Common Objects Image Recognition

Lewis Collum

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Pyenv

As of now, Tensorflow requires python 3.7, and the current python version is 3.8. To provide python 3.7 to this project only, I used `pyenv` (`https://github.com/pyenv/pyenv`). Since I'm using Arch Linux, I used `pacman` to install pyenv, `sudo pacman -S pyenv`. Then I added the following lines to my bash_profile:

```
export PYENV_ROOT="$HOME/.pyenv"
export PATH="$PYENV_ROOT/bin:$PATH"

if command -v pyenv 1>/dev/null 2>&1; then
    eval "$(pyenv init -)"
fi
```

Then I restarted my shell and went to my project directory and ran `pyenv local 3.7.6`. Finally, to install python 3.7.6: `pyenv install 3.7.6`.

In this directory I installed packages, via pip, for this version. For example, `sudo pip install matplotlib`. Refer to the github link above for more information.

Emacs Pyenv Mode

Emacs has the `pyenv-mode-auto` package which, when installed, will automatically detect the project's python version (via the .python-version file generated with `pyenv local 3.7.6` above). This means that we can run org-mode python code blocks will use the python version detected, instead of the system python version (which is currently python 3.8).

Downloading Images from AWS S3 Bucket

```
if [[ ! -d "data" ]]; then
    wget https://s3.us-east-2.amazonaws.com/naturalimages02/images.tar.gz
    tar -xzf images.tar.gz
    rm -f images.tar.gz*
fi;
echo "DONE!"
```

Common Variables

common.py

```
trainPath = '../data/train/'
testPath = '../data/test/'
classCount = 8
imageSize = 224
```

Preparing Training Data

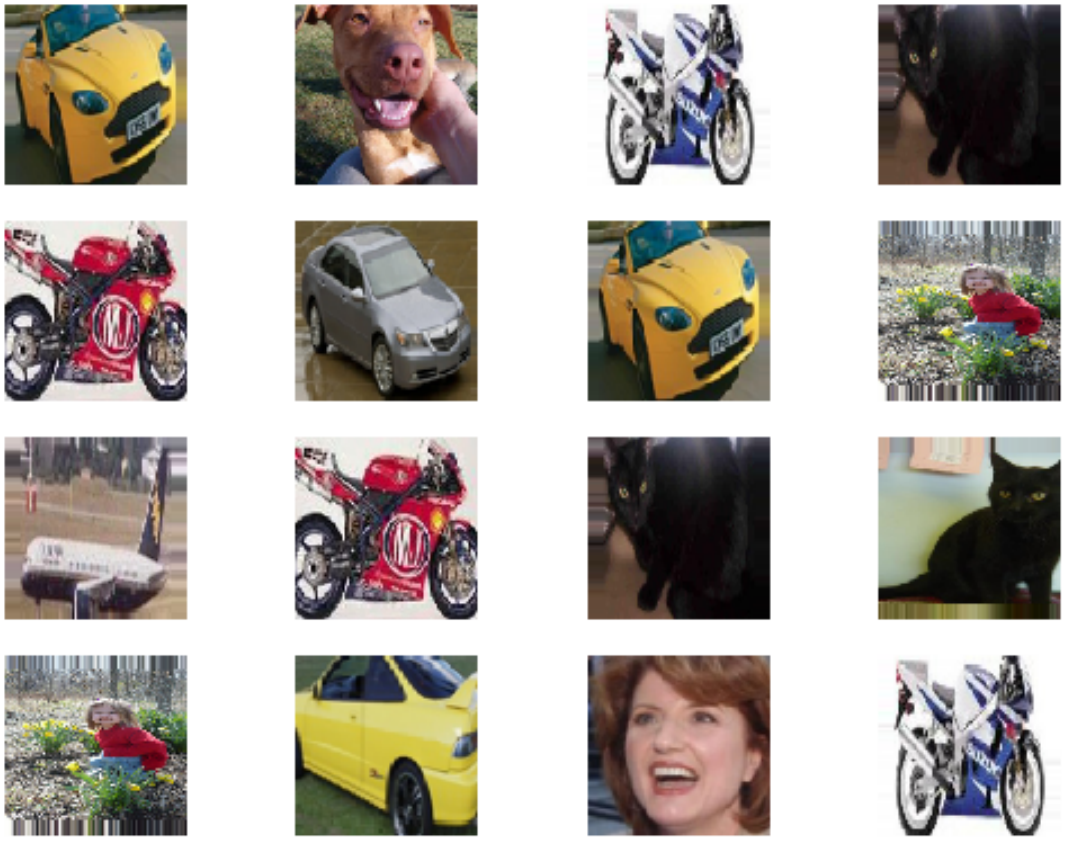
batch.py

```
from keras.preprocessing.image import ImageDataGenerator
import numpy as np
import common

size = 16

trainingBatchGenerator = ImageDataGenerator(
    validation_split = 0.3,
    shear_range = 0.2,
    zoom_range = 0.2,
    horizontal_flip = True)

trainingBatchIterator = trainingBatchGenerator.flow_from_directory(
    directory = common.trainPath,
    target_size = (common.imageSize, common.imageSize),
    batch_size = size,
    class_mode = 'categorical',
    color_mode = 'rgb',
    shuffle = True)

x, y = trainingBatchIterator.next()
sampleSize = trainingBatchIterator.n
```

Let's See the Batch

```
import matplotlib.pyplot as pyplot
import numpy

import batch

figure = pyplot.figure()
columns = 4
rows = 4

for i in range(1, columns*rows+1):
    randomImageIndex = numpy.random.randint(batch.size)
```

```
    randomImage = batch.x[randomImageIndex].astype(numpy.int)
    figure.add_subplot(rows, columns, i)
    pyplot.axis('off')
    pyplot.imshow(randomImage)

pyplot.savefig("../figure/generatedTrainingImages.png")
```



Model Creation from VGG16

model.py

```
import keras
from keras.models import Model, load_model
from keras.layers import Activation, Dropout, Flatten, Dense
from keras.preprocessing.image import ImageDataGenerator
from keras.applications.vgg16 import VGG16

import common

baseModel = VGG16(
    weights = 'imagenet',
```

```
    include_top = False,
    input_shape = (common.imageSize, common.imageSize, 3))

for layer in baseModel.layers:
    layer.trainable = False

model = keras.models.Sequential()
model.add(baseModel)

model.add(Flatten())
model.add(Dense(1024, activation='relu'))
model.add(Dense(1024, activation='relu'))
model.add(Dense(common.classCount, activation='softmax'))

if __name__ == '__main__':
    print(model.summary())
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
vgg16 (Model)                (None, 7, 7, 512)         14714688
_________________________________________________________________
flatten_1 (Flatten)          (None, 25088)             0
_________________________________________________________________
dense_1 (Dense)              (None, 1024)              25691136
_________________________________________________________________
dense_2 (Dense)              (None, 1024)              1049600
_________________________________________________________________
dense_3 (Dense)              (None, 8)                 8200
=================================================================
Total params: 41,463,624
Trainable params: 26,748,936
Non-trainable params: 14,714,688
_________________________________________________________________
None
```

Training

training.py

```
from keras.optimizers import SGD

import batch
from model import model

model.compile(
    loss = 'categorical_crossentropy',
    optimizer = SGD(lr=1e-3),
    metrics = ['accuracy'])

model.fit_generator(
```

```
    batch.trainingBatchIterator,
    steps_per_epoch = batch.sampleSize/batch.size,
    epochs = 2)

model.save('fine_tune.h5')
```

Testing Our Model

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

import matplotlib.pyplot as pyplot
import numpy as np
import common

model = load_model('fine_tune.h5')

test_datagen = ImageDataGenerator()

test_generator = test_datagen.flow_from_directory(
                        directory=common.testPath,
                        target_size=(common.imageSize, common.imageSize),
                        color_mode='rgb',
                        shuffle=False,
                        class_mode='categorical',
                        batch_size=1)

filenames = test_generator.filenames
nb_samples = len(filenames)

fig=pyplot.figure()
columns = 4
rows = 4
for i in range(1, columns*rows):
    x_batch, y_batch = test_generator.next()

    name = model.predict(x_batch)
    name = np.argmax(name, axis=-1)
    true_name = y_batch
    true_name = np.argmax(true_name, axis=-1)

    label_map = (test_generator.class_indices)
    label_map = dict((v,k) for k,v in label_map.items()) #flip k,v
    predictions = [label_map[k] for k in name]
    true_value = [label_map[k] for k in true_name]

    image = x_batch[0].astype(np.int)
    fig.add_subplot(rows, columns, i)
    pyplot.axis('off')
```

```
    pyplot.title(f"guess: {predictions[0]}\nactual: {true_value[0]}")
    pyplot.imshow(image)

pyplot.show()
```

guess: dog
actual: airplane

guess: fruit
actual: airplane

guess: airplane
actual: airplane

guess: car
actual: car

guess: car
actual: car

guess: cat
actual: cat

guess: dog
actual: dog

guess: flower
actual: flower

guess: flower
actual: flower

guess: fruit
actual: fruit

guess: fruit
actual: fruit

guess: motorbike
actual: motorbike

guess: motorbike
actual: motorbike

guess: person
actual: person

guess: person
actual: person

Reference

- https://www.guru99.com/keras-tutorial.html