Deep Learning based Food Image to recipe Generator

Mini Project

By Prince (19MIA1079)

Import Libraries

In [1]:
```
# Import necessary libraries
from tensorflow.keras.applications import ResNet152
from tensorflow.keras.layers import GlobalAveragePooling2D
from tensorflow import keras
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout
from tensorflow.keras.optimizers.legacy import Adam
import numpy as np
from sklearn.metrics import classification_report, confusion_matrix
import itertools
import matplotlib.pyplot as plt
```

Constants and Paths

In [2]:
```
# Define constants and paths
im_shape = (256,256)
TRAINING_DIR = r'dataset/train'
TEST_DIR = r'dataset/test'
seed = 10
BATCH_SIZE = 64
epochs = 300
```

Load the data generators

In [3]:
```
data_generator = ImageDataGenerator(
    validation_split=0.2,
    rotation_range=20,
    width_shift_range=0.2,
    height_shift_range=0.2,
    rescale=1./255,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)

val_data_generator = ImageDataGenerator(rescale=1./255, validation_split=0.2)

train_generator = data_generator.flow_from_directory(
    TRAINING_DIR, target_size=im_shape, shuffle=True, seed=seed,
    class_mode='categorical', batch_size=BATCH_SIZE, subset="training"
)

validation_generator = val_data_generator.flow_from_directory(
    TRAINING_DIR, target_size=im_shape, shuffle=False, seed=seed,
    class_mode='categorical', batch_size=BATCH_SIZE, subset="validation"
)

test_generator = ImageDataGenerator(rescale=1./255).flow_from_directory(
    TEST_DIR, target_size=im_shape, shuffle=False, seed=seed,
    class_mode='categorical', batch_size=BATCH_SIZE
)
global num_classes, nb_train_samples, nb_validation_samples, nb_test_samples, classes

nb_train_samples = train_generator.samples
nb_validation_samples = validation_generator.samples
nb_test_samples = test_generator.samples
classes = list(train_generator.class_indices.keys())
print('Classes: '+str(classes))
num_classes = len(classes)
```

```
Found 3200 images belonging to 80 classes.

Found 798 images belonging to 80 classes.

Found 958 images belonging to 80 classes.

Classes: ['Adhirasam', 'Aloo Gobi', 'Aloo Matar', 'Aloo Methi', 'Aloo Shimla Mirch', 'Aloo Tikki', 'Anarsa', 'Ariselu', 'Basundi', 'Bhatura', 'Bhindi Masala', 'Biryani', 'Boondi', 'Butter Chicken', 'Chak Hao Kheer', 'Cham Cham', 'Chana Masala', 'Chapati', 'Chhena Kheeri', 'Chicken Razala', 'Chicken Tikka', 'Chicken Tikka Masala', 'Chikki', 'Daal Baati Churma', 'Daal Puri', 'Dal Makhani', 'Dal Tadka', 'Dharwad Pedha', 'Doodhpak', 'Double Ka Meetha', 'Dum Aloo', 'Gajar Ka Halwa', 'Gavvalu', 'Ghevar', 'Gulab Jamun', 'Imarti', 'Jalebi', 'Kachori', 'Kadai Paneer', 'Kadhi Pakoda', 'Kajjikaya', 'Kakinada Khaja', 'Kalakand', 'Karela Bharta', 'Kofta', 'Kuzhi Paniyaram', 'Laddu', 'Lassi', 'Ledikeni', 'Litti Chokha', 'Lyangcha', 'Maach Jhol', 'Makki Di Roti Sarson Da Saag', 'Malapua', 'Misi Roti', 'Misti Doi', 'Modak', 'Mysore Pak', 'Naan', 'Navrattan Korma', 'Palak Paneer', 'Paneer Butter Masala', 'Phirni', 'Pithe', 'Poha', 'Poornalu', 'Pootharekulu', 'Qubani Ka Meetha', 'Rabri', 'Ras Malai', 'Rasgulla', 'Sandesh', 'Shankarpali', 'Sheer Korma', 'Sheera', 'Shrikhand', 'Sohan Halwa', 'Sohan Papdi', 'Sutar Feni', 'Unni Appam']
```

Define the CNN mmodel

In [4]:
```
base_model = ResNet152(weights='imagenet', include_top=False, input_shape=(im_shape[0], im_shape[1], 3))
model = Sequential()
model.add(base_model)
model.add(GlobalAveragePooling2D())
model.add(Dense(512, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(num_classes, activation='softmax'))
```

```
Metal device set to: Apple M1 Max



systemMemory: 64.00 GB

maxCacheSize: 24.00 GB
```

Compile and Train the model

In [5]:
```
model.compile(loss='categorical_crossentropy', optimizer=Adam(), metrics=['accuracy'])

callbacks_list = [
    keras.callbacks.ModelCheckpoint(filepath='model/best_model.h5', monitor='val_accuracy', save_best_only=True
    #keras.callbacks.EarlyStopping(monitor='val_loss', patience=10, verbose=1)
]

history = model.fit(
    train_generator,
    steps_per_epoch=nb_train_samples // BATCH_SIZE,
    epochs=epochs,
    callbacks=callbacks_list,
    validation_data=validation_generator,
    verbose=1,
    validation_steps=nb_validation_samples // BATCH_SIZE
)
```

```
Epoch 1/300
loc("mps_select"("(mpsFileLoc): /AppleInternal/Library/BuildRoots/0783246a-4091-11ee-8fca-aead88ae2785/Library/C
aches/com.apple.xbs/Sources/MetalPerformanceShadersGraph/mpsgraph/MetalPerformanceShadersGraph/Core/Files/MPSGra
phUtilities.mm":294:0)): error: 'anec.gain_offset_control' op result #0 must be 4D/5D memref of 16-bit float or
8-bit signed integer or 8-bit unsigned integer values, but got 'memref<1x64x1x512xi1>'

loc("mps_select"("(mpsFileLoc): /AppleInternal/Library/BuildRoots/0783246a-4091-11ee-8fca-aead88ae2785/Library/C
aches/com.apple.xbs/Sources/MetalPerformanceShadersGraph/mpsgraph/MetalPerformanceShadersGraph/Core/Files/MPSGra
phUtilities.mm":294:0)): error: 'anec.gain_offset_control' op result #0 must be 4D/5D memref of 16-bit float or
8-bit signed integer or 8-bit unsigned integer values, but got 'memref<1x64x1x512xi1>'
50/50 [==============================] - ETA: 0s - loss: 4.4604 - accuracy: 0.0206

Epoch 1: val_accuracy improved from -inf to 0.01302, saving model to model/best_model.h5
/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/site-packages/keras/src/engine/training.py:3000:
UserWarning: You are saving your model as an HDF5 file via `model.save()`. This file format is considered legacy
. We recommend using instead the native Keras format, e.g. `model.save('my_model.keras')`.

  saving_api.save_model(
50/50 [==============================] - 205s 2s/step - loss: 4.4604 - accuracy: 0.0206 - val_loss: 748.1485 - v
al_accuracy: 0.0130

Epoch 2/300

50/50 [==============================] - ETA: 0s - loss: 4.2888 - accuracy: 0.0347

Epoch 2: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 4.2888 - accuracy: 0.0347 - val_loss: 882.7305 - va
l_accuracy: 0.0130

Epoch 3/300

50/50 [==============================] - ETA: 0s - loss: 4.1756 - accuracy: 0.0369

Epoch 3: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 4.1756 - accuracy: 0.0369 - val_loss: 4.7964 - val_
accuracy: 0.0130

Epoch 4/300

50/50 [==============================] - ETA: 0s - loss: 4.0661 - accuracy: 0.0350

Epoch 4: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 4.0661 - accuracy: 0.0350 - val_loss: 4.8896 - val_
accuracy: 0.0130

Epoch 5/300

50/50 [==============================] - ETA: 0s - loss: 3.9462 - accuracy: 0.0519

Epoch 5: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 3.9462 - accuracy: 0.0519 - val_loss: 7.9865 - val_
accuracy: 0.0130

Epoch 6/300

50/50 [==============================] - ETA: 0s - loss: 3.8545 - accuracy: 0.0481

Epoch 6: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 3.8545 - accuracy: 0.0481 - val_loss: 4.9437 - val_
accuracy: 0.0130
```

```
Epoch 7/300

50/50 [==============================] - ETA: 0s - loss: 3.7563 - accuracy: 0.0600

Epoch 7: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 3.7563 - accuracy: 0.0600 - val_loss: 4.6514 - val_
accuracy: 0.0130

Epoch 8/300

50/50 [==============================] - ETA: 0s - loss: 3.6948 - accuracy: 0.0756

Epoch 8: val_accuracy did not improve from 0.01302

50/50 [==============================] - 69s 1s/step - loss: 3.6948 - accuracy: 0.0756 - val_loss: 5.3194 - val_
accuracy: 0.0130

Epoch 9/300

50/50 [==============================] - ETA: 0s - loss: 3.6360 - accuracy: 0.0800

Epoch 9: val_accuracy improved from 0.01302 to 0.01693, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 3.6360 - accuracy: 0.0800 - val_loss: 4.6110 - val_
accuracy: 0.0169

Epoch 10/300

50/50 [==============================] - ETA: 0s - loss: 3.5402 - accuracy: 0.0906

Epoch 10: val_accuracy did not improve from 0.01693

50/50 [==============================] - 69s 1s/step - loss: 3.5402 - accuracy: 0.0906 - val_loss: 6.4331 - val_
accuracy: 0.0130

Epoch 11/300

50/50 [==============================] - ETA: 0s - loss: 3.4216 - accuracy: 0.1112

Epoch 11: val_accuracy did not improve from 0.01693

50/50 [==============================] - 69s 1s/step - loss: 3.4216 - accuracy: 0.1112 - val_loss: 5.2967 - val_
accuracy: 0.0130

Epoch 12/300

50/50 [==============================] - ETA: 0s - loss: 3.3444 - accuracy: 0.1231

Epoch 12: val_accuracy did not improve from 0.01693

50/50 [==============================] - 69s 1s/step - loss: 3.3444 - accuracy: 0.1231 - val_loss: 5.6805 - val_
accuracy: 0.0130

Epoch 13/300

50/50 [==============================] - ETA: 0s - loss: 3.2488 - accuracy: 0.1441

Epoch 13: val_accuracy did not improve from 0.01693

50/50 [==============================] - 69s 1s/step - loss: 3.2488 - accuracy: 0.1441 - val_loss: 6.6559 - val_
accuracy: 0.0130

Epoch 14/300

50/50 [==============================] - ETA: 0s - loss: 3.1864 - accuracy: 0.1497

Epoch 14: val_accuracy did not improve from 0.01693

50/50 [==============================] - 69s 1s/step - loss: 3.1864 - accuracy: 0.1497 - val_loss: 5.1283 - val_
accuracy: 0.0156

Epoch 15/300

50/50 [==============================] - ETA: 0s - loss: 3.1217 - accuracy: 0.1628

Epoch 15: val_accuracy improved from 0.01693 to 0.02214, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 3.1217 - accuracy: 0.1628 - val_loss: 4.8344 - val_
accuracy: 0.0221

Epoch 16/300
```

```
50/50 [==============================] - ETA: 0s - loss: 3.0275 - accuracy: 0.1847

Epoch 16: val_accuracy did not improve from 0.02214

50/50 [==============================] - 69s 1s/step - loss: 3.0275 - accuracy: 0.1847 - val_loss: 5.2079 - val_
accuracy: 0.0195

Epoch 17/300

50/50 [==============================] - ETA: 0s - loss: 2.9291 - accuracy: 0.1891

Epoch 17: val_accuracy did not improve from 0.02214

50/50 [==============================] - 69s 1s/step - loss: 2.9291 - accuracy: 0.1891 - val_loss: 5.0262 - val_
accuracy: 0.0221

Epoch 18/300

50/50 [==============================] - ETA: 0s - loss: 2.8675 - accuracy: 0.2172

Epoch 18: val_accuracy improved from 0.02214 to 0.09635, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 2.8675 - accuracy: 0.2172 - val_loss: 3.8301 - val_
accuracy: 0.0964

Epoch 19/300

50/50 [==============================] - ETA: 0s - loss: 2.7951 - accuracy: 0.2306

Epoch 19: val_accuracy did not improve from 0.09635

50/50 [==============================] - 69s 1s/step - loss: 2.7951 - accuracy: 0.2306 - val_loss: 4.3438 - val_
accuracy: 0.0677

Epoch 20/300

50/50 [==============================] - ETA: 0s - loss: 2.6884 - accuracy: 0.2534

Epoch 20: val_accuracy did not improve from 0.09635

50/50 [==============================] - 69s 1s/step - loss: 2.6884 - accuracy: 0.2534 - val_loss: 4.9200 - val_
accuracy: 0.0859

Epoch 21/300

50/50 [==============================] - ETA: 0s - loss: 2.6149 - accuracy: 0.2697

Epoch 21: val_accuracy improved from 0.09635 to 0.12500, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 2.6149 - accuracy: 0.2697 - val_loss: 4.2422 - val_
accuracy: 0.1250

Epoch 22/300

50/50 [==============================] - ETA: 0s - loss: 2.5550 - accuracy: 0.2875

Epoch 22: val_accuracy did not improve from 0.12500

50/50 [==============================] - 69s 1s/step - loss: 2.5550 - accuracy: 0.2875 - val_loss: 3.8392 - val_
accuracy: 0.1185

Epoch 23/300

50/50 [==============================] - ETA: 0s - loss: 2.4631 - accuracy: 0.3013

Epoch 23: val_accuracy improved from 0.12500 to 0.15365, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 2.4631 - accuracy: 0.3013 - val_loss: 3.6524 - val_
accuracy: 0.1536

Epoch 24/300

50/50 [==============================] - ETA: 0s - loss: 2.4027 - accuracy: 0.3091

Epoch 24: val_accuracy improved from 0.15365 to 0.19010, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 2.4027 - accuracy: 0.3091 - val_loss: 3.4217 - val_
accuracy: 0.1901

Epoch 25/300

50/50 [==============================] - ETA: 0s - loss: 2.3173 - accuracy: 0.3359
```

```
Epoch 25: val_accuracy did not improve from 0.19010

50/50 [==============================] - 69s 1s/step - loss: 2.3173 - accuracy: 0.3359 - val_loss: 3.7623 - val_
accuracy: 0.1523

Epoch 26/300

50/50 [==============================] - ETA: 0s - loss: 2.2477 - accuracy: 0.3591

Epoch 26: val_accuracy did not improve from 0.19010

50/50 [==============================] - 69s 1s/step - loss: 2.2477 - accuracy: 0.3591 - val_loss: 3.6877 - val_
accuracy: 0.1641

Epoch 27/300

50/50 [==============================] - ETA: 0s - loss: 2.1548 - accuracy: 0.3809

Epoch 27: val_accuracy improved from 0.19010 to 0.19401, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 2.1548 - accuracy: 0.3809 - val_loss: 3.2502 - val_
accuracy: 0.1940

Epoch 28/300

50/50 [==============================] - ETA: 0s - loss: 2.1096 - accuracy: 0.3906

Epoch 28: val_accuracy improved from 0.19401 to 0.24870, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 2.1096 - accuracy: 0.3906 - val_loss: 2.9433 - val_
accuracy: 0.2487

Epoch 29/300

50/50 [==============================] - ETA: 0s - loss: 2.0058 - accuracy: 0.4059

Epoch 29: val_accuracy did not improve from 0.24870

50/50 [==============================] - 69s 1s/step - loss: 2.0058 - accuracy: 0.4059 - val_loss: 3.5811 - val_
accuracy: 0.1888

Epoch 30/300

50/50 [==============================] - ETA: 0s - loss: 1.9159 - accuracy: 0.4481

Epoch 30: val_accuracy did not improve from 0.24870

50/50 [==============================] - 69s 1s/step - loss: 1.9159 - accuracy: 0.4481 - val_loss: 3.8012 - val_
accuracy: 0.1927

Epoch 31/300

50/50 [==============================] - ETA: 0s - loss: 1.8770 - accuracy: 0.4459

Epoch 31: val_accuracy did not improve from 0.24870

50/50 [==============================] - 69s 1s/step - loss: 1.8770 - accuracy: 0.4459 - val_loss: 3.5169 - val_
accuracy: 0.1914

Epoch 32/300

50/50 [==============================] - ETA: 0s - loss: 1.7850 - accuracy: 0.4700

Epoch 32: val_accuracy improved from 0.24870 to 0.27344, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 1.7850 - accuracy: 0.4700 - val_loss: 3.9283 - val_
accuracy: 0.2734

Epoch 33/300

50/50 [==============================] - ETA: 0s - loss: 1.7212 - accuracy: 0.4822

Epoch 33: val_accuracy improved from 0.27344 to 0.28255, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 1.7212 - accuracy: 0.4822 - val_loss: 2.9212 - val_
accuracy: 0.2826

Epoch 34/300

50/50 [==============================] - ETA: 0s - loss: 1.6551 - accuracy: 0.5059

Epoch 34: val_accuracy improved from 0.28255 to 0.29948, saving model to model/best_model.h5
```

```
50/50 [==============================] - 70s 1s/step - loss: 1.6551 - accuracy: 0.5059 - val_loss: 2.6708 - val_
accuracy: 0.2995

Epoch 35/300

50/50 [==============================] - ETA: 0s - loss: 1.6346 - accuracy: 0.5100

Epoch 35: val_accuracy did not improve from 0.29948

50/50 [==============================] - 69s 1s/step - loss: 1.6346 - accuracy: 0.5100 - val_loss: 3.3494 - val_
accuracy: 0.2279

Epoch 36/300

50/50 [==============================] - ETA: 0s - loss: 1.5338 - accuracy: 0.5359

Epoch 36: val_accuracy improved from 0.29948 to 0.31120, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 1.5338 - accuracy: 0.5359 - val_loss: 2.8678 - val_
accuracy: 0.3112

Epoch 37/300

50/50 [==============================] - ETA: 0s - loss: 1.4520 - accuracy: 0.5516

Epoch 37: val_accuracy did not improve from 0.31120

50/50 [==============================] - 69s 1s/step - loss: 1.4520 - accuracy: 0.5516 - val_loss: 3.1817 - val_
accuracy: 0.2526

Epoch 38/300

50/50 [==============================] - ETA: 0s - loss: 1.4626 - accuracy: 0.5512

Epoch 38: val_accuracy did not improve from 0.31120

50/50 [==============================] - 69s 1s/step - loss: 1.4626 - accuracy: 0.5512 - val_loss: 3.2900 - val_
accuracy: 0.2956

Epoch 39/300

50/50 [==============================] - ETA: 0s - loss: 1.3938 - accuracy: 0.5819

Epoch 39: val_accuracy improved from 0.31120 to 0.32422, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 1.3938 - accuracy: 0.5819 - val_loss: 2.9315 - val_
accuracy: 0.3242

Epoch 40/300

50/50 [==============================] - ETA: 0s - loss: 1.3256 - accuracy: 0.5928

Epoch 40: val_accuracy did not improve from 0.32422

50/50 [==============================] - 69s 1s/step - loss: 1.3256 - accuracy: 0.5928 - val_loss: 3.2691 - val_
accuracy: 0.3125

Epoch 41/300

50/50 [==============================] - ETA: 0s - loss: 1.3029 - accuracy: 0.5903

Epoch 41: val_accuracy improved from 0.32422 to 0.39583, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 1.3029 - accuracy: 0.5903 - val_loss: 2.4813 - val_
accuracy: 0.3958

Epoch 42/300

50/50 [==============================] - ETA: 0s - loss: 1.2229 - accuracy: 0.6269

Epoch 42: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 1.2229 - accuracy: 0.6269 - val_loss: 3.2969 - val_
accuracy: 0.3151

Epoch 43/300

50/50 [==============================] - ETA: 0s - loss: 1.1907 - accuracy: 0.6350

Epoch 43: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 1.1907 - accuracy: 0.6350 - val_loss: 3.1815 - val_
accuracy: 0.2891
```

```
Epoch 44/300

50/50 [==============================] - ETA: 0s - loss: 1.1447 - accuracy: 0.6447

Epoch 44: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 1.1447 - accuracy: 0.6447 - val_loss: 2.6843 - val_
accuracy: 0.3542

Epoch 45/300

50/50 [==============================] - ETA: 0s - loss: 1.1158 - accuracy: 0.6591

Epoch 45: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 1.1158 - accuracy: 0.6591 - val_loss: 3.4112 - val_
accuracy: 0.2982

Epoch 46/300

50/50 [==============================] - ETA: 0s - loss: 1.0509 - accuracy: 0.6722

Epoch 46: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 1.0509 - accuracy: 0.6722 - val_loss: 3.4950 - val_
accuracy: 0.3620

Epoch 47/300

50/50 [==============================] - ETA: 0s - loss: 0.9942 - accuracy: 0.6909

Epoch 47: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.9942 - accuracy: 0.6909 - val_loss: 2.8355 - val_
accuracy: 0.3854

Epoch 48/300

50/50 [==============================] - ETA: 0s - loss: 0.9656 - accuracy: 0.6994

Epoch 48: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.9656 - accuracy: 0.6994 - val_loss: 3.3901 - val_
accuracy: 0.3099

Epoch 49/300

50/50 [==============================] - ETA: 0s - loss: 0.9296 - accuracy: 0.7009

Epoch 49: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.9296 - accuracy: 0.7009 - val_loss: 3.2893 - val_
accuracy: 0.3099

Epoch 50/300

50/50 [==============================] - ETA: 0s - loss: 0.8631 - accuracy: 0.7303

Epoch 50: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.8631 - accuracy: 0.7303 - val_loss: 3.5243 - val_
accuracy: 0.3242

Epoch 51/300

50/50 [==============================] - ETA: 0s - loss: 0.8852 - accuracy: 0.7234

Epoch 51: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.8852 - accuracy: 0.7234 - val_loss: 3.2635 - val_
accuracy: 0.3320

Epoch 52/300

50/50 [==============================] - ETA: 0s - loss: 0.8205 - accuracy: 0.7275

Epoch 52: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.8205 - accuracy: 0.7275 - val_loss: 2.9773 - val_
accuracy: 0.3763

Epoch 53/300
```

```
50/50 [==============================] - ETA: 0s - loss: 0.7607 - accuracy: 0.7459

Epoch 53: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.7607 - accuracy: 0.7459 - val_loss: 4.3148 - val_
accuracy: 0.2812

Epoch 54/300

50/50 [==============================] - ETA: 0s - loss: 0.7355 - accuracy: 0.7631

Epoch 54: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.7355 - accuracy: 0.7631 - val_loss: 3.2419 - val_
accuracy: 0.3581

Epoch 55/300

50/50 [==============================] - ETA: 0s - loss: 0.7132 - accuracy: 0.7628

Epoch 55: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.7132 - accuracy: 0.7628 - val_loss: 3.4490 - val_
accuracy: 0.3555

Epoch 56/300

50/50 [==============================] - ETA: 0s - loss: 0.7057 - accuracy: 0.7772

Epoch 56: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.7057 - accuracy: 0.7772 - val_loss: 3.6612 - val_
accuracy: 0.3555

Epoch 57/300

50/50 [==============================] - ETA: 0s - loss: 0.6911 - accuracy: 0.7859

Epoch 57: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.6911 - accuracy: 0.7859 - val_loss: 3.1356 - val_
accuracy: 0.3854

Epoch 58/300

50/50 [==============================] - ETA: 0s - loss: 0.6291 - accuracy: 0.7903

Epoch 58: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.6291 - accuracy: 0.7903 - val_loss: 4.1298 - val_
accuracy: 0.2956

Epoch 59/300

50/50 [==============================] - ETA: 0s - loss: 0.6551 - accuracy: 0.7850

Epoch 59: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.6551 - accuracy: 0.7850 - val_loss: 3.2967 - val_
accuracy: 0.3932

Epoch 60/300

50/50 [==============================] - ETA: 0s - loss: 0.6328 - accuracy: 0.7947

Epoch 60: val_accuracy did not improve from 0.39583

50/50 [==============================] - 69s 1s/step - loss: 0.6328 - accuracy: 0.7947 - val_loss: 5.0737 - val_
accuracy: 0.2839

Epoch 61/300

50/50 [==============================] - ETA: 0s - loss: 0.6270 - accuracy: 0.8009

Epoch 61: val_accuracy improved from 0.39583 to 0.44661, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.6270 - accuracy: 0.8009 - val_loss: 2.8605 - val_
accuracy: 0.4466

Epoch 62/300

50/50 [==============================] - ETA: 0s - loss: 0.5619 - accuracy: 0.8228
```

```
Epoch 62: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.5619 - accuracy: 0.8228 - val_loss: 4.0394 - val_
accuracy: 0.3229

Epoch 63/300

50/50 [==============================] - ETA: 0s - loss: 0.4882 - accuracy: 0.8347

Epoch 63: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.4882 - accuracy: 0.8347 - val_loss: 3.2490 - val_
accuracy: 0.4193

Epoch 64/300

50/50 [==============================] - ETA: 0s - loss: 0.5011 - accuracy: 0.8325

Epoch 64: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.5011 - accuracy: 0.8325 - val_loss: 4.9874 - val_
accuracy: 0.2982

Epoch 65/300

50/50 [==============================] - ETA: 0s - loss: 0.5557 - accuracy: 0.8216

Epoch 65: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.5557 - accuracy: 0.8216 - val_loss: 3.2549 - val_
accuracy: 0.4049

Epoch 66/300

50/50 [==============================] - ETA: 0s - loss: 0.4004 - accuracy: 0.8653

Epoch 66: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.4004 - accuracy: 0.8653 - val_loss: 4.1037 - val_
accuracy: 0.3802

Epoch 67/300

50/50 [==============================] - ETA: 0s - loss: 0.4566 - accuracy: 0.8566

Epoch 67: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.4566 - accuracy: 0.8566 - val_loss: 3.4700 - val_
accuracy: 0.3919

Epoch 68/300

50/50 [==============================] - ETA: 0s - loss: 0.4508 - accuracy: 0.8475

Epoch 68: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.4508 - accuracy: 0.8475 - val_loss: 3.8636 - val_
accuracy: 0.3646

Epoch 69/300

50/50 [==============================] - ETA: 0s - loss: 0.4542 - accuracy: 0.8578

Epoch 69: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.4542 - accuracy: 0.8578 - val_loss: 4.7519 - val_
accuracy: 0.3047

Epoch 70/300

50/50 [==============================] - ETA: 0s - loss: 0.4054 - accuracy: 0.8684

Epoch 70: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.4054 - accuracy: 0.8684 - val_loss: 4.4839 - val_
accuracy: 0.4089

Epoch 71/300

50/50 [==============================] - ETA: 0s - loss: 0.3647 - accuracy: 0.8816

Epoch 71: val_accuracy did not improve from 0.44661
```

```
50/50 [==============================] - 69s 1s/step - loss: 0.3647 - accuracy: 0.8816 - val_loss: 3.6329 - val_
accuracy: 0.3958

Epoch 72/300

50/50 [==============================] - ETA: 0s - loss: 0.3693 - accuracy: 0.8781

Epoch 72: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.3693 - accuracy: 0.8781 - val_loss: 3.6285 - val_
accuracy: 0.4167

Epoch 73/300

50/50 [==============================] - ETA: 0s - loss: 0.3712 - accuracy: 0.8778

Epoch 73: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.3712 - accuracy: 0.8778 - val_loss: 3.8850 - val_
accuracy: 0.4089

Epoch 74/300

50/50 [==============================] - ETA: 0s - loss: 0.3958 - accuracy: 0.8712

Epoch 74: val_accuracy did not improve from 0.44661

50/50 [==============================] - 69s 1s/step - loss: 0.3958 - accuracy: 0.8712 - val_loss: 3.9323 - val_
accuracy: 0.3633

Epoch 75/300

50/50 [==============================] - ETA: 0s - loss: 0.3495 - accuracy: 0.8913

Epoch 75: val_accuracy improved from 0.44661 to 0.46354, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.3495 - accuracy: 0.8913 - val_loss: 3.0964 - val_
accuracy: 0.4635

Epoch 76/300

50/50 [==============================] - ETA: 0s - loss: 0.3174 - accuracy: 0.8959

Epoch 76: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.3174 - accuracy: 0.8959 - val_loss: 3.2367 - val_
accuracy: 0.4544

Epoch 77/300

50/50 [==============================] - ETA: 0s - loss: 0.3331 - accuracy: 0.8931

Epoch 77: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.3331 - accuracy: 0.8931 - val_loss: 4.6934 - val_
accuracy: 0.3815

Epoch 78/300

50/50 [==============================] - ETA: 0s - loss: 0.3104 - accuracy: 0.8938

Epoch 78: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.3104 - accuracy: 0.8938 - val_loss: 3.2058 - val_
accuracy: 0.4635

Epoch 79/300

50/50 [==============================] - ETA: 0s - loss: 0.3097 - accuracy: 0.9003

Epoch 79: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.3097 - accuracy: 0.9003 - val_loss: 4.3139 - val_
accuracy: 0.4089

Epoch 80/300

50/50 [==============================] - ETA: 0s - loss: 0.2940 - accuracy: 0.9038

Epoch 80: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.2940 - accuracy: 0.9038 - val_loss: 3.6240 - val_
```

```
accuracy: 0.4427

Epoch 81/300

50/50 [==============================] - ETA: 0s - loss: 0.3061 - accuracy: 0.9028

Epoch 81: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.3061 - accuracy: 0.9028 - val_loss: 3.4870 - val_
accuracy: 0.4583

Epoch 82/300

50/50 [==============================] - ETA: 0s - loss: 0.2936 - accuracy: 0.9047

Epoch 82: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.2936 - accuracy: 0.9047 - val_loss: 4.4663 - val_
accuracy: 0.3672

Epoch 83/300

50/50 [==============================] - ETA: 0s - loss: 0.2967 - accuracy: 0.9041

Epoch 83: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.2967 - accuracy: 0.9041 - val_loss: 3.8282 - val_
accuracy: 0.3984

Epoch 84/300

50/50 [==============================] - ETA: 0s - loss: 0.3006 - accuracy: 0.9025

Epoch 84: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.3006 - accuracy: 0.9025 - val_loss: 4.0362 - val_
accuracy: 0.4349

Epoch 85/300

50/50 [==============================] - ETA: 0s - loss: 0.2581 - accuracy: 0.9209

Epoch 85: val_accuracy did not improve from 0.46354

50/50 [==============================] - 69s 1s/step - loss: 0.2581 - accuracy: 0.9209 - val_loss: 3.6152 - val_
accuracy: 0.4531

Epoch 86/300

50/50 [==============================] - ETA: 0s - loss: 0.2837 - accuracy: 0.9119

Epoch 86: val_accuracy improved from 0.46354 to 0.48047, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.2837 - accuracy: 0.9119 - val_loss: 3.4470 - val_
accuracy: 0.4805

Epoch 87/300

50/50 [==============================] - ETA: 0s - loss: 0.2637 - accuracy: 0.9166

Epoch 87: val_accuracy did not improve from 0.48047

50/50 [==============================] - 69s 1s/step - loss: 0.2637 - accuracy: 0.9166 - val_loss: 3.3858 - val_
accuracy: 0.4805

Epoch 88/300

50/50 [==============================] - ETA: 0s - loss: 0.2409 - accuracy: 0.9250

Epoch 88: val_accuracy did not improve from 0.48047

50/50 [==============================] - 69s 1s/step - loss: 0.2409 - accuracy: 0.9250 - val_loss: 4.1879 - val_
accuracy: 0.4049

Epoch 89/300

50/50 [==============================] - ETA: 0s - loss: 0.2737 - accuracy: 0.9112

Epoch 89: val_accuracy did not improve from 0.48047

50/50 [==============================] - 69s 1s/step - loss: 0.2737 - accuracy: 0.9112 - val_loss: 3.8925 - val_
accuracy: 0.4206
```

```
Epoch 90/300

50/50 [==============================] - ETA: 0s - loss: 0.2416 - accuracy: 0.9216

Epoch 90: val_accuracy did not improve from 0.48047

50/50 [==============================] - 69s 1s/step - loss: 0.2416 - accuracy: 0.9216 - val_loss: 3.9785 - val_
accuracy: 0.4440

Epoch 91/300

50/50 [==============================] - ETA: 0s - loss: 0.2108 - accuracy: 0.9306

Epoch 91: val_accuracy improved from 0.48047 to 0.49089, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.2108 - accuracy: 0.9306 - val_loss: 3.2114 - val_
accuracy: 0.4909

Epoch 92/300

50/50 [==============================] - ETA: 0s - loss: 0.2356 - accuracy: 0.9244

Epoch 92: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2356 - accuracy: 0.9244 - val_loss: 3.9283 - val_
accuracy: 0.4232

Epoch 93/300

50/50 [==============================] - ETA: 0s - loss: 0.2464 - accuracy: 0.9184

Epoch 93: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2464 - accuracy: 0.9184 - val_loss: 4.5757 - val_
accuracy: 0.3789

Epoch 94/300

50/50 [==============================] - ETA: 0s - loss: 0.2183 - accuracy: 0.9284

Epoch 94: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2183 - accuracy: 0.9284 - val_loss: 3.6904 - val_
accuracy: 0.4609

Epoch 95/300

50/50 [==============================] - ETA: 0s - loss: 0.2090 - accuracy: 0.9344

Epoch 95: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2090 - accuracy: 0.9344 - val_loss: 3.5173 - val_
accuracy: 0.4557

Epoch 96/300

50/50 [==============================] - ETA: 0s - loss: 0.2232 - accuracy: 0.9312

Epoch 96: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2232 - accuracy: 0.9312 - val_loss: 4.7574 - val_
accuracy: 0.3945

Epoch 97/300

50/50 [==============================] - ETA: 0s - loss: 0.2093 - accuracy: 0.9331

Epoch 97: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2093 - accuracy: 0.9331 - val_loss: 3.9148 - val_
accuracy: 0.4492

Epoch 98/300

50/50 [==============================] - ETA: 0s - loss: 0.2128 - accuracy: 0.9306

Epoch 98: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2128 - accuracy: 0.9306 - val_loss: 3.4923 - val_
accuracy: 0.4792

Epoch 99/300
```

```
50/50 [==============================] - ETA: 0s - loss: 0.2036 - accuracy: 0.9388

Epoch 99: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.2036 - accuracy: 0.9388 - val_loss: 4.0985 - val_
accuracy: 0.4596

Epoch 100/300

50/50 [==============================] - ETA: 0s - loss: 0.1717 - accuracy: 0.9472

Epoch 100: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.1717 - accuracy: 0.9472 - val_loss: 4.1347 - val_
accuracy: 0.4375

Epoch 101/300

50/50 [==============================] - ETA: 0s - loss: 0.1868 - accuracy: 0.9378

Epoch 101: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.1868 - accuracy: 0.9378 - val_loss: 3.8690 - val_
accuracy: 0.4505

Epoch 102/300

50/50 [==============================] - ETA: 0s - loss: 0.1757 - accuracy: 0.9347

Epoch 102: val_accuracy did not improve from 0.49089

50/50 [==============================] - 69s 1s/step - loss: 0.1757 - accuracy: 0.9347 - val_loss: 3.8713 - val_
accuracy: 0.4375

Epoch 103/300

50/50 [==============================] - ETA: 0s - loss: 0.2079 - accuracy: 0.9284

Epoch 103: val_accuracy improved from 0.49089 to 0.49609, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.2079 - accuracy: 0.9284 - val_loss: 3.1537 - val_
accuracy: 0.4961

Epoch 104/300

50/50 [==============================] - ETA: 0s - loss: 0.2215 - accuracy: 0.9294

Epoch 104: val_accuracy did not improve from 0.49609

50/50 [==============================] - 69s 1s/step - loss: 0.2215 - accuracy: 0.9294 - val_loss: 5.7253 - val_
accuracy: 0.3359

Epoch 105/300

50/50 [==============================] - ETA: 0s - loss: 0.2041 - accuracy: 0.9278

Epoch 105: val_accuracy did not improve from 0.49609

50/50 [==============================] - 69s 1s/step - loss: 0.2041 - accuracy: 0.9278 - val_loss: 3.6665 - val_
accuracy: 0.4596

Epoch 106/300

50/50 [==============================] - ETA: 0s - loss: 0.1929 - accuracy: 0.9384

Epoch 106: val_accuracy improved from 0.49609 to 0.51823, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.1929 - accuracy: 0.9384 - val_loss: 3.5323 - val_
accuracy: 0.5182

Epoch 107/300

50/50 [==============================] - ETA: 0s - loss: 0.1705 - accuracy: 0.9478

Epoch 107: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1705 - accuracy: 0.9478 - val_loss: 4.1279 - val_
accuracy: 0.4401

Epoch 108/300

50/50 [==============================] - ETA: 0s - loss: 0.1674 - accuracy: 0.9466
```

```
Epoch 108: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1674 - accuracy: 0.9466 - val_loss: 4.7879 - val_
accuracy: 0.4219

Epoch 109/300

50/50 [==============================] - ETA: 0s - loss: 0.1608 - accuracy: 0.9475

Epoch 109: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1608 - accuracy: 0.9475 - val_loss: 4.0354 - val_
accuracy: 0.4401

Epoch 110/300

50/50 [==============================] - ETA: 0s - loss: 0.1491 - accuracy: 0.9528

Epoch 110: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1491 - accuracy: 0.9528 - val_loss: 4.5206 - val_
accuracy: 0.4453

Epoch 111/300

50/50 [==============================] - ETA: 0s - loss: 0.1487 - accuracy: 0.9497

Epoch 111: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1487 - accuracy: 0.9497 - val_loss: 4.7009 - val_
accuracy: 0.4323

Epoch 112/300

50/50 [==============================] - ETA: 0s - loss: 0.1900 - accuracy: 0.9409

Epoch 112: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1900 - accuracy: 0.9409 - val_loss: 4.1316 - val_
accuracy: 0.4518

Epoch 113/300

50/50 [==============================] - ETA: 0s - loss: 0.1950 - accuracy: 0.9375

Epoch 113: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1950 - accuracy: 0.9375 - val_loss: 4.3241 - val_
accuracy: 0.4479

Epoch 114/300

50/50 [==============================] - ETA: 0s - loss: 0.2301 - accuracy: 0.9219

Epoch 114: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.2301 - accuracy: 0.9219 - val_loss: 4.2243 - val_
accuracy: 0.4076

Epoch 115/300

50/50 [==============================] - ETA: 0s - loss: 0.1726 - accuracy: 0.9444

Epoch 115: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1726 - accuracy: 0.9444 - val_loss: 4.2493 - val_
accuracy: 0.4479

Epoch 116/300

50/50 [==============================] - ETA: 0s - loss: 0.1417 - accuracy: 0.9534

Epoch 116: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1417 - accuracy: 0.9534 - val_loss: 4.9068 - val_
accuracy: 0.4219

Epoch 117/300

50/50 [==============================] - ETA: 0s - loss: 0.1653 - accuracy: 0.9463

Epoch 117: val_accuracy did not improve from 0.51823
```

```
50/50 [==============================] - 69s 1s/step - loss: 0.1653 - accuracy: 0.9463 - val_loss: 3.9631 - val_
accuracy: 0.4206

Epoch 118/300

50/50 [==============================] - ETA: 0s - loss: 0.1727 - accuracy: 0.9469

Epoch 118: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1727 - accuracy: 0.9469 - val_loss: 3.8754 - val_
accuracy: 0.4779

Epoch 119/300

50/50 [==============================] - ETA: 0s - loss: 0.1574 - accuracy: 0.9491

Epoch 119: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1574 - accuracy: 0.9491 - val_loss: 3.9699 - val_
accuracy: 0.4453

Epoch 120/300

50/50 [==============================] - ETA: 0s - loss: 0.1642 - accuracy: 0.9475

Epoch 120: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1642 - accuracy: 0.9475 - val_loss: 3.4392 - val_
accuracy: 0.5065

Epoch 121/300

50/50 [==============================] - ETA: 0s - loss: 0.1463 - accuracy: 0.9513

Epoch 121: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1463 - accuracy: 0.9513 - val_loss: 4.0428 - val_
accuracy: 0.4570

Epoch 122/300

50/50 [==============================] - ETA: 0s - loss: 0.1493 - accuracy: 0.9481

Epoch 122: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1493 - accuracy: 0.9481 - val_loss: 4.7450 - val_
accuracy: 0.3776

Epoch 123/300

50/50 [==============================] - ETA: 0s - loss: 0.1616 - accuracy: 0.9447

Epoch 123: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1616 - accuracy: 0.9447 - val_loss: 3.7000 - val_
accuracy: 0.4466

Epoch 124/300

50/50 [==============================] - ETA: 0s - loss: 0.1681 - accuracy: 0.9447

Epoch 124: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1681 - accuracy: 0.9447 - val_loss: 4.5130 - val_
accuracy: 0.4232

Epoch 125/300

50/50 [==============================] - ETA: 0s - loss: 0.1403 - accuracy: 0.9553

Epoch 125: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1403 - accuracy: 0.9553 - val_loss: 5.0781 - val_
accuracy: 0.4089

Epoch 126/300

50/50 [==============================] - ETA: 0s - loss: 0.1375 - accuracy: 0.9566

Epoch 126: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1375 - accuracy: 0.9566 - val_loss: 4.8819 - val_
accuracy: 0.4102
```

```
Epoch 127/300

50/50 [==============================] - ETA: 0s - loss: 0.1288 - accuracy: 0.9550

Epoch 127: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1288 - accuracy: 0.9550 - val_loss: 3.6430 - val_
accuracy: 0.4961

Epoch 128/300

50/50 [==============================] - ETA: 0s - loss: 0.1130 - accuracy: 0.9634

Epoch 128: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1130 - accuracy: 0.9634 - val_loss: 5.9403 - val_
accuracy: 0.3841

Epoch 129/300

50/50 [==============================] - ETA: 0s - loss: 0.1476 - accuracy: 0.9506

Epoch 129: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1476 - accuracy: 0.9506 - val_loss: 5.1210 - val_
accuracy: 0.4115

Epoch 130/300

50/50 [==============================] - ETA: 0s - loss: 0.1447 - accuracy: 0.9522

Epoch 130: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1447 - accuracy: 0.9522 - val_loss: 4.4167 - val_
accuracy: 0.4622

Epoch 131/300

50/50 [==============================] - ETA: 0s - loss: 0.1390 - accuracy: 0.9538

Epoch 131: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1390 - accuracy: 0.9538 - val_loss: 3.8490 - val_
accuracy: 0.4557

Epoch 132/300

50/50 [==============================] - ETA: 0s - loss: 0.1417 - accuracy: 0.9528

Epoch 132: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1417 - accuracy: 0.9528 - val_loss: 5.8548 - val_
accuracy: 0.3372

Epoch 133/300

50/50 [==============================] - ETA: 0s - loss: 0.1335 - accuracy: 0.9550

Epoch 133: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1335 - accuracy: 0.9550 - val_loss: 4.6235 - val_
accuracy: 0.4219

Epoch 134/300

50/50 [==============================] - ETA: 0s - loss: 0.1438 - accuracy: 0.9516

Epoch 134: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1438 - accuracy: 0.9516 - val_loss: 4.4867 - val_
accuracy: 0.4362

Epoch 135/300

50/50 [==============================] - ETA: 0s - loss: 0.1146 - accuracy: 0.9597

Epoch 135: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1146 - accuracy: 0.9597 - val_loss: 5.0634 - val_
accuracy: 0.4401

Epoch 136/300
```

```
50/50 [==============================] - ETA: 0s - loss: 0.0933 - accuracy: 0.9650

Epoch 136: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.0933 - accuracy: 0.9650 - val_loss: 4.7720 - val_
accuracy: 0.4167

Epoch 137/300

50/50 [==============================] - ETA: 0s - loss: 0.1201 - accuracy: 0.9591

Epoch 137: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1201 - accuracy: 0.9591 - val_loss: 5.4497 - val_
accuracy: 0.4193

Epoch 138/300

50/50 [==============================] - ETA: 0s - loss: 0.1235 - accuracy: 0.9606

Epoch 138: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1235 - accuracy: 0.9606 - val_loss: 4.5235 - val_
accuracy: 0.4635

Epoch 139/300

50/50 [==============================] - ETA: 0s - loss: 0.1098 - accuracy: 0.9634

Epoch 139: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1098 - accuracy: 0.9634 - val_loss: 4.4440 - val_
accuracy: 0.4557

Epoch 140/300

50/50 [==============================] - ETA: 0s - loss: 0.1327 - accuracy: 0.9600

Epoch 140: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1327 - accuracy: 0.9600 - val_loss: 5.4828 - val_
accuracy: 0.3711

Epoch 141/300

50/50 [==============================] - ETA: 0s - loss: 0.1196 - accuracy: 0.9622

Epoch 141: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1196 - accuracy: 0.9622 - val_loss: 4.1438 - val_
accuracy: 0.4544

Epoch 142/300

50/50 [==============================] - ETA: 0s - loss: 0.1269 - accuracy: 0.9588

Epoch 142: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1269 - accuracy: 0.9588 - val_loss: 3.3946 - val_
accuracy: 0.4948

Epoch 143/300

50/50 [==============================] - ETA: 0s - loss: 0.1187 - accuracy: 0.9603

Epoch 143: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1187 - accuracy: 0.9603 - val_loss: 3.6063 - val_
accuracy: 0.4870

Epoch 144/300

50/50 [==============================] - ETA: 0s - loss: 0.1103 - accuracy: 0.9638

Epoch 144: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1103 - accuracy: 0.9638 - val_loss: 4.5092 - val_
accuracy: 0.4010

Epoch 145/300

50/50 [==============================] - ETA: 0s - loss: 0.1163 - accuracy: 0.9625
```

```
Epoch 145: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1163 - accuracy: 0.9625 - val_loss: 4.2512 - val_
accuracy: 0.4753

Epoch 146/300

50/50 [==============================] - ETA: 0s - loss: 0.1373 - accuracy: 0.9566

Epoch 146: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1373 - accuracy: 0.9566 - val_loss: 4.3791 - val_
accuracy: 0.4609

Epoch 147/300

50/50 [==============================] - ETA: 0s - loss: 0.1263 - accuracy: 0.9619

Epoch 147: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1263 - accuracy: 0.9619 - val_loss: 6.1881 - val_
accuracy: 0.3581

Epoch 148/300

50/50 [==============================] - ETA: 0s - loss: 0.1300 - accuracy: 0.9569

Epoch 148: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1300 - accuracy: 0.9569 - val_loss: 4.6460 - val_
accuracy: 0.4089

Epoch 149/300

50/50 [==============================] - ETA: 0s - loss: 0.1036 - accuracy: 0.9650

Epoch 149: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1036 - accuracy: 0.9650 - val_loss: 5.2993 - val_
accuracy: 0.4258

Epoch 150/300

50/50 [==============================] - ETA: 0s - loss: 0.1166 - accuracy: 0.9619

Epoch 150: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1166 - accuracy: 0.9619 - val_loss: 3.9741 - val_
accuracy: 0.4896

Epoch 151/300

50/50 [==============================] - ETA: 0s - loss: 0.1202 - accuracy: 0.9597

Epoch 151: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1202 - accuracy: 0.9597 - val_loss: 4.1989 - val_
accuracy: 0.4987

Epoch 152/300

50/50 [==============================] - ETA: 0s - loss: 0.1227 - accuracy: 0.9613

Epoch 152: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1227 - accuracy: 0.9613 - val_loss: 4.1482 - val_
accuracy: 0.4648

Epoch 153/300

50/50 [==============================] - ETA: 0s - loss: 0.1139 - accuracy: 0.9613

Epoch 153: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1139 - accuracy: 0.9613 - val_loss: 3.8150 - val_
accuracy: 0.4531

Epoch 154/300

50/50 [==============================] - ETA: 0s - loss: 0.1289 - accuracy: 0.9566

Epoch 154: val_accuracy did not improve from 0.51823
```

```
50/50 [==============================] - 69s 1s/step - loss: 0.1289 - accuracy: 0.9566 - val_loss: 4.1138 - val_
accuracy: 0.5065

Epoch 155/300

50/50 [==============================] - ETA: 0s - loss: 0.1015 - accuracy: 0.9669

Epoch 155: val_accuracy did not improve from 0.51823

50/50 [==============================] - 69s 1s/step - loss: 0.1015 - accuracy: 0.9669 - val_loss: 4.2697 - val_
accuracy: 0.4948

Epoch 156/300

50/50 [==============================] - ETA: 0s - loss: 0.0801 - accuracy: 0.9709

Epoch 156: val_accuracy improved from 0.51823 to 0.54427, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.0801 - accuracy: 0.9709 - val_loss: 3.6972 - val_
accuracy: 0.5443

Epoch 157/300

50/50 [==============================] - ETA: 0s - loss: 0.1002 - accuracy: 0.9666

Epoch 157: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1002 - accuracy: 0.9666 - val_loss: 6.0303 - val_
accuracy: 0.3893

Epoch 158/300

50/50 [==============================] - ETA: 0s - loss: 0.1260 - accuracy: 0.9616

Epoch 158: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1260 - accuracy: 0.9616 - val_loss: 4.4499 - val_
accuracy: 0.4596

Epoch 159/300

50/50 [==============================] - ETA: 0s - loss: 0.1291 - accuracy: 0.9556

Epoch 159: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1291 - accuracy: 0.9556 - val_loss: 4.8949 - val_
accuracy: 0.4258

Epoch 160/300

50/50 [==============================] - ETA: 0s - loss: 0.1427 - accuracy: 0.9525

Epoch 160: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1427 - accuracy: 0.9525 - val_loss: 5.0995 - val_
accuracy: 0.3893

Epoch 161/300

50/50 [==============================] - ETA: 0s - loss: 0.1028 - accuracy: 0.9666

Epoch 161: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1028 - accuracy: 0.9666 - val_loss: 3.9991 - val_
accuracy: 0.4701

Epoch 162/300

50/50 [==============================] - ETA: 0s - loss: 0.0928 - accuracy: 0.9691

Epoch 162: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0928 - accuracy: 0.9691 - val_loss: 4.0761 - val_
accuracy: 0.4779

Epoch 163/300

50/50 [==============================] - ETA: 0s - loss: 0.0704 - accuracy: 0.9737

Epoch 163: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0704 - accuracy: 0.9737 - val_loss: 3.9824 - val_
```

```
accuracy: 0.4883

Epoch 164/300

50/50 [==============================] - ETA: 0s - loss: 0.0778 - accuracy: 0.9753

Epoch 164: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0778 - accuracy: 0.9753 - val_loss: 3.6456 - val_
accuracy: 0.5013

Epoch 165/300

50/50 [==============================] - ETA: 0s - loss: 0.0941 - accuracy: 0.9709

Epoch 165: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0941 - accuracy: 0.9709 - val_loss: 4.2992 - val_
accuracy: 0.4896

Epoch 166/300

50/50 [==============================] - ETA: 0s - loss: 0.1203 - accuracy: 0.9603

Epoch 166: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1203 - accuracy: 0.9603 - val_loss: 4.6231 - val_
accuracy: 0.4870

Epoch 167/300

50/50 [==============================] - ETA: 0s - loss: 0.1175 - accuracy: 0.9669

Epoch 167: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1175 - accuracy: 0.9669 - val_loss: 4.9785 - val_
accuracy: 0.4466

Epoch 168/300

50/50 [==============================] - ETA: 0s - loss: 0.1334 - accuracy: 0.9553

Epoch 168: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1334 - accuracy: 0.9553 - val_loss: 5.1459 - val_
accuracy: 0.3750

Epoch 169/300

50/50 [==============================] - ETA: 0s - loss: 0.1056 - accuracy: 0.9647

Epoch 169: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1056 - accuracy: 0.9647 - val_loss: 7.9554 - val_
accuracy: 0.2904

Epoch 170/300

50/50 [==============================] - ETA: 0s - loss: 0.0924 - accuracy: 0.9694

Epoch 170: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0924 - accuracy: 0.9694 - val_loss: 3.3854 - val_
accuracy: 0.5065

Epoch 171/300

50/50 [==============================] - ETA: 0s - loss: 0.1168 - accuracy: 0.9631

Epoch 171: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1168 - accuracy: 0.9631 - val_loss: 5.6374 - val_
accuracy: 0.4349

Epoch 172/300

50/50 [==============================] - ETA: 0s - loss: 0.1340 - accuracy: 0.9584

Epoch 172: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1340 - accuracy: 0.9584 - val_loss: 3.9687 - val_
accuracy: 0.4805
```

```
Epoch 173/300

50/50 [==============================] - ETA: 0s - loss: 0.1217 - accuracy: 0.9588

Epoch 173: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1217 - accuracy: 0.9588 - val_loss: 4.0204 - val_
accuracy: 0.4922

Epoch 174/300

50/50 [==============================] - ETA: 0s - loss: 0.0970 - accuracy: 0.9666

Epoch 174: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0970 - accuracy: 0.9666 - val_loss: 4.2807 - val_
accuracy: 0.4844

Epoch 175/300

50/50 [==============================] - ETA: 0s - loss: 0.0916 - accuracy: 0.9709

Epoch 175: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0916 - accuracy: 0.9709 - val_loss: 3.8395 - val_
accuracy: 0.4701

Epoch 176/300

50/50 [==============================] - ETA: 0s - loss: 0.0993 - accuracy: 0.9631

Epoch 176: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0993 - accuracy: 0.9631 - val_loss: 4.3472 - val_
accuracy: 0.4440

Epoch 177/300

50/50 [==============================] - ETA: 0s - loss: 0.1050 - accuracy: 0.9656

Epoch 177: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1050 - accuracy: 0.9656 - val_loss: 5.0771 - val_
accuracy: 0.4115

Epoch 178/300

50/50 [==============================] - ETA: 0s - loss: 0.0999 - accuracy: 0.9659

Epoch 178: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0999 - accuracy: 0.9659 - val_loss: 5.0202 - val_
accuracy: 0.3841

Epoch 179/300

50/50 [==============================] - ETA: 0s - loss: 0.1049 - accuracy: 0.9697

Epoch 179: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1049 - accuracy: 0.9697 - val_loss: 7.8411 - val_
accuracy: 0.2943

Epoch 180/300

50/50 [==============================] - ETA: 0s - loss: 0.0986 - accuracy: 0.9672

Epoch 180: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0986 - accuracy: 0.9672 - val_loss: 5.2893 - val_
accuracy: 0.4479

Epoch 181/300

50/50 [==============================] - ETA: 0s - loss: 0.0830 - accuracy: 0.9716

Epoch 181: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0830 - accuracy: 0.9716 - val_loss: 4.2806 - val_
accuracy: 0.4688

Epoch 182/300
```

```
50/50 [==============================] - ETA: 0s - loss: 0.0821 - accuracy: 0.9722

Epoch 182: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0821 - accuracy: 0.9722 - val_loss: 4.4030 - val_
accuracy: 0.4531

Epoch 183/300

50/50 [==============================] - ETA: 0s - loss: 0.0981 - accuracy: 0.9681

Epoch 183: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0981 - accuracy: 0.9681 - val_loss: 7.9965 - val_
accuracy: 0.2865

Epoch 184/300

50/50 [==============================] - ETA: 0s - loss: 0.0805 - accuracy: 0.9734

Epoch 184: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0805 - accuracy: 0.9734 - val_loss: 4.0462 - val_
accuracy: 0.5286

Epoch 185/300

50/50 [==============================] - ETA: 0s - loss: 0.0882 - accuracy: 0.9684

Epoch 185: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0882 - accuracy: 0.9684 - val_loss: 4.7704 - val_
accuracy: 0.4674

Epoch 186/300

50/50 [==============================] - ETA: 0s - loss: 0.1014 - accuracy: 0.9681

Epoch 186: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1014 - accuracy: 0.9681 - val_loss: 5.5326 - val_
accuracy: 0.4219

Epoch 187/300

50/50 [==============================] - ETA: 0s - loss: 0.0979 - accuracy: 0.9666

Epoch 187: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0979 - accuracy: 0.9666 - val_loss: 3.8772 - val_
accuracy: 0.5365

Epoch 188/300

50/50 [==============================] - ETA: 0s - loss: 0.0889 - accuracy: 0.9694

Epoch 188: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0889 - accuracy: 0.9694 - val_loss: 4.5672 - val_
accuracy: 0.4714

Epoch 189/300

50/50 [==============================] - ETA: 0s - loss: 0.0942 - accuracy: 0.9703

Epoch 189: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0942 - accuracy: 0.9703 - val_loss: 5.5718 - val_
accuracy: 0.4180

Epoch 190/300

50/50 [==============================] - ETA: 0s - loss: 0.0895 - accuracy: 0.9706

Epoch 190: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0895 - accuracy: 0.9706 - val_loss: 4.4495 - val_
accuracy: 0.4844

Epoch 191/300

50/50 [==============================] - ETA: 0s - loss: 0.0995 - accuracy: 0.9697
```

```
Epoch 191: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0995 - accuracy: 0.9697 - val_loss: 4.1640 - val_
accuracy: 0.5013

Epoch 192/300

50/50 [==============================] - ETA: 0s - loss: 0.0802 - accuracy: 0.9703

Epoch 192: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0802 - accuracy: 0.9703 - val_loss: 6.0058 - val_
accuracy: 0.4115

Epoch 193/300

50/50 [==============================] - ETA: 0s - loss: 0.0865 - accuracy: 0.9719

Epoch 193: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0865 - accuracy: 0.9719 - val_loss: 4.4219 - val_
accuracy: 0.4284

Epoch 194/300

50/50 [==============================] - ETA: 0s - loss: 0.1199 - accuracy: 0.9653

Epoch 194: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1199 - accuracy: 0.9653 - val_loss: 3.8660 - val_
accuracy: 0.5052

Epoch 195/300

50/50 [==============================] - ETA: 0s - loss: 0.0998 - accuracy: 0.9712

Epoch 195: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0998 - accuracy: 0.9712 - val_loss: 7.4448 - val_
accuracy: 0.3008

Epoch 196/300

50/50 [==============================] - ETA: 0s - loss: 0.0864 - accuracy: 0.9722

Epoch 196: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0864 - accuracy: 0.9722 - val_loss: 3.9930 - val_
accuracy: 0.4922

Epoch 197/300

50/50 [==============================] - ETA: 0s - loss: 0.0641 - accuracy: 0.9809

Epoch 197: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0641 - accuracy: 0.9809 - val_loss: 5.1676 - val_
accuracy: 0.4648

Epoch 198/300

50/50 [==============================] - ETA: 0s - loss: 0.0624 - accuracy: 0.9787

Epoch 198: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0624 - accuracy: 0.9787 - val_loss: 3.5494 - val_
accuracy: 0.5065

Epoch 199/300

50/50 [==============================] - ETA: 0s - loss: 0.0643 - accuracy: 0.9762

Epoch 199: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0643 - accuracy: 0.9762 - val_loss: 3.6356 - val_
accuracy: 0.4922

Epoch 200/300

50/50 [==============================] - ETA: 0s - loss: 0.0776 - accuracy: 0.9734

Epoch 200: val_accuracy did not improve from 0.54427
```

```
50/50 [==============================] - 69s 1s/step - loss: 0.0776 - accuracy: 0.9734 - val_loss: 4.7800 - val_
accuracy: 0.3867

Epoch 201/300

50/50 [==============================] - ETA: 0s - loss: 0.0909 - accuracy: 0.9737

Epoch 201: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0909 - accuracy: 0.9737 - val_loss: 5.6264 - val_
accuracy: 0.3880

Epoch 202/300

50/50 [==============================] - ETA: 0s - loss: 0.0831 - accuracy: 0.9741

Epoch 202: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0831 - accuracy: 0.9741 - val_loss: 5.8165 - val_
accuracy: 0.4284

Epoch 203/300

50/50 [==============================] - ETA: 0s - loss: 0.0885 - accuracy: 0.9691

Epoch 203: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0885 - accuracy: 0.9691 - val_loss: 4.4601 - val_
accuracy: 0.4635

Epoch 204/300

50/50 [==============================] - ETA: 0s - loss: 0.1047 - accuracy: 0.9681

Epoch 204: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1047 - accuracy: 0.9681 - val_loss: 5.9772 - val_
accuracy: 0.3646

Epoch 205/300

50/50 [==============================] - ETA: 0s - loss: 0.1048 - accuracy: 0.9625

Epoch 205: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1048 - accuracy: 0.9625 - val_loss: 4.7049 - val_
accuracy: 0.4674

Epoch 206/300

50/50 [==============================] - ETA: 0s - loss: 0.1348 - accuracy: 0.9575

Epoch 206: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.1348 - accuracy: 0.9575 - val_loss: 4.3989 - val_
accuracy: 0.4128

Epoch 207/300

50/50 [==============================] - ETA: 0s - loss: 0.0768 - accuracy: 0.9728

Epoch 207: val_accuracy did not improve from 0.54427

50/50 [==============================] - 69s 1s/step - loss: 0.0768 - accuracy: 0.9728 - val_loss: 4.3475 - val_
accuracy: 0.4935

Epoch 208/300

50/50 [==============================] - ETA: 0s - loss: 0.0689 - accuracy: 0.9756

Epoch 208: val_accuracy improved from 0.54427 to 0.54688, saving model to model/best_model.h5

50/50 [==============================] - 70s 1s/step - loss: 0.0689 - accuracy: 0.9756 - val_loss: 3.5950 - val_
accuracy: 0.5469

Epoch 209/300

50/50 [==============================] - ETA: 0s - loss: 0.0800 - accuracy: 0.9741

Epoch 209: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0800 - accuracy: 0.9741 - val_loss: 3.5173 - val_
accuracy: 0.5117
```

```
Epoch 210/300

50/50 [==============================] - ETA: 0s - loss: 0.0571 - accuracy: 0.9797

Epoch 210: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0571 - accuracy: 0.9797 - val_loss: 4.6114 - val_
accuracy: 0.4779

Epoch 211/300

50/50 [==============================] - ETA: 0s - loss: 0.0887 - accuracy: 0.9716

Epoch 211: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0887 - accuracy: 0.9716 - val_loss: 7.2381 - val_
accuracy: 0.2930

Epoch 212/300

50/50 [==============================] - ETA: 0s - loss: 0.0903 - accuracy: 0.9700

Epoch 212: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0903 - accuracy: 0.9700 - val_loss: 4.2567 - val_
accuracy: 0.4648

Epoch 213/300

50/50 [==============================] - ETA: 0s - loss: 0.0580 - accuracy: 0.9778

Epoch 213: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0580 - accuracy: 0.9778 - val_loss: 4.3007 - val_
accuracy: 0.4844

Epoch 214/300

50/50 [==============================] - ETA: 0s - loss: 0.0605 - accuracy: 0.9822

Epoch 214: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0605 - accuracy: 0.9822 - val_loss: 5.1464 - val_
accuracy: 0.4206

Epoch 215/300

50/50 [==============================] - ETA: 0s - loss: 0.0587 - accuracy: 0.9753

Epoch 215: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0587 - accuracy: 0.9753 - val_loss: 4.6580 - val_
accuracy: 0.4818

Epoch 216/300

50/50 [==============================] - ETA: 0s - loss: 0.0625 - accuracy: 0.9781

Epoch 216: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0625 - accuracy: 0.9781 - val_loss: 4.2933 - val_
accuracy: 0.5052

Epoch 217/300

50/50 [==============================] - ETA: 0s - loss: 0.0597 - accuracy: 0.9803

Epoch 217: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0597 - accuracy: 0.9803 - val_loss: 4.4938 - val_
accuracy: 0.5052

Epoch 218/300

50/50 [==============================] - ETA: 0s - loss: 0.0534 - accuracy: 0.9816

Epoch 218: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0534 - accuracy: 0.9816 - val_loss: 4.0179 - val_
accuracy: 0.5052

Epoch 219/300
```

```
50/50 [==============================] - ETA: 0s - loss: 0.0807 - accuracy: 0.9722

Epoch 219: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0807 - accuracy: 0.9722 - val_loss: 5.0848 - val_
accuracy: 0.4193

Epoch 220/300

50/50 [==============================] - ETA: 0s - loss: 0.0616 - accuracy: 0.9766

Epoch 220: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0616 - accuracy: 0.9766 - val_loss: 4.3070 - val_
accuracy: 0.4883

Epoch 221/300

50/50 [==============================] - ETA: 0s - loss: 0.0905 - accuracy: 0.9688

Epoch 221: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0905 - accuracy: 0.9688 - val_loss: 4.2020 - val_
accuracy: 0.4857

Epoch 222/300

50/50 [==============================] - ETA: 0s - loss: 0.0629 - accuracy: 0.9791

Epoch 222: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0629 - accuracy: 0.9791 - val_loss: 3.9694 - val_
accuracy: 0.5104

Epoch 223/300

50/50 [==============================] - ETA: 0s - loss: 0.0891 - accuracy: 0.9734

Epoch 223: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0891 - accuracy: 0.9734 - val_loss: 4.3207 - val_
accuracy: 0.4883

Epoch 224/300

50/50 [==============================] - ETA: 0s - loss: 0.0967 - accuracy: 0.9697

Epoch 224: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0967 - accuracy: 0.9697 - val_loss: 4.4155 - val_
accuracy: 0.4740

Epoch 225/300

50/50 [==============================] - ETA: 0s - loss: 0.0763 - accuracy: 0.9750

Epoch 225: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0763 - accuracy: 0.9750 - val_loss: 4.1988 - val_
accuracy: 0.5208

Epoch 226/300

50/50 [==============================] - ETA: 0s - loss: 0.0740 - accuracy: 0.9709

Epoch 226: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0740 - accuracy: 0.9709 - val_loss: 4.1051 - val_
accuracy: 0.5130

Epoch 227/300

50/50 [==============================] - ETA: 0s - loss: 0.0771 - accuracy: 0.9744

Epoch 227: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0771 - accuracy: 0.9744 - val_loss: 4.0504 - val_
accuracy: 0.5143

Epoch 228/300

50/50 [==============================] - ETA: 0s - loss: 0.0930 - accuracy: 0.9694
```

```
Epoch 228: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0930 - accuracy: 0.9694 - val_loss: 4.2883 - val_
accuracy: 0.4336

Epoch 229/300

50/50 [==============================] - ETA: 0s - loss: 0.0839 - accuracy: 0.9716

Epoch 229: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0839 - accuracy: 0.9716 - val_loss: 3.9683 - val_
accuracy: 0.5065

Epoch 230/300

50/50 [==============================] - ETA: 0s - loss: 0.0935 - accuracy: 0.9694

Epoch 230: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0935 - accuracy: 0.9694 - val_loss: 4.1961 - val_
accuracy: 0.4961

Epoch 231/300

50/50 [==============================] - ETA: 0s - loss: 0.0898 - accuracy: 0.9691

Epoch 231: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0898 - accuracy: 0.9691 - val_loss: 4.6163 - val_
accuracy: 0.4219

Epoch 232/300

50/50 [==============================] - ETA: 0s - loss: 0.0989 - accuracy: 0.9681

Epoch 232: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0989 - accuracy: 0.9681 - val_loss: 3.7604 - val_
accuracy: 0.5039

Epoch 233/300

50/50 [==============================] - ETA: 0s - loss: 0.0696 - accuracy: 0.9750

Epoch 233: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0696 - accuracy: 0.9750 - val_loss: 4.4942 - val_
accuracy: 0.4740

Epoch 234/300

50/50 [==============================] - ETA: 0s - loss: 0.0946 - accuracy: 0.9684

Epoch 234: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0946 - accuracy: 0.9684 - val_loss: 4.7223 - val_
accuracy: 0.4388

Epoch 235/300

50/50 [==============================] - ETA: 0s - loss: 0.0817 - accuracy: 0.9719

Epoch 235: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0817 - accuracy: 0.9719 - val_loss: 6.7891 - val_
accuracy: 0.3138

Epoch 236/300

50/50 [==============================] - ETA: 0s - loss: 0.1012 - accuracy: 0.9697

Epoch 236: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.1012 - accuracy: 0.9697 - val_loss: 4.3440 - val_
accuracy: 0.4740

Epoch 237/300

50/50 [==============================] - ETA: 0s - loss: 0.0925 - accuracy: 0.9678

Epoch 237: val_accuracy did not improve from 0.54688
```

```
50/50 [==============================] - 69s 1s/step - loss: 0.0925 - accuracy: 0.9678 - val_loss: 3.9824 - val_
accuracy: 0.4922

Epoch 238/300

50/50 [==============================] - ETA: 0s - loss: 0.0670 - accuracy: 0.9784

Epoch 238: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0670 - accuracy: 0.9784 - val_loss: 4.2186 - val_
accuracy: 0.4909

Epoch 239/300

50/50 [==============================] - ETA: 0s - loss: 0.0507 - accuracy: 0.9822

Epoch 239: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0507 - accuracy: 0.9822 - val_loss: 4.5668 - val_
accuracy: 0.4596

Epoch 240/300

50/50 [==============================] - ETA: 0s - loss: 0.0328 - accuracy: 0.9891

Epoch 240: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0328 - accuracy: 0.9891 - val_loss: 4.3731 - val_
accuracy: 0.4961

Epoch 241/300

50/50 [==============================] - ETA: 0s - loss: 0.0672 - accuracy: 0.9759

Epoch 241: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0672 - accuracy: 0.9759 - val_loss: 5.5542 - val_
accuracy: 0.4245

Epoch 242/300

50/50 [==============================] - ETA: 0s - loss: 0.0752 - accuracy: 0.9753

Epoch 242: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0752 - accuracy: 0.9753 - val_loss: 5.5116 - val_
accuracy: 0.4349

Epoch 243/300

50/50 [==============================] - ETA: 0s - loss: 0.0697 - accuracy: 0.9784

Epoch 243: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0697 - accuracy: 0.9784 - val_loss: 4.2030 - val_
accuracy: 0.5156

Epoch 244/300

50/50 [==============================] - ETA: 0s - loss: 0.0774 - accuracy: 0.9725

Epoch 244: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0774 - accuracy: 0.9725 - val_loss: 6.3309 - val_
accuracy: 0.4010

Epoch 245/300

50/50 [==============================] - ETA: 0s - loss: 0.0611 - accuracy: 0.9797

Epoch 245: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0611 - accuracy: 0.9797 - val_loss: 3.9408 - val_
accuracy: 0.5000

Epoch 246/300

50/50 [==============================] - ETA: 0s - loss: 0.0696 - accuracy: 0.9753

Epoch 246: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0696 - accuracy: 0.9753 - val_loss: 4.1014 - val_
```

```
accuracy: 0.4987

Epoch 247/300

50/50 [==============================] - ETA: 0s - loss: 0.0672 - accuracy: 0.9747

Epoch 247: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0672 - accuracy: 0.9747 - val_loss: 4.2275 - val_
accuracy: 0.5091

Epoch 248/300

50/50 [==============================] - ETA: 0s - loss: 0.0600 - accuracy: 0.9791

Epoch 248: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0600 - accuracy: 0.9791 - val_loss: 5.1981 - val_
accuracy: 0.4596

Epoch 249/300

50/50 [==============================] - ETA: 0s - loss: 0.0598 - accuracy: 0.9787

Epoch 249: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0598 - accuracy: 0.9787 - val_loss: 4.2396 - val_
accuracy: 0.4688

Epoch 250/300

50/50 [==============================] - ETA: 0s - loss: 0.0678 - accuracy: 0.9775

Epoch 250: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0678 - accuracy: 0.9775 - val_loss: 5.4181 - val_
accuracy: 0.4023

Epoch 251/300

50/50 [==============================] - ETA: 0s - loss: 0.0681 - accuracy: 0.9728

Epoch 251: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0681 - accuracy: 0.9728 - val_loss: 4.1505 - val_
accuracy: 0.4310

Epoch 252/300

50/50 [==============================] - ETA: 0s - loss: 0.0804 - accuracy: 0.9737

Epoch 252: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0804 - accuracy: 0.9737 - val_loss: 4.8861 - val_
accuracy: 0.4622

Epoch 253/300

50/50 [==============================] - ETA: 0s - loss: 0.0986 - accuracy: 0.9675

Epoch 253: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0986 - accuracy: 0.9675 - val_loss: 4.5800 - val_
accuracy: 0.4622

Epoch 254/300

50/50 [==============================] - ETA: 0s - loss: 0.0820 - accuracy: 0.9747

Epoch 254: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0820 - accuracy: 0.9747 - val_loss: 4.1149 - val_
accuracy: 0.5000

Epoch 255/300

50/50 [==============================] - ETA: 0s - loss: 0.0924 - accuracy: 0.9681

Epoch 255: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0924 - accuracy: 0.9681 - val_loss: 4.4513 - val_
accuracy: 0.4714
```

```
Epoch 256/300

50/50 [==============================] - ETA: 0s - loss: 0.0774 - accuracy: 0.9744

Epoch 256: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0774 - accuracy: 0.9744 - val_loss: 4.1506 - val_
accuracy: 0.5339

Epoch 257/300

50/50 [==============================] - ETA: 0s - loss: 0.0481 - accuracy: 0.9831

Epoch 257: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0481 - accuracy: 0.9831 - val_loss: 4.3061 - val_
accuracy: 0.4818

Epoch 258/300

50/50 [==============================] - ETA: 0s - loss: 0.0430 - accuracy: 0.9841

Epoch 258: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0430 - accuracy: 0.9841 - val_loss: 3.7945 - val_
accuracy: 0.5365

Epoch 259/300

50/50 [==============================] - ETA: 0s - loss: 0.0549 - accuracy: 0.9809

Epoch 259: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0549 - accuracy: 0.9809 - val_loss: 5.5269 - val_
accuracy: 0.4284

Epoch 260/300

50/50 [==============================] - ETA: 0s - loss: 0.0504 - accuracy: 0.9834

Epoch 260: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0504 - accuracy: 0.9834 - val_loss: 4.4283 - val_
accuracy: 0.5000

Epoch 261/300

50/50 [==============================] - ETA: 0s - loss: 0.0657 - accuracy: 0.9784

Epoch 261: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0657 - accuracy: 0.9784 - val_loss: 4.4627 - val_
accuracy: 0.4792

Epoch 262/300

50/50 [==============================] - ETA: 0s - loss: 0.0755 - accuracy: 0.9756

Epoch 262: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0755 - accuracy: 0.9756 - val_loss: 9.8551 - val_
accuracy: 0.2878

Epoch 263/300

50/50 [==============================] - ETA: 0s - loss: 0.0831 - accuracy: 0.9706

Epoch 263: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0831 - accuracy: 0.9706 - val_loss: 6.0643 - val_
accuracy: 0.3333

Epoch 264/300

50/50 [==============================] - ETA: 0s - loss: 0.0773 - accuracy: 0.9737

Epoch 264: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0773 - accuracy: 0.9737 - val_loss: 4.6733 - val_
accuracy: 0.4349

Epoch 265/300
```

```
50/50 [==============================] - ETA: 0s - loss: 0.0606 - accuracy: 0.9800

Epoch 265: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0606 - accuracy: 0.9800 - val_loss: 4.0370 - val_
accuracy: 0.5378

Epoch 266/300

50/50 [==============================] - ETA: 0s - loss: 0.0621 - accuracy: 0.9797

Epoch 266: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0621 - accuracy: 0.9797 - val_loss: 5.6529 - val_
accuracy: 0.4258

Epoch 267/300

50/50 [==============================] - ETA: 0s - loss: 0.0387 - accuracy: 0.9850

Epoch 267: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0387 - accuracy: 0.9850 - val_loss: 4.8140 - val_
accuracy: 0.4753

Epoch 268/300

50/50 [==============================] - ETA: 0s - loss: 0.0416 - accuracy: 0.9856

Epoch 268: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0416 - accuracy: 0.9856 - val_loss: 3.7864 - val_
accuracy: 0.5156

Epoch 269/300

50/50 [==============================] - ETA: 0s - loss: 0.0359 - accuracy: 0.9853

Epoch 269: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0359 - accuracy: 0.9853 - val_loss: 3.8191 - val_
accuracy: 0.5182

Epoch 270/300

50/50 [==============================] - ETA: 0s - loss: 0.0451 - accuracy: 0.9822

Epoch 270: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0451 - accuracy: 0.9822 - val_loss: 4.2997 - val_
accuracy: 0.5130

Epoch 271/300

50/50 [==============================] - ETA: 0s - loss: 0.0443 - accuracy: 0.9862

Epoch 271: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0443 - accuracy: 0.9862 - val_loss: 4.1918 - val_
accuracy: 0.5273

Epoch 272/300

50/50 [==============================] - ETA: 0s - loss: 0.0510 - accuracy: 0.9834

Epoch 272: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0510 - accuracy: 0.9834 - val_loss: 5.8006 - val_
accuracy: 0.4297

Epoch 273/300

50/50 [==============================] - ETA: 0s - loss: 0.0504 - accuracy: 0.9791

Epoch 273: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0504 - accuracy: 0.9791 - val_loss: 4.6607 - val_
accuracy: 0.4805

Epoch 274/300

50/50 [==============================] - ETA: 0s - loss: 0.0631 - accuracy: 0.9759
```

```
Epoch 274: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0631 - accuracy: 0.9759 - val_loss: 4.2789 - val_
accuracy: 0.4857

Epoch 275/300

50/50 [==============================] - ETA: 0s - loss: 0.0686 - accuracy: 0.9794

Epoch 275: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0686 - accuracy: 0.9794 - val_loss: 4.9552 - val_
accuracy: 0.4740

Epoch 276/300

50/50 [==============================] - ETA: 0s - loss: 0.0530 - accuracy: 0.9816

Epoch 276: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0530 - accuracy: 0.9816 - val_loss: 4.1062 - val_
accuracy: 0.4922

Epoch 277/300

50/50 [==============================] - ETA: 0s - loss: 0.0528 - accuracy: 0.9794

Epoch 277: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0528 - accuracy: 0.9794 - val_loss: 4.2578 - val_
accuracy: 0.4531

Epoch 278/300

50/50 [==============================] - ETA: 0s - loss: 0.0865 - accuracy: 0.9709

Epoch 278: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0865 - accuracy: 0.9709 - val_loss: 7.0727 - val_
accuracy: 0.3125

Epoch 279/300

50/50 [==============================] - ETA: 0s - loss: 0.0892 - accuracy: 0.9691

Epoch 279: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0892 - accuracy: 0.9691 - val_loss: 6.3193 - val_
accuracy: 0.3451

Epoch 280/300

50/50 [==============================] - ETA: 0s - loss: 0.0605 - accuracy: 0.9781

Epoch 280: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0605 - accuracy: 0.9781 - val_loss: 5.0488 - val_
accuracy: 0.4779

Epoch 281/300

50/50 [==============================] - ETA: 0s - loss: 0.0627 - accuracy: 0.9794

Epoch 281: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0627 - accuracy: 0.9794 - val_loss: 4.6857 - val_
accuracy: 0.4818

Epoch 282/300

50/50 [==============================] - ETA: 0s - loss: 0.0735 - accuracy: 0.9781

Epoch 282: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0735 - accuracy: 0.9781 - val_loss: 4.2852 - val_
accuracy: 0.5169

Epoch 283/300

50/50 [==============================] - ETA: 0s - loss: 0.0553 - accuracy: 0.9794

Epoch 283: val_accuracy did not improve from 0.54688
```

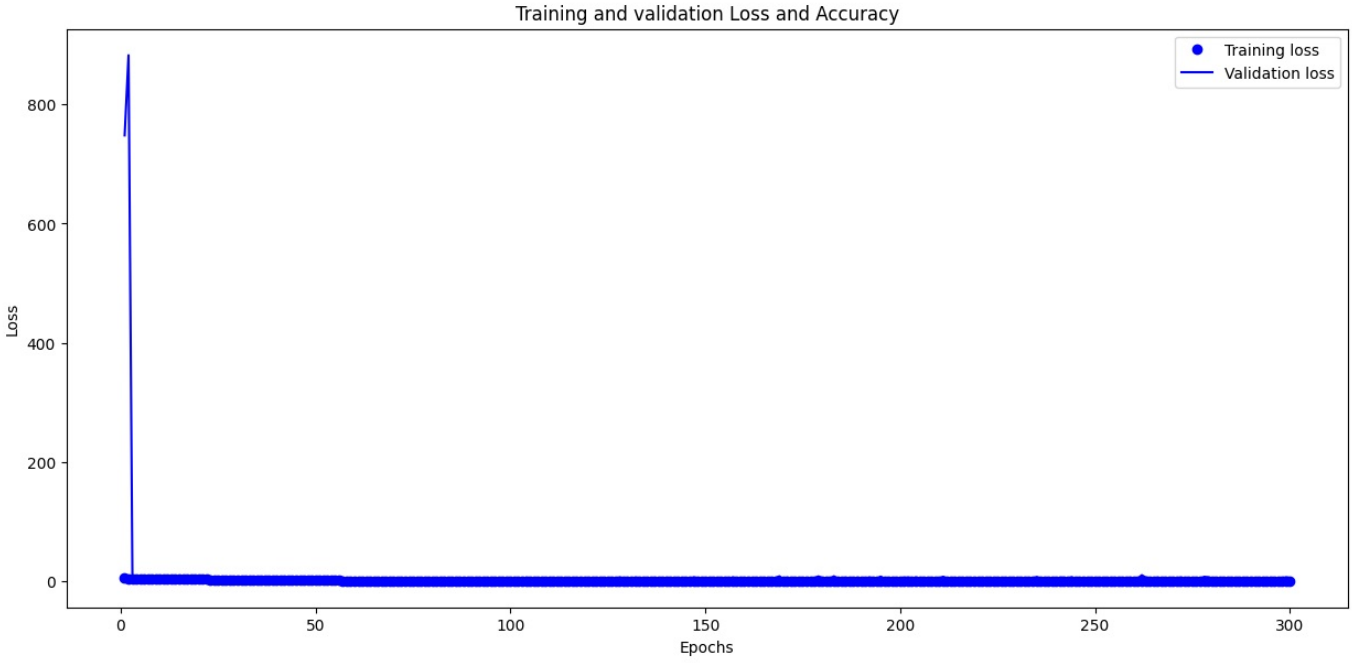
```
50/50 [==============================] - 69s 1s/step - loss: 0.0553 - accuracy: 0.9794 - val_loss: 4.2087 - val_
accuracy: 0.4831

Epoch 284/300

50/50 [==============================] - ETA: 0s - loss: 0.0539 - accuracy: 0.9812

Epoch 284: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0539 - accuracy: 0.9812 - val_loss: 4.4936 - val_
accuracy: 0.4766

Epoch 285/300

50/50 [==============================] - ETA: 0s - loss: 0.0543 - accuracy: 0.9809

Epoch 285: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0543 - accuracy: 0.9809 - val_loss: 5.0437 - val_
accuracy: 0.4766

Epoch 286/300

50/50 [==============================] - ETA: 0s - loss: 0.0347 - accuracy: 0.9881

Epoch 286: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0347 - accuracy: 0.9881 - val_loss: 4.1620 - val_
accuracy: 0.5247

Epoch 287/300

50/50 [==============================] - ETA: 0s - loss: 0.0480 - accuracy: 0.9831

Epoch 287: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0480 - accuracy: 0.9831 - val_loss: 5.0014 - val_
accuracy: 0.4557

Epoch 288/300

50/50 [==============================] - ETA: 0s - loss: 0.0469 - accuracy: 0.9831

Epoch 288: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0469 - accuracy: 0.9831 - val_loss: 4.5355 - val_
accuracy: 0.4766

Epoch 289/300

50/50 [==============================] - ETA: 0s - loss: 0.0679 - accuracy: 0.9787

Epoch 289: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0679 - accuracy: 0.9787 - val_loss: 4.0806 - val_
accuracy: 0.5143

Epoch 290/300

50/50 [==============================] - ETA: 0s - loss: 0.0597 - accuracy: 0.9766

Epoch 290: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0597 - accuracy: 0.9766 - val_loss: 5.1551 - val_
accuracy: 0.4427

Epoch 291/300

50/50 [==============================] - ETA: 0s - loss: 0.0757 - accuracy: 0.9772

Epoch 291: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0757 - accuracy: 0.9772 - val_loss: 4.7891 - val_
accuracy: 0.4479

Epoch 292/300

50/50 [==============================] - ETA: 0s - loss: 0.0789 - accuracy: 0.9744

Epoch 292: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0789 - accuracy: 0.9744 - val_loss: 4.2440 - val_
accuracy: 0.5221
```

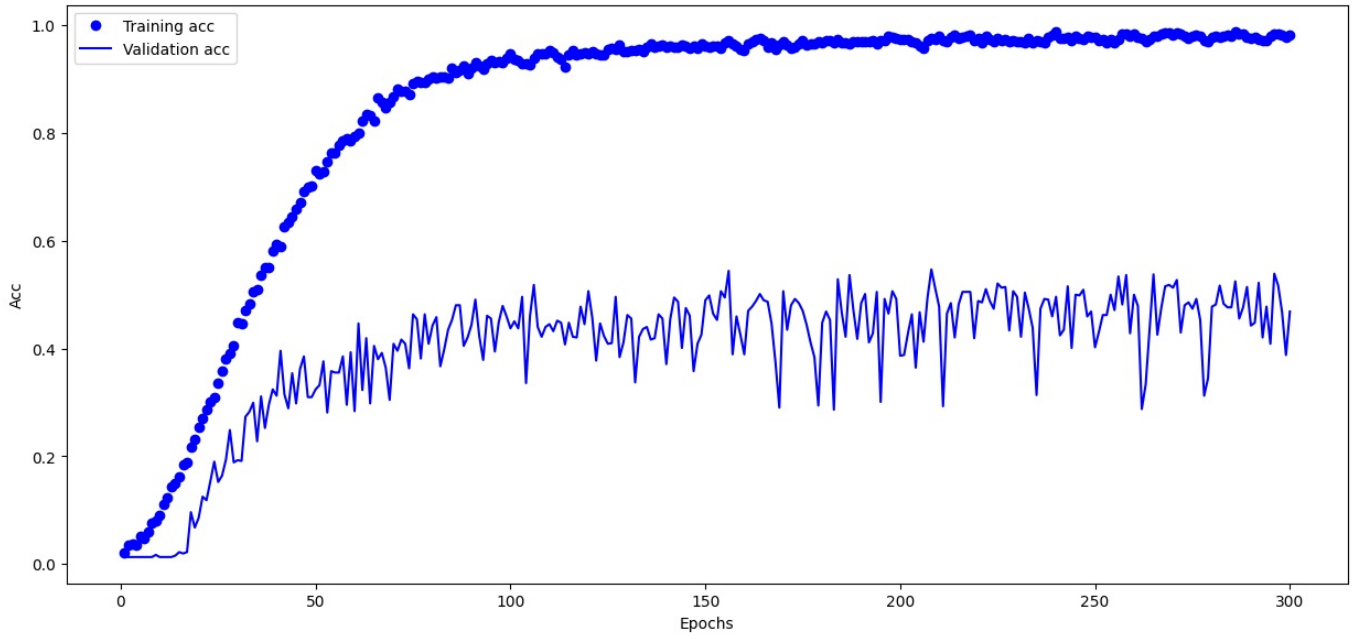
```
Epoch 293/300

50/50 [==============================] - ETA: 0s - loss: 0.0859 - accuracy: 0.9719

Epoch 293: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0859 - accuracy: 0.9719 - val_loss: 5.2997 - val_
accuracy: 0.4206

Epoch 294/300

50/50 [==============================] - ETA: 0s - loss: 0.0895 - accuracy: 0.9709

Epoch 294: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0895 - accuracy: 0.9709 - val_loss: 4.7809 - val_
accuracy: 0.4779

Epoch 295/300

50/50 [==============================] - ETA: 0s - loss: 0.0647 - accuracy: 0.9797

Epoch 295: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0647 - accuracy: 0.9797 - val_loss: 5.5002 - val_
accuracy: 0.4089

Epoch 296/300

50/50 [==============================] - ETA: 0s - loss: 0.0436 - accuracy: 0.9844

Epoch 296: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0436 - accuracy: 0.9844 - val_loss: 3.9005 - val_
accuracy: 0.5391

Epoch 297/300

50/50 [==============================] - ETA: 0s - loss: 0.0394 - accuracy: 0.9847

Epoch 297: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0394 - accuracy: 0.9847 - val_loss: 4.1209 - val_
accuracy: 0.5169

Epoch 298/300

50/50 [==============================] - ETA: 0s - loss: 0.0624 - accuracy: 0.9812

Epoch 298: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0624 - accuracy: 0.9812 - val_loss: 5.3231 - val_
accuracy: 0.4674

Epoch 299/300

50/50 [==============================] - ETA: 0s - loss: 0.0677 - accuracy: 0.9778

Epoch 299: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0677 - accuracy: 0.9778 - val_loss: 6.0752 - val_
accuracy: 0.3880

Epoch 300/300

50/50 [==============================] - ETA: 0s - loss: 0.0531 - accuracy: 0.9825

Epoch 300: val_accuracy did not improve from 0.54688

50/50 [==============================] - 69s 1s/step - loss: 0.0531 - accuracy: 0.9825 - val_loss: 5.1583 - val_
accuracy: 0.4688
```

Visualize Training Curves

In [16]:
```
history_dict = history.history
loss_values = history_dict['loss']
val_loss_values = history_dict['val_loss']

epochs_x = range(1, len(loss_values) + 1)
plt.figure(figsize=(15,15))
plt.subplot(2,1,1)
```

```
plt.plot(epochs_x, loss_values, 'bo', label='Training loss')
plt.plot(epochs_x, val_loss_values, 'b', label='Validation loss')
plt.title('Training and validation Loss and Accuracy')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
plt.subplot(2,1,2)
acc_values = history_dict['accuracy']
val_acc_values = history_dict['val_accuracy']
plt.plot(epochs_x, acc_values, 'bo', label='Training acc')
plt.plot(epochs_x, val_acc_values, 'b', label='Validation acc')
#plt.title('Training and validation accuracy')
plt.xlabel('Epochs')
plt.ylabel('Acc')
plt.legend()
plt.show()
```





Evaluate the model on validation and test sets

In [7]:
```
best_model = keras.models.load_model('model/best_model.h5')
score_val = best_model.evaluate(validation_generator)
score_test = best_model.evaluate(test_generator)
```

```
13/13 [==============================] - 72s 2s/step - loss: 3.5747 - accuracy: 0.5526

15/15 [==============================] - 31s 2s/step - loss: 0.9982 - accuracy: 0.8695
```

In [8]:
```
print('Validation loss:', score_val[0])
print(f'\nValidation accuracy:{round(score_val[1]*100,2)}%')
```

```
print('\nTest loss:', score_test[0])
print(f'\nTest accuracy:{round(score_test[1]*100,2)}%')
```

```
Validation loss: 3.5746994018554688


Validation accuracy:55.26%


Test loss: 0.9981935024261475


Test accuracy:86.95%
```

Plotting Test Images with Prediction

In [18]:

```
def plot_test_images_with_predictions(model, test_generator, num_images=9):
    test_images, true_labels = test_generator.next()
    predictions = model.predict(test_images)
    predicted_labels = [classes[np.argmax(pred)] for pred in predictions]

    plt.figure(figsize=(10, 10))
    for i in range(num_images):
        plt.subplot(3, 3, i + 1)
        plt.imshow(test_images[i])
        plt.title(f'Predicted: {predicted_labels[i]}\nTrue: {classes[np.argmax(true_labels[i])]}')
        plt.axis('off')

    plt.show()

# Plot test images with predictions
plot_test_images_with_predictions(best_model, test_generator, num_images=9)
```

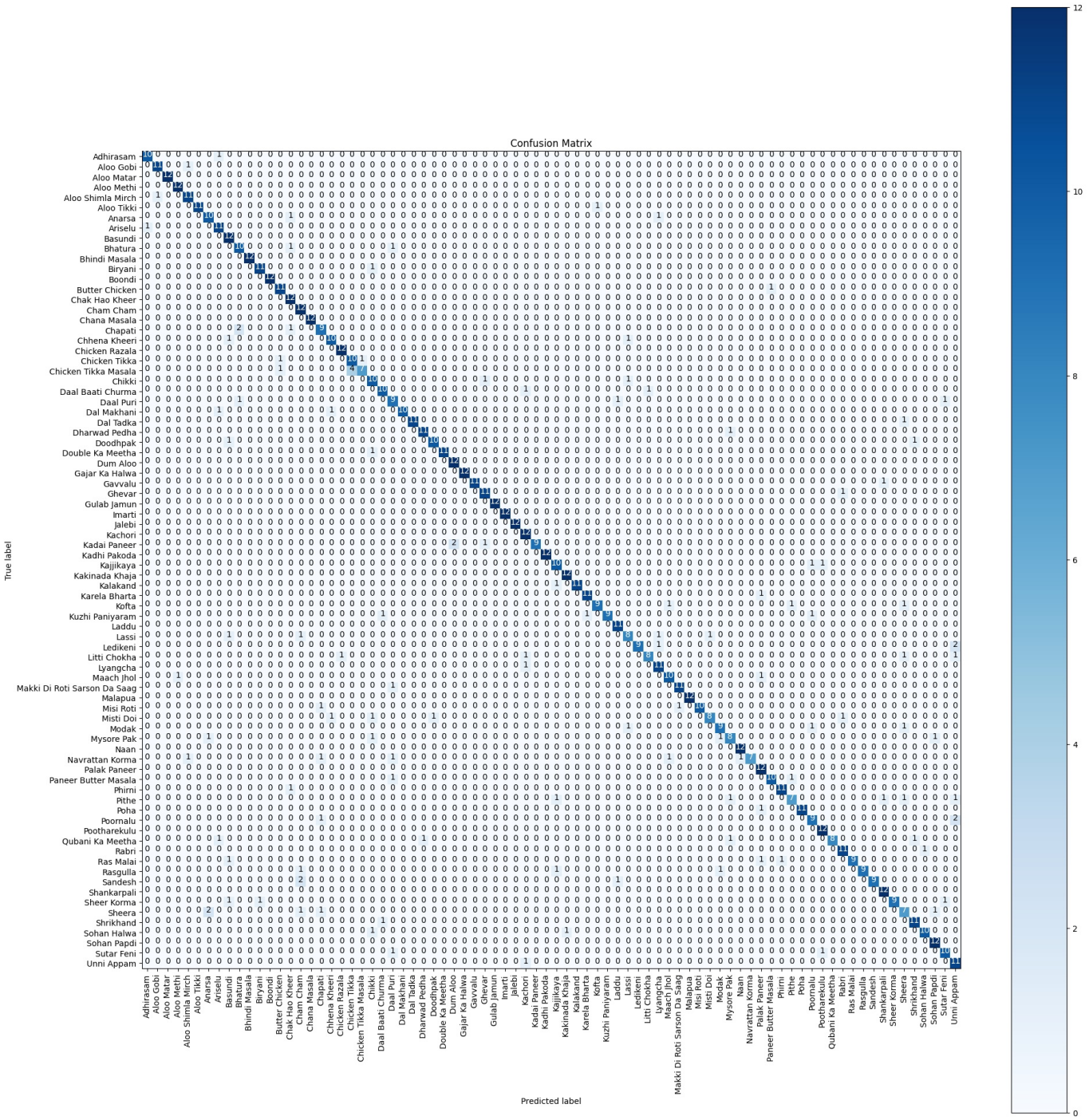
```
2/2 [==============================] - 1s 130ms/step
```

In [10]:
```
Y_pred = best_model.predict(test_generator)
y_pred = np.argmax(Y_pred, axis=1)
target_names = classes
```

```
15/15 [==============================] - 71s 3s/step
```

In [11]:
```
#Plot the confusion matrix. Set Normalize = True/False
def plot_confusion_matrix(cm, classes, normalize=True, title='Confusion matrix', cmap=plt.cm.Blues):
    """
    This function prints and plots the confusion matrix.
    Normalization can be applied by setting `normalize=True`.
    """
    plt.figure(figsize=(20,20))
    plt.imshow(cm, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(classes))
    plt.xticks(tick_marks, classes, rotation=90)
    plt.yticks(tick_marks, classes)
    if normalize:
        cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
        cm = np.around(cm, decimals=2)
        cm[np.isnan(cm)] = 0.0
    thresh = cm.max() / 2.
    for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
        plt.text(j, i, cm[i, j],
                 horizontalalignment="center",
                 color="white" if cm[i, j] > thresh else "black")
    plt.tight_layout()
    plt.ylabel('True label')
    plt.xlabel('Predicted label')

#Confution Matrix
cm = confusion_matrix(test_generator.classes, y_pred)
```

```
plot_confusion_matrix(cm, target_names, normalize=False, title='Confusion Matrix')
```



In [12]:
```
#Classification Report
print('Classification Report')
print(classification_report(test_generator.classes, y_pred, target_names=target_names))
```

Classification Report

	precision	recall	f1-score	support
Adhirasam	0.91	0.91	0.91	11
Aloo Gobi	0.92	0.92	0.92	12
Aloo Matar	1.00	1.00	1.00	12
Aloo Methi	0.92	1.00	0.96	12
Aloo Shimla Mirch	0.85	0.92	0.88	12
Aloo Tikki	1.00	0.92	0.96	12
Anarsa	0.77	0.83	0.80	12
Ariselu	0.79	0.92	0.85	12
Basundi	0.71	1.00	0.83	12

Bhatura	0.77	0.83	0.80	12
Bhindi Masala	1.00	1.00	1.00	12
Biryani	0.92	0.92	0.92	12
Boondi	1.00	1.00	1.00	12
Butter Chicken	0.85	0.92	0.88	12
Chak Hao Kheer	0.75	1.00	0.86	12
Cham Cham	0.71	1.00	0.83	12
Chana Masala	1.00	1.00	1.00	12
Chapati	0.69	0.75	0.72	12
Chhena Kheeri	0.83	0.83	0.83	12
Chicken Razala	0.92	1.00	0.96	12
Chicken Tikka	0.71	0.83	0.77	12
Chicken Tikka Masala	0.88	0.58	0.70	12
Chikki	0.67	0.83	0.74	12
Daal Baati Churma	0.83	0.83	0.83	12
Daal Puri	0.64	0.75	0.69	12
Dal Makhani	1.00	0.83	0.91	12
Dal Tadka	1.00	0.92	0.96	12
Dharwad Pedha	0.92	0.92	0.92	12
Doodhpak	0.91	0.83	0.87	12
Double Ka Meetha	1.00	0.92	0.96	12
Dum Aloo	0.86	1.00	0.92	12
Gajar Ka Halwa	1.00	1.00	1.00	12
Gavvalu	1.00	0.92	0.96	12
Ghevar	0.85	0.92	0.88	12
Gulab Jamun	1.00	1.00	1.00	12
Imarti	1.00	1.00	1.00	12
Jalebi	1.00	1.00	1.00	12
Kachori	0.75	1.00	0.86	12
Kadai Paneer	1.00	0.75	0.86	12
Kadhi Pakoda	1.00	1.00	1.00	12
Kajjikaya	0.77	0.83	0.80	12
Kakinada Khaja	0.92	1.00	0.96	12
Kalakand	1.00	0.92	0.96	12
Karela Bharta	0.92	0.92	0.92	12
Kofta	0.90	0.75	0.82	12
Kuzhi Paniyaram	1.00	0.75	0.86	12
Laddu	0.85	1.00	0.92	11
Lassi	0.73	0.67	0.70	12
Ledikeni	1.00	0.75	0.86	12
Litti Chokha	0.89	0.67	0.76	12

Lyangcha	0.79	0.92	0.85	12
Maach Jhol	0.83	0.83	0.83	12
Makki Di Roti Sarson Da Saag	0.92	0.92	0.92	12
Malapua	1.00	1.00	1.00	12
Misi Roti	1.00	0.83	0.91	12
Misti Doi	0.89	0.67	0.76	12
Modak	0.82	0.75	0.78	12
Mysore Pak	0.73	0.67	0.70	12
Naan	0.92	1.00	0.96	12
Navrattan Korma	1.00	0.58	0.74	12
Palak Paneer	0.75	1.00	0.86	12
Paneer Butter Masala	0.91	0.83	0.87	12
Phirni	0.92	0.92	0.92	12
Pithe	0.78	0.58	0.67	12
Poha	1.00	0.92	0.96	12
Poornalu	0.75	0.75	0.75	12
Pootharekulu	0.86	1.00	0.92	12
Qubani Ka Meetha	1.00	0.67	0.80	12
Rabri	0.85	0.92	0.88	12
Ras Malai	1.00	0.75	0.86	12
Rasgulla	1.00	0.75	0.86	12
Sandesh	1.00	0.75	0.86	12
Shankarpali	0.86	1.00	0.92	12
Sheer Korma	1.00	0.75	0.86	12
Sheera	0.58	0.58	0.58	12
Shrikhand	0.85	0.92	0.88	12
Sohan Halwa	0.91	0.83	0.87	12
Sohan Papdi	0.86	1.00	0.92	12
Sutar Feni	0.83	0.83	0.83	12
Unni Appam	0.65	0.92	0.76	12
accuracy			0.87	958
macro avg	0.88	0.87	0.87	958
weighted avg	0.88	0.87	0.87	958

Inference

In [13]:

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image

# Load the pre-trained model
model = load_model('model/best_model.h5')

# Function to preprocess the input image
def preprocess_input_image(img_path):
    img = image.load_img(img_path, target_size=(256,256))
    img = image.img_to_array(img)
```

```
    img = np.expand_dims(img, axis=0)
    img = img / 255.0  # Normalize the image
    return img

# Function to predict the class of the object in the image
def predict_class(img_path, model):
    preprocessed_img = preprocess_input_image(img_path)
    predictions = model.predict(preprocessed_img)
    class_index = np.argmax(predictions)
    predicted_class_label = classes[class_index]
    img = image.load_img(img_path)
    plt.imshow(img)
    plt.axis('off')
    plt.title('Predicted Class: ' + predicted_class_label)
    plt.show()
    return predicted_class_label


input_image_path = 'test1.jpg'

predicted_class_label=predict_class(input_image_path, model)
```

```
1/1 [==============================] - 30s 30s/step
```

Recipe Generation

In [14]:
```
import pandas as pd

recipe_data=pd.read_csv('dataset/recipe.csv')

# Function to get the recipe values of the predicted class
def get_recipe(predicted_class_label, recipe_data):
    # Find the row where the 'Name' column matches the predicted class label
    recipe = recipe_data.loc[recipe_data['Name'] == predicted_class_label]
    ingredients=recipe["Ingredients"].values[0]
    procedure=recipe["Procedure"].values[0]
    serving=recipe["Serving"].values[0]
    print(f"Recipe for {predicted_class_label}\n\nIngredients : {ingredients}\nProcedure : {procedure}\nServing
    return None

get_recipe(predicted_class_label, recipe_data)
```

```
Recipe for Chana Masala


Ingredients : Chickpeas, Onions, Tomatoes, Ginger-garlic paste, Green chilies, Coriander powder, Cumin seeds, Ga
ram masala, Oil, Salt

Procedure : Cook chickpeas and sauté with onions, tomatoes, and spices. Garnish with fresh coriander leaves.

Serving : Serve hot with rice or naan.
```

In [15]:
```
input_image_path = 'test2.jpg'
predicted_class_label=predict_class(input_image_path, model)
get_recipe(predicted_class_label, recipe_data)
```

```
1/1 [==============================] - 0s 80ms/step
```

Recipe for Gulab Jamun

Ingredients : Khoya, Paneer, All-purpose flour, Milk powder, Ghee, Milk, Sugar, Cardamom powder, Oil for frying

Procedure : Mix khoya, paneer, all-purpose flour, and milk powder to form a dough. Shape into balls and deep fry until golden brown. Soak in sugar syrup.

Serving : Serve as a sweet dessert.

In [ ]: