ASSIGNMENT 3

#Pip Install keras

Defaulting to user installation because normal site-packages is not writeable

Requirement already satisfied: keras in c:\users\mddan\appdata\roaming\python\python310\site-packages (2.12.0)

Task 1: Data Augmentation

Data augmentation is a technique that can be used to artificially increase the size of a training dataset by creating modified versions of images in the dataset. This is done to increase the diversity of the dataset and reduce overfitting. In Python, you can use the ImageDataGenerator class from the keras.preprocessing.image module to perform data augmentation.

#Importing all the important packages

```
from keras.preprocessing.image import ImageDataGenerator
from keras.models import Sequential
from keras.layers import Conv2D, MaxPooling2D, Flatten, Dense
```

#code for image generator

```
datagen = ImageDataGenerator(
    rotation_range=20,
    width_shift_range=0.1,
    height_shift_range=0.1,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)
```

#loading tha dataset

```
# load the dataset
train_data = datagen.flow_from_directory(
    'animals',
    target_size=(224, 224),
    batch_size=32,
    class_mode='categorical'
)
```

Output->

Found 5400 images belonging to 90 classes.

Task 2: Build the CNN Model

#creating instance sequence class

```
# create an instance of the Sequential class
model = Sequential()
```

#adding input layers

```
# add the input layer
model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(224, 224, 3)))
```

#adding convolution layer and max pooling layer

```
# add a convolution layer and a max pooling layer
model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(MaxPooling2D((2, 2)))
```

#adding a flatten layer

```
# add a flatten layer
model.add(Flatten())
```

#adding two hidden layer

```
# add two hidden layers
model.add(Dense(128, activation='relu'))
model.add(Dense(64, activation='relu'))
```

output->

2023-05-13 16:57:00.240491: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 396492800 exceeds 10% of free system memory.

2023-05-13 16:57:01.038085: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 396492800 exceeds 10% of free system memory.

2023-05-13 16:57:01.113837: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 396492800 exceeds 10% of free system memory.

#adding output layer

```
# add the output layer
model.add(Dense(90, activation='softmax'))
```

#compiling the model

```
# compile the model
model.compile(optimizer='adam', loss='categorical_crossentropy',
metrics=['accuracy'])
```

Task 3: Test the Model

To test the model, you can use the evaluate() method of the model object, which takes the test dataset as an argument.

#Testing the dataset

```
# evaluate the model on the test dataset
test_loss, test_accuracy = model.evaluate(train_data)
```

output->

1/169 [.....] - ETA: 5:53 - loss: 55.6361 - accuracy: 0.0000e+002023-05-13 16:29:24.310979: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 396492800 exceeds 10% of free system memory.

2/169 [.....] - ETA: 3:31 - loss: 54.3651 - accuracy: 0.01 3/169 [.....] - ETA: 3:54 - loss: 53.2210 - accuracy: 0.01 4/169 [.....] - ETA: 4:01 - loss: 53.7014 - accuracy: 0.00 5/169 [.....] - ETA: 4:05 - loss: 54.0545 - accuracy: 0.00 6/169 [>.....] - ETA: 4:02 - loss: 55.2397 - accuracy: 0.01 7/169 [>.....] - ETA: 3:55 - loss: 55.8656 - accuracy: 0.01 8/169

[>.....] - ETA: 4:03 - loss: 54.9884 - accuracy: 0.01 9/169 [>.....] - ETA: 4:02 - loss: 56.4786 - accuracy: 0.01 10/169 [>.....] - ETA: 4:00 - loss: 57.3817 - accuracy: 0.01 11/169 [>.....] - ETA: 3:58 - loss: 57.7663 - accuracy: 0.01 12/169 [=>.....] - ETA: 3:58 - loss: 58.3912 - accuracy: 0.01 13/169
[=>.....] - ETA: 3:55 - loss: 58.6915 - accuracy: 0.01 14/169
[=>.....] - ETA: 3:57 - loss: 58.8631 - accuracy: 0.01 15/169
[=>.....] - ETA: 3:57 - loss: 58.5209 - accuracy: 0.01 16/169
[=>.....] - ETA: 3:58 - loss: 58.1779 - accuracy: 0.01 17/169
[==>.....] - ETA: 3:54 - loss: 57.9405 - accuracy: 0.01 18/169
[==>.....] - ETA: 3:50 - loss: 58.2100 - accuracy: 0.01 19/169
[==>.....] - ETA: 3:49 - loss: 58.7476 - accuracy: 0.01 20/169
[==>.....] - ETA: 3:47 - loss: 58.5871 - accuracy: 0.01 21/169
[==>.....] - ETA: 3:46 - loss: 58.4861 - accuracy: 0.01 22/169
[==>.....] - ETA: 3:45 - loss: 58.5629 - accuracy: 0.01 23/169
[===>.....] - ETA: 3:42 - loss: 58.2879 - accuracy: 0.01 24/169
[===>.....] - ETA: 3:41 - loss: 58.3701 - accuracy: 0.01 25/169
[===>.....] - ETA: 3:41 - loss: 58.5500 - accuracy: 0.01 26/169
[===>.....] - ETA: 3:40 - loss: 58.5630 - accuracy: 0.01 27/169
[===>.....] - ETA: 3:39 - loss: 58.0571 - accuracy: 0.01 28/169
[===>.....] - ETA: 3:37 - loss: 58.1994 - accuracy: 0.01 29/169
[====>.....] - ETA: 3:36 - loss: 57.9997 - accuracy: 0.01 30/169
[====>.....] - ETA: 3:34 - loss: 58.0099 - accuracy: 0.01 31/169
[====>.....] - ETA: 3:33 - loss: 57.8277 - accuracy: 0.01 32/169
[====>.....] - ETA: 3:32 - loss: 57.7015 - accuracy: 0.01 33/169
[====>.....] - ETA: 3:31 - loss: 57.5497 - accuracy: 0.01 34/169
[=====>.....] - ETA: 3:29 - loss: 57.6961 - accuracy: 0.01 35/169
[=====>.....] - ETA: 3:28 - loss: 57.6789 - accuracy: 0.01 36/169
[=====>.....] - ETA: 3:26 - loss: 57.5080 - accuracy: 0.01 37/169
[=====>.....] - ETA: 3:25 - loss: 57.8632 - accuracy: 0.01 38/169
[=====>.....] - ETA: 3:24 - loss: 57.7786 - accuracy: 0.01 39/169
[=====>.....] - ETA: 3:22 - loss: 57.7157 - accuracy: 0.01 40/169
[======>.....] - ETA: 3:21 - loss: 57.8718 - accuracy: 0.01 41/169
[======>.....] - ETA: 3:19 - loss: 57.6797 - accuracy: 0.01 42/169
[======>.....] - ETA: 3:18 - loss: 57.6119 - accuracy: 0.01 43/169
[======>.....] - ETA: 3:16 - loss: 57.4339 - accuracy: 0.01 44/169
[======>.....] - ETA: 3:15 - loss: 57.4251 - accuracy: 0.01 45/169
[======>.....] - ETA: 3:14 - loss: 57.4079 - accuracy: 0.01 46/169
[=======>.....] - ETA: 3:11 - loss: 57.3612 - accuracy: 0.01 47/169
[=======>.....] - ETA: 3:10 - loss: 57.4126 - accuracy: 0.01 48/169
[=======>.....] - ETA: 3:09 - loss: 57.5039 - accuracy: 0.01 49/169
[=======>.....] - ETA: 3:07 - loss: 57.7151 - accuracy: 0.01 50/169

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[=======>.....................] - ETA: 3:05 - loss: 57.7730 - accuracy: 0.01 51/169
[========>....................] - ETA: 3:04 - loss: 57.7954 - accuracy: 0.01 52/169
[========>....................] - ETA: 3:03 - loss: 57.7089 - accuracy: 0.01 53/169
[========>....................] - ETA: 3:02 - loss: 57.6881 - accuracy: 0.01 54/169
[========>....................] - ETA: 3:01 - loss: 57.6918 - accuracy: 0.01 55/169
[========>....................] - ETA: 2:59 - loss: 57.6722 - accuracy: 0.01 56/169
[========>....................] - ETA: 2:57 - loss: 57.5167 - accuracy: 0.01 57/169
[=========>...................] - ETA: 2:55 - loss: 57.5209 - accuracy: 0.01 58/169
[=========>...................] - ETA: 2:54 - loss: 57.6485 - accuracy: 0.01 59/169
[=========>...................] - ETA: 2:52 - loss: 57.6198 - accuracy: 0.01 60/169
[=========>...................] - ETA: 2:50 - loss: 57.5638 - accuracy: 0.01 61/169
[=========>...................] - ETA: 2:48 - loss: 57.5846 - accuracy: 0.01 62/169
[==========>..................] - ETA: 2:47 - loss: 57.5277 - accuracy: 0.01 63/169
[==========>..................] - ETA: 2:45 - loss: 57.5855 - accuracy: 0.01 64/169
[==========>..................] - ETA: 2:43 - loss: 57.6428 - accuracy: 0.01 65/169
[==========>..................] - ETA: 2:42 - loss: 57.6683 - accuracy: 0.01 66/169
[==========>..................] - ETA: 2:40 - loss: 57.6090 - accuracy: 0.01 67/169
[==========>..................] - ETA: 2:38 - loss: 57.6697 - accuracy: 0.01 68/169
[===========>.................] - ETA: 2:37 - loss: 57.6536 - accuracy: 0.01 69/169
[===========>.................] - ETA: 2:35 - loss: 57.6400 - accuracy: 0.01 70/169
[===========>.................] - ETA: 2:34 - loss: 57.5362 - accuracy: 0.01 71/169
[===========>.................] - ETA: 2:32 - loss: 57.4574 - accuracy: 0.01 72/169
[===========>.................] - ETA: 2:30 - loss: 57.4664 - accuracy: 0.01 73/169
[===========>.................] - ETA: 2:29 - loss: 57.3943 - accuracy: 0.01 74/169
[============>................] - ETA: 2:27 - loss: 57.3911 - accuracy: 0.01 75/169
[============>................] - ETA: 2:25 - loss: 57.4159 - accuracy: 0.01 76/169
[============>................] - ETA: 2:24 - loss: 57.3898 - accuracy: 0.01 77/169
[============>................] - ETA: 2:22 - loss: 57.3741 - accuracy: 0.01 78/169
[============>................] - ETA: 2:21 - loss: 57.3588 - accuracy: 0.01 79/169
[=============>...............] - ETA: 2:19 - loss: 57.4166 - accuracy: 0.01 80/169
[=============>...............] - ETA: 2:18 - loss: 57.3958 - accuracy: 0.01 81/169
[=============>...............] - ETA: 2:16 - loss: 57.3626 - accuracy: 0.01 82/169
[=============>...............] - ETA: 2:14 - loss: 57.3402 - accuracy: 0.01 83/169
[=============>...............] - ETA: 2:13 - loss: 57.3720 - accuracy: 0.01 84/169
[=============>...............] - ETA: 2:11 - loss: 57.3060 - accuracy: 0.01 85/169
[==============>..............] - ETA: 2:10 - loss: 57.4806 - accuracy: 0.01 86/169
[==============>..............] - ETA: 2:08 - loss: 57.5425 - accuracy: 0.01 87/169
[==============>..............] - ETA: 2:06 - loss: 57.5518 - accuracy: 0.01 88/169
[==============>..............] - ETA: 2:05 - loss: 57.5930 - accuracy: 0.01 89/169
[==============>..............] - ETA: 2:03 - loss: 57.7078 - accuracy: 0.01 90/169
[==============>..............] - ETA: 2:02 - loss: 57.6960 - accuracy: 0.01 91/169
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[===============>.............] - ETA: 2:00 - loss: 57.7975 - accuracy: 0.01 92/169
[===============>.............] - ETA: 1:58 - loss: 57.8427 - accuracy: 0.01 93/169
[===============>.............] - ETA: 1:57 - loss: 57.9120 - accuracy: 0.01 94/169
[===============>.............] - ETA: 1:55 - loss: 57.8878 - accuracy: 0.01 95/169
[===============>.............] - ETA: 1:53 - loss: 57.8675 - accuracy: 0.01 96/169
[================>............] - ETA: 1:52 - loss: 57.8301 - accuracy: 0.01 97/169
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[================>............] - ETA: 1:47 - loss: 57.9060 - accuracy: 0.01100/169
[================>............] - ETA: 1:45 - loss: 57.8629 - accuracy: 0.01101/169
[================>............] - ETA: 1:44 - loss: 57.9124 - accuracy: 0.01102/169
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[=================>...........] - ETA: 1:41 - loss: 57.9066 - accuracy: 0.01104/169
[=================>...........] - ETA: 1:39 - loss: 57.9238 - accuracy: 0.01105/169
[=================>...........] - ETA: 1:38 - loss: 57.8872 - accuracy: 0.01106/169
[=================>...........] - ETA: 1:36 - loss: 57.8803 - accuracy: 0.01107/169
[=================>...........] - ETA: 1:35 - loss: 57.8277 - accuracy: 0.01108/169
[==================>..........] - ETA: 1:33 - loss: 57.8267 - accuracy: 0.01109/169
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[==================>..........] - ETA: 1:27 - loss: 57.7478 - accuracy: 0.01113/169
[===================>.........] - ETA: 1:26 - loss: 57.7510 - accuracy: 0.01114/169
[===================>.........] - ETA: 1:24 - loss: 57.7743 - accuracy: 0.01115/169
[===================>.........] - ETA: 1:23 - loss: 57.7583 - accuracy: 0.01116/169
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[===================>.........] - ETA: 1:19 - loss: 57.6718 - accuracy: 0.01118/169
[===================>.........] - ETA: 1:18 - loss: 57.6546 - accuracy: 0.01119/169
[====================>........] - ETA: 1:16 - loss: 57.6113 - accuracy: 0.01120/169
[====================>........] - ETA: 1:15 - loss: 57.5091 - accuracy: 0.01121/169
[====================>........] - ETA: 1:13 - loss: 57.5195 - accuracy: 0.01122/169
[====================>........] - ETA: 1:12 - loss: 57.4829 - accuracy: 0.01123/169
[====================>........] - ETA: 1:10 - loss: 57.4508 - accuracy: 0.01124/169
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[=====================>.......] - ETA: 1:02 - loss: 57.3896 - accuracy: 0.01129/169
[=====================>.......] - ETA: 1:01 - loss: 57.3488 - accuracy: 0.01130/169
[======================>......] - ETA: 59s - loss: 57.3656 - accuracy: 0.013131/169
[======================>......] - ETA: 58s - loss: 57.3931 - accuracy: 0.013132/169
```

```
[=====================>.......] - ETA: 56s - loss: 57.3847 - accuracy: 0.013133/169
[=====================>.......] - ETA: 55s - loss: 57.3928 - accuracy: 0.013134/169
[=====================>.......] - ETA: 53s - loss: 57.4889 - accuracy: 0.013135/169
[=====================>.......] - ETA: 52s - loss: 57.4324 - accuracy: 0.013136/169
[======================>......] - ETA: 50s - loss: 57.4243 - accuracy: 0.013137/169
[======================>......] - ETA: 49s - loss: 57.3884 - accuracy: 0.013138/169
[======================>......] - ETA: 47s - loss: 57.3507 - accuracy: 0.013139/169
[======================>......] - ETA: 46s - loss: 57.4252 - accuracy: 0.013140/169
[======================>......] - ETA: 44s - loss: 57.4325 - accuracy: 0.013141/169
[=======================>.....] - ETA: 43s - loss: 57.4399 - accuracy: 0.013142/169
[=======================>.....] - ETA: 41s - loss: 57.4696 - accuracy: 0.013143/169
[=======================>.....] - ETA: 39s - loss: 57.4671 - accuracy: 0.013144/169
[=======================>.....] - ETA: 38s - loss: 57.4538 - accuracy: 0.013145/169
[=======================>.....] - ETA: 36s - loss: 57.3954 - accuracy: 0.012146/169
[=======================>.....] - ETA: 35s - loss: 57.3937 - accuracy: 0.012147/169
[========================>....] - ETA: 33s - loss: 57.3307 - accuracy: 0.013148/169
[========================>....] - ETA: 32s - loss: 57.3406 - accuracy: 0.013149/169
[========================>....] - ETA: 30s - loss: 57.3304 - accuracy: 0.013150/169
[========================>....] - ETA: 29s - loss: 57.3583 - accuracy: 0.012151/169
[========================>....] - ETA: 27s - loss: 57.3924 - accuracy: 0.012152/169
[========================>....] - ETA: 26s - loss: 57.4459 - accuracy: 0.012153/169
[=========================>...] - ETA: 24s - loss: 57.4428 - accuracy: 0.012154/169
[=========================>...] - ETA: 23s - loss: 57.4417 - accuracy: 0.012155/169
[=========================>...] - ETA: 21s - loss: 57.3979 - accuracy: 0.012156/169
[=========================>...] - ETA: 19s - loss: 57.3674 - accuracy: 0.012157/169
[=========================>...] - ETA: 18s - loss: 57.3590 - accuracy: 0.012158/169
[==========================>..] - ETA: 16s - loss: 57.3801 - accuracy: 0.012159/169
[==========================>..] - ETA: 15s - loss: 57.3879 - accuracy: 0.012160/169
[==========================>..] - ETA: 13s - loss: 57.4010 - accuracy: 0.012161/169
[==========================>..] - ETA: 12s - loss: 57.3764 - accuracy: 0.012162/169
[==========================>..] - ETA: 10s - loss: 57.3952 - accuracy: 0.012163/169
[==========================>..] - ETA: 9s - loss: 57.3747 - accuracy: 0.0125

169/169 [==============================] - 260s 2s/step - loss: 57.3666 - accuracy: 0.0126
```

#Printing the test accuracy

```
# print the test accuracy
print('Test accuracy:', test_accuracy)
```

output-> Test accuracy: 0.012592592276632786.