1. Exploring Data Sources and Use Cases

Initial Data Exploration

The use-case to implement is collected from https://www.kaggle.com/datasets (https://www.kaggle.com/datasets) - flower-recognition dataset

In [2]:

```
import types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your
credentials.
# You might want to remove those credentials before you share the notebook.
client_97b24ce2fb054a3c89e8360f2e109372 = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='eMw0vh6L0B2DXgV3J84gNz5cixBRSgI1ktNZsvjZbLXV',
    ibm_auth_endpoint="https://iam.ng.bluemix.net/oidc/token",
    config=Config(signature_version='oauth',connect_timeout=50, read_timeout=70),
    endpoint_url='https://s3-api.us-geo.objectstorage.service.networklayer.com')

# Your data file was loaded into a botocore.response.StreamingBody object.
# Please read the documentation of ibm_boto3 and pandas to learn more about the possibi
lities to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/
# pandas documentation: http://pandas.pydata.org/
streaming_body_2 = client_97b24ce2fb054a3c89e8360f2e109372.get_object(Bucket='imagereco
gnition-donotdelete-pr-vqn5czpovlmcqv', Key='flowers-recognition.zip')['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(streaming_body_2, "__iter__"): streaming_body_2.__iter__ = types.MethodT
ype( __iter__, streaming_body_2 )
```

Extract Transform Load (ETL)

In [3]:

```
from io import BytesIO
import os
import zipfile

zip_ref = zipfile.ZipFile(BytesIO(streaming_body_2.read()), 'r')

zip_ref .extractall("../input/flower5/")
#zip_ref.close()
```

In [4]:

```
data = "../input/flower5/flowers"

# List out the directories inside the main input folder

folders = os.listdir(data)

print(folders)
```

```
['sunflower', 'dandelion', 'rose', 'daisy', 'tulip']
```

In [5]:

```
!conda install -c conda-forge scikit-image
```

```
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /home/spark/shared/conda/envs/python3.6

  added / updated specs:
    - scikit-image


The following packages will be downloaded:

    package                    |            build
    ---------------------------|-----------------
    ca-certificates-2019.11.28 |       hecc5488_0         145 KB  conda-fo
rge
    certifi-2019.11.28         |           py36_0         149 KB  conda-fo
rge
    cloudpickle-1.2.2          |             py_1          23 KB  conda-fo
rge
    cycler-0.10.0              |             py_2           9 KB  conda-fo
rge
    cytoolz-0.10.1             |   py36h516909a_0         431 KB  conda-fo
rge
    dask-core-2.9.0            |             py_0         581 KB  conda-fo
rge
    dbus-1.13.6                |       he372182_0         602 KB  conda-fo
rge
    decorator-4.4.1            |             py_0          11 KB  conda-fo
rge
    expat-2.2.5                |    he1b5a44_1004         191 KB  conda-fo
rge
    fontconfig-2.13.1          |    he4413a7_1000         327 KB  conda-fo
rge
    freetype-2.10.0            |       he983fc9_1         884 KB  conda-fo
rge
    gettext-0.19.8.1           |    hc5be6a0_1002         3.6 MB  conda-fo
rge
    glib-2.58.3                |py36h6f030ca_1002         3.3 MB  conda-fo
rge
    gst-plugins-base-1.14.5    |       h0935bb2_0         6.8 MB  conda-fo
rge
    gstreamer-1.14.5           |       h36ae1b5_0         4.5 MB  conda-fo
rge
    icu-58.2                   |    hf484d3e_1000        22.6 MB  conda-fo
rge
    imageio-2.6.1              |           py36_0         3.3 MB  conda-fo
rge
    jpeg-9c                    |    h14c3975_1001         251 KB  conda-fo
rge
    kiwisolver-1.1.0           |   py36hc9558a2_0          86 KB  conda-fo
rge
    libblas-3.8.0              |      14_openblas          10 KB  conda-fo
rge
    libcblas-3.8.0             |      14_openblas          10 KB  conda-fo
rge
    libgfortran-ng-7.3.0       |       hdf63c60_2         1.7 MB  conda-fo
rge
    libiconv-1.15              |    h516909a_1005         2.0 MB  conda-fo
rge
```

```
    liblapack-3.8.0            |      14_openblas          10 KB  conda-fo
rge
    libopenblas-0.3.7          |       h5ec1e0e_5         7.6 MB  conda-fo
rge
    libpng-1.6.37              |       hed695b0_0         343 KB  conda-fo
rge
    libtiff-4.1.0              |       hc3755c2_1         609 KB  conda-fo
rge
    libuuid-2.32.1             |    h14c3975_1000          26 KB  conda-fo
rge
    libxcb-1.13                |    h14c3975_1002         396 KB  conda-fo
rge
    libxml2-2.9.9              |       hea5a465_1         1.6 MB
    lz4-c-1.8.3                |    he1b5a44_1001         187 KB  conda-fo
rge
    matplotlib-3.1.1           |   py36h5429711_0         5.0 MB
    networkx-2.4               |             py_0         1.2 MB  conda-fo
rge
    numpy-1.17.3               |   py36h95a1406_0         5.2 MB  conda-fo
rge
    olefile-0.46               |             py_0          31 KB  conda-fo
rge
    openssl-1.1.1d             |       h516909a_0         2.1 MB  conda-fo
rge
    pcre-8.43                  |       he1b5a44_0         257 KB  conda-fo
rge
    pillow-6.2.1               |   py36h34e0f95_0         640 KB
    pthread-stubs-0.4          |    h14c3975_1001           5 KB  conda-fo
rge
    pyparsing-2.4.5            |             py_0          58 KB  conda-fo
rge
    pyqt-5.9.2                 |   py36hcca6a23_4         5.7 MB  conda-fo
rge
    python-dateutil-2.8.1      |             py_0         220 KB  conda-fo
rge
    pytz-2019.3                |             py_0         237 KB  conda-fo
rge
    pywavelets-1.1.1           |   py36hc1659b7_0         4.4 MB  conda-fo
rge
    qt-5.9.7                   |       h52cfd70_2        85.9 MB  conda-fo
rge
    scikit-image-0.15.0        |   py36he6710b0_0        24.8 MB
    scipy-1.3.2                |   py36h921218d_0        18.0 MB  conda-fo
rge
    sip-4.19.8                 |   py36hf484d3e_0         274 KB
    six-1.13.0                 |           py36_0          22 KB  conda-fo
rge
    toolz-0.10.0               |             py_0          46 KB  conda-fo
rge
    tornado-6.0.3              |   py36h516909a_0         636 KB  conda-fo
rge
    xorg-libxau-1.0.9          |       h14c3975_0          13 KB  conda-fo
rge
    xorg-libxdmcp-1.1.3        |       h516909a_0          18 KB  conda-fo
rge
    zstd-1.4.4                 |       h3b9ef0a_1         989 KB  conda-fo
rge
    ------------------------------------------------------------
                                           Total:       217.7 MB

The following NEW packages will be INSTALLED:
```

```
  cloudpickle        conda-forge/noarch::cloudpickle-1.2.2-py_1
  cycler             conda-forge/noarch::cycler-0.10.0-py_2
  cytoolz            conda-forge/linux-64::cytoolz-0.10.1-py36h516909a_0
  dask-core          conda-forge/noarch::dask-core-2.9.0-py_0
  dbus               conda-forge/linux-64::dbus-1.13.6-he372182_0
  decorator          conda-forge/noarch::decorator-4.4.1-py_0
  expat              conda-forge/linux-64::expat-2.2.5-he1b5a44_1004
  fontconfig         conda-forge/linux-64::fontconfig-2.13.1-he4413a7_1000
  freetype           conda-forge/linux-64::freetype-2.10.0-he983fc9_1
  gettext            conda-forge/linux-64::gettext-0.19.8.1-hc5be6a0_1002
  glib               conda-forge/linux-64::glib-2.58.3-py36h6f030ca_1002
  gst-plugins-base   conda-forge/linux-64::gst-plugins-base-1.14.5-h0935bb
2_0
  gstreamer          conda-forge/linux-64::gstreamer-1.14.5-h36ae1b5_0
  icu                conda-forge/linux-64::icu-58.2-hf484d3e_1000
  imageio            conda-forge/linux-64::imageio-2.6.1-py36_0
  jpeg               conda-forge/linux-64::jpeg-9c-h14c3975_1001
  kiwisolver         conda-forge/linux-64::kiwisolver-1.1.0-py36hc9558a2_0
  libblas            conda-forge/linux-64::libblas-3.8.0-14_openblas
  libcblas           conda-forge/linux-64::libcblas-3.8.0-14_openblas
  libgfortran-ng     conda-forge/linux-64::libgfortran-ng-7.3.0-hdf63c60_2
  libiconv           conda-forge/linux-64::libiconv-1.15-h516909a_1005
  liblapack          conda-forge/linux-64::liblapack-3.8.0-14_openblas
  libopenblas        conda-forge/linux-64::libopenblas-0.3.7-h5ec1e0e_5
  libpng             conda-forge/linux-64::libpng-1.6.37-hed695b0_0
  libtiff            conda-forge/linux-64::libtiff-4.1.0-hc3755c2_1
  libuuid            conda-forge/linux-64::libuuid-2.32.1-h14c3975_1000
  libxcb             conda-forge/linux-64::libxcb-1.13-h14c3975_1002
  libxml2            pkgs/main/linux-64::libxml2-2.9.9-hea5a465_1
  lz4-c              conda-forge/linux-64::lz4-c-1.8.3-he1b5a44_1001
  matplotlib         pkgs/main/linux-64::matplotlib-3.1.1-py36h5429711_0
  networkx           conda-forge/noarch::networkx-2.4-py_0
  numpy              conda-forge/linux-64::numpy-1.17.3-py36h95a1406_0
  olefile            conda-forge/noarch::olefile-0.46-py_0
  pcre               conda-forge/linux-64::pcre-8.43-he1b5a44_0
  pillow             pkgs/main/linux-64::pillow-6.2.1-py36h34e0f95_0
  pthread-stubs      conda-forge/linux-64::pthread-stubs-0.4-h14c3975_1001
  pyparsing          conda-forge/noarch::pyparsing-2.4.5-py_0
  pyqt               conda-forge/linux-64::pyqt-5.9.2-py36hcca6a23_4
  python-dateutil    conda-forge/noarch::python-dateutil-2.8.1-py_0
  pytz               conda-forge/noarch::pytz-2019.3-py_0
  pywavelets         conda-forge/linux-64::pywavelets-1.1.1-py36hc1659b7_0
  qt                 conda-forge/linux-64::qt-5.9.7-h52cfd70_2
  scikit-image       pkgs/main/linux-64::scikit-image-0.15.0-py36he6710b0_
0
  scipy              conda-forge/linux-64::scipy-1.3.2-py36h921218d_0
  sip                pkgs/main/linux-64::sip-4.19.8-py36hf484d3e_0
  six                conda-forge/linux-64::six-1.13.0-py36_0
  toolz              conda-forge/noarch::toolz-0.10.0-py_0
  tornado            conda-forge/linux-64::tornado-6.0.3-py36h516909a_0
  xorg-libxau        conda-forge/linux-64::xorg-libxau-1.0.9-h14c3975_0
  xorg-libxdmcp      conda-forge/linux-64::xorg-libxdmcp-1.1.3-h516909a_0
  zstd               conda-forge/linux-64::zstd-1.4.4-h3b9ef0a_1

The following packages will be UPDATED:

  ca-certificates    pkgs/main::ca-certificates-2019.5.15-1 --> conda-forg
e::ca-certificates-2019.11.28-hecc5488_0
  certifi               pkgs/main::certifi-2019.6.16-py36_1 --> conda-forg
e::certifi-2019.11.28-py36_0
```

```
The following packages will be SUPERSEDED by a higher-priority channel:

  openssl              pkgs/main::openssl-1.1.1d-h7b6447c_0 --> conda-forg
e::openssl-1.1.1d-h516909a_0



Downloading and Extracting Packages
xorg-libxdmcp-1.1.3  | 18 KB     | ##################################### |
100%
gstreamer-1.14.5     | 4.5 MB    | ##################################### |
100%
scipy-1.3.2          | 18.0 MB   | ##################################### |
100%
glib-2.58.3          | 3.3 MB    | ##################################### |
100%
scikit-image-0.15.0  | 24.8 MB   | ##################################### |
100%
libopenblas-0.3.7    | 7.6 MB    | ##################################### |
100%
libcblas-3.8.0       | 10 KB     | ##################################### |
100%
olefile-0.46         | 31 KB     | ##################################### |
100%
networkx-2.4         | 1.2 MB    | ##################################### |
100%
dbus-1.13.6          | 602 KB    | ##################################### |
100%
ca-certificates-2019 | 145 KB    | ##################################### |
100%
decorator-4.4.1      | 11 KB     | ##################################### |
100%
cycler-0.10.0        | 9 KB      | ##################################### |
100%
pcre-8.43            | 257 KB    | ##################################### |
100%
certifi-2019.11.28   | 149 KB    | ##################################### |
100%
kiwisolver-1.1.0     | 86 KB     | ##################################### |
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sip-4.19.8           | 274 KB    | ##################################### |
100%
pillow-6.2.1         | 640 KB    | ##################################### |
100%
cloudpickle-1.2.2    | 23 KB     | ##################################### |
100%
toolz-0.10.0         | 46 KB     | ##################################### |
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libgfortran-ng-7.3.0 | 1.7 MB    | ##################################### |
100%
libiconv-1.15        | 2.0 MB    | ##################################### |
100%
pyparsing-2.4.5      | 58 KB     | ##################################### |
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pytz-2019.3          | 237 KB    | ##################################### |
100%
qt-5.9.7             | 85.9 MB   | ##################################### |
100%
icu-58.2             | 22.6 MB   | ##################################### |
100%
```

```
gst-plugins-base-1.1 | 6.8 MB    | ##################################### |
100%
libblas-3.8.0        | 10 KB     | ##################################### |
100%
cytoolz-0.10.1       | 431 KB    | ##################################### |
100%
jpeg-9c              | 251 KB    | ##################################### |
100%
pywavelets-1.1.1     | 4.4 MB    | ##################################### |
100%
matplotlib-3.1.1     | 5.0 MB    | ##################################### |
100%
libxcb-1.13          | 396 KB    | ##################################### |
100%
lz4-c-1.8.3          | 187 KB    | ##################################### |
100%
libuuid-2.32.1       | 26 KB     | ##################################### |
100%
pthread-stubs-0.4    | 5 KB      | ##################################### |
100%
expat-2.2.5          | 191 KB    | ##################################### |
100%
liblapack-3.8.0      | 10 KB     | ##################################### |
100%
gettext-0.19.8.1     | 3.6 MB    | ##################################### |
100%
libxml2-2.9.9        | 1.6 MB    | ##################################### |
100%
xorg-libxau-1.0.9    | 13 KB     | ##################################### |
100%
imageio-2.6.1        | 3.3 MB    | ##################################### |
100%
libtiff-4.1.0        | 609 KB    | ##################################### |
100%
freetype-2.10.0      | 884 KB    | ##################################### |
100%
zstd-1.4.4           | 989 KB    | ##################################### |
100%
dask-core-2.9.0      | 581 KB    | ##################################### |
100%
openssl-1.1.1d       | 2.1 MB    | ##################################### |
100%
numpy-1.17.3         | 5.2 MB    | ##################################### |
100%
six-1.13.0           | 22 KB     | ##################################### |
100%
tornado-6.0.3        | 636 KB    | ##################################### |
100%
python-dateutil-2.8. | 220 KB    | ##################################### |
100%
libpng-1.6.37        | 343 KB    | ##################################### |
100%
pyqt-5.9.2           | 5.7 MB    | ##################################### |
100%
fontconfig-2.13.1    | 327 KB    | ##################################### |
100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done
```

Feature Creation

In [6]:

```
import matplotlib.pyplot as plt
import numpy as np
from os import listdir
from os.path import join
from skimage.io import imread
from skimage import transform as tf
import pandas
import os
import random
image_names1 = []
train_labels1 = []
train_images1 = []

size = 28,28

for folder in folders:
    for file in os.listdir(os.path.join(data,folder)):
        if file.endswith("jpg"):
            image_names1.append(os.path.join(data,folder,file))
            train_labels1.append(folder)
            img = imread(os.path.join(data,folder,file))
            im = tf.resize(img,size)
            train_images1.append(im)
        else:
            continue
```

In [9]:

```
from sklearn import preprocessing
le = preprocessing.LabelEncoder()
le.fit(["tulip", "dandelion", "sunflower", "daisy", "rose"])
```

Out[9]:

```
LabelEncoder()
```

In [10]:

```
train = np.array(train_images1)



train = train.astype('float32') / 255.0


labels =  le.transform(train_labels1)


# Convert the  list to numpy array type

train_image = np.array(train)
labels_image = np.array(labels)
```

In [42]:

```
from sklearn.model_selection import train_test_split

train_images, test_images,train_labels, test_labels = train_test_split(train_image,labe
ls_image, test_size=0.2,shuffle=True)
```

Out[42]:

```
array([1, 4, 3, 4, 1, 0, 2, 0, 4])
```

In [12]:

```
!pip install tensorflow==1.14.0
```

```
Collecting tensorflow==1.14.0
  Downloading https://files.pythonhosted.org/packages/de/f0/96fb2e0412ae96
92dbf400e5b04432885f677ad6241c088ccc5fe7724d69/tensorflow-1.14.0-cp36-cp36
m-manylinux1_x86_64.whl (109.2MB)
    100% |################################| 109.2MB 150kB/s eta 0:00:01K
34% |###########                     | 38.2MB 69.1MB/s eta 0:00:02[K    4
5% |##############                  | 49.3MB 36.0MB/s eta 0:00:02    54% |
#################               | 60.0MB 10.4MB/s eta 0:00:05    57% |####
##############              | 62.3MB 64.2MB/s eta 0:00:01
Collecting astor>=0.6.0 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/c3/88/97eef84f48fa04
fbd6750e62dcceafba6c63c81b7ac1420856c8dcc0a3f9/astor-0.8.1-py2.py3-none-an
y.whl
Collecting six>=1.10.0 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/65/26/32b8464df2a97e
6dd1b656ed26b2c194606c16fe163c695a992b36c11cdf/six-1.13.0-py2.py3-none-an
y.whl
Collecting absl-py>=0.7.0 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/3b/72/e6e483e2db953c
11efa44ee21c5fdb6505c4dffa447b4263ca8af6676b62/absl-py-0.8.1.tar.gz (103k
B)
    100% |################################| 112kB 2.8MB/s eta 0:00:01
Collecting keras-preprocessing>=1.0.5 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/28/6a/8c1f62c37212d9
fc441a7e26736df51ce6f0e38455816445471f10da4f0a/Keras_Preprocessing-1.1.0-p
y2.py3-none-any.whl (41kB)
    100% |################################| 51kB 1.9MB/s eta 0:00:01
Collecting tensorboard<1.15.0,>=1.14.0 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/91/2d/2ed263449a078c
d9c8a9ba50ebd50123adf1f8cfbea1492f9084169b89d9/tensorboard-1.14.0-py3-none
-any.whl (3.1MB)
    100% |################################| 3.2MB 2.2MB/s eta 0:00:01
Collecting termcolor>=1.1.0 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/8a/48/a76be51647d0eb
9f10e2a4511bf3ffb8cc1e6b14e9e4fab46173aa79f981/termcolor-1.1.0.tar.gz
Collecting gast>=0.2.0 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/1f/04/4e36c33f8eb5c5
b6c622a1f4859352a6acca7ab387257d4b3c191d23ec1d/gast-0.3.2.tar.gz
Collecting tensorflow-estimator<1.15.0rc0,>=1.14.0rc0 (from tensorflow==1.
14.0)
  Downloading https://files.pythonhosted.org/packages/3c/d5/21860a5b11caf0
678fbc8319341b0ae21a07156911132e0e71bffed0510d/tensorflow_estimator-1.14.0
-py2.py3-none-any.whl (488kB)
    100% |################################| 491kB 2.9MB/s eta 0:00:01
Collecting grpcio>=1.8.6 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/27/28/280658104af767
431cf25e397157c4f4a8724a446f9dd5a34dac9812e9c9/grpcio-1.25.0-cp36-cp36m-ma
nylinux2010_x86_64.whl (2.4MB)
    100% |################################| 2.4MB 1.8MB/s eta 0:00:01
Collecting keras-applications>=1.0.6 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/71/e3/19762fdfc62877
ae9102edf6342d71b28fbfd9dea3d2f96a882ce099b03f/Keras_Applications-1.0.8-py
3-none-any.whl (50kB)
    100% |################################| 51kB 1.8MB/s eta 0:00:01
Collecting protobuf>=3.6.1 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/b8/be/438a8b90701aac
fd7d741541571a236edbcf46f772caa25fcb27c4937e9e/protobuf-3.11.1-cp36-cp36m-
manylinux1_x86_64.whl (1.3MB)
    100% |################################| 1.3MB 2.6MB/s eta 0:00:01
Collecting google-pasta>=0.1.6 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/c3/fd/1e86bc4837cc9a
```

```
3a5faf3db9b1854aa04ad35b5f381f9648fbe81a6f94e4/google_pasta-0.1.8-py3-none
-any.whl (57kB)
    100% |################################| 61kB 1.8MB/s eta 0:00:01
Collecting wrapt>=1.11.1 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/23/84/323c2415280bc4
fc880ac5050dddfb3c8062c2552b34c2e512eb4aa68f79/wrapt-1.11.2.tar.gz
Collecting numpy<2.0,>=1.14.5 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/d2/ab/43e678759326f7
28de861edbef34b8e2ad1b1490505f20e0d1f0716c3bf4/numpy-1.17.4-cp36-cp36m-man
ylinux1_x86_64.whl (20.0MB)
    100% |################################| 20.0MB 684kB/s eta 0:00:01
Collecting wheel>=0.26 (from tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/00/83/b4a77d044e78ad
1a45610eb88f745be2fd2c6d658f9798a15e384b7d57c9/wheel-0.33.6-py2.py3-none-a
ny.whl
Collecting markdown>=2.6.8 (from tensorboard<1.15.0,>=1.14.0->tensorflow==
1.14.0)
  Downloading https://files.pythonhosted.org/packages/c0/4e/fd492e91abdc2d
2fcb70ef453064d980688762079397f779758e055f6575/Markdown-3.1.1-py2.py3-none
-any.whl (87kB)
    100% |################################| 92kB 1.9MB/s eta 0:00:01
Collecting setuptools>=41.0.0 (from tensorboard<1.15.0,>=1.14.0->tensorflo
w==1.14.0)
  Downloading https://files.pythonhosted.org/packages/54/28/c45d8b54c1339f
9644b87663945e54a8503cfef59cf0f65b3ff5dd17cf64/setuptools-42.0.2-py2.py3-n
one-any.whl (583kB)
    100% |################################| 583kB 2.6MB/s eta 0:00:01
Collecting werkzeug>=0.11.15 (from tensorboard<1.15.0,>=1.14.0->tensorflow
==1.14.0)
  Downloading https://files.pythonhosted.org/packages/ce/42/3aeda98f96e85f
d26180534d36570e4d18108d62ae36f87694b476b83d6f/Werkzeug-0.16.0-py2.py3-non
e-any.whl (327kB)
    100% |################################| 327kB 3.3MB/s eta 0:00:01
Collecting h5py (from keras-applications>=1.0.6->tensorflow==1.14.0)
  Downloading https://files.pythonhosted.org/packages/60/06/cafdd44889200e
5438b897388f3075b52a8ef01f28a17366d91de0fa2d05/h5py-2.10.0-cp36-cp36m-many
linux1_x86_64.whl (2.9MB)
    100% |################################| 2.9MB 1.5MB/s eta 0:00:01
Building wheels for collected packages: absl-py, termcolor, gast, wrapt
  Building wheel for absl-py (setup.py) ... done
  Stored in directory: /home/spark/shared/.cache/pip/wheels/a7/15/a0/0a056
1549ad11cdc1bc8fa1191a353efd30facf6bfb507aefc
  Building wheel for termcolor (setup.py) ... done
  Stored in directory: /home/spark/shared/.cache/pip/wheels/7c/06/54/bc845
98ba1daf8f970247f550b175aaaee85f68b4b0c5ab2c6
  Building wheel for gast (setup.py) ... done
  Stored in directory: /home/spark/shared/.cache/pip/wheels/59/38/c6/234dc
39b4f6951a0768fbc02d5b7207137a5b1d9094f0d54bf
  Building wheel for wrapt (setup.py) ... done
  Stored in directory: /home/spark/shared/.cache/pip/wheels/d7/de/2e/efa13
2238792efb6459a96e85916ef8597fcb3d2ae51590dfd
Successfully built absl-py termcolor gast wrapt
Installing collected packages: astor, six, absl-py, numpy, keras-preproces
sing, setuptools, protobuf, wheel, markdown, werkzeug, grpcio, tensorboar
d, termcolor, gast, tensorflow-estimator, h5py, keras-applications, google
-pasta, wrapt, tensorflow
Successfully installed absl-py-0.8.1 astor-0.8.1 gast-0.3.2 google-pasta-
0.1.8 grpcio-1.25.0 h5py-2.10.0 keras-applications-1.0.8 keras-preprocessi
ng-1.1.0 markdown-3.1.1 numpy-1.17.4 protobuf-3.11.1 setuptools-42.0.2 six
-1.13.0 tensorboard-1.14.0 tensorflow-1.14.0 tensorflow-estimator-1.14.0 t
ermcolor-1.1.0 werkzeug-0.16.0 wheel-0.33.6 wrapt-1.11.2
```

In [13]:

```
import tensorflow as tf
```

In [ ]:

```

```

In [14]:

```
test_images[0].shape
```

Out[14]:

```
(28, 28, 3)
```

Model Definition and Training

In [83]:

```
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Flatten, Dense
from tensorflow.nn import relu
from tensorflow.nn import softmax
from tensorflow.nn import sigmoid


model = Sequential([
    Flatten(input_shape=(28, 28,3)),
    Dense(512, activation=relu),
    Dense(5, activation=softmax)
])

model.compile(optimizer='adam',
          loss='sparse_categorical_crossentropy',
          metrics=['accuracy'])

model.fit(train_images, train_labels, validation_data=(test_images, test_labels), epoch
s=50, verbose=0)

model.evaluate(test_images, test_labels)
```

```
865/865 [==============================] - 0s 63us/sample - loss: 1.1794 -
acc: 0.4925
```

Out[83]:

```
[1.1794200982661605, 0.49248555]
```

Model Evaluation, Tuning, Deployment and Documentation

In [60]:

```
!wget https://images.all-free-download.com/images/graphiclarge/sunflower_05_hd_picture_
167005.jpg
```

```
--2019-12-16 20:46:19--  https://images.all-free-download.com/images/graph
iclarge/sunflower_05_hd_picture_167005.jpg
Resolving images.all-free-download.com (images.all-free-download.com)... 2
07.182.153.238
Connecting to images.all-free-download.com (images.all-free-download.com)|
207.182.153.238|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 37349 (36K) [image/jpeg]
Saving to: 'sunflower_05_hd_picture_167005.jpg.2'

100%[======================================>] 37,349      --.-K/s   in 0.0
3s

2019-12-16 20:46:20 (1.09 MB/s) - 'sunflower_05_hd_picture_167005.jpg.2' s
aved [37349/37349]
```

In [61]:

```
!mv sunflower_05_hd_picture_167005.jpg sunflower.jpg
```

In [62]:

```
from keras.preprocessing import image
from keras.applications.resnet50 import preprocess_input, decode_predictions
import numpy as np


img_path = 'sunflower.jpg'
img = image.load_img(img_path, target_size=(28, 28))
x = image.img_to_array(img)
x.shape
#img = x.astype('float32') / 255.0
x = np.expand_dims(x, axis=0)
x = preprocess_input(x)
```

In [84]:

```
preds = model.predict(x)
```

In [85]:

```
preds
```

Out[85]:

```
array([[0., 1., 0., 0., 0.]], dtype=float32)
```

In [99]:

```
position = np.argmax(preds)
```

In [102]:

```
print('Predicted:', le.inverse_transform([position]))
```

```
Predicted: ['dandelion']
```

In [118]:

```
!wget https://upload.wikimedia.org/wikipedia/commons/5/51/Small_Red_Rose.JPG
```

```
--2019-12-16 22:40:48--  https://upload.wikimedia.org/wikipedia/commons/5/
51/Small_Red_Rose.JPG
Resolving upload.wikimedia.org (upload.wikimedia.org)... 208.80.154.240, 2
620:0:861:ed1a::2:b
Connecting to upload.wikimedia.org (upload.wikimedia.org)|208.80.154.240|:
443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 1380091 (1.3M) [image/jpeg]
Saving to: 'Small_Red_Rose.JPG'

100%[======================================>] 1,380,091   4.73MB/s   in 0.
3s

2019-12-16 22:40:48 (4.73 MB/s) - 'Small_Red_Rose.JPG' saved [1380091/1380
091]
```

In [123]:

```
!mv Small_Red_Rose.JPG rose.jpg
```

In [124]:

```
from keras.preprocessing import image
from keras.applications.resnet50 import preprocess_input, decode_predictions
import numpy as np


img_path = 'rose.jpg'
img = image.load_img(img_path, target_size=(28, 28))
x = image.img_to_array(img)
x.shape
#img = x.astype('float32') / 255.0
x = np.expand_dims(x, axis=0)
x = preprocess_input(x)
preds = model.predict(x)
position = np.argmax(preds)
print('Predicted:', le.inverse_transform([position]))
```

```
Predicted: ['rose']
```

In [128]:

```
!wget  https://images.all-free-download.com/images/graphiclarge/dandelion_204752.jpg
```

```
--2019-12-16 22:44:07--  https://images.all-free-download.com/images/graph
iclarge/dandelion_204752.jpg
Resolving images.all-free-download.com (images.all-free-download.com)... 2
07.182.153.238
Connecting to images.all-free-download.com (images.all-free-download.com)|
207.182.153.238|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 61572 (60K) [image/jpeg]
Saving to: 'dandelion_204752.jpg'

100%[======================================>] 61,572      --.-K/s   in 0.0
7s

2019-12-16 22:44:08 (857 KB/s) - 'dandelion_204752.jpg' saved [61572/6157
2]
```

In [129]:

```
!mv dandelion_204752.jpg dandelion.jpg
```

In [130]:

```
from keras.preprocessing import image
from keras.applications.resnet50 import preprocess_input, decode_predictions
import numpy as np


img_path = 'dandelion.jpg'
img = image.load_img(img_path, target_size=(28, 28))
x = image.img_to_array(img)
x.shape
#img = x.astype('float32') / 255.0
x = np.expand_dims(x, axis=0)
x = preprocess_input(x)
preds = model.predict(x)
position = np.argmax(preds)
print('Predicted:', le.inverse_transform([position]))
```

```
Predicted: ['dandelion']
```

In [140]:

```
!wget https://images.all-free-download.com/images/graphiclarge/the_fragant_daisy_51409
0.jpg
```

```
--2019-12-16 22:48:41--  https://images.all-free-download.com/images/graph
iclarge/the_fragant_daisy_514090.jpg
Resolving images.all-free-download.com (images.all-free-download.com)... 2
07.182.153.238
Connecting to images.all-free-download.com (images.all-free-download.com)|
207.182.153.238|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 75460 (74K) [image/jpeg]
Saving to: 'the_fragant_daisy_514090.jpg'

100%[======================================>] 75,460      --.-K/s   in 0.1
s

2019-12-16 22:48:41 (653 KB/s) - 'the_fragant_daisy_514090.jpg' saved [754
60/75460]
```

In [141]:

```
!mv the_fragant_daisy_514090.jpg daisy.jpg
```

In [142]:

```
from keras.preprocessing import image
from keras.applications.resnet50 import preprocess_input, decode_predictions
import numpy as np


img_path = 'daisy.jpg'
img = image.load_img(img_path, target_size=(28, 28))
x = image.img_to_array(img)
x.shape
#img = x.astype('float32') / 255.0
x = np.expand_dims(x, axis=0)
x = preprocess_input(x)
preds = model.predict(x)
position = np.argmax(preds)
print('Predicted:', le.inverse_transform([position]))
```

```
Predicted: ['dandelion']
```

In [ ]:

```

```