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 4 worker

In [2]:

```
# Set the number of threads
number_of_worker = 4
os.environ['OMP_NUM_THREADS'] = '4'  # OpenMP threads for parallelism
os.environ['TF_NUM_INTEROP_THREADS'] = '4'  # Threads for inter-operation parallelism
os.environ['TF_NUM_INTRAOP_THREADS'] = '4'  # 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"
```

```
 Layout (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 173ms/step - accuracy: 0.0870 - loss: 2.3293 - val_accuracy: 0.1100 - val_loss: 2.3020
Epoch 2/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 216ms/step - accuracy: 0.0947 - loss: 2.2986 - val_accuracy: 0.1950 - val_loss: 2.2405
Epoch 3/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 225ms/step - accuracy: 0.1855 - loss: 2.2011 - val_accuracy: 0.2150 - val_loss: 2.0685
Epoch 4/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.2282 - loss: 2.0942 - val_accuracy: 0.2550 - val_loss: 2.0424
Epoch 5/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.2203 - loss: 2.0702 - val_accuracy: 0.2550 - val_loss: 2.0806
Epoch 6/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 217ms/step - accuracy: 0.2572 - loss: 1.9645 - val_accuracy: 0.2900 - val_loss: 1.9782
Epoch 7/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.3156 - loss: 1.9579 - val_accuracy: 0.3250 - val_loss: 1.8348
Epoch 8/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.3074 - loss: 1.8452 - val_accuracy: 0.3250 - val_loss: 1.8351
Epoch 9/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 226ms/step - accuracy: 0.3443 - loss: 1.8782 - val_accuracy: 0.2900 - val_loss: 1.8884
Epoch 10/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.3463 - loss: 1.8369 - val_accuracy: 0.3250 - val_loss: 1.8362
Epoch 11/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 217ms/step - accuracy: 0.3712 - loss: 1.7110 - val_accuracy: 0.3650 - val_loss: 1.7915
Epoch 12/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 220ms/step - accuracy: 0.3908 - loss: 1.6327 - val_accuracy: 0.3700 - val_loss: 1.6816
Epoch 13/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.4393 - loss: 1.5735 - val_accuracy: 0.3700 - val_loss: 1.5917
Epoch 14/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.4326 - loss: 1.5463 - val_accuracy: 0.4000 - val_loss: 1.5241
Epoch 15/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 217ms/step - accuracy: 0.4399 - loss: 1.5921 - val_accuracy: 0.4650 - val_loss: 1.4620
Epoch 16/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 220ms/step - accuracy: 0.4507 - loss: 1.4386 - val_accuracy: 0.4450 - val_loss: 1.4631
Epoch 17/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.4912 - loss: 1.3967 - val_accuracy: 0.4400 - val_loss: 1.4481
Epoch 18/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 217ms/step - accuracy: 0.5001 - loss: 1.3790 - val_accuracy: 0.3750 - val_loss: 2.0581
Epoch 19/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.5079 - loss: 1.4559 - val_accuracy: 0.5000 - val_loss: 1.3329
Epoch 20/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.5149 - loss: 1.3141 - val_accuracy: 0.5050 - val_loss: 1.3870
Epoch 21/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.5731 - loss: 1.1841 - val_accuracy: 0.4200 - val_loss: 1.6203
Epoch 22/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.5305 - loss: 1.2805 - val_accuracy: 0.4950 - val_loss: 1.3256
Epoch 23/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.5929 - loss: 1.1132 - val_accuracy: 0.5200 - val_loss: 1.3397
Epoch 24/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.5806 - loss: 1.2093 - val_accuracy: 0.4350 - val_loss: 1.6354
Epoch 25/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.5817 - loss: 1.1601 - val_accuracy: 0.4750 - val_loss: 1.3573
Epoch 26/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.5897 - loss: 1.1286 - val_accuracy: 0.5000 - val_loss: 1.2507
Epoch 27/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.6270 - loss: 1.0092 - val_accuracy: 0.4900 - val_loss: 1.2686
Epoch 28/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.6185 - loss: 1.0675 - val_accuracy: 0.4900 - val_loss: 1.2638
Epoch 29/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.6287 - loss: 1.0181 - val_accuracy: 0.5050 - val_loss: 1.2547
Epoch 30/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.6260 - loss: 0.9962 - val_accuracy: 0.5350 - val_loss: 1.1956
Epoch 31/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.6691 - loss: 0.9625 - val_accuracy: 0.5700 - val_loss: 1.2107
Epoch 32/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.6510 - loss: 0.9998 - val_accuracy: 0.5350 - val_loss: 1.2706
Epoch 33/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.6723 - loss: 0.9011 - val_accuracy: 0.5750 - val_loss: 1.2675
Epoch 34/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.6595 - loss: 0.9651 - val_accuracy: 0.5950 - val_loss: 1.1681
Epoch 35/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.6944 - loss: 0.9113 - val_accuracy: 0.5800 - val_loss: 1.2224
Epoch 36/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.7236 - loss: 0.7811 - val_accuracy: 0.5850 - val_loss: 1.2078
Epoch 37/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.7506 - loss: 0.7508 - val_accuracy: 0.5300 - val_loss: 1.3483
Epoch 38/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.6970 - loss: 0.7597 - val_accuracy: 0.5600 - val_loss: 1.2773
Epoch 39/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.7253 - loss: 0.7940 - val_accuracy: 0.5750 - val_loss: 1.3194
Epoch 40/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.7113 - loss: 0.7393 - val_accuracy: 0.6100 - val_loss: 1.2596
Epoch 41/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 191ms/step - accuracy: 0.7447 - loss: 0.7134 - val_accuracy: 0.5700 - val_loss: 1.3982
```

```
Epoch 42/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.7806 - loss: 0.6490 - val_accuracy: 0.5650 - val_loss: 1.2638
Epoch 43/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 223ms/step - accuracy: 0.7568 - loss: 0.6466 - val_accuracy: 0.5850 - val_loss: 1.2449
Epoch 44/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.7851 - loss: 0.5774 - val_accuracy: 0.5750 - val_loss: 1.3505
Epoch 45/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.7652 - loss: 0.6773 - val_accuracy: 0.6100 - val_loss: 1.4523
Epoch 46/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.7777 - loss: 0.5810 - val_accuracy: 0.5950 - val_loss: 1.4568
Epoch 47/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.7944 - loss: 0.5911 - val_accuracy: 0.6000 - val_loss: 1.4199
Epoch 48/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.8184 - loss: 0.5705 - val_accuracy: 0.5950 - val_loss: 1.4033
Epoch 49/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.8032 - loss: 0.4969 - val_accuracy: 0.5350 - val_loss: 1.5725
Epoch 50/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.8524 - loss: 0.4568 - val_accuracy: 0.5650 - val_loss: 1.5162
Epoch 51/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.8675 - loss: 0.4323 - val_accuracy: 0.5550 - val_loss: 1.6451
Epoch 52/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.8801 - loss: 0.3655 - val_accuracy: 0.6250 - val_loss: 1.4862
Epoch 53/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.8359 - loss: 0.4234 - val_accuracy: 0.6050 - val_loss: 1.5294
Epoch 54/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.8761 - loss: 0.3410 - val_accuracy: 0.5500 - val_loss: 1.8546
Epoch 55/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.8498 - loss: 0.4090 - val_accuracy: 0.6050 - val_loss: 1.5737
Epoch 56/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 216ms/step - accuracy: 0.8667 - loss: 0.3876 - val_accuracy: 0.5550 - val_loss: 2.0229
Epoch 57/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.8925 - loss: 0.3106 - val_accuracy: 0.6200 - val_loss: 1.6577
Epoch 58/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.8861 - loss: 0.3055 - val_accuracy: 0.6050 - val_loss: 1.7928
Epoch 59/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9239 - loss: 0.2821 - val_accuracy: 0.6300 - val_loss: 1.6734
Epoch 60/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9099 - loss: 0.2721 - val_accuracy: 0.6400 - val_loss: 1.8624
Epoch 61/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.8851 - loss: 0.2915 - val_accuracy: 0.6300 - val_loss: 1.7194
Epoch 62/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.9221 - loss: 0.2401 - val_accuracy: 0.5750 - val_loss: 2.4121
Epoch 63/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.8771 - loss: 0.4255 - val_accuracy: 0.6400 - val_loss: 1.6150
Epoch 64/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9291 - loss: 0.2064 - val_accuracy: 0.6100 - val_loss: 2.1086
Epoch 65/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.8845 - loss: 0.2733 - val_accuracy: 0.5550 - val_loss: 1.9794
Epoch 66/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9221 - loss: 0.2269 - val_accuracy: 0.6400 - val_loss: 1.6637
Epoch 67/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9380 - loss: 0.2449 - val_accuracy: 0.5950 - val_loss: 1.9453
Epoch 68/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9244 - loss: 0.1791 - val_accuracy: 0.6150 - val_loss: 1.8998
Epoch 69/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 218ms/step - accuracy: 0.9393 - loss: 0.1946 - val_accuracy: 0.6400 - val_loss: 2.0027
Epoch 70/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9358 - loss: 0.1815 - val_accuracy: 0.6250 - val_loss: 2.1165
Epoch 71/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.8922 - loss: 0.2702 - val_accuracy: 0.6250 - val_loss: 1.6935
Epoch 72/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9485 - loss: 0.1672 - val_accuracy: 0.6050 - val_loss: 1.8513
Epoch 73/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9588 - loss: 0.1375 - val_accuracy: 0.6150 - val_loss: 2.1926
Epoch 74/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9385 - loss: 0.1757 - val_accuracy: 0.6100 - val_loss: 2.0779
Epoch 75/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9415 - loss: 0.1850 - val_accuracy: 0.6000 - val_loss: 2.5533
Epoch 76/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9361 - loss: 0.1930 - val_accuracy: 0.6200 - val_loss: 2.0268
Epoch 77/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9443 - loss: 0.1485 - val_accuracy: 0.6150 - val_loss: 1.9755
Epoch 78/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9376 - loss: 0.1604 - val_accuracy: 0.6000 - val_loss: 2.1409
Epoch 79/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9639 - loss: 0.1241 - val_accuracy: 0.6350 - val_loss: 1.8937
Epoch 80/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9295 - loss: 0.1915 - val_accuracy: 0.6250 - val_loss: 2.3712
Epoch 81/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9673 - loss: 0.1002 - val_accuracy: 0.6200 - val_loss: 2.1481
Epoch 82/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.9725 - loss: 0.1002 - val_accuracy: 0.6100 - val_loss: 2.2447
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Epoch 83/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.9341 - loss: 0.1945 - val_accuracy: 0.6350 - val_loss: 2.1486
Epoch 84/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9491 - loss: 0.1159 - val_accuracy: 0.6250 - val_loss: 2.4833
Epoch 85/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9479 - loss: 0.1705 - val_accuracy: 0.6550 - val_loss: 2.0087
Epoch 86/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9279 - loss: 0.2786 - val_accuracy: 0.6250 - val_loss: 1.9962
Epoch 87/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9769 - loss: 0.0652 - val_accuracy: 0.6300 - val_loss: 2.4628
Epoch 88/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9497 - loss: 0.1454 - val_accuracy: 0.6500 - val_loss: 2.3110
Epoch 89/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9618 - loss: 0.1068 - val_accuracy: 0.6050 - val_loss: 2.2710
Epoch 90/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.9721 - loss: 0.0832 - val_accuracy: 0.5950 - val_loss: 2.7386
Epoch 91/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9349 - loss: 0.1676 - val_accuracy: 0.6250 - val_loss: 2.4609
Epoch 92/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.9738 - loss: 0.0941 - val_accuracy: 0.6350 - val_loss: 2.3282
Epoch 93/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9720 - loss: 0.0798 - val_accuracy: 0.6100 - val_loss: 2.5202
Epoch 94/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9720 - loss: 0.0775 - val_accuracy: 0.6000 - val_loss: 2.6692
Epoch 95/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9602 - loss: 0.1247 - val_accuracy: 0.6050 - val_loss: 2.3386
Epoch 96/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9693 - loss: 0.1137 - val_accuracy: 0.5850 - val_loss: 2.4407
Epoch 97/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9746 - loss: 0.0910 - val_accuracy: 0.6400 - val_loss: 2.2343
Epoch 98/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9675 - loss: 0.0999 - val_accuracy: 0.6050 - val_loss: 2.4878
Epoch 99/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9729 - loss: 0.1077 - val_accuracy: 0.6300 - val_loss: 2.3810
Epoch 100/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9738 - loss: 0.0803 - val_accuracy: 0.6200 - val_loss: 2.4213
Epoch 101/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9728 - loss: 0.0843 - val_accuracy: 0.6150 - val_loss: 2.6465
Epoch 102/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9731 - loss: 0.0868 - val_accuracy: 0.6150 - val_loss: 2.2760
Epoch 103/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9727 - loss: 0.0999 - val_accuracy: 0.6450 - val_loss: 2.4515
Epoch 104/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9519 - loss: 0.1494 - val_accuracy: 0.6300 - val_loss: 2.3754
Epoch 105/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9746 - loss: 0.0898 - val_accuracy: 0.6300 - val_loss: 2.7129
Epoch 106/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9821 - loss: 0.0691 - val_accuracy: 0.6300 - val_loss: 2.8243
Epoch 107/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9801 - loss: 0.0752 - val_accuracy: 0.6200 - val_loss: 2.7709
Epoch 108/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 216ms/step - accuracy: 0.9664 - loss: 0.1235 - val_accuracy: 0.6100 - val_loss: 2.7197
Epoch 109/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9812 - loss: 0.0641 - val_accuracy: 0.6400 - val_loss: 2.7450
Epoch 110/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9763 - loss: 0.0770 - val_accuracy: 0.6200 - val_loss: 2.6184
Epoch 111/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9752 - loss: 0.0604 - val_accuracy: 0.6100 - val_loss: 2.6203
Epoch 112/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9920 - loss: 0.0344 - val_accuracy: 0.6200 - val_loss: 2.7276
Epoch 113/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9461 - loss: 0.1494 - val_accuracy: 0.6650 - val_loss: 2.4975
Epoch 114/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9848 - loss: 0.0547 - val_accuracy: 0.6350 - val_loss: 2.7020
Epoch 115/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9735 - loss: 0.0877 - val_accuracy: 0.6250 - val_loss: 2.7517
Epoch 116/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9790 - loss: 0.0701 - val_accuracy: 0.6350 - val_loss: 2.5372
Epoch 117/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9793 - loss: 0.0651 - val_accuracy: 0.6350 - val_loss: 3.0050
Epoch 118/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9703 - loss: 0.0804 - val_accuracy: 0.6500 - val_loss: 2.2230
Epoch 119/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9836 - loss: 0.0570 - val_accuracy: 0.6300 - val_loss: 2.7662
Epoch 120/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 216ms/step - accuracy: 0.9821 - loss: 0.0468 - val_accuracy: 0.6450 - val_loss: 2.6975
Epoch 121/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9702 - loss: 0.0829 - val_accuracy: 0.6350 - val_loss: 2.5993
Epoch 122/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9644 - loss: 0.1291 - val_accuracy: 0.6450 - val_loss: 2.7768
Epoch 123/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9766 - loss: 0.0689 - val_accuracy: 0.6200 - val_loss: 2.8439
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Epoch 124/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9886 - loss: 0.0279 - val_accuracy: 0.6100 - val_loss: 3.0244
Epoch 125/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9813 - loss: 0.0663 - val_accuracy: 0.6500 - val_loss: 3.1208
Epoch 126/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.9855 - loss: 0.0411 - val_accuracy: 0.6500 - val_loss: 2.7819
Epoch 127/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9888 - loss: 0.0385 - val_accuracy: 0.6600 - val_loss: 3.1580
Epoch 128/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9817 - loss: 0.0764 - val_accuracy: 0.6650 - val_loss: 2.7910
Epoch 129/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9767 - loss: 0.0670 - val_accuracy: 0.6450 - val_loss: 3.1073
Epoch 130/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9796 - loss: 0.0653 - val_accuracy: 0.6350 - val_loss: 2.9026
Epoch 131/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9897 - loss: 0.0606 - val_accuracy: 0.5650 - val_loss: 4.0656
Epoch 132/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9431 - loss: 0.2323 - val_accuracy: 0.6550 - val_loss: 2.6973
Epoch 133/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.9872 - loss: 0.0522 - val_accuracy: 0.6400 - val_loss: 2.6923
Epoch 134/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9980 - loss: 0.0147 - val_accuracy: 0.6550 - val_loss: 2.8682
Epoch 135/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9789 - loss: 0.0659 - val_accuracy: 0.6550 - val_loss: 2.9029
Epoch 136/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9781 - loss: 0.0519 - val_accuracy: 0.6450 - val_loss: 3.3952
Epoch 137/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9841 - loss: 0.0550 - val_accuracy: 0.6950 - val_loss: 2.4342
Epoch 138/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9835 - loss: 0.0416 - val_accuracy: 0.5950 - val_loss: 3.0843
Epoch 139/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9796 - loss: 0.0624 - val_accuracy: 0.6200 - val_loss: 3.3547
Epoch 140/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9814 - loss: 0.0590 - val_accuracy: 0.6500 - val_loss: 2.9060
Epoch 141/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9790 - loss: 0.0728 - val_accuracy: 0.6400 - val_loss: 3.7736
Epoch 142/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 218ms/step - accuracy: 0.9811 - loss: 0.0637 - val_accuracy: 0.6450 - val_loss: 3.2781
Epoch 143/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9746 - loss: 0.0844 - val_accuracy: 0.6050 - val_loss: 3.2517
Epoch 144/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9946 - loss: 0.0231 - val_accuracy: 0.6300 - val_loss: 3.2410
Epoch 145/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9646 - loss: 0.1369 - val_accuracy: 0.6450 - val_loss: 3.3306
Epoch 146/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 196ms/step - accuracy: 0.9848 - loss: 0.0446 - val_accuracy: 0.6400 - val_loss: 2.9006
Epoch 147/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9890 - loss: 0.0328 - val_accuracy: 0.6350 - val_loss: 3.0408
Epoch 148/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9745 - loss: 0.0681 - val_accuracy: 0.6250 - val_loss: 2.8711
Epoch 149/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9827 - loss: 0.0773 - val_accuracy: 0.6700 - val_loss: 3.0453
Epoch 150/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9862 - loss: 0.0550 - val_accuracy: 0.6600 - val_loss: 2.8548
Epoch 151/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9790 - loss: 0.0703 - val_accuracy: 0.6650 - val_loss: 2.9448
Epoch 152/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9811 - loss: 0.0715 - val_accuracy: 0.6550 - val_loss: 3.0744
Epoch 153/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9831 - loss: 0.0430 - val_accuracy: 0.6500 - val_loss: 3.1276
Epoch 154/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9720 - loss: 0.0975 - val_accuracy: 0.6400 - val_loss: 2.9376
Epoch 155/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9923 - loss: 0.0249 - val_accuracy: 0.6200 - val_loss: 3.2989
Epoch 156/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9571 - loss: 0.0950 - val_accuracy: 0.6300 - val_loss: 3.2689
Epoch 157/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9922 - loss: 0.0247 - val_accuracy: 0.6300 - val_loss: 3.2124
Epoch 158/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9918 - loss: 0.0198 - val_accuracy: 0.6200 - val_loss: 3.5101
Epoch 159/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9756 - loss: 0.0976 - val_accuracy: 0.6450 - val_loss: 3.0890
Epoch 160/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9899 - loss: 0.0320 - val_accuracy: 0.5250 - val_loss: 4.3071
Epoch 161/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 200ms/step - accuracy: 0.9500 - loss: 0.1923 - val_accuracy: 0.6150 - val_loss: 2.8679
Epoch 162/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9766 - loss: 0.0628 - val_accuracy: 0.6350 - val_loss: 2.5324
Epoch 163/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.9859 - loss: 0.0392 - val_accuracy: 0.6400 - val_loss: 2.7800
Epoch 164/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.9729 - loss: 0.0914 - val_accuracy: 0.6250 - val_loss: 3.1907
```

```
Epoch 165/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9707 - loss: 0.0861 - val_accuracy: 0.6700 - val_loss: 3.0659
Epoch 166/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9804 - loss: 0.0650 - val_accuracy: 0.6550 - val_loss: 2.8892
Epoch 167/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9777 - loss: 0.0900 - val_accuracy: 0.6450 - val_loss: 3.1240
Epoch 168/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9789 - loss: 0.0641 - val_accuracy: 0.6600 - val_loss: 2.8889
Epoch 169/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9611 - loss: 0.1326 - val_accuracy: 0.6800 - val_loss: 2.6419
Epoch 170/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9922 - loss: 0.0444 - val_accuracy: 0.6250 - val_loss: 3.5239
Epoch 171/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 224ms/step - accuracy: 0.9777 - loss: 0.0627 - val_accuracy: 0.6350 - val_loss: 3.0843
Epoch 172/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9845 - loss: 0.0833 - val_accuracy: 0.6400 - val_loss: 3.2503
Epoch 173/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9847 - loss: 0.0406 - val_accuracy: 0.6300 - val_loss: 3.2927
Epoch 174/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 205ms/step - accuracy: 0.9957 - loss: 0.0156 - val_accuracy: 0.6350 - val_loss: 3.5053
Epoch 175/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9836 - loss: 0.0420 - val_accuracy: 0.5950 - val_loss: 3.7164
Epoch 176/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9834 - loss: 0.0705 - val_accuracy: 0.6450 - val_loss: 3.0541
Epoch 177/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9733 - loss: 0.0997 - val_accuracy: 0.6600 - val_loss: 3.0176
Epoch 178/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9859 - loss: 0.0259 - val_accuracy: 0.6150 - val_loss: 3.4758
Epoch 179/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 199ms/step - accuracy: 0.9645 - loss: 0.1496 - val_accuracy: 0.6200 - val_loss: 3.6725
Epoch 180/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 203ms/step - accuracy: 0.9876 - loss: 0.0493 - val_accuracy: 0.6200 - val_loss: 3.2856
Epoch 181/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 195ms/step - accuracy: 0.9886 - loss: 0.0565 - val_accuracy: 0.6250 - val_loss: 3.9449
Epoch 182/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 202ms/step - accuracy: 0.9770 - loss: 0.0616 - val_accuracy: 0.6200 - val_loss: 3.2310
Epoch 183/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.9864 - loss: 0.0475 - val_accuracy: 0.6450 - val_loss: 3.0371
Epoch 184/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 228ms/step - accuracy: 0.9862 - loss: 0.0486 - val_accuracy: 0.6350 - val_loss: 3.6485
Epoch 185/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 207ms/step - accuracy: 0.9795 - loss: 0.0680 - val_accuracy: 0.6100 - val_loss: 3.3821
Epoch 186/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.9834 - loss: 0.0764 - val_accuracy: 0.6450 - val_loss: 3.2714
Epoch 187/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 201ms/step - accuracy: 0.9888 - loss: 0.0797 - val_accuracy: 0.6800 - val_loss: 3.0651
Epoch 188/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 198ms/step - accuracy: 0.9895 - loss: 0.0452 - val_accuracy: 0.6000 - val_loss: 3.8176
Epoch 189/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9764 - loss: 0.0732 - val_accuracy: 0.6300 - val_loss: 3.2673
Epoch 190/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9867 - loss: 0.0555 - val_accuracy: 0.6400 - val_loss: 3.1765
Epoch 191/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9903 - loss: 0.0231 - val_accuracy: 0.6750 - val_loss: 3.3168
Epoch 192/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.9844 - loss: 0.0556 - val_accuracy: 0.6400 - val_loss: 2.8865
Epoch 193/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9779 - loss: 0.0447 - val_accuracy: 0.6750 - val_loss: 3.1290
Epoch 194/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.9906 - loss: 0.0313 - val_accuracy: 0.5900 - val_loss: 3.4275
Epoch 195/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 206ms/step - accuracy: 0.9902 - loss: 0.0367 - val_accuracy: 0.6250 - val_loss: 3.2306
Epoch 196/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.9877 - loss: 0.0718 - val_accuracy: 0.5900 - val_loss: 3.6389
Epoch 197/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9846 - loss: 0.0554 - val_accuracy: 0.6650 - val_loss: 3.2400
Epoch 198/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9880 - loss: 0.0415 - val_accuracy: 0.6450 - val_loss: 3.2804
Epoch 199/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 197ms/step - accuracy: 0.9821 - loss: 0.0445 - val_accuracy: 0.6550 - val_loss: 3.3964
Epoch 200/200
25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.9776 - loss: 0.0669 - val_accuracy: 0.6150 - val_loss: 3.7908
```

In [8]:

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

```
Execution time: 1036.82 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)
```