```
!pip3 install autokeras
```

```
    Requirement already satisfied: ipython in /usr/local/lib/python3.7/dist-packages (
    Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-packages (fr
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    Requirement already satisfied: keras-preprocessing~=1.1.2 in /usr/local/lib/python
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    Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.7/dist-pa
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    Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /usr/local
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    Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.7/dist-pack
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    Requirement already satisfied: importlib-metadata>=4.4 in /usr/local/lib/python3.7
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    Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist
    Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/loc
    Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packa
    Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.7/dist-pa
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    Requirement already satisfied: simplegeneric>0.8 in /usr/local/lib/python3.7/dist-
    Requirement already satisfied: traitlets>=4.2 in /usr/local/lib/python3.7/dist-pac

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    Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/
    Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-packa
    Requirement already satisfied: ptyprocess>=0.5 in /usr/local/lib/python3.7/dist-pa
    Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.7/di
    Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packa
```

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```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.m
```

```
from numpy import mean
from numpy import std
import numpy as np
from matplotlib import pyplot
from sklearn.model_selection import KFold
from tensorflow.keras.datasets import mnist
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D
```

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```
from tensorflow.keras.optimizers import SGD
from tensorflow.keras.layers import Dropout
from tensorflow.keras.layers import BatchNormalization
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras import backend as K
import matplotlib.pyplot as plt
import sklearn
from sklearn.metrics import confusion_matrix
from scipy.io import loadmat
import numpy as np
import PIL
import cv2
import os
from sklearn.model_selection import train_test_split
import autokeras as ak


'''
x = list()
data = list()
y = list()
z = 0
# ##Class-1 images##
 folder_path_class1 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/STFT_Github
# #folder_path_class2 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physionet_
# #folder_path_class3 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physionet_
# #folder_path_class4 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physionet_
# #folder_path_class5 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physionet_

# #folder_path_class1b = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physione
# #folder_path_class2b = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physione
# #folder_path_class3b = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physione
# #folder_path_class4b = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physione
```

```
# #folder_path_class5b = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physione

 paths = [folder_path_class1]

class_types = {'MVP':0,'MR':1,'MS':2,'normal':3,'AS':4}

for p in paths:
   #print(p)
  for image in os.walk(p):
     data.append(image[2])
     #print(image[2])

  for i in range(len(data[0])):
    name = data[0][i].split('_')[0]
    #print(name)
    y.append(class_types[str(name)])
     str_complete = p + data[0][i]
    #print(str_complete)
    img = cv2.imread(str_complete)
```

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```
  data = []

data_x = np.asarray(x)
 y = np.asarray(y)
 np.save('/content/drive/MyDrive/PCG_signal_time_frequency_image/STFT_Github/x',data_x)
 np.save('/content/drive/MyDrive/PCG_signal_time_frequency_image/STFT_Github/y',y)
 '''
```

```
'\nx = list()\ndata = list()\ny = list()\nz = 0\n# ##Class-1 images##\n folder_path_
class1 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/STFT_Github')\n# #
folder_path_class2 = ('/content/drive/MyDrive/PCG_signal_time_frequency_image/Physio
net_complete/scheme1/normal_TDPCT_SetB/')\n# #folder_path_class3 = ('/content/drive/
MyDrive/PCG_signal_time_frequency_image/Physionet_complete/scheme1/normal_TDPCT_Set
C/')\n# #folder_path_class4 = ('/content/drive/MyDrive/PCG_signal_time_frequency_ima
ge/Physionet_complete/scheme1/normal_TDPCT_SetD/')\n# #folder_path_class5 = ('/conte
nt/drive/MyDrive/PCG_signal_time_frequency_image/Physionet_complete/scheme1/normal_T
DPCT_SetE/')\n\n# #folder_path_class1b = ('/content/drive/MyDrive/PCG_signal_time_fr
```

```
x  = np.load("/content/drive/MyDrive/PCG_signal_time_frequency_image/STFT_Github/x.npy")
y = np.load("/content/drive/MyDrive/PCG_signal_time_frequency_image/STFT_Github/y.npy")


x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.1, random_state=1)
x_train, x_val, y_train, y_val = train_test_split(x_train, y_train, test_size=1/8, random_

y_tr_one_hot  = np.zeros((np.array(y_train).shape[0],5))
for i in range(np.array(y_train).shape[0]):
  label = y_train[i]
  y_tr_one_hot[i][int(label)] = 1

y_te_one_hot  = np.zeros((np.array(y_test).shape[0],5))
for i in range(np.array(y_test).shape[0]):
  label = y_test[i]
  y_te_one_hot[i][int(label)] = 1
```

```
y_val_one_hot  = np.zeros((np.array(y_val).shape[0],5))
for i in range(np.array(y_val).shape[0]):
  label = y_val[i]
  y_val_one_hot[i][int(label)] = 1
```

AutoKeras Code

```
input_node = ak.ImageInput()
output_node = ak.Normalization()(input_node)
output_node1 = ak.ConvBlock()(output_node)
output_node2 = ak.ConvBlock(max_pooling=True)(output_node1)
output_node = ak.ClassificationHead()(output_node)

auto_model = ak.AutoModel(
    inputs=input_node, outputs=output_node, overwrite=True, max_trials=1
)
```

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```
print(y_tr_one_hot.shape)

# Feed the AutoModel with training data.
auto_model.fit(x_train, y_train, epochs=10)
# Predict with the best model.
predicted_y = auto_model.predict(x_test)
# Evaluate the best model with testing data.
print(auto_model.evaluate(x_test, y_test))
```

```
Trial 1 Complete [00h 00m 12s]
val_loss: 0.5416480898857117

Best val_loss So Far: 0.5416480898857117
Total elapsed time: 00h 00m 12s
INFO:tensorflow:Oracle triggered exit
Epoch 1/10
25/25 [==============================] - 1s 26ms/step - loss: 3.4218 - accuracy: 0.2
Epoch 2/10
25/25 [==============================] - 1s 26ms/step - loss: 0.7467 - accuracy: 0.7
Epoch 3/10
25/25 [==============================] - 1s 26ms/step - loss: 0.3103 - accuracy: 0.9
Epoch 4/10
25/25 [==============================] - 1s 26ms/step - loss: 0.1464 - accuracy: 0.9
Epoch 5/10
25/25 [==============================] - 1s 26ms/step - loss: 0.1024 - accuracy: 0.9
Epoch 6/10
25/25 [==============================] - 1s 26ms/step - loss: 0.0786 - accuracy: 1.0
Epoch 7/10
25/25 [==============================] - 1s 25ms/step - loss: 0.0641 - accuracy: 1.0
Epoch 8/10
25/25 [==============================] - 1s 26ms/step - loss: 0.0543 - accuracy: 1.0
Epoch 9/10
25/25 [==============================] - 1s 26ms/step - loss: 0.0472 - accuracy: 1.0
Epoch 10/10
25/25 [==============================] - 1s 26ms/step - loss: 0.0417 - accuracy: 1.0
INFO:tensorflow:Assets written to: ./auto_model/best_model/assets
```

```
4/4 [==============================] - 0s 14ms/step
4/4 [==============================] - 0s 15ms/step - loss: 0.3715 - accuracy: 0.900(
[0.3714759945869446, 0.8999999761581421]
```

```
predicted_y = auto_model.predict(x_test)
```

```
4/4 [==============================] - 0s 14ms/step
```

```
p_list = predicted_y.reshape(100).tolist()
p_list_int = []
for i in p_list:
  p_list_int.append(int(i))
```

```
from sklearn.metrics import confusion_matrix
cm1 = confusion_matrix(y_test,p_list_int)
print("confusion matrix \n",cm1)
```

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```
 [ 2 23  1  0  0]
 [ 1  0 14  0  0]
 [ 1  0  0 19  0]
 [ 0  0  2  0 16]]
```

```
precision = sklearn.metrics.precision_score(y_test,p_list_int,average='micro')
print(precision)
```

```
0.9
```

```
accuracy=np.diag(cm1).sum()/cm1.sum().sum()
print(accuracy)
```

```
0.9
```

```
  recall = sklearn.metrics.recall_score(y_test,p_list_int,average='micro')
  print(recall)
```

```
0.9
```

```
F1 = sklearn.metrics.f1_score(y_test,p_list_int,average='micro')
print(F1)
```

```
0.9
```

```
K_cappa = sklearn.metrics.cohen_kappa_score(y_test,p_list_int)
print(K_cappa)
```

```
0.8741346758967904
```

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