Image Preprocessing

In [10]:

```
import os, 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 c
redentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='tGcNDmAc_N8W25Ld_PCWuPUl9MOPW3PLmzlOU0XjZCI2',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'traincnnmodel-donotdelete-pr-y2q0cidugru0d7'
object_key = 'conversation_engine_for_deaf_and_dumb.zip'

streaming_body_1 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']

# 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 possibili
ties to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/
# pandas documentation: http://pandas.pydata.org/
from io import BytesIO
import zipfile
zip_ref = zipfile.ZipFile(BytesIO(streaming_body_1.read()), 'r')
file_paths=zip_ref.namelist()
for path in file_paths:
    zip_ref.extract(path)
```

In [14]:

```
f=os.listdir('/home/wsuser/work/Dataset/training_set')
f
```

Out[14]:

```
['B', 'E', 'F', 'G', 'D', 'I', 'C', 'H', 'A']
```

In [15]:

```
#image Preprocessing
from keras.preprocessing.image import ImageDataGenerator
from keras.preprocessing.image import ImageDataGenerator
train_datagen=ImageDataGenerator(rescale = 1./255, shear_range=0.2, zoom_range=0.2, horiz
ontal_flip=True)
test_datagen=ImageDataGenerator (rescale = 1./255)
x_train = train_datagen.flow_from_directory('/home/wsuser/work/Dataset/training_set', tar
get_size=(64,64), batch_size=300, class_mode='categorical', color_mode = "grayscale")
x_test = train_datagen.flow_from_directory('/home/wsuser/work/Dataset/test_set', target_s
ize=(64,64), batch_size=300, class_mode='categorical', color_mode = "grayscale")
```

```
Found 15750 images belonging to 9 classes.
Found 2250 images belonging to 9 classes.
```

Model Building

In [16]:

```
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Convolution2D
from keras.layers import MaxPooling2D
from keras.layers import Dropout
from keras.layers import Flatten
model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(64,64,1),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(units=512,activation='relu'))
model.add(Dense(units=9,activation='softmax'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
model.fit_generator(x_train, steps_per_epoch=24, epochs=10, validation_data=x_test, vali
dation_steps=40)
```

```
/tmp/wsuser/ipykernel_210/3767310412.py:14: UserWarning: `Model.fit_generator` is depreca
ted and will be removed in a future version. Please use `Model.fit`, which supports gener
ators.
  model.fit_generator(x_train, steps_per_epoch=24, epochs=10, validation_data=x_test, val
idation_steps=40)
```

```
Epoch 1/10
24/24 [==============================] - ETA: 0s - loss: 1.2163 - accuracy: 0.6738WARNING
:tensorflow:Your input ran out of data; interrupting training. Make sure that your datase
t or generator can generate at least `steps_per_epoch * epochs` batches (in this case, 40
batches). You may need to use the repeat() function when building your dataset.
24/24 [==============================] - 23s 950ms/step - loss: 1.2163 - accuracy: 0.6738
- val_loss: 0.5050 - val_accuracy: 0.8818
Epoch 2/10
24/24 [==============================] - 20s 846ms/step - loss: 0.2580 - accuracy: 0.9283
Epoch 3/10
24/24 [==============================] - 21s 853ms/step - loss: 0.1422 - accuracy: 0.9651
Epoch 4/10
24/24 [==============================] - 21s 851ms/step - loss: 0.0847 - accuracy: 0.9803
Epoch 5/10
24/24 [==============================] - 21s 850ms/step - loss: 0.0531 - accuracy: 0.9872
Epoch 6/10
24/24 [==============================] - 20s 826ms/step - loss: 0.0505 - accuracy: 0.9872
Epoch 7/10
24/24 [==============================] - 20s 841ms/step - loss: 0.0361 - accuracy: 0.9926
Epoch 8/10
24/24 [==============================] - 21s 863ms/step - loss: 0.0260 - accuracy: 0.9946
Epoch 9/10
24/24 [==============================] - 20s 833ms/step - loss: 0.0213 - accuracy: 0.9955
Epoch 10/10
24/24 [==============================] - 20s 837ms/step - loss: 0.0188 - accuracy: 0.9959
```

Out[16]:

```
<keras.callbacks.History at 0x7f478d08ce20>
```

In [17]:

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

In [19]:

```
!tar -zcvf cbotModel.tgz cbot.h5
```

```
cbot.h5
```

In [21]:

```
ls
```

```
cbot.h5  cbotModel.tgz  Dataset/
```

In [22]:

```
!pip install watson-machine-learning-client --upgrade
```

```
Collecting watson-machine-learning-client
```

```
  Downloading watson_machine_learning_client-1.0.391-py3-none-any.whl (538 kB)
     |████████████████████████████████| 538 kB 24.4 MB/s eta 0:00:01
Requirement already satisfied: ibm-cos-sdk in /opt/conda/envs/Python-3.9/lib/python3.9/si
te-packages (from watson-machine-learning-client) (2.11.0)
Requirement already satisfied: tqdm in /opt/conda/envs/Python-3.9/lib/python3.9/site-pack
ages (from watson-machine-learning-client) (4.62.3)
Requirement already satisfied: boto3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-pac
kages (from watson-machine-learning-client) (1.18.21)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site-
packages (from watson-machine-learning-client) (0.8.9)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-p
ackages (from watson-machine-learning-client) (1.26.7)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site-p
ackages (from watson-machine-learning-client) (2022.9.24)
Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site-
packages (from watson-machine-learning-client) (2.26.0)
Requirement already satisfied: pandas in /opt/conda/envs/Python-3.9/lib/python3.9/site-pa
ckages (from watson-machine-learning-client) (1.3.4)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site-pa
ckages (from watson-machine-learning-client) (0.3.3)
Requirement already satisfied: s3transfer<0.6.0,>=0.5.0 in /opt/conda/envs/Python-3.9/lib
/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.5.0)
Requirement already satisfied: botocore<1.22.0,>=1.21.21 in /opt/conda/envs/Python-3.9/li
b/python3.9/site-packages (from boto3->watson-machine-learning-client) (1.21.41)
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /opt/conda/envs/Python-3.9/lib/p
ython3.9/site-packages (from boto3->watson-machine-learning-client) (0.10.0)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python-3.9/
lib/python3.9/site-packages (from botocore<1.22.0,>=1.21.21->boto3->watson-machine-learni
ng-client) (2.8.2)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-
packages (from python-dateutil<3.0.0,>=2.1->botocore<1.22.0,>=1.21.21->boto3->watson-mach
ine-learning-client) (1.15.0)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python-3.9/lib
/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python-3
.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0
)
Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python-3.9/li
b/python3.9/site-packages (from requests->watson-machine-learning-client) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/s
ite-packages (from requests->watson-machine-learning-client) (3.3)
Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-3.9/lib/python3.9/s
ite-packages (from pandas->watson-machine-learning-client) (2021.3)
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/
site-packages (from pandas->watson-machine-learning-client) (1.20.3)
Installing collected packages: watson-machine-learning-client
Successfully installed watson-machine-learning-client-1.0.391
```

In [24]:

```
#ibm watson machine learing Credentials
from ibm_watson_machine_learning import APIClient
wmlC={
    "url":"https://us-south.ml.cloud.ibm.com",
    "apikey":"4uZlU1UcvB87fqoarYOEb-x5_awZ3DlCBz7JfwC6xJBZ"
}
client=APIClient(wmlC)
```

In [28]:

```
def guid_from_space_name(client,space_name):
    space=client.spaces.get_details()
    return (next(item for item in space['resources'] if item['entity']['name']==space_na
me)['metadata']['id'])
```

In [29]:

```
space_uid=guid_from_space_name(client,'CNNDep')
print("SpaceUID: "+space_uid)
```

```
SpaceUID: e72d505f-489e-476c-8d00-5342a7d6b46f
```

In [30]:

```
client.set.default_space(space_uid)
```

Out[30]:

```
'SUCCESS'
```

In [31]:

```
client.software_specifications.list()
```

NAME	ASSET_ID	TYPE
default_py3.6	0062b8c9-8b7d-44a0-a9b9-46c416adcbd9	base
kernel-spark3.2-scala2.12	020d69ce-7ac1-5e68-ac1a-31189867356a	base
pytorch-onnx_1.3-py3.7-edt	069ea134-3346-5748-b513-49120e15d288	base
scikit-learn_0.20-py3.6	09c5a1d0-9c1e-4473-a344-eb7b665ff687	base
spark-mllib_3.0-scala_2.12	09f4cff0-90a7-5899-b9ed-1ef348aebdee	base
pytorch-onnx_rt22.1-py3.9	0b848dd4-e681-5599-be41-b5f6fccc6471	base
ai-function_0.1-py3.6	0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda	base
shiny-r3.6	0e6e79df-875e-4f24-8ae9-62dcc2148306	base
tensorflow_2.4-py3.7-horovod	1092590a-307d-563d-9b62-4eb7d64b3f22	base
pytorch_1.1-py3.6	10ac12d6-6b30-4ccd-8392-3e922c096a92	base
tensorflow_1.15-py3.6-ddl	111e41b3-de2d-5422-a4d6-bf776828c4b7	base
autoai-kb_rt22.2-py3.10	125b6d9a-5b1f-5e8d-972a-b251688ccf40	base
runtime-22.1-py3.9	12b83a17-24d8-5082-900f-0ab31fbfd3cb	base
scikit-learn_0.22-py3.6	154010fa-5b3b-4ac1-82af-4d5ee5abbc85	base
default_r3.6	1b70aec3-ab34-4b87-8aa0-a4a3c8296a36	base
pytorch-onnx_1.3-py3.6	1bc6029a-cc97-56da-b8e0-39c3880dbbe7	base
kernel-spark3.3-r3.6	1c9e5454-f216-59dd-a20e-474a5cdf5988	base
pytorch-onnx_rt22.1-py3.9-edt	1d362186-7ad5-5b59-8b6c-9d0880bde37f	base
tensorflow_2.1-py3.6	1eb25b84-d6ed-5dde-b6a5-3fbdf1665666	base
spark-mllib_3.2	20047f72-0a98-58c7-9ff5-a77b012eb8f5	base
tensorflow_2.4-py3.8-horovod	217c16f6-178f-56bf-824a-b19f20564c49	base
runtime-22.1-py3.9-cuda	26215f05-08c3-5a41-a1b0-da66306ce658	base
do_py3.8	295addb5-9ef9-547e-9bf4-92ae3563e720	base
autoai-ts_3.8-py3.8	2aa0c932-798f-5ae9-abd6-15e0c2402fb5	base
tensorflow_1.15-py3.6	2b73a275-7cbf-420b-a912-eae7f436e0bc	base
kernel-spark3.3-py3.9	2b7961e2-e3b1-5a8c-a491-482c8368839a	base
pytorch_1.2-py3.6	2c8ef57d-2687-4b7d-acce-01f94976dac1	base
spark-mllib_2.3	2e51f700-bca0-4b0d-88dc-5c6791338875	base
pytorch-onnx_1.1-py3.6-edt	32983cea-3f32-4400-8965-dde874a8d67e	base
spark-mllib_3.0-py37	36507ebe-8770-55ba-ab2a-eafe787600e9	base
spark-mllib_2.4	390d21f8-e58b-4fac-9c55-d7ceda621326	base
autoai-ts_rt22.2-py3.10	396b2e83-0953-5b86-9a55-7ce1628a406f	base
xgboost_0.82-py3.6	39e31acd-5f30-41dc-ae44-60233c80306e	base
pytorch-onnx_1.2-py3.6-edt	40589d0e-7019-4e28-8daa-fb03b6f4fe12	base
pytorch-onnx_rt22.2-py3.10	40e73f55-783a-5535-b3fa-0c8b94291431	base
default_r36py38	41c247d3-45f8-5a71-b065-8580229facf0	base
autoai-ts_rt22.1-py3.9	4269d26e-07ba-5d40-8f66-2d495b0c71f7	base
autoai-obm_3.0	42b92e18-d9ab-567f-988a-4240ba1ed5f7	base
pmml-3.0_4.3	493bcb95-16f1-5bc5-bee8-81b8af80e9c7	base
spark-mllib_2.4-r_3.6	49403dff-92e9-4c87-a3d7-a42d0021c095	base
xgboost_0.90-py3.6	4ff8d6c2-1343-4c18-85e1-689c965304d3	base
pytorch-onnx_1.1-py3.6	50f95b2a-bc16-43bb-bc94-b0bed208c60b	base
autoai-ts_3.9-py3.8	52c57136-80fa-572e-8728-a5e7cbb42cde	base
spark-mllib_2.4-scala_2.11	55a70f99-7320-4be5-9fb9-9edb5a443af5	base
spark-mllib_3.0	5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9	base
autoai-obm_2.0	5c2e37fa-80b8-5e77-840f-d912469614ee	base
spss-modeler_18.1	5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b	base
cuda-py3.8	5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e	base
autoai-kb_3.1-py3.7	632d4b22-10aa-5180-88f0-f52dfb6444d7	base
pytorch-onnx_1.7-py3.8	634d3cdc-b562-5bf9-a2d4-ea90a478456b	base

Note: Only first 50 records were displayed. To display more use 'limit' parameter.

In [40]:

```
software_spec_uid=client.software_specifications.get_uid_by_name('tensorflow_rt22.1-py3.9
')
```

```
software_spec_uid
```

Out[40]:

```
'acd9c798-6974-5d2f-a657-ce06e986df4d'
```

In [49]:

```
model_details=client.repository.store_model(model='cbotModel.tgz',meta_props={
    client.repository.ModelMetaNames.NAME:"CNN",
    client.repository.ModelMetaNames.TYPE:"tensorflow_2.7",
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_spec_uid

})
model_id=client.repository.get_model_id(model_details)
model_id
```

Out[49]:

```
'5ca9eb20-97a7-4bf5-a583-c152ee8ef9ad'
```

In [50]:

```
client.repository.download(model_id,"cbotModel.tar.gz")
```

```
Successfully saved model content to file: 'cbotModel.tar.gz'
```

Out[50]:

```
'/home/wsuser/work/cbotModel.tar.gz'
```

Test The Model

In [63]:

```
from keras.models import load_model
import numpy as np
import cv2
from keras.preprocessing import image
```

In [52]:

```
model=load_model('cbot.h5')
```

In [57]:

```
from skimage.transform import resize
def detect(frame):
    img=image.img_to_array(frame)
    img = resize(img,(64,64,1))
    img = np.expand_dims(img,axis=0)
    pred=np.argmax(model.predict(img))
    op=['A','B','C','D','E','F','G','H','I']
    print("THE PREDICTED LETTER IS ",op[pred])
```

In [65]:

```
img=image.load_img("/home/wsuser/work/Dataset/test_set/D/102.png")
detect(img)
```

```
THE PREDICTED LETTER IS  D
```

In [ ]:

```

```