

Date	24 November 2022
Team ID	PNT2022TMID14708
Project Name	Real-Time Communication System Powered by AI for Specially Abled

IMPORT LIBRARIES

```

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, Flatten, Dropout, MaxPooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import numpy as np
import matplotlib.pyplot as plt
import cv2
import zipfile

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!unzip '/content/drive/MyDrive/IBMPROJECT/conversation engine for deaf and dumb.zip'
```

Streaming output truncated to the last 5000 lines.

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inflating: Dataset/training_set/I/1714.png
inflating: Dataset/training_set/I/1715.png
inflating: Dataset/training_set/I/1716.png
inflating: Dataset/training_set/I/1717.png
inflating: Dataset/training_set/I/1718.png
extracting: Dataset/training_set/I/1719.png
inflating: Dataset/training_set/I/172.png
extracting: Dataset/training_set/I/1720.png
extracting: Dataset/training_set/I/1721.png
inflating: Dataset/training_set/I/1722.png
extracting: Dataset/training_set/I/1723.png
inflating: Dataset/training_set/I/1724.png
inflating: Dataset/training_set/I/1725.png
inflating: Dataset/training_set/I/1726.png
inflating: Dataset/training_set/I/1727.png
inflating: Dataset/training_set/I/1728.png
inflating: Dataset/training_set/I/1729.png
inflating: Dataset/training_set/I/173.png
inflating: Dataset/training_set/I/1730.png
inflating: Dataset/training_set/I/1731.png
inflating: Dataset/training_set/I/1732.png
inflating: Dataset/training_set/I/1733.png
inflating: Dataset/training_set/I/1734.png
inflating: Dataset/training_set/I/1735.png
extracting: Dataset/training_set/I/1736.png
inflating: Dataset/training_set/I/1737.png
inflating: Dataset/training_set/I/1738.png
extracting: Dataset/training_set/I/1739.png
inflating: Dataset/training_set/I/174.png
inflating: Dataset/training_set/I/1740.png
inflating: Dataset/training_set/I/1741.png
inflating: Dataset/training_set/I/1742.png
inflating: Dataset/training_set/I/1743.png
inflating: Dataset/training_set/I/1744.png
inflating: Dataset/training_set/I/1745.png
inflating: Dataset/training_set/I/1746.png
inflating: Dataset/training_set/I/1747.png

[illegible]

[illegible]

[illegible]

[illegible]

Dataset/training_set/I/370.png inflating:
Dataset/training_set/I/371.png inflating:
Dataset/training_set/I/372.png extracting:
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Dataset/training_set/I/377.png inflating:
Dataset/training_set/I/378.png inflating:
Dataset/training_set/I/379.png inflating:
Dataset/training_set/I/38.png inflating:
Dataset/training_set/I/380.png inflating:
Dataset/training_set/I/381.png inflating:
Dataset/training_set/I/382.png inflating:
Dataset/training_set/I/383.png inflating:
Dataset/training_set/I/384.png extracting:
Dataset/training_set/I/385.png inflating:
Dataset/training_set/I/386.png extracting:
Dataset/training_set/I/387.png inflating:
Dataset/training_set/I/388.png inflating:
Dataset/training_set/I/389.png inflating:
Dataset/training_set/I/39.png inflating:
Dataset/training_set/I/390.png inflating:
Dataset/training_set/I/391.png inflating:
Dataset/training_set/I/392.png extracting:
Dataset/training_set/I/393.png inflating:
Dataset/training_set/I/394.png inflating:
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Dataset/training_set/I/396.png inflating:
Dataset/training_set/I/397.png inflating:
Dataset/training_set/I/398.png inflating:
Dataset/training_set/I/399.png inflating:
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Dataset/training_set/I/402.png extracting:
Dataset/training_set/I/403.png extracting:
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Dataset/training_set/I/405.png inflating:
Dataset/training_set/I/406.png inflating:
Dataset/training_set/I/407.png inflating:
Dataset/training_set/I/408.png inflating:
Dataset/training_set/I/409.png extracting:
Dataset/training_set/I/41.png inflating:
Dataset/training_set/I/410.png inflating:
Dataset/training_set/I/411.png inflating:
Dataset/training_set/I/412.png inflating:
Dataset/training_set/I/413.png inflating:
Dataset/training_set/I/414.png inflating:
Dataset/training_set/I/415.png inflating:
Dataset/training_set/I/416.png inflating:
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Dataset/training_set/I/418.png inflating:
Dataset/training_set/I/419.png inflating:
Dataset/training_set/I/42.png inflating:

Dataset/training_set/I/420.png inflating:
Dataset/training_set/I/421.png inflating:
Dataset/training_set/I/422.png inflating:
Dataset/training_set/I/423.png inflating:
Dataset/training_set/I/424.png inflating:
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Dataset/training_set/I/427.png inflating:
Dataset/training_set/I/428.png
extracting: Dataset/training_set/I/429.png
extracting: Dataset/training_set/I/43.png
inflating: Dataset/training_set/I/430.png
inflating: Dataset/training_set/I/431.png
inflating: Dataset/training_set/I/432.png
inflating: Dataset/training_set/I/433.png
inflating: Dataset/training_set/I/434.png
inflating: Dataset/training_set/I/435.png
inflating: Dataset/training_set/I/436.png
inflating: Dataset/training_set/I/437.png
inflating: Dataset/training_set/I/438.png
inflating: Dataset/training_set/I/439.png
inflating: Dataset/training_set/I/44.png
inflating: Dataset/training_set/I/440.png
inflating: Dataset/training_set/I/441.png
inflating: Dataset/training_set/I/442.png
inflating: Dataset/training_set/I/443.png
extracting: Dataset/training_set/I/444.png
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inflating: Dataset/training_set/I/446.png
extracting: Dataset/training_set/I/447.png
inflating: Dataset/training_set/I/448.png
inflating: Dataset/training_set/I/449.png
inflating: Dataset/training_set/I/45.png
inflating: Dataset/training_set/I/450.png
inflating: Dataset/training_set/I/451.png
inflating: Dataset/training_set/I/452.png
inflating: Dataset/training_set/I/453.png
inflating: Dataset/training_set/I/454.png
extracting: Dataset/training_set/I/455.png
inflating: Dataset/training_set/I/456.png
extracting: Dataset/training_set/I/457.png
inflating: Dataset/training_set/I/458.png
extracting: Dataset/training_set/I/459.png
inflating: Dataset/training_set/I/46.png
extracting: Dataset/training_set/I/460.png
inflating: Dataset/training_set/I/461.png
inflating: Dataset/training_set/I/462.png
inflating: Dataset/training_set/I/463.png
extracting: Dataset/training_set/I/464.png
inflating: Dataset/training_set/I/465.png
inflating: Dataset/training_set/I/466.png
inflating: Dataset/training_set/I/467.png
extracting: Dataset/training_set/I/468.png
extracting: Dataset/training_set/I/469.png
inflating: Dataset/training_set/I/47.png
inflating: Dataset/training_set/I/470.png

inflating: Dataset/training_set/I/471.png
inflating: Dataset/training_set/I/472.png
inflating: Dataset/training_set/I/473.png
inflating: Dataset/training_set/I/474.png
inflating: Dataset/training_set/I/475.png
extracting: Dataset/training_set/I/476.png
extracting: Dataset/training_set/I/477.png
inflating: Dataset/training_set/I/478.png
extracting: Dataset/training_set/I/479.png
inflating: Dataset/training_set/I/48.png
inflating: Dataset/training_set/I/480.png
inflating: Dataset/training_set/I/481.png
extracting: Dataset/training_set/I/482.png
inflating: Dataset/training_set/I/483.png
extracting: Dataset/training_set/I/484.png
inflating: Dataset/training_set/I/485.png
inflating: Dataset/training_set/I/486.png
inflating: Dataset/training_set/I/487.png
extracting: Dataset/training_set/I/488.png
inflating: Dataset/training_set/I/489.png
extracting: Dataset/training_set/I/49.png
extracting: Dataset/training_set/I/490.png
extracting: Dataset/training_set/I/491.png
extracting: Dataset/training_set/I/492.png
extracting: Dataset/training_set/I/493.png
inflating: Dataset/training_set/I/494.png
extracting: Dataset/training_set/I/495.png
extracting: Dataset/training_set/I/496.png
extracting: Dataset/training_set/I/497.png
inflating: Dataset/training_set/I/498.png
extracting: Dataset/training_set/I/499.png
inflating: Dataset/training_set/I/5.png
inflating:
Dataset/training_set/I/50.png inflating:
Dataset/training_set/I/500.png inflating:
Dataset/training_set/I/501.png extracting:
Dataset/training_set/I/502.png inflating:
Dataset/training_set/I/503.png inflating:
Dataset/training_set/I/504.png inflating:
Dataset/training_set/I/505.png inflating:
Dataset/training_set/I/506.png inflating:
Dataset/training_set/I/507.png inflating:
Dataset/training_set/I/508.png inflating:
Dataset/training_set/I/509.png inflating:
Dataset/training_set/I/51.png inflating:
Dataset/training_set/I/510.png inflating:
Dataset/training_set/I/511.png inflating:
Dataset/training_set/I/512.png inflating:
Dataset/training_set/I/513.png inflating:
Dataset/training_set/I/514.png inflating:
Dataset/training_set/I/515.png inflating:
Dataset/training_set/I/516.png inflating:
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Dataset/training_set/I/518.png inflating:
Dataset/training_set/I/519.png inflating:
Dataset/training_set/I/52.png inflating:

[illegible]

inflating: Dataset/training_set/I/571.png
inflating: Dataset/training_set/I/572.png
inflating: Dataset/training_set/I/573.png
extracting: Dataset/training_set/I/574.png
extracting: Dataset/training_set/I/575.png
inflating: Dataset/training_set/I/576.png
inflating: Dataset/training_set/I/577.png
inflating: Dataset/training_set/I/578.png
extracting: Dataset/training_set/I/579.png
inflating: Dataset/training_set/I/58.png
inflating:
Dataset/training_set/I/580.png inflating:
Dataset/training_set/I/581.png inflating:
Dataset/training_set/I/582.png inflating:
Dataset/training_set/I/583.png inflating:
Dataset/training_set/I/584.png inflating:
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Dataset/training_set/I/587.png inflating:
Dataset/training_set/I/588.png inflating:
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Dataset/training_set/I/608.png inflating:
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Dataset/training_set/I/612.png inflating:
Dataset/training_set/I/613.png extracting:
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Dataset/training_set/I/615.png inflating:
Dataset/training_set/I/616.png inflating:
Dataset/training_set/I/617.png inflating:
Dataset/training_set/I/618.png inflating:
Dataset/training_set/I/619.png inflating:
Dataset/training_set/I/62.png inflating:

[illegible]

Dataset/training_set/I/670.png inflating:
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Dataset/training_set/I/672.png inflating:
Dataset/training_set/I/673.png inflating:
Dataset/training_set/I/674.png 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:
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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:
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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 inflating:
Dataset/training_set/I/714.png inflating:
Dataset/training_set/I/715.png inflating:
Dataset/training_set/I/716.png inflating:
Dataset/training_set/I/717.png inflating:
Dataset/training_set/I/718.png inflating:
Dataset/training_set/I/719.png inflating:
Dataset/training_set/I/72.png inflating:

Dataset/training_set/I/720.png inflating:
Dataset/training_set/I/721.png inflating:
Dataset/training_set/I/722.png inflating:
Dataset/training_set/I/723.png inflating:
Dataset/training_set/I/724.png inflating:
Dataset/training_set/I/725.png inflating:
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Dataset/training_set/I/727.png inflating:
Dataset/training_set/I/728.png inflating:
Dataset/training_set/I/729.png inflating:
Dataset/training_set/I/73.png inflating:
Dataset/training_set/I/730.png extracting:
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Dataset/training_set/I/734.png inflating:
Dataset/training_set/I/735.png inflating:
Dataset/training_set/I/736.png inflating:
Dataset/training_set/I/737.png inflating:
Dataset/training_set/I/738.png
extracting: Dataset/training_set/I/739.png
inflating: Dataset/training_set/I/74.png
extracting: Dataset/training_set/I/740.png
inflating: Dataset/training_set/I/741.png
inflating: Dataset/training_set/I/742.png
inflating: Dataset/training_set/I/743.png
inflating: Dataset/training_set/I/744.png
inflating: Dataset/training_set/I/745.png
inflating: Dataset/training_set/I/746.png
extracting: Dataset/training_set/I/747.png
inflating: Dataset/training_set/I/748.png
inflating: Dataset/training_set/I/749.png
inflating: Dataset/training_set/I/75.png
inflating: Dataset/training_set/I/750.png
inflating: Dataset/training_set/I/751.png
inflating: Dataset/training_set/I/752.png
inflating: Dataset/training_set/I/753.png
inflating: Dataset/training_set/I/754.png
inflating: Dataset/training_set/I/755.png
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inflating: Dataset/training_set/I/757.png
inflating: Dataset/training_set/I/758.png
inflating: Dataset/training_set/I/759.png
inflating: Dataset/training_set/I/76.png
inflating: Dataset/training_set/I/760.png
inflating: Dataset/training_set/I/761.png
inflating: Dataset/training_set/I/762.png
inflating: Dataset/training_set/I/763.png
inflating: Dataset/training_set/I/764.png
extracting: Dataset/training_set/I/765.png
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inflating: Dataset/training_set/I/767.png
inflating: Dataset/training_set/I/768.png
inflating: Dataset/training_set/I/769.png
inflating: Dataset/training_set/I/77.png
inflating: Dataset/training_set/I/770.png

[illegible]

[illegible]

inflating: Dataset/training_set/I/871.png
inflating: Dataset/training_set/I/872.png
inflating: Dataset/training_set/I/873.png
inflating: Dataset/training_set/I/874.png
inflating: Dataset/training_set/I/875.png
inflating: Dataset/training_set/I/876.png
inflating: Dataset/training_set/I/877.png
inflating: Dataset/training_set/I/878.png
inflating: Dataset/training_set/I/879.png
inflating: Dataset/training_set/I/88.png
inflating: Dataset/training_set/I/880.png
inflating: Dataset/training_set/I/881.png
inflating: Dataset/training_set/I/882.png
inflating: Dataset/training_set/I/883.png
inflating: Dataset/training_set/I/884.png
inflating: Dataset/training_set/I/885.png
extracting: Dataset/training_set/I/886.png
extracting: Dataset/training_set/I/887.png
inflating: Dataset/training_set/I/888.png
inflating: Dataset/training_set/I/889.png
inflating: Dataset/training_set/I/89.png
inflating:
Dataset/training_set/I/890.png inflating:
Dataset/training_set/I/891.png inflating:
Dataset/training_set/I/892.png inflating:
Dataset/training_set/I/893.png inflating:
Dataset/training_set/I/894.png inflating:
Dataset/training_set/I/895.png inflating:
Dataset/training_set/I/896.png inflating:
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Dataset/training_set/I/898.png inflating:
Dataset/training_set/I/899.png inflating:
Dataset/training_set/I/9.png inflating:
Dataset/training_set/I/90.png inflating:
Dataset/training_set/I/900.png inflating:
Dataset/training_set/I/901.png inflating:
Dataset/training_set/I/902.png inflating:
Dataset/training_set/I/903.png inflating:
Dataset/training_set/I/904.png extracting:
Dataset/training_set/I/905.png inflating:
Dataset/training_set/I/906.png inflating:
Dataset/training_set/I/907.png inflating:
Dataset/training_set/I/908.png inflating:
Dataset/training_set/I/909.png inflating:
Dataset/training_set/I/91.png inflating:
Dataset/training_set/I/910.png extracting:
Dataset/training_set/I/911.png extracting:
Dataset/training_set/I/912.png inflating:
Dataset/training_set/I/913.png inflating:
Dataset/training_set/I/914.png extracting:
Dataset/training_set/I/915.png inflating:
Dataset/training_set/I/916.png inflating:
Dataset/training_set/I/917.png inflating:
Dataset/training_set/I/918.png inflating:
Dataset/training_set/I/919.png inflating:
Dataset/training_set/I/92.png inflating:

[illegible]

```

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

```

DATA AUGMENTATION

```

from keras.preprocessing.image import ImageDataGenerator train_datagen=ImageDataGenerator(rescale =
1./255, shear_range=0.2, zoom_range=0.2,horizontal_flip=True,vertical_flip=False) test_datagen =
ImageDataGenerator(rescale=1./255)

```

```

x_train = train_datagen.flow_from_directory("/content/Dataset/training_set",
target_size=(64,64),batch_size=100,                                class_mode='categorical', color_mode
="grayscale")

```

Found 15750 images belonging to 9 classes.

```

x_test = test_datagen.flow_from_directory("/content/Dataset/test_set", target_size=(64,64),batch_size=100,
class_mode='categorical', color_mode ="grayscale")

```

Found 2250 images belonging to 9 classes.

```
len(x_train)
```

```
158
```

```
len(x_test)
```

```
x_train.class_indices
```

```
{'A': 0, 'B': 1, 'C': 2, 'D': 3, 'E': 4, 'F': 5, 'G': 6, 'H': 7, 'I': 8}
```

MODEL BUILDING

```
from keras.models import Sequential from keras.layers import Dense from keras.layers import
Convolution2D from tensorflow.keras.layers import Conv2D, MaxPooling2D
from keras.layers import Dropout from keras.layers import Flatten
```

```
#Creating the model model=Sequential()
```

```
#Adding
```

```
the layers
```

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

```
model.add(MaxPooling2D(pool_size=(2,2))) model.add(Flatten())
```

```
#adding hidden layers model.add(Dense(400,
activation='relu')) model.add(Dense(200,
activation='relu')) model.add(Dense(100,
activation='relu'))
```

```
#Adding the output layer
```

```
model.add(Dense(9, activation='softmax'))
```

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

```
model.fit_generator(x_train, steps_per_epoch=30, epochs=10, validation_data=x_test,validation_steps=50)
```

```
Epoch 1/10
```

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

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

```
30/30 [=====] - ETA: 0s - loss: 0.0083 - accuracy: 0.9957
```

```
WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your dataset or generato
r can generate at least `steps_per_epoch * epochs` batches (in this case, 50 batches). You may need to use the re
peat() function when building your dataset.
```

```
30/30 [=====] - 18s 587ms/step - loss: 0.0083 - accuracy: 0.9957 - val_loss:
0.2910 - val_accuracy: 0.9693
```

```
Epoch 2/10
```

```
30/30 [=====] - 12s 402ms/step - loss: 0.0081 - accuracy: 0.9980
```

```
Epoch 3/10
```

```
30/30 [=====] - 12s 400ms/step - loss: 0.0102 - accuracy: 0.9963
```

```
Epoch 4/10
```

```
30/30 [=====] - 12s 402ms/step - loss: 0.0049 - accuracy: 0.9993
```

```
Epoch 5/10
```

```
30/30 [=====] - 12s 402ms/step - loss: 0.0030 - accuracy: 0.9997
```

```
Epoch 6/10
```

```
30/30 [=====] - 12s 394ms/step - loss: 0.0019 - accuracy: 0.9997
```

```
Epoch 7/10
```

```
30/30 [=====] - 12s 401ms/step - loss: 0.0081 - accuracy: 0.9973
```

```
Epoch 8/10
```

```
30/30 [=====] - 12s 402ms/step - loss: 0.0124 - accuracy: 0.9960
```

```
Epoch 9/10
```

```
30/30 [=====] - 12s 401ms/step - loss: 0.0070 - accuracy: 0.9987
```

Epoch 10/10

30/30 [=====] - 12s 399ms/step - loss: 0.0089 - accuracy: 0.9973

model.save('Real_time.h5')

TEST THE MODEL

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

```
model = load_model('/content/Real_time.h5')
img =
```

```
image.load_img('/content/Dataset/test_set/H/107.png', target_size = (100,100))
img =
```

```
    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])
```

```
img = image.load_img("/content/Dataset/test_set/H/107.png")
detect(img)
```

1/1 [=====] - 0s 28ms/step

THE PREDICTED LETTER IS H

```
img = image.load_img('/content/Dataset/test_set/A/110.png')
pred = detect(img)
```

1/1 [=====] - 0s 26ms/step THE

PREDICTED LETTER IS A

```
img = image.load_img('/content/Dataset/test_set/E/111.png')
detect(img)
```

1/1 [=====] - 0s 30ms/step

THE PREDICTED LETTER IS E