

IBM Project Name: Real-Time Communication System Powered by AI for Specially Abled TEAM
ID: PNT2022TMID14994

Model Building

Import The Required Model Building Libraries

```
In [ ]:  
#import imagedatagenerator  
from keras.preprocessing.image import ImageDataGenerator  
  
In [ ]:  
#training datagen  
train_datagen=ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=  
0.2, horizontal_flip=True)  
  
In [ ]:  
#testing datagen  
test_datagen=ImageDataGenerator(rescale=1./255)
```

IMPORTING tensorflow

```
In [ ]:  
import tensorflow as tf  
import os
```

Initialize The Model

```
In [ ]:  
#create model  
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  
from tensorflow.keras.preprocessing.image import ImageDataGenerator  
  
In [ ]:  
import numpy as np  
import matplotlib.pyplot as plt #to view graph in colab itself  
import IPython.display as display  
from PIL import Image  
import pathlib
```

Unzipping the dataset

```
In [ ]:  
!unzip '/content/conversation engine for deaf and dumb (1).zip'
```

Streaming output truncated to the last 5000 lines.

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 inflating: Dataset/training_set/I/1475.png
 inflating: Dataset/training_set/I/1476.png
 inflating: Dataset/training_set/I/1477.png
 inflating: Dataset/training_set/I/1478.png
 inflating: Dataset/training_set/I/1479.png
 inflating: Dataset/training_set/I/148.png
 inflating: Dataset/training_set/I/1480.png
 inflating: Dataset/training_set/I/1481.png
 inflating: Dataset/training_set/I/1482.png
extracting: Dataset/training_set/I/1483.png
 inflating: Dataset/training_set/I/1484.png
 inflating: Dataset/training_set/I/1485.png
extracting: Dataset/training_set/I/1486.png
extracting: Dataset/training_set/I/1487.png
 inflating: Dataset/training_set/I/1488.png
 inflating: Dataset/training_set/I/1489.png
 inflating: Dataset/training_set/I/149.png
 inflating: Dataset/training_set/I/1490.png
extracting: Dataset/training_set/I/1491.png
extracting: Dataset/training_set/I/1492.png
extracting: Dataset/training_set/I/1493.png
extracting: Dataset/training_set/I/1494.png
extracting: Dataset/training_set/I/1495.png
 inflating: Dataset/training_set/I/1496.png
extracting: Dataset/training_set/I/1497.png
extracting: Dataset/training_set/I/1498.png
extracting: Dataset/training_set/I/1499.png
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 inflating: Dataset/training_set/I/150.png
 inflating: Dataset/training_set/I/1500.png
extracting: Dataset/training_set/I/1501.png
extracting: Dataset/training_set/I/1502.png
 inflating: Dataset/training_set/I/1503.png
 inflating: Dataset/training_set/I/1504.png
extracting: Dataset/training_set/I/1505.png
extracting: Dataset/training_set/I/1506.png
 inflating: Dataset/training_set/I/1507.png
 inflating: Dataset/training_set/I/1508.png
 inflating: Dataset/training_set/I/1509.png
 inflating: Dataset/training_set/I/151.png
 inflating: Dataset/training_set/I/1510.png
 inflating: Dataset/training_set/I/1511.png
extracting: Dataset/training_set/I/1512.png
extracting: Dataset/training_set/I/1513.png
extracting: Dataset/training_set/I/1514.png
extracting: Dataset/training_set/I/1515.png
extracting: Dataset/training_set/I/1516.png
extracting: Dataset/training_set/I/1517.png
 inflating: Dataset/training_set/I/1518.png
 inflating: Dataset/training_set/I/1519.png

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extracting: Dataset/training_set/I/1573.png
extracting: Dataset/training_set/I/1574.png
extracting: Dataset/training_set/I/1575.png
extracting: Dataset/training_set/I/1576.png
extracting: Dataset/training_set/I/1577.png
inflating: Dataset/training_set/I/1578.png
inflating: Dataset/training_set/I/1579.png
inflating: Dataset/training_set/I/158.png
inflating: Dataset/training_set/I/1580.png
inflating: Dataset/training_set/I/1581.png
inflating: Dataset/training_set/I/1582.png
inflating: Dataset/training_set/I/1583.png
extracting: Dataset/training_set/I/1584.png
inflating: Dataset/training_set/I/1585.png
inflating: Dataset/training_set/I/1586.png
inflating: Dataset/training_set/I/1587.png
extracting: Dataset/training_set/I/1588.png
inflating: Dataset/training_set/I/1589.png
inflating: Dataset/training_set/I/159.png
inflating: Dataset/training_set/I/1590.png
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inflating: Dataset/training_set/I/1592.png
inflating: Dataset/training_set/I/1593.png
inflating: Dataset/training_set/I/1594.png
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inflating: Dataset/training_set/I/1602.png
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inflating: Dataset/training_set/I/1605.png
extracting: Dataset/training_set/I/1606.png
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extracting: Dataset/training_set/I/1672.png
extracting: Dataset/training_set/I/1673.png

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inflating: Dataset/training_set/I/1724.png

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inflating: Dataset/training_set/I/610.png

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inflating: Dataset/training_set/I/675.png
inflating: Dataset/training_set/I/676.png
inflating: Dataset/training_set/I/677.png
extracting: Dataset/training_set/I/678.png
inflating: Dataset/training_set/I/679.png
inflating: Dataset/training_set/I/68.png
inflating: Dataset/training_set/I/680.png
inflating: Dataset/training_set/I/681.png
inflating: Dataset/training_set/I/682.png
extracting: Dataset/training_set/I/683.png
inflating: Dataset/training_set/I/684.png
inflating: Dataset/training_set/I/685.png
inflating: Dataset/training_set/I/686.png
inflating: Dataset/training_set/I/687.png
inflating: Dataset/training_set/I/688.png
inflating: Dataset/training_set/I/689.png
inflating: Dataset/training_set/I/69.png
inflating: Dataset/training_set/I/690.png
inflating: Dataset/training_set/I/691.png
inflating: Dataset/training_set/I/692.png
inflating: Dataset/training_set/I/693.png
extracting: Dataset/training_set/I/694.png
inflating: Dataset/training_set/I/695.png
extracting: Dataset/training_set/I/696.png
extracting: Dataset/training_set/I/697.png
inflating: Dataset/training_set/I/698.png
inflating: Dataset/training_set/I/699.png
extracting: Dataset/training_set/I/7.png
extracting: Dataset/training_set/I/70.png
extracting: Dataset/training_set/I/700.png
inflating: Dataset/training_set/I/701.png
inflating: Dataset/training_set/I/702.png
inflating: Dataset/training_set/I/703.png
inflating: Dataset/training_set/I/704.png
extracting: Dataset/training_set/I/705.png
inflating: Dataset/training_set/I/706.png
inflating: Dataset/training_set/I/707.png
inflating: Dataset/training_set/I/708.png
inflating: Dataset/training_set/I/709.png
inflating: Dataset/training_set/I/71.png
inflating: Dataset/training_set/I/710.png
inflating: Dataset/training_set/I/711.png
inflating: Dataset/training_set/I/712.png
inflating: Dataset/training_set/I/713.png

[illegible]

[illegible]

```
inflating: Dataset/training_set/I/817.png  
inflating: Dataset/training_set/I/818.png  
inflating: Dataset/training_set/I/819.png  
inflating: Dataset/training_set/I/820.png  
inflating: Dataset/training_set/I/821.png  
inflating: Dataset/training_set/I/822.png  
inflating: Dataset/training_set/I/823.png  
inflating: Dataset/training_set/I/824.png  
inflating: Dataset/training_set/I/825.png  
inflating: Dataset/training_set/I/826.png  
inflating: Dataset/training_set/I/827.png  
inflating: Dataset/training_set/I/828.png  
inflating: Dataset/training_set/I/829.png  
inflating: Dataset/training_set/I/830.png  
inflating: Dataset/training_set/I/831.png  
inflating: Dataset/training_set/I/832.png  
inflating: Dataset/training_set/I/833.png  
inflating: Dataset/training_set/I/834.png  
inflating: Dataset/training_set/I/835.png  
inflating: Dataset/training_set/I/836.png  
inflating: Dataset/training_set/I/837.png  
inflating: Dataset/training_set/I/838.png  
inflating: Dataset/training_set/I/839.png  
inflating: Dataset/training_set/I/840.png  
extracting: Dataset/training_set/I/841.png  
inflating: Dataset/training_set/I/842.png  
inflating: Dataset/training_set/I/843.png  
inflating: Dataset/training_set/I/844.png  
inflating: Dataset/training_set/I/845.png  
inflating: Dataset/training_set/I/846.png  
inflating: Dataset/training_set/I/847.png  
inflating: Dataset/training_set/I/848.png  
inflating: Dataset/training_set/I/849.png  
inflating: Dataset/training_set/I/850.png  
inflating: Dataset/training_set/I/851.png  
inflating: Dataset/training_set/I/852.png  
inflating: Dataset/training_set/I/853.png  
inflating: Dataset/training_set/I/854.png  
extracting: Dataset/training_set/I/855.png  
inflating: Dataset/training_set/I/856.png  
inflating: Dataset/training_set/I/857.png  
inflating: Dataset/training_set/I/858.png  
inflating: Dataset/training_set/I/859.png  
extracting: Dataset/training_set/I/860.png  
inflating: Dataset/training_set/I/861.png  
inflating: Dataset/training_set/I/862.png  
extracting: Dataset/training_set/I/863.png  
inflating: Dataset/training_set/I/864.png  
inflating: Dataset/training_set/I/865.png  
inflating: Dataset/training_set/I/866.png  
inflating: Dataset/training_set/I/867.png  
extracting: Dataset/training_set/I/868.png
```

[illegible]

[illegible]


```
inflating: Dataset/training_set/I/971.png
inflating: Dataset/training_set/I/972.png
extracting: Dataset/training_set/I/973.png
inflating: Dataset/training_set/I/974.png
inflating: Dataset/training_set/I/975.png
inflating: Dataset/training_set/I/976.png
inflating: Dataset/training_set/I/977.png
inflating: Dataset/training_set/I/978.png
inflating: Dataset/training_set/I/979.png
inflating: Dataset/training_set/I/98.png
inflating: Dataset/training_set/I/980.png
inflating: Dataset/training_set/I/981.png
inflating: Dataset/training_set/I/982.png
extracting: Dataset/training_set/I/983.png
inflating: Dataset/training_set/I/984.png
inflating: Dataset/training_set/I/985.png
inflating: Dataset/training_set/I/986.png
inflating: Dataset/training_set/I/987.png
inflating: Dataset/training_set/I/988.png
inflating: Dataset/training_set/I/989.png
inflating: Dataset/training_set/I/99.png
inflating: Dataset/training_set/I/990.png
inflating: Dataset/training_set/I/991.png
inflating: Dataset/training_set/I/992.png
extracting: Dataset/training_set/I/993.png
inflating: Dataset/training_set/I/994.png
inflating: Dataset/training_set/I/995.png
extracting: Dataset/training_set/I/996.png
inflating: Dataset/training_set/I/997.png
inflating: Dataset/training_set/I/998.png
inflating: Dataset/training_set/I/999.png
```

Applying ImageDataGenerator to training set

In []:

```
x_train=train_datagen.flow_from_directory('/content/Dataset/training_set',target_size=(64,64),batch_size=200,
```

```
class_mode='categorical',color_mode="grayscale")
```

Found 15750 images belonging to 9 classes.

Applying ImageDataGenerator to test set

In []:

```
x_test=test_datagen.flow_from_directory('/content/Dataset/test_set',target_size=(64,64),batch_size=200,
```

```
class_mode='categorical',color_mode="grayscale")
```

Found 2250 images belonging to 9 classes.

In []:

```
a=len(x_train)
```

```
b=len(x_test)
```

Length of training set

In []:

```
print(a)
```

Length of test set

```
In [ ]:  
print(b)  
12
```

Add Layers

```
In [ ]:  
#create model  
model=Sequential()
```

Add The Convolution Layer

```
In [ ]:  
model.add(Convolution2D(32, (3, 3), input_shape=(64, 64, 1), activation='relu'))
```

Add Pooling Layer

```
In [ ]:  
model.add(MaxPooling2D(pool_size=(2, 2)))
```

Add The Flatten Layer

```
In [ ]:  
model.add(Flatten())
```

Adding The Dense Layers

```
In [ ]:  
#1st hidden layer  
model.add(Dense(units=512, activation='relu'))  
#2nd hidden layer  
model.add(Dense(units=261, activation='relu'))
```

```
In [ ]:  
#output layer  
model.add(Dense(units=9, activation='softmax'))
```

Compile The Model

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

Fit The Model

```
In [ ]:  
model.fit_generator(x_train, steps_per_epoch=len(x_train), epochs=10, validation_data=x_test, validation_steps=len(x_test))
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning  
: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.
```

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

```
Epoch 1/10
```

```
79/79 [=====] - 90s 1s/step - loss: 0.3965 - accuracy: 0.8746 - val_loss: 0.2797 - val_accuracy: 0.9529
```

```
Epoch 2/10
```

```
79/79 [=====] - 86s 1s/step - loss: 0.0419 - accuracy: 0.9884 - val_loss: 0.2846 - val_accuracy: 0.9751
```

```

Epoch 3/10
79/79 [=====] - 84s 1s/step - loss: 0.0195 - accur
acy: 0.9947 - val_loss: 0.3436 - val_accuracy: 0.9751
Epoch 4/10
79/79 [=====] - 87s 1s/step - loss: 0.0083 - accur
acy: 0.9982 - val_loss: 0.3722 - val_accuracy: 0.9751
Epoch 5/10
79/79 [=====] - 83s 1s/step - loss: 0.0066 - accur
acy: 0.9983 - val_loss: 0.4095 - val_accuracy: 0.9756
Epoch 6/10
79/79 [=====] - 88s 1s/step - loss: 0.0072 - accur
acy: 0.9979 - val_loss: 0.3874 - val_accuracy: 0.9756
Epoch 7/10
79/79 [=====] - 86s 1s/step - loss: 0.0059 - accur
acy: 0.9985 - val_loss: 0.3891 - val_accuracy: 0.9747
Epoch 8/10
79/79 [=====] - 86s 1s/step - loss: 0.0027 - accur
acy: 0.9992 - val_loss: 0.4429 - val_accuracy: 0.9756
Epoch 9/10
79/79 [=====] - 84s 1s/step - loss: 0.0073 - accur
acy: 0.9981 - val_loss: 0.4907 - val_accuracy: 0.9756
Epoch 10/10
79/79 [=====] - 85s 1s/step - loss: 0.0048 - accur
acy: 0.9987 - val_loss: 0.4866 - val_accuracy: 0.9702

```

Save The Model

```

In [ ]:
model.save('aslpng2.h5')

```

Import The Packages And Load The Saved Model

```

In [38]:
from tensorflow.keras.models import load_model
import numpy as np
import cv2
from tensorflow.keras.preprocessing import image

```

```

In [45]:
#load the model
model=load_model('aslpng2.h5')

```

```

In [46]:
img=image.load_img('/content/Dataset/test_set/A/10.png',target_size=(400,50
0))
img

```

out[46]:



