

```
1 import tensorflow as tf
2 from tensorflow.keras.callbacks import
  LearningRateScheduler
3 from tensorflow.keras.layers import Dense, Conv2D,
  MaxPooling2D, Dropout, Flatten,
  GlobalAveragePooling2D
4 from tensorflow.keras.optimizers import Adam, SGD,
  RMSprop
5 from tensorflow.keras.preprocessing.image import
  ImageDataGenerator
6 import numpy as np
7 import matplotlib.pyplot as plt
8 import os
9 import multiprocessing
10
11 def trainCNN( ):
12
13     tf.keras.backend.clear_session()
14
15     base_dir = 'C:\work_dir\meteor_classification\
  labeledData\evenData'
16     train_dir = os.path.join(base_dir, 'train')
17     validation_dir = os.path.join(base_dir, 'valid')
18
19     train_meteors_dir = os.path.join(train_dir, '
  meteors')
20     train_non_meteors_dir = os.path.join(train_dir, '
  non_meteors')
21     validation_meteors_dir = os.path.join(
  validation_dir, 'meteors')
22     validation_non_meteors_dir = os.path.join(
  validation_dir, 'non_meteors')
23
24     print('total training meteors images: ', len(os.
  listdir(train_meteors_dir)))
25     print('total training non-meteors images: ', len(
  os.listdir(train_non_meteors_dir)))
26     print('total validation meteors images: ', len(os
  .listdir(validation_meteors_dir)))
27     print('total validation non-meteors images: ',
  len(os.listdir(validation_non_meteors_dir)))
28
29
30     #Rescale all images by 1./255
```

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31
32     train_datagen = ImageDataGenerator(rescale=1.0/
33     255,
34                                     rotation_range
35     =10, # Range from 0 to 180 degrees to randomly rotate
36     images
37     width_shift_range=0.05,
38     height_shift_range=0.05,
39     shear_range=5
40     , # Shear the image by 5 degrees
41     zoom_range=0.1
42     ,
43     horizontal_flip=True,
44     vertical_flip=
45     True,
46     fill_mode='
47     nearest'
48     )
49
50     test_datagen = ImageDataGenerator(rescale=1.0/255
51     .)
52
53     train_generator = train_datagen.
54     flow_from_directory(train_dir,
55
56     batch_size=16,
57
58     class_mode='binary',
59
60     color_mode='grayscale',
61
62     target_size=(480, 480)) # 640x360 = 480x480. (640
63     , 360)
64
65     validation_generator = test_datagen.
66     flow_from_directory(validation_dir,
67
68     batch_size=16,
69
70     class_mode='binary',
71
72     color_mode='grayscale',

```

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54         target_size=(480, 480))
55
56
57     model = tf.keras.models.Sequential([
58         Conv2D(32, (3, 3), activation='relu',
59         input_shape=(480, 480, 1)), MaxPooling2D(2,2), #
60         Dropout(0.05),
61         Conv2D(16, (3, 3), activation='relu',
62         kernel_initializer='he_uniform'), MaxPooling2D(2, 2
63         ), #Dropout(0.05),
64         Conv2D(16, (3, 3), activation='relu',
65         kernel_initializer='he_uniform'), MaxPooling2D(2, 2
66         ), #Dropout(0.05),
67         Conv2D(12, (2, 2), activation='relu',
68         kernel_initializer='he_uniform'), MaxPooling2D(2, 2
69         ), #Dropout(0.05),
70         Conv2D(8, (2, 2), activation='relu',
71         kernel_initializer='he_uniform'), MaxPooling2D(2, 2
72         ), #Dropout(0.05),
73         Conv2D(4, (2, 2), activation='relu',
74         kernel_initializer='he_uniform'), MaxPooling2D(2, 2
75         ), #Dropout(0.05),
76         #Conv2D(4, (2, 2), activation='relu'),
77         Flatten(),
78         Dense(144, activation='relu',
79         kernel_initializer='he_uniform'),
80         #Dense(32, activation='relu',
81         kernel_initializer='he_uniform'),
82         Dense(8, activation='relu',
83         kernel_initializer='he_uniform'),
84         Dense(1, activation='sigmoid',
85         kernel_initializer='he_uniform')
86     ])
87
88     print(model.summary())
89     optimizer = Adam(learning_rate=4e-3) #3e-3 # Try
90     with more and less learning rate # 5e-3
91     model.compile(optimizer=optimizer,
92                   loss='binary_crossentropy',
93                   metrics=['accuracy'])
94
95     #39.480 -> Training 39480 = 2 x 2 x 2 x 3 x 5 x 7
96     x 47

```

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79      #9.872 -> Validation = 2 x 2 x 2 x 2 x 617
80
81      history = model.fit(train_generator,
82                          validation_data=
83                          validation_generator,
84                          steps_per_epoch=2467, #2467
85                          epochs=50, #Later train with
86                          more epochs if neccessary
87                          validation_steps=617, #617
88                          verbose=1)
89
90      acc      = history.history['accuracy']
91      val_acc   = history.history['val_accuracy']
92      loss      = history.history['loss']
93      val_loss  = history.history['val_loss']
94      epochs   = range(len(acc)) #Get number of epochs
95
96      plt.plot(epochs, acc)
97      plt.plot(epochs, val_acc)
98      plt.title('Meteor detection training and
99      validation accuracy')
100
101     plt.figure()
102     plt.plot(epochs, loss)
103     plt.plot(epochs, val_loss)
104     plt.title('Meteor detection training and
105     validation loss')
106
107     plt.show()
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