

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

TEAM ID: PNT2022TMID51692

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

inflating: inflating:

inflating: inflating:

inflating: inflating:

Dataset/training_set/G/453.png

Dataset/training_set/G/454.png

Dataset/training_set/G/455.png

Dataset/training_set/G/456.png

inflating: Dataset/training_set/G/457.png

inflating: Dataset/training_set/G/458.png

inflating: Dataset/training_set/G/459.png

inflating: Dataset/training_set/G/46.png

inflating: Dataset/training_set/G/460.png

inflating: Dataset/training_set/G/461.png

inflating: Dataset/training_set/G/462.png

inflating: Dataset/training_set/G/463.png

inflating: Dataset/training_set/G/464.png

inflating: Dataset/training_set/G/465.png

inflating: Dataset/training_set/G/466.png

extracting: Dataset/training_set/G/467.png

extracting: Dataset/training_set/G/468.png

inflating: Dataset/training_set/G/469.png

inflating: Dataset/training_set/G/47.png

inflating: Dataset/training_set/G/470.png

inflating: Dataset/training_set/G/471.png

inflating:

inflating:

extracting: Dataset/training_set/G/472.png

extracting: Dataset/training_set/G/473.png

extracting: Dataset/training_set/G/474.png

Dataset/training_set/G/475.png

Dataset/training_set/G/476.png extracting:

Dataset/training_set/G/477.png inflating:

Dataset/training_set/G/478.png inflating:

Dataset/training_set/G/479.png inflating:

Dataset/training_set/G/48.png extracting:

Dataset/training_set/G/480.png inflating:

Dataset/training_set/G/481.png inflating:

Dataset/training_set/G/482.png extracting:

Dataset/training_set/G/483.png inflating:

Dataset/training_set/G/484.png inflating:

Dataset/training_set/G/485.png inflating:

Dataset/training_set/G/486.png extracting:

Dataset/training_set/G/487.png inflating:

Dataset/training_set/G/488.png inflating:

Dataset/training_set/G/489.png inflating:

Dataset/training_set/G/49.png inflating:

Dataset/training_set/G/490.png inflating:

Dataset/training_set/G/491.png inflating:

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Dataset/training_set/G/492.png inflating:

Dataset/training_set/G/493.png

inflating: Dataset/training_set/G/494.png

Dataset/training_set/G/495.png

Dataset/training_set/G/496.png

Dataset/training_set/G/497.png

Dataset/training_set/G/498.png

Dataset/training_set/G/499.png

Dataset/training_set/G/5.png

Dataset/training_set/G/50.png

Dataset/training_set/G/500.png

inflating: Dataset/training_set/G/501.png

inflating: Dataset/training_set/I/528.png

inflating: Dataset/training_set/I/529.png

inflating: Dataset/training_set/I/53.png

inflating: Dataset/training_set/I/530.png

inflating: Dataset/training_set/I/531.png

inflating: Dataset/training_set/I/532.png

inflating: Dataset/training_set/I/533.png

extracting: Dataset/training_set/I/534.png

inflating: Dataset/training_set/I/535.png

inflating: inflating:

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inflating: Dataset/training_set/l/536.png
inflating: Dataset/training_set/l/537.png
inflating: Dataset/training_set/l/538.png
inflating: Dataset/training_set/l/539.png
inflating: Dataset/training_set/l/54.png
inflating: Dataset/training_set/l/540.png
extracting: Dataset/training_set/l/541.png
extracting: Dataset/training_set/l/542.png
Dataset/training_set/l/543.png
Dataset/training_set/l/544.png
Dataset/training_set/l/545.png

inflating: inflating:

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Dataset/training_set/l/546.png

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inflating: Dataset/training_set/l/55.png

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inflating: Dataset/training_set/l/56.png

inflating: Dataset/training_set/l/560.png

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inflating: Dataset/training_set/l/562.png

inflating: Dataset/training_set/l/563.png

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inflating: Dataset/training_set/l/564.png

Dataset/training_set/l/565.png

Dataset/training_set/l/566.png

Dataset/training_set/l/567.png

Dataset/training_set/l/568.png

Dataset/training_set/l/569.png

Dataset/training_set/l/57.png

Dataset/training_set/l/570.png

Dataset/training_set/l/571.png

inflating: Dataset/training_set/l/572.png

inflating: Dataset/training_set/l/573.png

extracting: Dataset/training_set/l/574.png

extracting: Dataset/training_set/l/575.png

inflating: Dataset/training_set/l/576.png

inflating: Dataset/training_set/l/577.png

inflating: Dataset/training_set/l/578.png

extracting: Dataset/training_set/l/579.png

inflating: Dataset/training_set/l/58.png

inflating: Dataset/training_set/l/580.png

inflating: Dataset/training_set/l/581.png

inflating: Dataset/training_set/l/582.png

inflating: Dataset/training_set/l/583.png

inflating: Dataset/training_set/l/584.png

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inflating: Dataset/training_set/l/585.png

inflating: Dataset/training_set/l/586.png

inflating: Dataset/training_set/l/587.png

Dataset/training_set/l/588.png

Dataset/training_set/l/589.png

Dataset/training_set/l/59.png

Dataset/training_set/l/590.png

Dataset/training_set/l/591.png

extracting:

Dataset/training_set/l/592.png

inflating:

Dataset/training_set/l/593.png

inflating:

Dataset/training_set/l/594.png

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Dataset/training_set/l/595.png

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Dataset/training_set/l/598.png

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Dataset/training_set/l/599.png

inflating:

Dataset/training_set/l/6.png

inflating:

Dataset/training_set/l/60.png

extracting:

Dataset/training_set/l/600.png

inflating:

Dataset/training_set/l/601.png

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Dataset/training_set/l/602.png

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Dataset/training_set/l/603.png

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Dataset/training_set/l/606.png

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Dataset/training_set/l/607.png

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Dataset/training_set/l/608.png

inflating: Dataset/training_set/l/609.png

Dataset/training_set/l/61.png

Dataset/training_set/l/610.png

Dataset/training_set/l/611.png

Dataset/training_set/l/612.png

inflating: inflating:

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Dataset/training_set/l/613.png

extracting: Dataset/training_set/l/614.png

inflating: Dataset/training_set/l/615.png

inflating: Dataset/training_set/l/616.png

inflating: Dataset/training_set/l/617.png

inflating: Dataset/training_set/l/618.png

inflating: Dataset/training_set/l/619.png

inflating: Dataset/training_set/l/62.png

inflating: Dataset/training_set/l/620.png

inflating: Dataset/training_set/l/621.png

inflating: Dataset/training_set/l/622.png

inflating: Dataset/training_set/l/623.png

inflating: Dataset/training_set/l/624.png

inflating: Dataset/training_set/l/625.png

inflating: Dataset/training_set/l/626.png

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inflating: Dataset/training_set/l/628.png

inflating: Dataset/training_set/l/629.png

inflating: Dataset/training_set/l/63.png

inflating: Dataset/training_set/l/630.png

inflating: Dataset/training_set/l/631.png

Dataset/training_set/l/632.png

Dataset/training_set/l/633.png

Dataset/training_set/l/634.png

inflating: inflating:

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Dataset/training_set/I/635.png

Dataset/training_set/I/636.png

Dataset/training_set/I/637.png

inflating: Dataset/training_set/I/638.png

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inflating: inflating:

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extracting: Dataset/training_set/l/657.png

extracting: Dataset/training_set/l/658.png

Dataset/training_set/l/659.png

Dataset/training_set/l/66.png

inflating: Dataset/training_set/l/660.png

inflating: Dataset/training_set/l/661.png

inflating: Dataset/training_set/l/662.png

inflating: Dataset/training_set/l/663.png

extracting: Dataset/training_set/l/664.png

inflating: Dataset/training_set/l/665.png

inflating: Dataset/training_set/l/666.png

inflating: Dataset/training_set/l/667.png

inflating: Dataset/training_set/l/668.png

inflating: Dataset/training_set/l/669.png

inflating: Dataset/training_set/l/67.png

inflating: Dataset/training_set/l/670.png

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inflating: Dataset/training_set/l/672.png

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inflating: Dataset/training_set/l/674.png

inflating: Dataset/training_set/l/675.png

inflating: Dataset/training_set/l/676.png

inflating: Dataset/training_set/l/677.png

inflating: inflating:

extracting: Dataset/training_set/l/678.png

Dataset/training_set/l/679.png

Dataset/training_set/l/68.png

Dataset/training_set/l/680.png

inflating: inflating:

inflating:

inflating: inflating:

Dataset/training_set/l/681.png

Dataset/training_set/l/682.png

extracting: Dataset/training_set/l/683.png

inflating: Dataset/training_set/l/684.png

inflating: Dataset/training_set/l/685.png

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inflating: Dataset/training_set/l/689.png

inflating: Dataset/training_set/l/69.png

inflating: Dataset/training_set/l/690.png

inflating: Dataset/training_set/l/691.png

inflating: Dataset/training_set/l/692.png

inflating: Dataset/training_set/l/693.png

extracting: Dataset/training_set/l/694.png

inflating: Dataset/training_set/l/695.png

extracting: Dataset/training_set/l/696.png

extracting: Dataset/training_set/l/697.png

inflating: Dataset/training_set/l/698.png

inflating: Dataset/training_set/l/699.png

extracting: Dataset/training_set/l/7.png

extracting: Dataset/training_set/l/70.png

extracting: Dataset/training_set/l/700.png

inflating:

inflating: inflating:

inflating: Dataset/training_set/l/701.png

Dataset/training_set/l/702.png

Dataset/training_set/l/703.png

Dataset/training_set/l/704.png

extracting: Dataset/training_set/l/705.png

inflating: Dataset/training_set/l/706.png

inflating: Dataset/training_set/l/707.png

inflating: Dataset/training_set/l/708.png

inflating: Dataset/training_set/l/709.png

inflating: Dataset/training_set/l/71.png

inflating: Dataset/training_set/l/710.png

inflating: Dataset/training_set/l/711.png

inflating: Dataset/training_set/l/712.png

inflating: Dataset/training_set/l/713.png

inflating: Dataset/training_set/l/714.png

inflating: Dataset/training_set/l/715.png

inflating: Dataset/training_set/l/716.png

inflating: Dataset/training_set/l/717.png

inflating: Dataset/training_set/l/718.png

inflating: Dataset/training_set/l/719.png

inflating: inflating:

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inflating: inflating:

inflating: Dataset/training_set/l/72.png

inflating: Dataset/training_set/l/720.png

inflating: Dataset/training_set/l/721.png

Dataset/training_set/l/722.png

Dataset/training_set/l/723.png

Dataset/training_set/l/724.png

Dataset/training_set/l/725.png

Dataset/training_set/l/726.png

Dataset/training_set/l/727.png

Dataset/training_set/l/728.png

Dataset/training_set/l/729.png

inflating: Dataset/training_set/l/73.png

inflating: Dataset/training_set/l/730.png

extracting: Dataset/training_set/l/731.png

inflating: Dataset/training_set/l/732.png

inflating: Dataset/training_set/l/733.png

inflating: Dataset/training_set/l/734.png

inflating: Dataset/training_set/l/735.png

inflating: Dataset/training_set/l/736.png

inflating: Dataset/training_set/l/737.png

inflating: Dataset/training_set/l/738.png

extracting: Dataset/training_set/l/739.png

inflating: Dataset/training_set/l/74.png

inflating:

inflating: inflating:

extracting: Dataset/training_set/l/740.png

inflating: Dataset/training_set/l/741.png

inflating: Dataset/training_set/l/742.png

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inflating: Dataset/training_set/l/744.png

inflating: Dataset/training_set/l/745.png

inflating: Dataset/training_set/l/746.png

extracting: Dataset/training_set/l/747.png

Dataset/training_set/l/748.png

inflating: inflating:

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Dataset/training_set/l/749.png

Dataset/training_set/l/75.png

Dataset/training_set/l/750.png

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inflating: Dataset/training_set/l/76.png

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inflating: Dataset/training_set/l/762.png

inflating: Dataset/training_set/l/763.png

inflating: Dataset/training_set/l/764.png

extracting: Dataset/training_set/l/765.png

inflating: Dataset/training_set/l/766.png

inflating: Dataset/training_set/l/767.png

Dataset/training_set/l/768.png

Dataset/training_set/l/769.png

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Dataset/training_set/l/77.png

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Dataset/training_set/l/771.png

Dataset/training_set/l/772.png

Dataset/training_set/l/773.png

Dataset/training_set/l/774.png

inflating: Dataset/training_set/l/775.png

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Dataset/training_set/l/790.png

Dataset/training_set/l/791.png

Dataset/training_set/l/792.png

Dataset/training_set/l/793.png

extracting:

Dataset/training_set/l/794.png

inflating:

Dataset/training_set/l/795.png

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Dataset/training_set/l/796.png

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Dataset/training_set/l/797.png

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Dataset/training_set/l/798.png

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Dataset/training_set/l/799.png

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Dataset/training_set/l/8.png

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Dataset/training_set/l/80.png

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Dataset/training_set/l/800.png

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Dataset/training_set/l/801.png

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Dataset/training_set/l/808.png

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Dataset/training_set/l/809.png

inflating:

Dataset/training_set/l/81.png

extracting:

Dataset/training_set/l/810.png

inflating: Dataset/training_set/l/811.png

Dataset/training_set/l/812.png

inflating: inflating:

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Dataset/training_set/l/813.png

Dataset/training_set/l/814.png

Dataset/training_set/l/815.png

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Dataset/training_set/l/816.png

Dataset/training_set/l/817.png

inflating: Dataset/training_set/l/818.png

inflating: Dataset/training_set/l/819.png

inflating: Dataset/training_set/l/82.png

inflating: Dataset/training_set/l/820.png

inflating: Dataset/training_set/l/821.png

inflating: Dataset/training_set/l/822.png

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inflating: Dataset/training_set/l/824.png

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inflating: Dataset/training_set/l/826.png

inflating: Dataset/training_set/l/827.png

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inflating: Dataset/training_set/l/83.png

inflating: Dataset/training_set/l/830.png

inflating: Dataset/training_set/l/831.png

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inflating: Dataset/training_set/l/834.png

Dataset/training_set/l/835.png

inflating: inflating:

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Dataset/training_set/l/836.png

Dataset/training_set/l/837.png

Dataset/training_set/l/838.png

Dataset/training_set/l/839.png

Dataset/training_set/l/84.png

inflating: Dataset/training_set/l/840.png

extracting: Dataset/training_set/l/841.png

inflating: Dataset/training_set/l/842.png

inflating: Dataset/training_set/l/843.png

inflating: Dataset/training_set/l/844.png

inflating: Dataset/training_set/l/845.png

inflating: Dataset/training_set/l/846.png

inflating: Dataset/training_set/l/847.png

inflating: Dataset/training_set/l/848.png

inflating: Dataset/training_set/l/849.png

inflating: Dataset/training_set/l/85.png

inflating: Dataset/training_set/l/850.png

inflating: Dataset/training_set/l/851.png

inflating: Dataset/training_set/l/852.png

inflating: Dataset/training_set/l/853.png

inflating: Dataset/training_set/l/854.png

extracting: Dataset/training_set/l/855.png

inflating: Dataset/training_set/l/856.png

inflating: Dataset/training_set/l/857.png

inflating:

inflating: inflating:

inflating: Dataset/training_set/l/858.png

inflating: Dataset/training_set/l/859.png

extracting: Dataset/training_set/l/86.png

Dataset/training_set/l/860.png

Dataset/training_set/l/861.png

Dataset/training_set/l/862.png

extracting: Dataset/training_set/l/863.png

inflating: Dataset/training_set/l/864.png

inflating: Dataset/training_set/l/865.png

inflating: Dataset/training_set/l/866.png

inflating: Dataset/training_set/l/867.png

extracting: Dataset/training_set/l/868.png

inflating: Dataset/training_set/l/869.png

inflating: Dataset/training_set/l/87.png

inflating: Dataset/training_set/l/870.png

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inflating: Dataset/training_set/l/88.png

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inflating: Dataset/training_set/l/882.png

Dataset/training_set/l/883.png

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inflating: inflating:

Dataset/training_set/l/884.png

Dataset/training_set/l/885.png

extracting: Dataset/training_set/l/886.png

extracting: Dataset/training_set/l/887.png

inflating: Dataset/training_set/l/888.png

inflating: Dataset/training_set/l/889.png

inflating: Dataset/training_set/l/89.png

inflating: Dataset/training_set/l/890.png

inflating: Dataset/training_set/l/891.png

inflating: Dataset/training_set/l/892.png

inflating: Dataset/training_set/l/893.png

inflating: Dataset/training_set/l/894.png

inflating: Dataset/training_set/l/895.png

inflating: Dataset/training_set/l/896.png

inflating: Dataset/training_set/l/897.png

inflating: Dataset/training_set/l/898.png

inflating: Dataset/training_set/l/899.png

inflating: Dataset/training_set/l/9.png

inflating: Dataset/training_set/l/90.png

inflating: Dataset/training_set/l/900.png

inflating: Dataset/training_set/l/901.png

inflating: Dataset/training_set/l/902.png

inflating: Dataset/training_set/l/903.png

inflating: Dataset/training_set/l/904.png

inflating: inflating:

inflating: inflating:

extracting: Dataset/training_set/l/905.png

Dataset/training_set/l/906.png

Dataset/training_set/l/907.png

Dataset/training_set/l/908.png

Dataset/training_set/l/909.png

inflating: Dataset/training_set/l/91.png

inflating: Dataset/training_set/l/910.png

extracting: Dataset/training_set/l/911.png

extracting: Dataset/training_set/l/912.png

inflating: Dataset/training_set/l/913.png

inflating: Dataset/training_set/l/914.png

extracting: Dataset/training_set/l/915.png

inflating: Dataset/training_set/l/916.png

inflating: Dataset/training_set/l/917.png

inflating: Dataset/training_set/l/918.png

inflating: Dataset/training_set/l/919.png

inflating: Dataset/training_set/l/92.png

inflating: Dataset/training_set/l/920.png

inflating: Dataset/training_set/l/921.png

inflating: Dataset/training_set/l/922.png

inflating: Dataset/training_set/l/923.png

inflating: Dataset/training_set/l/924.png

inflating: inflating:

inflating: inflating:

inflating: Dataset/training_set/l/925.png

inflating: Dataset/training_set/l/926.png

inflating: Dataset/training_set/l/927.png

inflating: Dataset/training_set/l/928.png

Dataset/training_set/l/929.png

Dataset/training_set/l/93.png

Dataset/training_set/l/930.png

Dataset/training_set/l/931.png

inflating: Dataset/training_set/l/932.png

inflating: Dataset/training_set/l/933.png

inflating: Dataset/training_set/l/934.png

inflating: Dataset/training_set/l/935.png

inflating: Dataset/training_set/l/936.png

inflating: Dataset/training_set/l/937.png

inflating: Dataset/training_set/l/938.png

inflating: Dataset/training_set/l/939.png

inflating: Dataset/training_set/l/94.png

inflating: Dataset/training_set/l/940.png

inflating: Dataset/training_set/l/941.png

inflating: Dataset/training_set/l/942.png

inflating: Dataset/training_set/l/943.png

inflating: Dataset/training_set/l/944.png

inflating: inflating:

inflating: inflating:

inflating: Dataset/training_set/I/945.png

inflating: Dataset/training_set/I/946.png

inflating: Dataset/training_set/I/947.png

inflating: Dataset/training_set/I/948.png

inflating: Dataset/training_set/I/949.png

inflating: Dataset/training_set/I/95.png

inflating: Dataset/training_set/I/950.png

Dataset/training_set/I/951.png

Dataset/training_set/I/952.png

Dataset/training_set/I/953.png

Dataset/training_set/I/954.png

inflating: Dataset/training_set/I/955.png

inflating: Dataset/training_set/I/956.png

inflating: Dataset/training_set/I/957.png

inflating: Dataset/training_set/I/958.png

inflating: Dataset/training_set/I/959.png

inflating: Dataset/training_set/I/96.png

inflating: Dataset/training_set/I/960.png

inflating: Dataset/training_set/I/961.png

inflating: Dataset/training_set/I/962.png

inflating: Dataset/training_set/I/963.png

inflating: Dataset/training_set/I/964.png

inflating: inflating:

inflating: inflating:

inflating: Dataset/training_set/l/965.png

inflating: Dataset/training_set/l/966.png

inflating: Dataset/training_set/l/967.png

inflating: Dataset/training_set/l/968.png

inflating: Dataset/training_set/l/969.png

inflating: Dataset/training_set/l/97.png

inflating: Dataset/training_set/l/970.png

inflating: Dataset/training_set/l/971.png

inflating: Dataset/training_set/l/972.png

extracting: Dataset/training_set/l/973.png

Dataset/training_set/l/974.png

Dataset/training_set/l/975.png

Dataset/training_set/l/976.png

Dataset/training_set/l/977.png

inflating: Dataset/training_set/l/978.png

inflating: Dataset/training_set/l/979.png

inflating: Dataset/training_set/l/98.png

inflating: Dataset/training_set/l/980.png

inflating: Dataset/training_set/l/981.png

inflating: Dataset/training_set/l/982.png

extracting: Dataset/training_set/l/983.png

inflating: Dataset/training_set/l/984.png

inflating: inflating:

inflating: inflating:

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: inflating:

inflating:

Dataset/training_set/1/997.png

Dataset/training_set/1/998.png

Dataset/training_set/1/999.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)
```

```
23
```

```
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 deprecated 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 generator can generate at least `steps_per_epoch * epochs` batches (in this case, 50 batches). You may need to use the repeat() 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

```