**MAHENDRA ENGINEERING COLLEGE FOR WOMEN**

**ASSIGNMENT III SOLUTION**

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import numpy as np

import pandas as pd

from PIL import ImageFile

from tqdm import tqdm

import h5py

import cv2

import matplotlib.pyplot as plt

%matplotlib inline

import seaborn as sns

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import confusion\_matrix

from sklearn.metrics import plot\_confusion\_matrix

from tensorflow.keras.utils import to\_categorical

from tensorflow.keras.preprocessing import image as keras\_image

from tensorflow.keras.models import Sequential, load\_model

from tensorflow.keras.layers import Dense

from tensorflow.keras.layers import Activation, Dropout

from tensorflow.keras.layers import Conv2D, MaxPooling2D, GlobalMaxPooling2D

from tensorflow.keras.callbacks import ReduceLROnPlateau, ModelCheckpoint

from tensorflow.keras.layers import LeakyReLU

def model():

    model = Sequential()

    model.add(Conv2D(128, (3, 3), input\_shape=x\_train.shape[1:]))

    model.add(LeakyReLU(alpha=0.02))

    model.add(MaxPooling2D(pool\_size=(2, 2)))

    model.add(Dropout(0.25))

    model.add(Conv2D(128, (3, 3)))

    model.add(LeakyReLU(alpha=0.02))

    model.add(MaxPooling2D(pool\_size=(2, 2)))

    model.add(Dropout(0.25))

    model.add(GlobalMaxPooling2D())

    model.add(Dense(512))

    model.add(LeakyReLU(alpha=0.02))

    model.add(Dropout(0.5))

    model.add(Dense(10))

    model.add(Activation('softmax'))

    model.compile(loss='categorical\_crossentropy', optimizer='adam', metrics=['accuracy'])

    return model

model = model()

# To save the best model

checkpointer = ModelCheckpoint(filepath='weights.best.model.hdf5', verbose=2, save\_best\_only=True)

# To reduce learning rate dynamically

lr\_reduction = ReduceLROnPlateau(monitor='val\_loss', patience=5, verbose=2, factor=0.2)

# Train the model

history = model.fit(x\_train, y\_train, epochs=75, batch\_size=32, verbose=2,

                    validation\_data=(x\_valid, y\_valid),

                    callbacks=[checkpointer,

data\_generator = keras\_image.ImageDataGenerator(shear\_range=0.3,

                                                zoom\_range=0.3,

                                                rotation\_range=30,

                                                horizontal\_flip=True)

dg\_history = model.fit\_generator(data\_generator.flow(x\_train, y\_train, batch\_size=64),

                                 steps\_per\_epoch = len(x\_train)//64, epochs=7, verbose=2,

                                 validation\_data=(x\_valid, y\_valid),

                                 callbacks=[checkpointer,lr\_reduction])