000
167/167 - 4s - loss: 0.7194 - accuracy: 0.7051 - val_loss: 0.6052 - val_accuracy: 0.7680
Epoch 269/1000
167/167 - 4s - loss: 0.7212 - accuracy: 0.7092 - val_loss: 0.8865 - val_accuracy: 0.6492
Epoch 270/1000
167/167 - 4s - loss: 0.7731 - accuracy: 0.6924 - val_loss: 0.5560 - val_accuracy: 0.7953
Epoch 271/1000
167/167 - 4s - loss: 0.7309 - accuracy: 0.6927 - val_loss: 0.5420 - val_accuracy: 0.7953
Epoch 272/1000
167/167 - 4s - loss: 0.7192 - accuracy: 0.7133 - val_loss: 0.6127 - val_accuracy: 0.7652
Epoch 273/1000
167/167 - 4s - loss: 0.7419 - accuracy: 0.6984 - val_loss: 0.5669 - val_accuracy: 0.7871
Epoch 274/1000
167/167 - 4s - loss: 0.7086 - accuracy: 0.7159 - val_loss: 0.5441 - val_accuracy: 0.7918
Epoch 275/1000
167/167 - 4s - loss: 0.7365 - accuracy: 0.7058 - val_loss: 0.5802 - val_accuracy: 0.7777
Epoch 276/1000
167/167 - 4s - loss: 0.7156 - accuracy: 0.6939 - val_loss: 0.5308 - val_accuracy: 0.8023
Epoch 277/1000
167/167 - 4s - loss: 0.6697 - accuracy: 0.7212 - val_loss: 0.6146 - val_accuracy: 0.7629
Epoch 278/1000
167/167 - 4s - loss: 0.7239 - accuracy: 0.7043 - val_loss: 0.5357 - val_accuracy: 0.8008
Epoch 279/1000
167/167 - 4s - loss: 0.6991 - accuracy: 0.7141 - val_loss: 0.5043 - val_accuracy: 0.8117
Epoch 280/1000
167/167 - 4s - loss: 0.6911 - accuracy: 0.7103 - val_loss: 0.5235 - val_accuracy: 0.8129
Epoch 281/1000
167/167 - 4s - loss: 0.7334 - accuracy: 0.7043 - val_loss: 0.5194 - val_accuracy: 0.8027
Epoch 282/1000
167/167 - 4s - loss: 0.6828 - accuracy: 0.7268 - val_loss: 0.5258 - val_accuracy: 0.8051
Epoch 283/1000
167/167 - 4s - loss: 0.6822 - accuracy: 0.7204 - val_loss: 0.4822 - val_accuracy: 0.8262
Epoch 284/1000
167/167 - 4s - loss: 0.7078 - accuracy: 0.7092 - val_loss: 0.5232 - val_accuracy: 0.8098
Epoch 285/1000
167/167 - 4s - loss: 0.6806 - accuracy: 0.7174 - val_loss: 0.5648 - val_accuracy: 0.7844
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Epoch 286/1000
167/167 - 4s - loss: 0.6489 - accuracy: 0.7317 - val_loss: 0.5471 - val_accuracy: 0.7844
Epoch 287/1000
167/167 - 4s - loss: 0.6853 - accuracy: 0.7219 - val_loss: 0.5799 - val_accuracy: 0.7852
Epoch 288/1000
167/167 - 4s - loss: 0.6547 - accuracy: 0.7317 - val_loss: 0.4967 - val_accuracy: 0.8043
Epoch 289/1000
167/167 - 4s - loss: 0.6995 - accuracy: 0.7092 - val_loss: 0.5079 - val_accuracy: 0.8113
Epoch 290/1000
167/167 - 4s - loss: 0.6603 - accuracy: 0.7347 - val_loss: 0.5411 - val_accuracy: 0.7926
Epoch 291/1000
167/167 - 4s - loss: 0.6497 - accuracy: 0.7290 - val_loss: 0.4447 - val_accuracy: 0.8414
Epoch 292/1000
167/167 - 4s - loss: 0.5845 - accuracy: 0.7680 - val_loss: 0.5748 - val_accuracy: 0.7711
Epoch 293/1000
167/167 - 4s - loss: 0.6405 - accuracy: 0.7429 - val_loss: 0.5803 - val_accuracy: 0.7840
Epoch 294/1000
167/167 - 4s - loss: 0.7808 - accuracy: 0.6931 - val_loss: 0.6290 - val_accuracy: 0.7402
Epoch 295/1000
167/167 - 4s - loss: 0.6184 - accuracy: 0.7466 - val_loss: 0.4497 - val_accuracy: 0.8344
Epoch 296/1000
167/167 - 4s - loss: 0.6818 - accuracy: 0.7238 - val_loss: 0.5026 - val_accuracy: 0.8156
Epoch 297/1000
167/167 - 4s - loss: 0.6327 - accuracy: 0.7504 - val_loss: 0.4465 - val_accuracy: 0.8395
Epoch 298/1000
167/167 - 4s - loss: 0.5489 - accuracy: 0.7754 - val_loss: 0.3960 - val_accuracy: 0.8676
Epoch 299/1000
167/167 - 4s - loss: 0.5742 - accuracy: 0.7586 - val_loss: 0.4286 - val_accuracy: 0.8348
Epoch 300/1000
167/167 - 4s - loss: 0.5534 - accuracy: 0.7687 - val_loss: 0.4151 - val_accuracy: 0.8438
Epoch 301/1000
167/167 - 4s - loss: 0.6028 - accuracy: 0.7455 - val_loss: 0.4343 - val_accuracy: 0.8414
Epoch 302/1000
167/167 - 4s - loss: 0.6082 - accuracy: 0.7545 - val_loss: 0.6226 - val_accuracy: 0.7527
Epoch 303/1000
167/167 - 4s - loss: 0.6039 - accuracy: 0.7642 - val_loss: 0.4124 - val_accuracy: 0.8473
Epoch 304/1000
167/167 - 4s - loss: 0.6586 - accuracy: 0.7380 - val_loss: 0.5288 - val_accuracy: 0.7910
Epoch 305/1000
167/167 - 4s - loss: 0.6708 - accuracy: 0.7283 - val_loss: 0.3780 - val_accuracy: 0.8770
Epoch 306/1000
167/167 - 4s - loss: 0.5806 - accuracy: 0.7683 - val_loss: 0.4286 - val_accuracy: 0.8445
Epoch 307/1000
167/167 - 4s - loss: 0.6132 - accuracy: 0.7448 - val_loss: 0.4579 - val_accuracy: 0.8230
Epoch 308/1000
167/167 - 4s - loss: 0.5464 - accuracy: 0.7803 - val_loss: 0.4037 - val_accuracy: 0.8539
Epoch 309/1000
167/167 - 4s - loss: 0.5687 - accuracy: 0.7728 - val_loss: 0.4081 - val_accuracy: 0.8504
Epoch 310/1000
167/167 - 4s - loss: 0.5765 - accuracy: 0.7653 - val_loss: 0.4328 - val_accuracy: 0.8422
Epoch 311/1000
167/167 - 4s - loss: 0.5459 - accuracy: 0.7878 - val_loss: 0.4085 - val_accuracy: 0.8527
Epoch 312/1000
167/167 - 4s - loss: 0.5621 - accuracy: 0.7698 - val_loss: 0.4282 - val_accuracy: 0.8328
Epoch 313/1000
167/167 - 4s - loss: 0.7647 - accuracy: 0.6931 - val_loss: 0.4441 - val_accuracy: 0.8355
Epoch 314/1000
167/167 - 4s - loss: 0.5405 - accuracy: 0.7796 - val_loss: 0.3952 - val_accuracy: 0.8555
```

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Epoch 315/1000
167/167 - 4s - loss: 0.5308 - accuracy: 0.7867 - val_loss: 0.3774 - val_accuracy: 0.8672
Epoch 316/1000
167/167 - 4s - loss: 0.5133 - accuracy: 0.7900 - val_loss: 0.4176 - val_accuracy: 0.8418
Epoch 317/1000
167/167 - 4s - loss: 0.5894 - accuracy: 0.7713 - val_loss: 0.4500 - val_accuracy: 0.8301
Epoch 318/1000
167/167 - 4s - loss: 0.5059 - accuracy: 0.7908 - val_loss: 0.3485 - val_accuracy: 0.8816
Epoch 319/1000
167/167 - 4s - loss: 0.5561 - accuracy: 0.7784 - val_loss: 0.5056 - val_accuracy: 0.8023
Epoch 320/1000
167/167 - 4s - loss: 0.5844 - accuracy: 0.7762 - val_loss: 0.3586 - val_accuracy: 0.8758
Epoch 321/1000
167/167 - 4s - loss: 0.5719 - accuracy: 0.7706 - val_loss: 0.5225 - val_accuracy: 0.7961
Epoch 322/1000
167/167 - 4s - loss: 0.5584 - accuracy: 0.7732 - val_loss: 0.3416 - val_accuracy: 0.8875
Epoch 323/1000
167/167 - 4s - loss: 0.4944 - accuracy: 0.8039 - val_loss: 0.4461 - val_accuracy: 0.8289
Epoch 324/1000
167/167 - 4s - loss: 0.5019 - accuracy: 0.8020 - val_loss: 0.3407 - val_accuracy: 0.8844
Epoch 325/1000
167/167 - 4s - loss: 0.6391 - accuracy: 0.7493 - val_loss: 0.6384 - val_accuracy: 0.7371
Epoch 326/1000
167/167 - 4s - loss: 0.5873 - accuracy: 0.7713 - val_loss: 0.3610 - val_accuracy: 0.8719
Epoch 327/1000
167/167 - 4s - loss: 0.5138 - accuracy: 0.7934 - val_loss: 0.7022 - val_accuracy: 0.7254
Epoch 328/1000
167/167 - 4s - loss: 0.5118 - accuracy: 0.7930 - val_loss: 0.3288 - val_accuracy: 0.8852
Epoch 329/1000
167/167 - 4s - loss: 0.4666 - accuracy: 0.8162 - val_loss: 0.3939 - val_accuracy: 0.8418
Epoch 330/1000
167/167 - 4s - loss: 0.4781 - accuracy: 0.8069 - val_loss: 0.3775 - val_accuracy: 0.8621
Epoch 331/1000
167/167 - 4s - loss: 0.4668 - accuracy: 0.8189 - val_loss: 0.3156 - val_accuracy: 0.8953
Epoch 332/1000
167/167 - 4s - loss: 0.4468 - accuracy: 0.8226 - val_loss: 0.3289 - val_accuracy: 0.8848
Epoch 333/1000
167/167 - 4s - loss: 0.5660 - accuracy: 0.7784 - val_loss: 0.4501 - val_accuracy: 0.8250
Epoch 334/1000
167/167 - 4s - loss: 0.5073 - accuracy: 0.8005 - val_loss: 0.3518 - val_accuracy: 0.8848
Epoch 335/1000
167/167 - 4s - loss: 0.5535 - accuracy: 0.7833 - val_loss: 0.4273 - val_accuracy: 0.8313
Epoch 336/1000
167/167 - 4s - loss: 0.4882 - accuracy: 0.8099 - val_loss: 0.4436 - val_accuracy: 0.8309
Epoch 337/1000
167/167 - 4s - loss: 0.5289 - accuracy: 0.7852 - val_loss: 0.4246 - val_accuracy: 0.8387
Epoch 338/1000
167/167 - 4s - loss: 0.4953 - accuracy: 0.8058 - val_loss: 0.3642 - val_accuracy: 0.8602
Epoch 339/1000
167/167 - 4s - loss: 0.4468 - accuracy: 0.8222 - val_loss: 0.3538 - val_accuracy: 0.8719
Epoch 340/1000
167/167 - 4s - loss: 0.4989 - accuracy: 0.7908 - val_loss: 0.2946 - val_accuracy: 0.9000
Epoch 341/1000
167/167 - 4s - loss: 0.4471 - accuracy: 0.8237 - val_loss: 0.4095 - val_accuracy: 0.8387
Epoch 342/1000
167/167 - 4s - loss: 0.4974 - accuracy: 0.8065 - val_loss: 0.3389 - val_accuracy: 0.8836
Epoch 343/1000
```

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167/167 - 4s - loss: 0.5005 - accuracy: 0.8013 - val_loss: 0.2821 - val_accuracy: 0.9094
Epoch 344/1000
167/167 - 4s - loss: 0.5143 - accuracy: 0.8024 - val_loss: 0.4040 - val_accuracy: 0.8445
Epoch 345/1000
167/167 - 4s - loss: 0.4855 - accuracy: 0.8084 - val_loss: 0.4616 - val_accuracy: 0.8191
Epoch 346/1000
167/167 - 4s - loss: 0.4989 - accuracy: 0.8147 - val_loss: 0.3896 - val_accuracy: 0.8438
Epoch 347/1000
167/167 - 4s - loss: 0.4947 - accuracy: 0.8069 - val_loss: 0.3504 - val_accuracy: 0.8691
Epoch 348/1000
167/167 - 4s - loss: 0.5261 - accuracy: 0.7998 - val_loss: 0.3770 - val_accuracy: 0.8586
Epoch 349/1000
167/167 - 4s - loss: 0.5414 - accuracy: 0.8005 - val_loss: 0.4264 - val_accuracy: 0.8320
Epoch 350/1000
167/167 - 4s - loss: 0.5213 - accuracy: 0.7904 - val_loss: 0.4094 - val_accuracy: 0.8398
Epoch 351/1000
167/167 - 4s - loss: 0.4697 - accuracy: 0.8099 - val_loss: 0.3782 - val_accuracy: 0.8547
Epoch 352/1000
167/167 - 4s - loss: 0.4420 - accuracy: 0.8275 - val_loss: 0.3103 - val_accuracy: 0.8930
Epoch 353/1000
167/167 - 4s - loss: 0.4139 - accuracy: 0.8290 - val_loss: 0.2671 - val_accuracy: 0.9086
Epoch 354/1000
167/167 - 4s - loss: 0.4197 - accuracy: 0.8312 - val_loss: 0.9292 - val_accuracy: 0.6629
Epoch 355/1000
167/167 - 4s - loss: 0.4747 - accuracy: 0.8121 - val_loss: 0.2861 - val_accuracy: 0.8969
Epoch 356/1000
167/167 - 4s - loss: 0.4421 - accuracy: 0.8222 - val_loss: 0.3784 - val_accuracy: 0.8590
Epoch 357/1000
167/167 - 4s - loss: 0.4179 - accuracy: 0.8323 - val_loss: 0.3433 - val_accuracy: 0.8598
Epoch 358/1000
167/167 - 4s - loss: 0.4253 - accuracy: 0.8421 - val_loss: 0.2966 - val_accuracy: 0.8957
Epoch 359/1000
167/167 - 4s - loss: 0.4223 - accuracy: 0.8271 - val_loss: 0.3209 - val_accuracy: 0.8824
Epoch 360/1000
167/167 - 4s - loss: 0.4513 - accuracy: 0.8174 - val_loss: 0.3576 - val_accuracy: 0.8672
Epoch 361/1000
167/167 - 4s - loss: 0.4935 - accuracy: 0.8016 - val_loss: 0.3072 - val_accuracy: 0.8891
Epoch 362/1000
167/167 - 4s - loss: 0.5033 - accuracy: 0.7994 - val_loss: 0.3244 - val_accuracy: 0.8828
Epoch 363/1000
167/167 - 4s - loss: 0.4496 - accuracy: 0.8207 - val_loss: 0.2950 - val_accuracy: 0.8957
Epoch 364/1000
167/167 - 4s - loss: 0.3957 - accuracy: 0.8447 - val_loss: 0.3159 - val_accuracy: 0.8891
Epoch 365/1000
167/167 - 4s - loss: 0.6367 - accuracy: 0.7717 - val_loss: 0.3398 - val_accuracy: 0.8770
Epoch 366/1000
167/167 - 4s - loss: 0.4615 - accuracy: 0.8166 - val_loss: 0.4747 - val_accuracy: 0.8152
Epoch 367/1000
167/167 - 5s - loss: 0.4020 - accuracy: 0.8409 - val_loss: 0.2916 - val_accuracy: 0.8934
Epoch 368/1000
167/167 - 5s - loss: 0.3711 - accuracy: 0.8510 - val_loss: 0.3041 - val_accuracy: 0.8859
Epoch 369/1000
167/167 - 5s - loss: 0.4463 - accuracy: 0.8230 - val_loss: 0.2749 - val_accuracy: 0.8957
Epoch 370/1000
167/167 - 5s - loss: 0.5014 - accuracy: 0.8028 - val_loss: 0.2730 - val_accuracy: 0.9086
Epoch 371/1000
167/167 - 5s - loss: 0.4205 - accuracy: 0.8372 - val_loss: 0.3153 - val_accuracy: 0.8949
Epoch 372/1000
```

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167/167 - 5s - loss: 0.4201 - accuracy: 0.8346 - val_loss: 0.3340 - val_accuracy: 0.8691
Epoch 373/1000
167/167 - 5s - loss: 0.4409 - accuracy: 0.8327 - val_loss: 0.3057 - val_accuracy: 0.8906
```

```
model.evaluate(test_dataset)
```

```
10/10 [==============================] - 0s 36ms/step - loss: 0.3136 - accuracy: 0.8883
[0.3136028558015823, 0.8882812]
```