

Connect to Colab

In [0]: `!/opt/bin/nvidia-smi`

```
Sat Nov 23 17:35:28 2019
+-----+
+-----+
| NVIDIA-SMI 418.67      Driver Version: 418.67      CUDA Version: 10.1
|
|-----+-----+-----+
+-----+
| GPU   Name               Persistence-M| Bus-Id        Disp.A | Volatile Uncorr.
ECC |
| Fan   Temp   Perf   Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Comput
e M. |
|====+=====+-----+=====+-----+=====+
|    0   Tesla P100-PCIE...    Off   | 00000000:00:04.0 Off |
0 |
| N/A    36C    P0      26W / 250W |      0MiB / 16280MiB |      0%      Def
ault |
+-----+-----+-----+-----+-----+-----+
+-----+
+-----+
| Processes:                                     GPU Me
mory |
|   GPU          PID    Type    Process name                     Usage
|
|=====+=====+=====+=====+=====+=====+
|   No running processes found
|
+-----+-----+-----+-----+-----+-----+
+-----+
```

```
In [1]: from google.colab import drive
drive.mount('/content/drive')
```

Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3aietf%3awg%3aoauth%3a2.0%3aob&response_type=code&scope=email%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdocs.test%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive.photos.readonly%20https%3a%2f%2fwww.googleapis.com%2fauth%2fpeopleapi.readonly

Enter your authorization code:

.....

Mounted at /content/drive

Import necessary packages

```
In [2]: from keras.layers import Input, Dense, Flatten, Dropout
from keras.models import Model
from keras.datasets import cifar100
from keras.optimizers import Adam, SGD
from keras.utils import np_utils
from keras import backend as K
import numpy as np
import os
from keras.regularizers import l2
import tensorflow as tf
import time
import datetime
import argparse
import datetime
import socket
from sklearn import preprocessing
import scipy.io as sio
import numpy as np
import matplotlib.pyplot as plt
from sklearn import preprocessing
import time
from keras.preprocessing.image import ImageDataGenerator, array_to_img, img
from PIL import Image, ImageOps
from keras.preprocessing import image
from keras.preprocessing.image import ImageDataGenerator
##### For one-hot label
from keras.utils import np_utils
```

Using TensorFlow backend.

The default version of TensorFlow in Colab will soon switch to TensorFlow 2.x.

We recommend you [upgrade](https://www.tensorflow.org/guide/migrate) (https://www.tensorflow.org/guide/migrate) now or ensure your notebook will continue to use TensorFlow 1.x via the %tensorflow_version 1.x magic: [more info](https://colab.research.google.com/notebooks/tensorflow_version.ipynb) (https://colab.research.google.com/notebooks/tensorflow_version.ipynb).

```
In [0]: pip install -U scikit-learn
```

```
Requirement already up-to-date: scikit-learn in /usr/local/lib/python3.6/
dist-packages (0.21.3)
Requirement already satisfied, skipping upgrade: numpy>=1.11.0 in /usr/lo
cal/lib/python3.6/dist-packages (from scikit-learn) (1.17.4)
Requirement already satisfied, skipping upgrade: joblib>=0.11 in /usr/loc
al/lib/python3.6/dist-packages (from scikit-learn) (0.14.0)
Requirement already satisfied, skipping upgrade: scipy>=0.17.0 in /usr/lo
cal/lib/python3.6/dist-packages (from scikit-learn) (1.3.2)
```

Load Data File

Load data file. We sperate loading training data and testing. And define variables which can represent file path.

```
In [0]: nb_classes = 397
img_depth = 3
data_dir = '/content/drive/My Drive/Colab Notebooks/SUN_Practice/'+'SUN397'
train_img_file = '/content/drive/My Drive/Colab Notebooks/SUN_Practice/Part
test_img_file = '/content/drive/My Drive/Colab Notebooks/SUN_Practice/Parti
classes_name_list = '/content/drive/My Drive/Colab Notebooks/SUN_Practice/F
train_label_file = '/content/drive/My Drive/Colab Notebooks/SUN_Practice/Par
test_label_file = '/content/drive/My Drive/Colab Notebooks/SUN_Practice/Par

train_img_file_path='/content/drive/My Drive/Colab Notebooks/SUN_Practice/F
test_img_file_path='/content/drive/My Drive/Colab Notebooks/SUN_Practice/Pa
```

```
In [4]: print(train_img_file)

/content/drive/My Drive/Colab Notebooks/SUN_Practice/Partitions/Training_
01.txt
```

```
In [5]: print(classes_name_list)

/content/drive/My Drive/Colab Notebooks/SUN_Practice/Partitions/ClassNam
e.txt
```

```
In [6]: print('Begin to create a map to transfer the str label to int label...')

Begin to create a map to transfer the str label to int label...
```

```
In [0]: class_name_file = classes_name_list
```

Through class_name_file, we can get each class using readlines function. And using split() function to remove '\n'

```
In [0]: class_str = [str(line.strip()) for line in open(class_name_file).readlines(
```

```
In [9]: print(class_str)
```

```
['/a/abbey', '/a/airplane_cabin', '/a/airport_terminal', '/a/alley', '/a/amphitheater', '/a/amusement_arcade', '/a/amusement_park', '/a/anechoic_chamber', '/a/apartment_building/outdoor', '/a/apse/indoor', '/a/aquarium', '/a/aqueduct', '/a/arch', '/a/archive', '/a/arrival_gate/outdoor', '/a/art_gallery', '/a/art_school', '/a/art_studio', '/a/assembly_line', '/a/athletic_field/outdoor', '/a/atrium/public', '/a/attic', '/a/auditorium', '/a/auto_factory', '/b/badlands', '/b/badminton_court/indoor', '/b/baggage_claim', '/b/bakery/shop', '/b/balcony/exterior', '/b/balcony/interior', '/b/ball_pit', '/b/ballroom', '/b/bamboo_forest', '/b/banquet_hall', '/b/bar', '/b/barn', '/b/barndoor', '/b/baseball_field', '/b/basement', '/b/basilica', '/b/basketball_court/outdoor', '/b/bathroom', '/b/batters_box', '/b/bayou', '/b/bazaar/indoor', '/b/bazaar/outdoor', '/b/beach', '/b/beauty_salon', '/b/bedroom', '/b/berth', '/b/biology_laboratory', '/b/bistro/indoor', '/b/boardwalk', '/b/boat_deck', '/b/boathouse', '/b/bookstore', '/b/booth/indoor', '/b/botanical_garden', '/b/bow_window/indoor', '/b/bow_window/outdoor', '/b/bowling_alley', '/b/boxing_ring', '/b/brewery/indoor', '/b/bridge', '/b/building_facade', '/b/bullring', '/b/burial_chamber', '/b/bus_interior', '/b/butchers_shop', '/b/butte', '/c/cabin/outdoor', '/c/cafeteria', '/c/campsite', '/c/campus', '/c/canal/natural', '/c/canal/urban', '/c/candy_store', '/c/canyon', '/c/car_interior/backseat', '/c/car_interior/frontseat', '/c/carrousel', '/c/casino/indoor', '/c/castle', '/c/catacomb', '/c/cathedral/indoor', '/c/cathedral/outdoor', '/c/cavern/indoor', '/c/cemetery', '/c/chalet', '/c/cheese_factory', '/c/chemistry_lab', '/c/chicken_coop/indoor', '/c/chicken_coop/outdoor', '/c/childs_room', '/c/church/indoor', '/c/church/outdoor', '/c/classroom', '/c/clean_room', '/c/cliff', '/c/cloister/indoor', '/c/closet', '/c/clothing_store', '/c/coast', '/c/cockpit', '/c/coffee_shop', '/c/computer_room', '/c/conference_center', '/c/conference_room', '/c/construction_site', '/c/control_room', '/c/control_tower/outdoor', '/c/corn_field', '/c/corral', '/c/corridor', '/c/cottage_garden', '/c/courthouse', '/c/courtroom', '/c/courtyard', '/c/covered_bridge/exterior', '/c/creek', '/c/crevasse', '/c/crosswalk', '/c/cubicle/office', '/d/dam', '/d/delicatessen', '/d/dentists_office', '/d/desert/sand', '/d/desert/vegetation', '/d/diner/indoor', '/d/diner/outdoor', '/d/dinette/home', '/d/dinette/vehicle', '/d/dining_car', '/d/dining_room', '/d/discotheque', '/d/dock', '/d/doorway/outdoor', '/d/dorm_room', '/d/driveway', '/d/driving_range/outdoor', '/d/drugstore', '/e/electrical_substation', '/e/elevator/door', '/e/elevator/interior', '/e/elevator_shaft', '/e/engine_room', '/e/escalator/indoor', '/e/excavation', '/f/factory/indoor', '/f/fairway', '/f/fastfood_restaurant', '/f/field/cultivated', '/f/field/wild', '/f/fire_escape', '/f/fire_station', '/f/firing_range/indoor', '/f/fishpond', '/f/florist_shop/indoor', '/f/food_court', '/f/forest/broadleaf', '/f/forest/needleleaf', '/f/forest_path', '/f/forest_road', '/f/formal_garden', '/f/fountain', '/g/galley', '/g/game_room', '/g/garage/indoor', '/g/garbage_dump', '/g/gas_station', '/g/gazebo/exterior', '/g/general_store/indoor', '/g/general_store/outdoor', '/g/gift_shop', '/g/golf_course', '/g/greenhouse/indoor', '/g/greenhouse/outdoor', '/g/gymnasium/indoor', '/h/hangar/indoor', '/h/hangar/outdoor', '/h/harbor', '/h/hayfield', '/h/heliport', '/h/herb_garden', '/h/highway', '/h/hill', '/h/home_office', '/h/hospital', '/h/hospital_room', '/h/hot_spring', '/h/hot_tub/outdoor', '/h/hotel/outdoor', '/h/hotel_room', '/h/house', '/h/hunting_lodge/outdoor', '/i/ice_cream_parlor', '/i/ice_floe', '/i/ice_shelf', '/i/ice_skating_rink/indoor', '/i/ice_skating_rink/outdoor', '/i/iceberg', '/i/igloo', '/i/industrial_area', '/i/inn/outdoor', '/i/islet', '/j/jacuzzi/indoor', '/j/jail/indoor', '/j/jail_cell', '/j/jewelry_shop', '/k/kasbah', '/k/kennel/indoor', '/k/kennel/outdoor', '/
```

```
k/kindergarden_classroom', '/k/kitchen', '/k/kitchenette', '/l/labyrinth/
outdoor', '/l/lake/natural', '/l/landfill', '/l/landing_deck', '/l/laundr
omat', '/l/lecture_room', '/l/library/indoor', '/l/library/outdoor', '/l/
lido_deck/outdoor', '/l/lift_bridge', '/l/lighthouse', '/l/limousine_inte
rior', '/l/living_room', '/l/lobby', '/l/lock_chamber', '/l/locker_room',
'/m/mansion', '/m/manufactured_home', '/m/market/indoor', '/m/market/outd
oor', '/m/marsh', '/m/martial_arts_gym', '/m/mausoleum', '/m/medina', '/
m/moat/water', '/m/monastery/outdoor', '/m/mosque/indoor', '/m/mosque/out
door', '/m/motel', '/m/mountain', '/m/mountain_snowy', '/m/movie_theater/
indoor', '/m/museum/indoor', '/m/music_store', '/m/music_studio', '/n/nuc
lear_power_plant/outdoor', '/n/nursery', '/o/oast_house', '/o/observator
y/outdoor', '/o/ocean', '/o/office', '/o/office_building', '/o/oil_refine
ry/outdoor', '/o/oilrig', '/o/operating_room', '/o/orchard', '/o/outhous
e/outdoor', '/p/pagoda', '/p/palace', '/p/pantry', '/p/park', '/p/parking
_garage/indoor', '/p/parking_garage/outdoor', '/p/parking_lot', '/p/parlo
r', '/p/pasture', '/p/patio', '/p/pavilion', '/p/pharmacy', '/p/phone_boo
th', '/p/physics_laboratory', '/p/picnic_area', '/p/pilothouse/indoor',
'/p/planetarium/outdoor', '/p/playground', '/p/playroom', '/p/plaza', '/
p/podium/indoor', '/p/podium/outdoor', '/p/pond', '/p/poolroom/establishm
ent', '/p/poolroom/home', '/p/power_plant/outdoor', '/p/promenade_deck',
'/p/pub/indoor', '/p/pulpit', '/p/putting_green', '/r/racecourse', '/r/ra
ceway', '/r/raft', '/r/railroad_track', '/r/rainforest', '/r/reception',
'/r/recreation_room', '/r/residential_neighborhood', '/r/restaurant', '/
r/restaurant_kitchen', '/r/restaurant_patio', '/r/rice_paddy', '/r/riding
_arena', '/r/river', '/r/rock_arch', '/r/rope_bridge', '/r/ruin', '/r/run
way', '/s/sandbar', '/s/sandbox', '/s/sauna', '/s/schoolhouse', '/s/sea_c
liff', '/s/server_room', '/s/shed', '/s/shoe_shop', '/s/shopfront', '/s/s
hopping_mall/indoor', '/s/shower', '/s/skatepark', '/s/ski_lodge', '/s/sk
i_resort', '/s/ski_slope', '/s/sky', '/s/skyscraper', '/s/slum', '/s/snow
field', '/s/squash_court', '/s/stable', '/s/stadium/baseball', '/s/stadiu
m/football', '/s/stage/indoor', '/s/staircase', '/s/street', '/s/subway_i
nterior', '/s/subway_station/platform', '/s/supermarket', '/s/sushi_bar',
'/s/swamp', '/s/swimming_pool/indoor', '/s/swimming_pool/outdoor', '/s/sy
nagogue/indoor', '/s/synagogue/outdoor', '/t/television_studio', '/t/temp
le/east_asia', '/t/temple/south_asia', '/t/tennis_court/indoor', '/t/tenn
is_court/outdoor', '/t/tent/outdoor', '/t/theater/indoor_procenium', '/t/
theater/indoor_seats', '/t/thriftshop', '/t/throne_room', '/t/ticket_boot
h', '/t/toll_plaza', '/t/topiary_garden', '/t/tower', '/t/toyshop', '/t/t
rack/outdoor', '/t/train_railway', '/t/train_station/platform', '/t/tree_
farm', '/t/tree_house', '/t/trench', '/u/underwater/coral_reef', '/u/util
ity_room', '/v/valley', '/v/van_interior', '/v/vegetable_garden', '/v/ver
anda', '/v/veterinarians_office', '/v/viaduct', '/v/videostore', '/v/vill
age', '/v/vineyard', '/v/volcano', '/v/volleyball_court/indoor', '/v/voll
eyball_court/outdoor', '/w/waiting_room', '/w/warehouse/indoor', '/w/wate
r_tower', '/w/waterfall/block', '/w/waterfall/fan', '/w/waterfall/plung
e', '/w/watering_hole', '/w/wave', '/w/wet_bar', '/w/wheat_field', '/w/wi
nd_farm', '/w/windmill', '/w/wine_cellar/barrel_storage', '/w/wine_cella
r/bottle_storage', '/w/wrestling_ring/indoor', '/y/yard', '/y/youth_hoste
l']
```

```
In [10]: class_count = len(class_str)
print('%d class names are loaded' % class_count)
```

397 class names are loaded

begin to create the map

Using preprocessing.LabelEncoder function to encode labels with value between 0 and n_classes-1. It can be used to transform non-numerical labels (as long as they are hashable and comparable) to numerical labels.

```
In [0]: le = preprocessing.LabelEncoder()
```

Fit label encoder

```
In [12]: le.fit(class_str)
```

```
Out[12]: LabelEncoder()
```

```
In [13]: print(list(le.classes_))
print('Label map created...')
```

```
['/a/abbey', '/a/airplane_cabin', '/a/airport_terminal', '/a/alley', '/a/
amphitheater', '/a/amusement_arcade', '/a/amusement_park', '/a/anechoic_c
hamber', '/a/apartment_building/outdoor', '/a/apse/indoor', '/a/aquariu
m', '/a/aqueduct', '/a/arch', '/a/archive', '/a/arrival_gate/outdoor', '/
a/art_gallery', '/a/art_school', '/a/art_studio', '/a/assembly_line', '/
a/athletic_field/outdoor', '/a/atrium/public', '/a/attic', '/a/auditoriu
m', '/a/auto_factory', '/b/badlands', '/b/badminton_court/indoor', '/b/ba
ggage_claim', '/b/bakery/shop', '/b/balcony/exterior', '/b/balcony/interi
or', '/b/ball_pit', '/b/ballroom', '/b/bamboo_forest', '/b/banquet_hall',
'/b/bar', '/b/barn', '/b/barndoor', '/b/baseball_field', '/b/basement',
'/b/basilica', '/b/basketball_court/outdoor', '/b/bathroom', '/b/batters_
box', '/b/bayou', '/b/bazaar/indoor', '/b/bazaar/outdoor', '/b/beach', '/
b/beauty_salon', '/b/bedroom', '/b/berth', '/b/biology_laboratory', '/b/b
istro/indoor', '/b/boardwalk', '/b/boat_deck', '/b/boathouse', '/b/bookst
ore', '/b/booth/indoor', '/b/botanical_garden', '/b/bow_window/indoor',
'/b/bow_window/outdoor', '/b/bowling_alley', '/b/boxing_ring', '/b/brewer
y/indoor', '/b/bridge', '/b/building_facade', '/b/bullring', '/b/burial_c
hamber', '/b/bus_interior', '/b/butchers_shop', '/b/butte', '/c/cabin/out
door', '/c/cafeteria', '/c/campsite', '/c/campus', '/c/canal/natural', '/
c/canal/urban', '/c/candy_store', '/c/canyon', '/c/car_interior/backsea
t', '/c/car_interior/frontseat', '/c/carrousel', '/c/casino/indoor', '/c/
castle', '/c/catacomb', '/c/cathedral/indoor', '/c/cathedral/outdoor', '/
c/cavern/indoor', '/c/cemetery', '/c/chalet', '/c/cheese_factory', '/c/ch
emistry_lab', '/c/chicken_coop/indoor', '/c/chicken_coop/outdoor', '/c/ch
ilds_room', '/c/church/indoor', '/c/church/outdoor', '/c/classroom', '/c/
clean_room', '/c/cliff', '/c/cloister/indoor', '/c/closet', '/c/clothing_
store', '/c/coast', '/c/cockpit', '/c/coffee_shop', '/c/computer_room',
'/c/conference_center', '/c/conference_room', '/c/construction_site', '/
c/control_room', '/c/control_tower/outdoor', '/c/corn_field', '/c/corra
l', '/c/corridor', '/c/cottage_garden', '/c/courthouse', '/c/courtroom',
'/c/courtyard', '/c/covered_bridge/exterior', '/c/creek', '/c/crevasse',
'/c/crosswalk', '/c/cubicle/office', '/d/dam', '/d/delicatessen', '/d/den
tists_office', '/d/desert/sand', '/d/desert/vegetation', '/d/diner/indoo
r', '/d/diner/outdoor', '/d/dinette/home', '/d/dinette/vehicle', '/d/dini
ng_car', '/d/dining_room', '/d/discotheque', '/d/dock', '/d/doorway/outdo
or', '/d/dorm_room', '/d/driveway', '/d/driving_range/outdoor', '/d/drugs
tore', '/e/electrical_substation', '/e/elevator/door', '/e/elevator/interi
or', '/e/elevator_shaft', '/e/engine_room', '/e/escalator/indoor', '/e/e
xcavation', '/f/factory/indoor', '/f/fairway', '/f/fastfood_restaurant',
'/f/field/cultivated', '/f/field/wild', '/f/fire_escape', '/f/fire_statio
n', '/f/firing_range/indoor', '/f/fishpond', '/f/florist_shop/indoor', '/
f/food_court', '/f/forest/broadleaf', '/f/forest/needleleaf', '/f/forest_
path', '/f/forest_road', '/f/formal_garden', '/f/fountain', '/g/galley',
'/g/game_room', '/g/garage/indoor', '/g/garbage_dump', '/g/gas_station',
'/g/gazebo/exterior', '/g/general_store/indoor', '/g/general_store/outdoo
r', '/g/gift_shop', '/g/golf_course', '/g/greenhouse/indoor', '/g/greenho
use/outdoor', '/g/gymnasium/indoor', '/h/hangar/indoor', '/h/hangar/outdo
or', '/h/harbor', '/h/hayfield', '/h/heliport', '/h/herb_garden', '/h/hig
hway', '/h/hill', '/h/home_office', '/h/hospital', '/h/hospital_room', '/
h/hot_spring', '/h/hot_tub/outdoor', '/h/hotel/outdoor', '/h/hotel_room',
'/h/house', '/h/hunting_lodge/outdoor', '/i/ice_cream_parlor', '/i/ice_fl
oe', '/i/ice_shelf', '/i/ice_skating_rink/indoor', '/i/ice_skating_rink/o
utdoor', '/i/iceberg', '/i/igloo', '/i/industrial_area', '/i/inn/outdoo
r', '/i/islet', '/j/jacuzzi/indoor', '/j/jail/indoor', '/j/jail_cell', '/
```



```
j/jewelry_shop', '/k/kasbah', '/k/kennel/indoor', '/k/kennel/outdoor', '/k/kindergarden_classroom', '/k/kitchen', '/k/kitchenette', '/l/labyrinth/outdoor', '/l/lake/natural', '/l/landfill', '/l/landing_deck', '/l/laundromat', '/l/lecture_room', '/l/library/indoor', '/l/library/outdoor', '/l/lido_deck/outdoor', '/l/lift_bridge', '/l/lighthouse', '/l/limousine_interior', '/l/living_room', '/l/lobby', '/l/lock_chamber', '/l/locker_room', '/m/mansion', '/m/manufactured_home', '/m/market/indoor', '/m/market/outdoor', '/m/marsh', '/m/martial_arts_gym', '/m/mausoleum', '/m/medina', '/m/moat/water', '/m/monastery/outdoor', '/m/mosque/indoor', '/m/mosque/outdoor', '/m/motel', '/m/mountain', '/m/mountain_snowy', '/m/movie_theater/indoor', '/m/museum/indoor', '/m/music_store', '/m/music_studio', '/n/nuclear_power_plant/outdoor', '/n/nursery', '/o/oast_house', '/o/observatory/outdoor', '/o/ocean', '/o/office', '/o/office_building', '/o/oil_refinery/outdoor', '/o/oilrig', '/o/operating_room', '/o/orchard', '/o/outhouse/outdoor', '/p/pagoda', '/p/palace', '/p/pantry', '/p/park', '/p/parking_garage/indoor', '/p/parking_garage/outdoor', '/p/parking_lot', '/p/parlor', '/p/pasture', '/p/patio', '/p/pavilion', '/p/pharmacy', '/p/phone_booth', '/p/physics_laboratory', '/p/picnic_area', '/p/pilothouse/indoor', '/p/planetarium/outdoor', '/p/playground', '/p/playroom', '/p/plaza', '/p/podium/indoor', '/p/podium/outdoor', '/p/pond', '/p/poolroom/establishment', '/p/poolroom/home', '/p/power_plant/outdoor', '/p/promenade_deck', '/p/pub/indoor', '/p/pulpit', '/p/putting_green', '/r/racecourse', '/r/raceway', '/r/raft', '/r/railroad_track', '/r/rainforest', '/r/reception', '/r/recreation_room', '/r/residential_neighborhood', '/r/restaurant', '/r/restaurant_kitchen', '/r/restaurant_patio', '/r/rice_paddy', '/r/riding_arena', '/r/river', '/r/rock_arch', '/r/rope_bridge', '/r/ruin', '/r/runway', '/s/sandbar', '/s/sandbox', '/s/sauna', '/s/schoolhouse', '/s/sea_cliff', '/s/server_room', '/s/shed', '/s/shoe_shop', '/s/shopfront', '/s/shopping_mall/indoor', '/s/shower', '/s/skatepark', '/s/ski_lodge', '/s/ski_resort', '/s/ski_slope', '/s/sky', '/s/skyscraper', '/s/slum', '/s/snowfield', '/s/squash_court', '/s/stable', '/s/stadium/baseball', '/s/stadium/football', '/s/stage/indoor', '/s/staircase', '/s/street', '/s/subway_interior', '/s/subway_station/platform', '/s/supermarket', '/s/sushi_bar', '/s/swamp', '/s/swimming_pool/indoor', '/s/swimming_pool/outdoor', '/s/synagogue/indoor', '/s/synagogue/outdoor', '/t/television_studio', '/t/temple/east_asia', '/t/temple/south_asia', '/t/tennis_court/indoor', '/t/tennis_court/outdoor', '/t/tent/outdoor', '/t/theater/indoor_proscenium', '/t/theater/indoor_seats', '/t/thriftshop', '/t/throne_room', '/t/ticket_booth', '/t/toll_plaza', '/t/topiary_garden', '/t/tower', '/t/toyshop', '/t/track/outdoor', '/t/train_railway', '/t/train_station/platform', '/t/tree_farm', '/t/tree_house', '/t/trench', '/u/underwater/coral_reef', '/u/utility_room', '/v/valley', '/v/van_interior', '/v/vegetable_garden', '/v/veranda', '/v/veterinarians_office', '/v/viaduct', '/v/videostore', '/v/village', '/v/vineyard', '/v/volcano', '/v/volleyball_court/indoor', '/v/volleyball_court/outdoor', '/w/waiting_room', '/w/warehouse/indoor', '/w/water_tower', '/w/waterfall/block', '/w/waterfall/fan', '/w/waterfall/plunge', '/w/watering_hole', '/w/wave', '/w/wet_bar', '/w/wheat_field', '/w/wind_farm', '/w/windmill', '/w/wine_cellar/barrel_storage', '/w/wine_cellar/bottle_storage', '/w/wrestling_ring/indoor', '/y/yard', '/y/youth_hostel']
```

Label map created...

load training data

```
In [14]: print('\nBegin to load training data...\n')
desired_img_dim=224
print('Loading image file %s' % train_img_file_path)
#train_img_file_path = data_dir + train_img_file
#train_label_file_path = data_dir + train_label_file
```

Begin to load training data...

Loading image file /content/drive/My Drive/Colab Notebooks/SUN_Practice/Partitions/Training_01.txt

read all the image file name

```
In [15]: start_time_ = time.time()
train_img_file_path = [str(line.strip()) for line in open(train_img_file_path)]
nb_sample = len(train_img_file_path)
print('Image count: %d' % nb_sample)
```

Image count: 19850

Firstly, we use np.empty to create data_resized_holder which just contain non-meaning value : zero

```
In [0]: data_resized_holder = np.empty([nb_sample, desired_img_dim, desired_img_dim])
```

```
In [17]: data_resized_holder.shape
```

```
Out[17]: (19850, 224, 224, 3)
```

```
In [20]: print(data_dir)
print(data_dir+img_file1)
```

/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/y/youth_hosted
1/sun_ammfvvfoiqxeovyl.jpg

```
In [19]: for idx in range(nb_sample):
          img_file1 = train_img_file_path[idx].replace("\\", "/")      # the image
          print(img_file1)
          # print(img_file1)
/a/abbey/sun_akighlforrjygtkv.jpg
/a/abbey/sun_aakbdcgfpksytcwj.jpg
/a/abbey/sun_aqyoszxqzenqukbn.jpg
/a/abbey/sun_aesfrdpuprlhzzss.jpg
/a/abbey/sun_anunhwbsxmmdzwmk.jpg
/a/abbey/sun_aamvxnvoucstkjb.jpg
/a/abbey/sun_asvrsxpizfhvufq.jpg
/a/abbey/sun_ajgccggyendxydwa.jpg
/a/abbey/sun_atghahjqptwxcnbu.jpg
/a/abbey/sun_afuhbsqqwerjshqj.jpg
/a/abbey/sun_acguwqihawgzdnju.jpg
/a/abbey/sun_aggditxsglyqqgsk.jpg
/a/abbey/sun_alqgvwyohunprcsh.jpg
/a/abbey/sun_axcwnadpsaegsupw.jpg
/a/abbey/sun_argijfirtajgytjrs.jpg
/a/abbey/sun_ayahbvkpizprwkbw.jpg
/a/abbey/sun_awbmttvnojoatvva.jpg
/a/abbey/sun_akkyidsxmnaeupuv.jpg
/a/abbey/sun_ayqybhyaetvpnyts.jpg
/a/abbey/sun_atbsoznnhinmofa.jpg
```

We get the img_file1 and then use this file path we can load image, get each image and resize it to our expected dimension ,and then give to the holder

In [0]:

```

for idx in range(nb_sample):
    img_file1 = train_img_file_path[idx].replace("\\", "/")      # the image
    # print(str(img_file1))
    # 1. read the image
    img1 = image.load_img(data_dir+img_file1)

    # 2. resize
    img1 = img1.resize((desired_img_dim, desired_img_dim), resample=0)

    # 6. give to the holder
    data_resized_holder[idx] = img1
    if(idx % 1000==0):
        print('%d image loaded.' % idx)

print('\nImage file loaded, the shape is ' + str(data_resized_holder.shape))

```

```

Image count: 19850
0 image loaded.
1000 image loaded.
2000 image loaded.
3000 image loaded.
4000 image loaded.
5000 image loaded.
6000 image loaded.
7000 image loaded.
8000 image loaded.
9000 image loaded.
10000 image loaded.

```

In [0]: x_train.shape

Out[12]: (0,)

loading the training labels text

In [23]:

```

one_hot = True
print('Loading label file %s' % train_label_file)
label_str = [str(line.strip()) for line in open(train_label_file).readlines]

Loading label file /content/drive/My Drive/Colab Notebooks/SUN_Practice/P
artitions/ClassName.txt

```

```
In [24]: print(label_str)
```

```
['/a/abbey', '/a/airplane_cabin', '/a/airport_terminal', '/a/alley', '/a/amphitheater', '/a/amusement_arcade', '/a/amusement_park', '/a/anechoic_chamber', '/a/apartment_building/outdoor', '/a/apse/indoor', '/a/aquarium', '/a/aqueduct', '/a/arch', '/a/archive', '/a/arrival_gate/outdoor', '/a/art_gallery', '/a/art_school', '/a/art_studio', '/a/assembly_line', '/a/athletic_field/outdoor', '/a/atrium/public', '/a/attic', '/a/auditorium', '/a/auto_factory', '/b/badlands', '/b/badminton_court/indoor', '/b/baggage_claim', '/b/bakery/shop', '/b/balcony/exterior', '/b/balcony/interior', '/b/ball_pit', '/b/ballroom', '/b/bamboo_forest', '/b/banquet_hall', '/b/bar', '/b/barn', '/b/barndoor', '/b/baseball_field', '/b/basement', '/b/basilica', '/b/basketball_court/outdoor', '/b/bathroom', '/b/batters_box', '/b/bayou', '/b/bazaar/indoor', '/b/bazaar/outdoor', '/b/beach', '/b/beauty_salon', '/b/bedroom', '/b/berth', '/b/biology_laboratory', '/b/bistro/indoor', '/b/boardwalk', '/b/boat_deck', '/b/boathouse', '/b/bookstore', '/b/booth/indoor', '/b/botanical_garden', '/b/bow_window/indoor', '/b/bow_window/outdoor', '/b/bowling_alley', '/b/boxing_ring', '/b/brewery/indoor', '/b/bridge', '/b/building_facade', '/b/bullring', '/b/burial_chamber', '/b/bus_interior', '/b/butchers_shop', '/b/butte', '/c/cabin/outdoor', '/c/cafeteria', '/c/campsite', '/c/campus', '/c/canal/natural', '/c/canal/urban', '/c/candy_store', '/c/canyon', '/c/car_interior/backseat', '/c/car_interior/frontseat', '/c/carrousel', '/c/casino/indoor', '/c/castle', '/c/catacomb', '/c/cathedral/indoor', '/c/cathedral/outdoor', '/c/cavern/indoor', '/c/cemetery', '/c/chalet', '/c/cheese_factory', '/c/chemistry_lab', '/c/chicken_coop/indoor', '/c/chicken_coop/outdoor', '/c/childs_room', '/c/church/indoor', '/c/church/outdoor', '/c/classroom', '/c/clean_room', '/c/cliff', '/c/cloister/indoor', '/c/closet', '/c/clothing_store', '/c/coast', '/c/cockpit', '/c/coffee_shop', '/c/computer_room', '/c/conference_center', '/c/conference_room', '/c/construction_site', '/c/control_room', '/c/control_tower/outdoor', '/c/corn_field', '/c/corral', '/c/corridor', '/c/cottage_garden', '/c/courthouse', '/c/courtroom', '/c/courtyard', '/c/covered_bridge/exterior', '/c/creek', '/c/crevasse', '/c/crosswalk', '/c/cubicle/office', '/d/dam', '/d/delicatessen', '/d/dentists_office', '/d/desert/sand', '/d/desert/vegetation', '/d/diner/indoor', '/d/diner/outdoor', '/d/dinette/home', '/d/dinette/vehicle', '/d/dining_car', '/d/dining_room', '/d/discotheque', '/d/dock', '/d/doorway/outdoor', '/d/dorm_room', '/d/driveway', '/d/driving_range/outdoor', '/d/drugstore', '/e/electrical_substation', '/e/elevator/door', '/e/elevator/interior', '/e/elevator_shaft', '/e/engine_room', '/e/escalator/indoor', '/e/excavation', '/f/factory/indoor', '/f/fairway', '/f/fastfood_restaurant', '/f/field/cultivated', '/f/field/wild', '/f/fire_escape', '/f/fire_station', '/f/firing_range/indoor', '/f/fishpond', '/f/florist_shop/indoor', '/f/food_court', '/f/forest/broadleaf', '/f/forest/needleleaf', '/f/forest_path', '/f/forest_road', '/f/formal_garden', '/f/fountain', '/g/galley', '/g/game_room', '/g/garage/indoor', '/g/garbage_dump', '/g/gas_station', '/g/gazebo/exterior', '/g/general_store/indoor', '/g/general_store/outdoor', '/g/gift_shop', '/g/golf_course', '/g/greenhouse/indoor', '/g/greenhouse/outdoor', '/g/gymnasium/indoor', '/h/hangar/indoor', '/h/hangar/outdoor', '/h/harbor', '/h/hayfield', '/h/heliport', '/h/herb_garden', '/h/highway', '/h/hill', '/h/home_office', '/h/hospital', '/h/hospital_room', '/h/hot_spring', '/h/hot_tub/outdoor', '/h/hotel/outdoor', '/h/hotel_room', '/h/house', '/h/hunting_lodge/outdoor', '/i/ice_cream_parlor', '/i/ice_floe', '/i/ice_shelf', '/i/ice_skating_rink/indoor', '/i/ice_skating_rink/outdoor', '/i/iceberg', '/i/igloo', '/i/industrial_area', '/i/inn/outdoor', '/i/islet', '/j/jacuzzi/indoor', '/j/jail/indoor', '/j/jail_cell', '/j/jewelry_shop', '/k/kasbah', '/k/kennel/indoor', '/k/kennel/outdoor', '/
```

```
k/kindergarden_classroom', '/k/kitchen', '/k/kitchenette', '/l/labyrinth/
outdoor', '/l/lake/natural', '/l/landfill', '/l/landing_deck', '/l/laundr
omat', '/l/lecture_room', '/l/library/indoor', '/l/library/outdoor', '/l/
lido_deck/outdoor', '/l/lift_bridge', '/l/lighthouse', '/l/limousine_inte
rior', '/l/living_room', '/l/lobby', '/l/lock_chamber', '/l/locker_room',
'/m/mansion', '/m/manufactured_home', '/m/market/indoor', '/m/market/outd
oor', '/m/marsh', '/m/martial_arts_gym', '/m/mausoleum', '/m/medina', '/
m/moat/water', '/m/monastery/outdoor', '/m/mosque/indoor', '/m/mosque/out
door', '/m/motel', '/m/mountain', '/m/mountain_snowy', '/m/movie_theater/
indoor', '/m/museum/indoor', '/m/music_store', '/m/music_studio', '/n/nuc
lear_power_plant/outdoor', '/n/nursery', '/o/oast_house', '/o/observator
y/outdoor', '/o/ocean', '/o/office', '/o/office_building', '/o/oil_refine
ry/outdoor', '/o/oilrig', '/o/operating_room', '/o/orchard', '/o/outhous
e/outdoor', '/p/pagoda', '/p/palace', '/p/pantry', '/p/park', '/p/parking
_garage/indoor', '/p/parking_garage/outdoor', '/p/parking_lot', '/p/parlo
r', '/p/pasture', '/p/patio', '/p/pavilion', '/p/pharmacy', '/p/phone_boo
th', '/p/physics_laboratory', '/p/picnic_area', '/p/pilothouse/indoor',
'/p/planetarium/outdoor', '/p/playground', '/p/playroom', '/p/plaza', '/
p/podium/indoor', '/p/podium/outdoor', '/p/pond', '/p/poolroom/establishm
ent', '/p/poolroom/home', '/p/power_plant/outdoor', '/p/promenade_deck',
'/p/pub/indoor', '/p/pulpit', '/p/putting_green', '/r/racecourse', '/r/ra
ceway', '/r/raft', '/r/railroad_track', '/r/rainforest', '/r/reception',
'/r/recreation_room', '/r/residential_neighborhood', '/r/restaurant', '/
r/restaurant_kitchen', '/r/restaurant_patio', '/r/rice_paddy', '/r/riding
_arena', '/r/river', '/r/rock_arch', '/r/rope_bridge', '/r/ruin', '/r/run
way', '/s/sandbar', '/s/sandbox', '/s/sauna', '/s/schoolhouse', '/s/sea_c
liff', '/s/server_room', '/s/shed', '/s/shoe_shop', '/s/shopfront', '/s/s
hopping_mall/indoor', '/s/shower', '/s/skatepark', '/s/ski_lodge', '/s/sk
i_resort', '/s/ski_slope', '/s/sky', '/s/skyscraper', '/s/slum', '/s/snow
field', '/s/squash_court', '/s/stable', '/s/stadium/baseball', '/s/stadiu
m/football', '/s/stage/indoor', '/s/staircase', '/s/street', '/s/subway_i
nterior', '/s/subway_station/platform', '/s/supermarket', '/s/sushi_bar',
'/s/swamp', '/s/swimming_pool/indoor', '/s/swimming_pool/outdoor', '/s/sy
nagogue/indoor', '/s/synagogue/outdoor', '/t/television_studio', '/t/temp
le/east_asia', '/t/temple/south_asia', '/t/tennis_court/indoor', '/t/tenn
is_court/outdoor', '/t/tent/outdoor', '/t/theater/indoor_procenium', '/t/
theater/indoor_seats', '/t/thriftshop', '/t/throne_room', '/t/ticket_boot
h', '/t/toll_plaza', '/t/topiary_garden', '/t/tower', '/t/toyshop', '/t/t
rack/outdoor', '/t/train_railway', '/t/train_station/platform', '/t/tree_
farm', '/t/tree_house', '/t/trench', '/u/underwater/coral_reef', '/u/util
ity_room', '/v/valley', '/v/van_interior', '/v/vegetable_garden', '/v/ver
anda', '/v/veterinarians_office', '/v/viaduct', '/v/videostore', '/v/vill
age', '/v/vineyard', '/v/volcano', '/v/volleyball_court/indoor', '/v/voll
eyball_court/outdoor', '/w/waiting_room', '/w/warehouse/indoor', '/w/wate
r_tower', '/w/waterfall/block', '/w/waterfall/fan', '/w/waterfall/plung
e', '/w/watering_hole', '/w/wave', '/w/wet_bar', '/w/wheat_field', '/w/wi
nd_farm', '/w/windmill', '/w/wine_cellar/barrel_storage', '/w/wine_cella
r/bottle_storage', '/w/wrestling_ring/indoor', '/y/yard', '/y/youth_hoste
l']
```

Transform Categories Into Integers

```
In [0]: nb_unique = len(label_str)
labels_unique = le.transform(label_str)
```

```
In [26]: print(nb_unique)
```

```
397
```

```
In [27]: print(labels_unique)
```

```
[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396]
```

Stack arrays in sequence horizontally (column wise).And choose each label 50 times! in each class

```
In [28]: labels_holder = np.hstack(( [ labels_unique[i] ] * 50 for i in range(nb_un
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:1: FutureWarning: arrays to stack must be passed as a "sequence" type such as list or tuple. Support for non-sequence iterables such as generators is deprecated as of NumPy 1.16 and will raise an error in the future.
```

```
"""Entry point for launching an IPython kernel.
```



```
In [0]: y_train.shape
```

```
Out[37]: (19850, 397)
```

Saving train data and test data

Saving x_train y_train as .npy file

```
In [0]: np.save('/content/drive/My Drive/Colab Notebooks/SUN_Practice/x_train.npy', x_train)
```

```
In [0]: np.save('/content/drive/My Drive/Colab Notebooks/SUN_Practice/y_train.npy', y_train)
```

```
In [0]: del x_train
        #del y_train
```

loading testing data

load testing data

read all the image file name

```
In [31]: print('Loading image file %s' % test_img_file_path )
        start_time_ = time.time()
        test_img_file_path = [str(line.strip()) for line in open(test_img_file_path)]
        nb_sample = len(test_img_file_path)
        print('Image count: %d' % nb_sample)
```

```
Loading image file /content/drive/My Drive/Colab Notebooks/SUN_Practice/Partitions/Testing_01.txt
Image count: 19850
```

Firstly, we use np.empty to create data_resized_holder which just contain non-meaning value : zero

```
In [0]: data_resized_holder = np.empty([nb_sample, desired_img_dim, desired_img_dim])
```

```
In [33]: data_resized_holder.shape
```

```
Out[33]: (19850, 224, 224, 3)
```

```
In [34]: for idx in range(nb_sample):  
         img_file1 = data_dir + test_img_file_path[idx].replace("\\", "/")  
         print(str(img_file1))
```

```
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
jkqrqitspwywirx.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
jhtswxgrqbeiikc.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
hebfjjooupcqbjht.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
mdwiijwnagslgef.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
wzqxzqukmbujwzm.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
upohozmrmtfgcsw.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
lwjgbdpxuskytjo.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
utcnwvjhdroaklu.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a  
kgjeakhepssnilh.jpg  
/content/drive/My Drive/Colab Notebooks/SUN_Practice/SUN397/a/abbey/sun_a
```

read the image

```
In [0]: for idx in range(nb_sample):
        img_file1 = data_dir + test_img_file_path[idx].replace("\\", "/")
        # print(str(img_file1))
        # 1. read the image
        img1 = image.load_img(img_file1)

        # 2. resize
        img1 = img1.resize((desired_img_dim, desired_img_dim), resample=0)

        # 6. give to the holder
        data_resized_holder[idx] = img1
        if(idx % 1000==0):
            print('%d image loaded.' % idx)

print('\nImage file loaded, the shape is ' + str(data_resized_holder.shape))
```

Loading image file /content/drive/My Drive/Colab Notebooks/SUN_Practice/Partitions/Testing_01.txt

Image count: 19850

0 image loaded.

/usr/local/lib/python3.6/dist-packages/PIL/TiffImagePlugin.py:742: UserWarning: Corrupt EXIF data. Expecting to read 4 bytes but only got 0.
warnings.warn(str(msg))

1000 image loaded.

2000 image loaded.

3000 image loaded.

/usr/local/lib/python3.6/dist-packages/PIL/TiffImagePlugin.py:725: UserWarning: Possibly corrupt EXIF data. Expecting to read 4718592 bytes but only got 0. Skipping tag 0
" Skipping tag %s" % (size, len(data), tag))

4000 image loaded.

5000 image loaded.

Load test labels text

```
In [35]: one_hot = True
        # loading the training labels
        print('Loading label file %s' % test_label_file)
        label_str = [str(line.strip()) for line in open(test_label_file).readlines()]
```

Loading label file /content/drive/My Drive/Colab Notebooks/SUN_Practice/Partitions/ClassName.txt

```
In [36]: print(label_str)
```

```
['/a/abbey', '/a/airplane_cabin', '/a/airport_terminal', '/a/alley', '/a/amphitheater', '/a/amusement_arcade', '/a/amusement_park', '/a/anechoic_chamber', '/a/apartment_building/outdoor', '/a/apse/indoor', '/a/aquarium', '/a/aqueduct', '/a/arch', '/a/archive', '/a/arrival_gate/outdoor', '/a/art_gallery', '/a/art_school', '/a/art_studio', '/a/assembly_line', '/a/athletic_field/outdoor', '/a/atrium/public', '/a/attic', '/a/auditorium', '/a/auto_factory', '/b/badlands', '/b/badminton_court/indoor', '/b/baggage_claim', '/b/bakery/shop', '/b/balcony/exterior', '/b/balcony/interior', '/b/ball_pit', '/b/ballroom', '/b/bamboo_forest', '/b/banquet_hall', '/b/bar', '/b/barn', '/b/barndoor', '/b/baseball_field', '/b/basement', '/b/basilica', '/b/basketball_court/outdoor', '/b/bathroom', '/b/batters_box', '/b/bayou', '/b/bazaar/indoor', '/b/bazaar/outdoor', '/b/beach', '/b/beauty_salon', '/b/bedroom', '/b/berth', '/b/biology_laboratory', '/b/bistro/indoor', '/b/boardwalk', '/b/boat_deck', '/b/boathouse', '/b/bookstore', '/b/booth/indoor', '/b/botanical_garden', '/b/bow_window/indoor', '/b/bow_window/outdoor', '/b/bowling_alley', '/b/boxing_ring', '/b/brewery/indoor', '/b/bridge', '/b/building_facade', '/b/bullring', '/b/burial_chamber', '/b/bus_interior', '/b/butchers_shop', '/b/butte', '/c/cabin/outdoor', '/c/cafeteria', '/c/campsite', '/c/campus', '/c/canal/natural', '/c/canal/urban', '/c/candy_store', '/c/canyon', '/c/car_interior/backseat', '/c/car_interior/frontseat', '/c/carrousel', '/c/casino/indoor', '/c/castle', '/c/catacomb', '/c/cathedral/indoor', '/c/cathedral/outdoor', '/c/cavern/indoor', '/c/cemetery', '/c/chalet', '/c/cheese_factory', '/c/chemistry_lab', '/c/chicken_coop/indoor', '/c/chicken_coop/outdoor', '/c/childs_room', '/c/church/indoor', '/c/church/outdoor', '/c/classroom', '/c/clean_room', '/c/cliff', '/c/cloister/indoor', '/c/closet', '/c/clothing_store', '/c/coast', '/c/cockpit', '/c/coffee_shop', '/c/computer_room', '/c/conference_center', '/c/conference_room', '/c/construction_site', '/c/control_room', '/c/control_tower/outdoor', '/c/corn_field', '/c/corral', '/c/corridor', '/c/cottage_garden', '/c/courthouse', '/c/courtroom', '/c/courtyard', '/c/covered_bridge/exterior', '/c/creek', '/c/crevasse', '/c/crosswalk', '/c/cubicle/office', '/d/dam', '/d/delicatessen', '/d/dentists_office', '/d/desert/sand', '/d/desert/vegetation', '/d/diner/indoor', '/d/diner/outdoor', '/d/dinette/home', '/d/dinette/vehicle', '/d/dining_car', '/d/dining_room', '/d/discotheque', '/d/dock', '/d/doorway/outdoor', '/d/dorm_room', '/d/driveway', '/d/driving_range/outdoor', '/d/drugstore', '/e/electrical_substation', '/e/elevator/door', '/e/elevator/interior', '/e/elevator_shaft', '/e/engine_room', '/e/escalator/indoor', '/e/excavation', '/f/factory/indoor', '/f/fairway', '/f/fastfood_restaurant', '/f/field/cultivated', '/f/field/wild', '/f/fire_escape', '/f/fire_station', '/f/firing_range/indoor', '/f/fishpond', '/f/florist_shop/indoor', '/f/food_court', '/f/forest/broadleaf', '/f/forest/needleleaf', '/f/forest_path', '/f/forest_road', '/f/formal_garden', '/f/fountain', '/g/galley', '/g/game_room', '/g/garage/indoor', '/g/garbage_dump', '/g/gas_station', '/g/gazebo/exterior', '/g/general_store/indoor', '/g/general_store/outdoor', '/g/gift_shop', '/g/golf_course', '/g/greenhouse/indoor', '/g/greenhouse/outdoor', '/g/gymnasium/indoor', '/h/hangar/indoor', '/h/hangar/outdoor', '/h/harbor', '/h/hayfield', '/h/heliport', '/h/herb_garden', '/h/highway', '/h/hill', '/h/home_office', '/h/hospital', '/h/hospital_room', '/h/hot_spring', '/h/hot_tub/outdoor', '/h/hotel/outdoor', '/h/hotel_room', '/h/house', '/h/hunting_lodge/outdoor', '/i/ice_cream_parlor', '/i/ice_floe', '/i/ice_shelf', '/i/ice_skating_rink/indoor', '/i/ice_skating_rink/outdoor', '/i/iceberg', '/i/igloo', '/i/industrial_area', '/i/inn/outdoor', '/i/islet', '/j/jacuzzi/indoor', '/j/jail/indoor', '/j/jail_cell', '/j/jewelry_shop', '/k/kasbah', '/k/kennel/indoor', '/k/kennel/outdoor', '/
```

```
k/kindergarden_classroom', '/k/kitchen', '/k/kitchenette', '/l/labyrinth/
outdoor', '/l/lake/natural', '/l/landfill', '/l/landing_deck', '/l/laundr
omat', '/l/lecture_room', '/l/library/indoor', '/l/library/outdoor', '/l/
lido_deck/outdoor', '/l/lift_bridge', '/l/lighthouse', '/l/limousine_inte
rior', '/l/living_room', '/l/lobby', '/l/lock_chamber', '/l/locker_room',
'/m/mansion', '/m/manufactured_home', '/m/market/indoor', '/m/market/outd
oor', '/m/marsh', '/m/martial_arts_gym', '/m/mausoleum', '/m/medina', '/
m/moat/water', '/m/monastery/outdoor', '/m/mosque/indoor', '/m/mosque/out
door', '/m/motel', '/m/mountain', '/m/mountain_snowy', '/m/movie_theater/
indoor', '/m/museum/indoor', '/m/music_store', '/m/music_studio', '/n/nuc
lear_power_plant/outdoor', '/n/nursery', '/o/oast_house', '/o/observator
y/outdoor', '/o/ocean', '/o/office', '/o/office_building', '/o/oil_refine
ry/outdoor', '/o/oilrig', '/o/operating_room', '/o/orchard', '/o/outhous
e/outdoor', '/p/pagoda', '/p/palace', '/p/pantry', '/p/park', '/p/parking
_garage/indoor', '/p/parking_garage/outdoor', '/p/parking_lot', '/p/parlo
r', '/p/pasture', '/p/patio', '/p/pavilion', '/p/pharmacy', '/p/phone_boo
th', '/p/physics_laboratory', '/p/picnic_area', '/p/pilothouse/indoor',
'/p/planetarium/outdoor', '/p/playground', '/p/playroom', '/p/plaza', '/
p/podium/indoor', '/p/podium/outdoor', '/p/pond', '/p/poolroom/establishm
ent', '/p/poolroom/home', '/p/power_plant/outdoor', '/p/promenade_deck',
'/p/pub/indoor', '/p/pulpit', '/p/putting_green', '/r/racecourse', '/r/ra
ceway', '/r/raft', '/r/railroad_track', '/r/rainforest', '/r/reception',
'/r/recreation_room', '/r/residential_neighborhood', '/r/restaurant', '/
r/restaurant_kitchen', '/r/restaurant_patio', '/r/rice_paddy', '/r/riding
_arena', '/r/river', '/r/rock_arch', '/r/rope_bridge', '/r/ruin', '/r/run
way', '/s/sandbar', '/s/sandbox', '/s/sauna', '/s/schoolhouse', '/s/sea_c
liff', '/s/server_room', '/s/shed', '/s/shoe_shop', '/s/shopfront', '/s/s
hopping_mall/indoor', '/s/shower', '/s/skatepark', '/s/ski_lodge', '/s/sk
i_resort', '/s/ski_slope', '/s/sky', '/s/skyscraper', '/s/slum', '/s/snow
field', '/s/squash_court', '/s/stable', '/s/stadium/baseball', '/s/stadiu
m/football', '/s/stage/indoor', '/s/staircase', '/s/street', '/s/subway_i
nterior', '/s/subway_station/platform', '/s/supermarket', '/s/sushi_bar',
'/s/swamp', '/s/swimming_pool/indoor', '/s/swimming_pool/outdoor', '/s/sy
nagogue/indoor', '/s/synagogue/outdoor', '/t/television_studio', '/t/temp
le/east_asia', '/t/temple/south_asia', '/t/tennis_court/indoor', '/t/tenn
is_court/outdoor', '/t/tent/outdoor', '/t/theater/indoor_procenium', '/t/
theater/indoor_seats', '/t/thriftshop', '/t/throne_room', '/t/ticket_boot
h', '/t/toll_plaza', '/t/topiary_garden', '/t/tower', '/t/toyshop', '/t/t
rack/outdoor', '/t/train_railway', '/t/train_station/platform', '/t/tree_
farm', '/t/tree_house', '/t/trench', '/u/underwater/coral_reef', '/u/util
ity_room', '/v/valley', '/v/van_interior', '/v/vegetable_garden', '/v/ver
anda', '/v/veterinarians_office', '/v/viaduct', '/v/videostore', '/v/vill
age', '/v/vineyard', '/v/volcano', '/v/volleyball_court/indoor', '/v/voll
eyball_court/outdoor', '/w/waiting_room', '/w/warehouse/indoor', '/w/wate
r_tower', '/w/waterfall/block', '/w/waterfall/fan', '/w/waterfall/plung
e', '/w/watering_hole', '/w/wave', '/w/wet_bar', '/w/wheat_field', '/w/wi
nd_farm', '/w/windmill', '/w/wine_cellar/barrel_storage', '/w/wine_cella
r/bottle_storage', '/w/wrestling_ring/indoor', '/y/yard', '/y/youth_hoste
l']
```

Transform Categories Into Integers

```
In [0]: nb_unique = len(label_str)
labels_unique = le.transform(label_str)
```

```
In [38]: print(labels_unique)
```

```
[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396]
```

Stack arrays in sequence horizontally (column wise).And choose each label 50 times! in each class

```
In [40]: labels_holder = np.hstack(( [ labels_unique[i] ] * 50 for i in range(nb_un
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:1: FutureWarning: arrays to stack must be passed as a "sequence" type such as list or tuple. Support for non-sequence iterables such as generators is deprecated as of NumPy 1.16 and will raise an error in the future.
    """Entry point for launching an IPython kernel.
```

```
In [41]: print(labels_holder)
```

```
[ 0  0  0 ... 396 396 396]
```

get training data labels

```
In [42]: nb_sample = len(labels_holder)
         if one_hot == True:
             labels = np.array([[float(i == l) for i in range(nb_classes)] for l in
         else:
             labels = labels_holder
         print('Labels loaded, shape is:' + str(labels.shape))
```

Labels loaded, shape is:(19850, 397)

Loading testing data

```
In [0]: x_test, nb_test_sample_1 = data_resized_holder, nb_sample
```

```
In [0]: y_test, nb_test_sample_2 = labels, nb_sample
```

```
In [0]: del data_resized_holder
         del labels
```

Saving x_test y_test .npz file

```
In [0]: np.save('/content/drive/My Drive/Colab Notebooks/SUN_Practice/x_test.npz', x_test)
```

```
In [0]: np.save('/content/drive/My Drive/Colab Notebooks/SUN_Practice/y_test.npz', y_test)
```

```
In [0]: del x_test
         del y_test
```

```
In [0]: y_test.shape
```

Out[45]: (19850, 397)

Load train data and test data

Load train data

```
In [0]: x_train = np.load('/content/drive/My Drive/Colab Notebooks/SUN_Practice/x_train.npz')
```

```
In [0]: y_train = np.load('/content/drive/My Drive/Colab Notebooks/SUN_Practice/y_train.npz')
```

```
In [0]: x_train.shape
```

Out[21]: (19850, 224, 224, 3)

```
In [0]: print(y_train[0])
```

0

Load test data

```
In [0]: x_test = np.load('/content/drive/My Drive/Colab Notebooks/SUN_Practice/x_te
```

```
In [0]: y_test = np.load('/content/drive/My Drive/Colab Notebooks/SUN_Practice/y_te
```

```
In [0]: print(x_train.shape)
print(y_train.shape)
print(x_test.shape)
print(y_test.shape)
```

Data Auguation

```
In [0]: generator = ImageDataGenerator(
    rotation_range=40,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest')
```