Import Req Lib

In [1]:

```
%matplotlib inline


import shutil
import random
import numpy as np
from warnings import filterwarnings
filterwarnings('ignore')

from tensorflow.keras import layers,regularizers, optimizers
from tensorflow.keras import models
from tensorflow.keras.models import Sequential, Model
from tensorflow.keras.layers import LeakyReLU,Dense, Activation, Flatten, Dropout, BatchNormalization,Conv2D, MaxPooling2D
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import tensorflow as tf

import os
import time
import csv

from matplotlib import figure
```

Define 5 worker

In [2]:

```
# Set the number of threads
number_of_worker = 5
os.environ['OMP_NUM_THREADS'] = '5'  # OpenMP threads for parallelism
os.environ['TF_NUM_INTEROP_THREADS'] = '5'  # Threads for inter-operation parallelism
os.environ['TF_NUM_INTRAOP_THREADS'] = '5'  # Threads for intra-operation parallelism

# Confirm TensorFlow is using the specified number of threads
tf.config.threading.set_inter_op_parallelism_threads(number_of_worker)
tf.config.threading.set_intra_op_parallelism_threads(number_of_worker)
```

Train Val data Split

In [3]:

```
source_dir = r"C:\Users\nikhi\OneDrive\Desktop\Final Project\DATA\Convert_Audio_File_to_jpg_file"
target_dir = r'genres_train_val_split_data'
split_ratio = 0.8

def Train_Test_Split(source_dir,target_dir,split_ratio):
    # Define source and target directories
    train_dir = os.path.join(target_dir, 'train')
    val_dir = os.path.join(target_dir, 'val')

    # Create target directories if they don't exist
    os.makedirs(train_dir, exist_ok=True)
    os.makedirs(val_dir, exist_ok=True)

    # Get the list of class directories
    classes = [d for d in os.listdir(source_dir) if os.path.isdir(os.path.join(source_dir, d))]

    for class_name in classes:
        # Create class directories in train and val folders
        os.makedirs(os.path.join(train_dir, class_name), exist_ok=True)
        os.makedirs(os.path.join(val_dir, class_name), exist_ok=True)

        # Get list of images in the class directory
        class_dir = os.path.join(source_dir, class_name)
        images = [f for f in os.listdir(class_dir) if os.path.isfile(os.path.join(class_dir, f))]

        # Shuffle the images
        random.shuffle(images)

        # Compute the split point
        split_point = int(len(images) * split_ratio)

        # Split the images into training and validation sets
        train_images = images[:split_point]
        val_images = images[split_point:]
        # Move the images to the respective directories
        for img in train_images:
            shutil.copy(os.path.join(class_dir, img), os.path.join(train_dir, class_name, img))

        for img in val_images:
            shutil.copy(os.path.join(class_dir, img), os.path.join(val_dir, class_name, img))

    print("Data split completed successfully!")
```

In [4]:

```
Train_Test_Split(source_dir,target_dir,split_ratio)
```

```
Data split completed successfully!
```

Load the Data

In [5]:

```
WIDTH = 64
HEIGHT = 64
BATCH_SIZE = 32
TRAIN_DIR=r'genres_train_val_split_data/train'
val_dir = r'genres_train_val_split_data/val'

# data prep
train_datagen = ImageDataGenerator(
    rescale=1./255.,validation_split=0.25)


train_generator = train_datagen.flow_from_directory(
    TRAIN_DIR,
    target_size=(HEIGHT, WIDTH),
        batch_size=BATCH_SIZE,
        class_mode='categorical')

validation_gen = train_datagen.flow_from_directory(
    val_dir,target_size = (HEIGHT,WIDTH),
    batch_size = BATCH_SIZE,
    class_mode = 'categorical'
 )
```

```
Found 800 images belonging to 10 classes.
Found 200 images belonging to 10 classes.
```

Model Architecture

In [6]:

```
model = Sequential()
model.add(Conv2D(32, (3, 3), padding='same',
                 input_shape=(64,64,3)))
model.add(Activation('relu'))
model.add(Conv2D(64, (3, 3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))
model.add(Conv2D(64, (3, 3), padding='same'))
model.add(Activation('relu'))
model.add(Conv2D(64, (3, 3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.5))
model.add(Conv2D(128, (3, 3), padding='same'))
model.add(Activation('relu'))
model.add(Conv2D(128, (3, 3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.5))
model.add(Flatten())
model.add(Dense(512))
model.add(Activation('relu'))
model.add(Dropout(0.5))
model.add(Dense(10, activation='softmax'))
model.compile(optimizers.RMSprop(learning_rate=0.0005, decay=1e-6),loss="categorical_crossentropy",metrics=["accuracy"])
model.summary()
```

```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 64, 64, 32)	896
activation (Activation)	(None, 64, 64, 32)	0
conv2d_1 (Conv2D)	(None, 62, 62, 64)	18,496
activation_1 (Activation)	(None, 62, 62, 64)	0
max_pooling2d (MaxPooling2D)	(None, 31, 31, 64)	0
dropout (Dropout)	(None, 31, 31, 64)	0
conv2d_2 (Conv2D)	(None, 31, 31, 64)	36,928
activation_2 (Activation)	(None, 31, 31, 64)	0
conv2d_3 (Conv2D)	(None, 29, 29, 64)	36,928
activation_3 (Activation)	(None, 29, 29, 64)	0
max_pooling2d_1 (MaxPooling2D)	(None, 14, 14, 64)	0
dropout_1 (Dropout)	(None, 14, 14, 64)	0
conv2d_4 (Conv2D)	(None, 14, 14, 128)	73,856
activation_4 (Activation)	(None, 14, 14, 128)	0
conv2d_5 (Conv2D)	(None, 12, 12, 128)	147,584
activation_5 (Activation)	(None, 12, 12, 128)	0
max_pooling2d_2 (MaxPooling2D)	(None, 6, 6, 128)	0
dropout_2 (Dropout)	(None, 6, 6, 128)	0
flatten (Flatten)	(None, 4608)	0
dense (Dense)	(None, 512)	2,359,808
activation_6 (Activation)	(None, 512)	0
dropout_3 (Dropout)	(None, 512)	0
dense_1 (Dense)	(None, 10)	5,130

Total params: 2,679,626 (10.22 MB)

Trainable params: 2,679,626 (10.22 MB)

Non-trainable params: 0 (0.00 B)

In [7]:

```
STEP_SIZE_TRAIN=train_generator.n//train_generator.batch_size
# Measure the execution time
start_time = time.time()

model.fit(train_generator,validation_data=validation_gen,epochs=200)

end_time = time.time()
elapsed_time = end_time - start_time
```

```
Epoch 1/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 153ms/step - accuracy: 0.0947 - loss: 2.3395 - val_accuracy: 0.1800 - val_loss: 2.2968
Epoch 2/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.1267 - loss: 2.2874 - val_accuracy: 0.2250 - val_loss: 2.2684
Epoch 3/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.1525 - loss: 2.2579 - val_accuracy: 0.1450 - val_loss: 2.2890
Epoch 4/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.1746 - loss: 2.2096 - val_accuracy: 0.1300 - val_loss: 2.3036
Epoch 5/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.2015 - loss: 2.1897 - val_accuracy: 0.2700 - val_loss: 1.9919
Epoch 6/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.2600 - loss: 2.0449 - val_accuracy: 0.3150 - val_loss: 1.9102
Epoch 7/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.2192 - loss: 2.1385 - val_accuracy: 0.3200 - val_loss: 1.9702
Epoch 8/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.2778 - loss: 1.9687 - val_accuracy: 0.2950 - val_loss: 2.0048
Epoch 9/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.2959 - loss: 1.9138 - val_accuracy: 0.3400 - val_loss: 1.8138
Epoch 10/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.3270 - loss: 1.8565 - val_accuracy: 0.3700 - val_loss: 1.8105
Epoch 11/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.3472 - loss: 1.7873 - val_accuracy: 0.2900 - val_loss: 1.9588
Epoch 12/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.3980 - loss: 1.6698 - val_accuracy: 0.4450 - val_loss: 1.6245
Epoch 13/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.4249 - loss: 1.6145 - val_accuracy: 0.4050 - val_loss: 1.6579
Epoch 14/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.3869 - loss: 1.6297 - val_accuracy: 0.4300 - val_loss: 1.5762
Epoch 15/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.3926 - loss: 1.6391 - val_accuracy: 0.4050 - val_loss: 1.6126
Epoch 16/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.4444 - loss: 1.5492 - val_accuracy: 0.4450 - val_loss: 1.4956
Epoch 17/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.3875 - loss: 1.6314 - val_accuracy: 0.4400 - val_loss: 1.5098
Epoch 18/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.4552 - loss: 1.4967 - val_accuracy: 0.4350 - val_loss: 1.5309
Epoch 19/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.4820 - loss: 1.3829 - val_accuracy: 0.4600 - val_loss: 1.4706
Epoch 20/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.4636 - loss: 1.4114 - val_accuracy: 0.4750 - val_loss: 1.4325
Epoch 21/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.5140 - loss: 1.3883 - val_accuracy: 0.4900 - val_loss: 1.4102
Epoch 22/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 185ms/step - accuracy: 0.5524 - loss: 1.2626 - val_accuracy: 0.4800 - val_loss: 1.4580
Epoch 23/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.5119 - loss: 1.3195 - val_accuracy: 0.5000 - val_loss: 1.3673
Epoch 24/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.5571 - loss: 1.2439 - val_accuracy: 0.4900 - val_loss: 1.3707
Epoch 25/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.5772 - loss: 1.1844 - val_accuracy: 0.5100 - val_loss: 1.3961
Epoch 26/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.5738 - loss: 1.1956 - val_accuracy: 0.5150 - val_loss: 1.3461
Epoch 27/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.5962 - loss: 1.1263 - val_accuracy: 0.5350 - val_loss: 1.3342
Epoch 28/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.5756 - loss: 1.1709 - val_accuracy: 0.5850 - val_loss: 1.2785
Epoch 29/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.6157 - loss: 1.0428 - val_accuracy: 0.5050 - val_loss: 1.3166
Epoch 30/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.5870 - loss: 1.1603 - val_accuracy: 0.5200 - val_loss: 1.3354
Epoch 31/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.5897 - loss: 1.0747 - val_accuracy: 0.5750 - val_loss: 1.3224
Epoch 32/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.6535 - loss: 0.9584 - val_accuracy: 0.5150 - val_loss: 1.3154
Epoch 33/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.6701 - loss: 0.9027 - val_accuracy: 0.5900 - val_loss: 1.2023
Epoch 34/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.6354 - loss: 0.9593 - val_accuracy: 0.6050 - val_loss: 1.1918
Epoch 35/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.6474 - loss: 0.9642 - val_accuracy: 0.5800 - val_loss: 1.2895
Epoch 36/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.7099 - loss: 0.7981 - val_accuracy: 0.5900 - val_loss: 1.2998
Epoch 37/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 182ms/step - accuracy: 0.6821 - loss: 0.8373 - val_accuracy: 0.5450 - val_loss: 1.3157
Epoch 38/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 198ms/step - accuracy: 0.7395 - loss: 0.7698 - val_accuracy: 0.5550 - val_loss: 1.3241
Epoch 39/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.7437 - loss: 0.7579 - val_accuracy: 0.5700 - val_loss: 1.3051
Epoch 40/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.7123 - loss: 0.7496 - val_accuracy: 0.6300 - val_loss: 1.2596
Epoch 41/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.7576 - loss: 0.6787 - val_accuracy: 0.5650 - val_loss: 1.4545
```

```
Epoch 42/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.7592 - loss: 0.7017 - val_accuracy: 0.5650 - val_loss: 1.4580
Epoch 43/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.7450 - loss: 0.6825 - val_accuracy: 0.5950 - val_loss: 1.3154
Epoch 44/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.8020 - loss: 0.5688 - val_accuracy: 0.5600 - val_loss: 1.3848
Epoch 45/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.8079 - loss: 0.5317 - val_accuracy: 0.5700 - val_loss: 1.4590
Epoch 46/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.7713 - loss: 0.6108 - val_accuracy: 0.5650 - val_loss: 1.3786
Epoch 47/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.7668 - loss: 0.6010 - val_accuracy: 0.5900 - val_loss: 1.4130
Epoch 48/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.8221 - loss: 0.4975 - val_accuracy: 0.5700 - val_loss: 1.4629
Epoch 49/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.7979 - loss: 0.5379 - val_accuracy: 0.5650 - val_loss: 1.4927
Epoch 50/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.8335 - loss: 0.4722 - val_accuracy: 0.6000 - val_loss: 1.5870
Epoch 51/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.8321 - loss: 0.4891 - val_accuracy: 0.5650 - val_loss: 1.8292
Epoch 52/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.8426 - loss: 0.4643 - val_accuracy: 0.6250 - val_loss: 1.5597
Epoch 53/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.8810 - loss: 0.3997 - val_accuracy: 0.5900 - val_loss: 1.5873
Epoch 54/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.8325 - loss: 0.4602 - val_accuracy: 0.6000 - val_loss: 1.7301
Epoch 55/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.8486 - loss: 0.4165 - val_accuracy: 0.5950 - val_loss: 1.6603
Epoch 56/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.8677 - loss: 0.3930 - val_accuracy: 0.6050 - val_loss: 1.5699
Epoch 57/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.8873 - loss: 0.3440 - val_accuracy: 0.6050 - val_loss: 1.5525
Epoch 58/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.8883 - loss: 0.3339 - val_accuracy: 0.5850 - val_loss: 1.8909
Epoch 59/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 185ms/step - accuracy: 0.8920 - loss: 0.2942 - val_accuracy: 0.5700 - val_loss: 1.7802
Epoch 60/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9011 - loss: 0.3193 - val_accuracy: 0.5950 - val_loss: 2.0626
Epoch 61/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.8948 - loss: 0.3518 - val_accuracy: 0.6150 - val_loss: 1.9260
Epoch 62/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.8986 - loss: 0.2625 - val_accuracy: 0.5950 - val_loss: 1.8665
Epoch 63/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9059 - loss: 0.2910 - val_accuracy: 0.6100 - val_loss: 1.7793
Epoch 64/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9151 - loss: 0.2510 - val_accuracy: 0.6300 - val_loss: 1.8918
Epoch 65/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.9331 - loss: 0.2084 - val_accuracy: 0.5800 - val_loss: 1.9621
Epoch 66/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9136 - loss: 0.2767 - val_accuracy: 0.6150 - val_loss: 1.8002
Epoch 67/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9290 - loss: 0.2592 - val_accuracy: 0.6050 - val_loss: 2.0399
Epoch 68/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.8988 - loss: 0.2698 - val_accuracy: 0.5950 - val_loss: 2.1498
Epoch 69/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9527 - loss: 0.1518 - val_accuracy: 0.6100 - val_loss: 2.1151
Epoch 70/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9299 - loss: 0.1859 - val_accuracy: 0.6050 - val_loss: 2.1399
Epoch 71/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.9354 - loss: 0.1745 - val_accuracy: 0.5850 - val_loss: 2.1911
Epoch 72/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9467 - loss: 0.1526 - val_accuracy: 0.5800 - val_loss: 2.0856
Epoch 73/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9430 - loss: 0.1523 - val_accuracy: 0.5550 - val_loss: 2.4861
Epoch 74/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9512 - loss: 0.1692 - val_accuracy: 0.5850 - val_loss: 2.1487
Epoch 75/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9661 - loss: 0.1040 - val_accuracy: 0.6400 - val_loss: 2.2880
Epoch 76/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9370 - loss: 0.1945 - val_accuracy: 0.6150 - val_loss: 2.5149
Epoch 77/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9633 - loss: 0.2527 - val_accuracy: 0.6050 - val_loss: 2.1542
Epoch 78/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9281 - loss: 0.2165 - val_accuracy: 0.5850 - val_loss: 2.1198
Epoch 79/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9671 - loss: 0.1049 - val_accuracy: 0.5950 - val_loss: 2.1969
Epoch 80/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9430 - loss: 0.1505 - val_accuracy: 0.5700 - val_loss: 2.4307
Epoch 81/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 185ms/step - accuracy: 0.9560 - loss: 0.1293 - val_accuracy: 0.5650 - val_loss: 2.3232
Epoch 82/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.9472 - loss: 0.1393 - val_accuracy: 0.5800 - val_loss: 2.6178
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Epoch 83/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9441 - loss: 0.1490 - val_accuracy: 0.5950 - val_loss: 2.2539
Epoch 84/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9621 - loss: 0.1124 - val_accuracy: 0.5850 - val_loss: 2.4427
Epoch 85/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9460 - loss: 0.1516 - val_accuracy: 0.6250 - val_loss: 2.1418
Epoch 86/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9625 - loss: 0.1522 - val_accuracy: 0.6050 - val_loss: 2.3322
Epoch 87/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9580 - loss: 0.1109 - val_accuracy: 0.6100 - val_loss: 2.1526
Epoch 88/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9683 - loss: 0.1126 - val_accuracy: 0.6200 - val_loss: 2.5570
Epoch 89/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9610 - loss: 0.1214 - val_accuracy: 0.5750 - val_loss: 2.4782
Epoch 90/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9599 - loss: 0.1022 - val_accuracy: 0.5550 - val_loss: 2.3816
Epoch 91/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9712 - loss: 0.1005 - val_accuracy: 0.5700 - val_loss: 2.6433
Epoch 92/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.9472 - loss: 0.1302 - val_accuracy: 0.5750 - val_loss: 3.0499
Epoch 93/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9653 - loss: 0.1075 - val_accuracy: 0.5850 - val_loss: 2.9033
Epoch 94/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9574 - loss: 0.1204 - val_accuracy: 0.5850 - val_loss: 2.7043
Epoch 95/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9684 - loss: 0.1105 - val_accuracy: 0.6000 - val_loss: 2.6137
Epoch 96/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 185ms/step - accuracy: 0.9573 - loss: 0.1077 - val_accuracy: 0.6000 - val_loss: 2.3739
Epoch 97/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9490 - loss: 0.1130 - val_accuracy: 0.6100 - val_loss: 2.3640
Epoch 98/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9790 - loss: 0.0706 - val_accuracy: 0.5750 - val_loss: 3.0800
Epoch 99/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9857 - loss: 0.0605 - val_accuracy: 0.6050 - val_loss: 2.4089
Epoch 100/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9794 - loss: 0.0811 - val_accuracy: 0.5750 - val_loss: 2.9083
Epoch 101/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9759 - loss: 0.0625 - val_accuracy: 0.6000 - val_loss: 3.0784
Epoch 102/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9781 - loss: 0.0984 - val_accuracy: 0.6300 - val_loss: 2.7971
Epoch 103/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9554 - loss: 0.1220 - val_accuracy: 0.6150 - val_loss: 2.3903
Epoch 104/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.9743 - loss: 0.0762 - val_accuracy: 0.5700 - val_loss: 2.5217
Epoch 105/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9893 - loss: 0.0418 - val_accuracy: 0.5900 - val_loss: 2.6067
Epoch 106/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9804 - loss: 0.0651 - val_accuracy: 0.6000 - val_loss: 2.2410
Epoch 107/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.9545 - loss: 0.0943 - val_accuracy: 0.5700 - val_loss: 2.6078
Epoch 108/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9713 - loss: 0.0938 - val_accuracy: 0.5700 - val_loss: 2.6523
Epoch 109/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9663 - loss: 0.1164 - val_accuracy: 0.6000 - val_loss: 2.6464
Epoch 110/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9702 - loss: 0.0860 - val_accuracy: 0.5700 - val_loss: 2.7814
Epoch 111/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9639 - loss: 0.1292 - val_accuracy: 0.6100 - val_loss: 2.4844
Epoch 112/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9848 - loss: 0.0520 - val_accuracy: 0.6100 - val_loss: 3.0841
Epoch 113/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9740 - loss: 0.0715 - val_accuracy: 0.5800 - val_loss: 2.8770
Epoch 114/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9860 - loss: 0.0509 - val_accuracy: 0.6000 - val_loss: 3.2372
Epoch 115/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9700 - loss: 0.0779 - val_accuracy: 0.5750 - val_loss: 3.0240
Epoch 116/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9712 - loss: 0.1071 - val_accuracy: 0.5850 - val_loss: 2.9968
Epoch 117/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9741 - loss: 0.0612 - val_accuracy: 0.6000 - val_loss: 3.3724
Epoch 118/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9812 - loss: 0.0701 - val_accuracy: 0.6150 - val_loss: 2.8990
Epoch 119/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9770 - loss: 0.0852 - val_accuracy: 0.5900 - val_loss: 2.3540
Epoch 120/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9712 - loss: 0.0952 - val_accuracy: 0.6200 - val_loss: 2.4252
Epoch 121/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9906 - loss: 0.0291 - val_accuracy: 0.5500 - val_loss: 3.8702
Epoch 122/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9757 - loss: 0.0829 - val_accuracy: 0.6100 - val_loss: 3.0957
Epoch 123/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9720 - loss: 0.0825 - val_accuracy: 0.5850 - val_loss: 3.0245
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Epoch 124/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.9676 - loss: 0.1079 - val_accuracy: 0.5900 - val_loss: 3.5802
Epoch 125/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9640 - loss: 0.1216 - val_accuracy: 0.5550 - val_loss: 2.6271
Epoch 126/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9681 - loss: 0.1053 - val_accuracy: 0.5950 - val_loss: 3.2023
Epoch 127/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9804 - loss: 0.0468 - val_accuracy: 0.5600 - val_loss: 2.7726
Epoch 128/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9893 - loss: 0.0385 - val_accuracy: 0.5950 - val_loss: 3.2134
Epoch 129/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9809 - loss: 0.0590 - val_accuracy: 0.5950 - val_loss: 2.9174
Epoch 130/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9780 - loss: 0.0603 - val_accuracy: 0.5900 - val_loss: 2.7604
Epoch 131/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9894 - loss: 0.0479 - val_accuracy: 0.5800 - val_loss: 3.1874
Epoch 132/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9859 - loss: 0.0606 - val_accuracy: 0.5750 - val_loss: 3.1136
Epoch 133/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9753 - loss: 0.0876 - val_accuracy: 0.6050 - val_loss: 2.9528
Epoch 134/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9896 - loss: 0.0464 - val_accuracy: 0.5900 - val_loss: 3.2710
Epoch 135/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9720 - loss: 0.1045 - val_accuracy: 0.5950 - val_loss: 2.7128
Epoch 136/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9933 - loss: 0.0282 - val_accuracy: 0.6050 - val_loss: 3.0566
Epoch 137/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9833 - loss: 0.0745 - val_accuracy: 0.5650 - val_loss: 3.8128
Epoch 138/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9689 - loss: 0.0789 - val_accuracy: 0.6200 - val_loss: 2.9367
Epoch 139/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9794 - loss: 0.0616 - val_accuracy: 0.5650 - val_loss: 2.7952
Epoch 140/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9961 - loss: 0.0180 - val_accuracy: 0.5850 - val_loss: 3.2651
Epoch 141/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9910 - loss: 0.0361 - val_accuracy: 0.5300 - val_loss: 3.2572
Epoch 142/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9853 - loss: 0.0725 - val_accuracy: 0.5800 - val_loss: 2.8074
Epoch 143/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9817 - loss: 0.0475 - val_accuracy: 0.5700 - val_loss: 3.0449
Epoch 144/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9891 - loss: 0.0474 - val_accuracy: 0.5900 - val_loss: 3.5814
Epoch 145/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.9811 - loss: 0.0532 - val_accuracy: 0.5900 - val_loss: 3.5755
Epoch 146/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.9628 - loss: 0.1155 - val_accuracy: 0.5650 - val_loss: 3.1388
Epoch 147/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 198ms/step - accuracy: 0.9839 - loss: 0.0366 - val_accuracy: 0.6000 - val_loss: 3.2828
Epoch 148/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.9905 - loss: 0.0346 - val_accuracy: 0.5800 - val_loss: 2.7950
Epoch 149/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9843 - loss: 0.0378 - val_accuracy: 0.5900 - val_loss: 3.3712
Epoch 150/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9826 - loss: 0.0814 - val_accuracy: 0.5600 - val_loss: 3.1906
Epoch 151/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9868 - loss: 0.0411 - val_accuracy: 0.6100 - val_loss: 3.3522
Epoch 152/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9826 - loss: 0.0764 - val_accuracy: 0.5850 - val_loss: 3.1451
Epoch 153/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9711 - loss: 0.0864 - val_accuracy: 0.5700 - val_loss: 3.3927
Epoch 154/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9854 - loss: 0.0434 - val_accuracy: 0.5650 - val_loss: 3.5499
Epoch 155/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9890 - loss: 0.0358 - val_accuracy: 0.5900 - val_loss: 3.3332
Epoch 156/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.9874 - loss: 0.0431 - val_accuracy: 0.5850 - val_loss: 3.6944
Epoch 157/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9905 - loss: 0.0310 - val_accuracy: 0.5700 - val_loss: 3.6082
Epoch 158/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9814 - loss: 0.0555 - val_accuracy: 0.5950 - val_loss: 3.4962
Epoch 159/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9585 - loss: 0.0979 - val_accuracy: 0.6000 - val_loss: 3.2705
Epoch 160/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9963 - loss: 0.0190 - val_accuracy: 0.5800 - val_loss: 3.3270
Epoch 161/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9895 - loss: 0.0377 - val_accuracy: 0.5650 - val_loss: 2.9575
Epoch 162/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9772 - loss: 0.0976 - val_accuracy: 0.5950 - val_loss: 3.2801
Epoch 163/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9748 - loss: 0.0613 - val_accuracy: 0.5600 - val_loss: 2.9793
Epoch 164/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9830 - loss: 0.0523 - val_accuracy: 0.6050 - val_loss: 3.0790
```

```
Epoch 165/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9915 - loss: 0.0286 - val_accuracy: 0.6050 - val_loss: 3.7859
Epoch 166/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.9891 - loss: 0.0436 - val_accuracy: 0.5500 - val_loss: 3.0983
Epoch 167/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9789 - loss: 0.0917 - val_accuracy: 0.5500 - val_loss: 3.3727
Epoch 168/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.9814 - loss: 0.0524 - val_accuracy: 0.5650 - val_loss: 3.5163
Epoch 169/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.9922 - loss: 0.0449 - val_accuracy: 0.5700 - val_loss: 3.3930
Epoch 170/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9858 - loss: 0.0606 - val_accuracy: 0.5400 - val_loss: 3.3500
Epoch 171/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 187ms/step - accuracy: 0.9942 - loss: 0.0179 - val_accuracy: 0.5700 - val_loss: 3.6854
Epoch 172/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9836 - loss: 0.0725 - val_accuracy: 0.6050 - val_loss: 3.5931
Epoch 173/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9918 - loss: 0.0542 - val_accuracy: 0.5700 - val_loss: 3.5743
Epoch 174/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9908 - loss: 0.0405 - val_accuracy: 0.5850 - val_loss: 3.6747
Epoch 175/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9892 - loss: 0.0261 - val_accuracy: 0.6050 - val_loss: 3.7958
Epoch 176/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9804 - loss: 0.0539 - val_accuracy: 0.5300 - val_loss: 3.9636
Epoch 177/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9904 - loss: 0.0310 - val_accuracy: 0.6100 - val_loss: 3.5858
Epoch 178/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9821 - loss: 0.0586 - val_accuracy: 0.6000 - val_loss: 3.3208
Epoch 179/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9860 - loss: 0.0452 - val_accuracy: 0.5850 - val_loss: 3.4362
Epoch 180/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9893 - loss: 0.0315 - val_accuracy: 0.6050 - val_loss: 3.4990
Epoch 181/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9871 - loss: 0.0347 - val_accuracy: 0.5950 - val_loss: 3.3163
Epoch 182/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 188ms/step - accuracy: 0.9882 - loss: 0.0513 - val_accuracy: 0.5800 - val_loss: 3.4056
Epoch 183/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 185ms/step - accuracy: 0.9828 - loss: 0.0370 - val_accuracy: 0.5450 - val_loss: 3.7495
Epoch 184/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9824 - loss: 0.0682 - val_accuracy: 0.6000 - val_loss: 3.6786
Epoch 185/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9805 - loss: 0.0477 - val_accuracy: 0.5550 - val_loss: 3.7180
Epoch 186/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9865 - loss: 0.0487 - val_accuracy: 0.5350 - val_loss: 3.4560
Epoch 187/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9870 - loss: 0.0400 - val_accuracy: 0.5700 - val_loss: 3.4295
Epoch 188/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9863 - loss: 0.0447 - val_accuracy: 0.5650 - val_loss: 3.5240
Epoch 189/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9796 - loss: 0.0755 - val_accuracy: 0.5950 - val_loss: 3.6435
Epoch 190/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9626 - loss: 0.1290 - val_accuracy: 0.5600 - val_loss: 3.2255
Epoch 191/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9832 - loss: 0.0353 - val_accuracy: 0.5250 - val_loss: 3.6364
Epoch 192/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9832 - loss: 0.0420 - val_accuracy: 0.5600 - val_loss: 3.4615
Epoch 193/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9907 - loss: 0.0301 - val_accuracy: 0.5600 - val_loss: 4.0156
Epoch 194/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 194ms/step - accuracy: 0.9744 - loss: 0.0831 - val_accuracy: 0.5800 - val_loss: 3.4824
Epoch 195/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9933 - loss: 0.0319 - val_accuracy: 0.5500 - val_loss: 4.6713
Epoch 196/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9767 - loss: 0.1003 - val_accuracy: 0.5400 - val_loss: 5.9740
Epoch 197/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 193ms/step - accuracy: 0.9628 - loss: 0.2369 - val_accuracy: 0.5600 - val_loss: 3.9092
Epoch 198/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 192ms/step - accuracy: 0.9807 - loss: 0.0682 - val_accuracy: 0.5750 - val_loss: 4.1215
Epoch 199/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 190ms/step - accuracy: 0.9963 - loss: 0.0230 - val_accuracy: 0.5950 - val_loss: 3.8465
Epoch 200/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 189ms/step - accuracy: 0.9853 - loss: 0.0466 - val_accuracy: 0.5800 - val_loss: 3.8862
```

In [8]:

```
print(f"Execution time: {elapsed_time:.2f} seconds")
```

```
Execution time: 967.01 seconds
```

In [9]:

```
def append_core_data(score_path, num_cores, elapsed_time):
    # Check if the file already exists
    file_exists = os.path.exists(score_path)

    # Open the file in append mode
    with open(score_path, mode='a', newline='') as file:
        writer = csv.writer(file)

        # If the file is new, write the header
        if not file_exists:
            writer.writerow(["Number of Cores", "Elapsed Time"])

        # Write the new data
        writer.writerow([num_cores, elapsed_time])
```

In [10]:

```
score_path = r"C:\Users\nikhi\OneDrive\Desktop\Final Project\DEEP LEARNING WITH HPSC\core_data.txt"
append_core_data(score_path, number_of_worker, elapsed_time)
```