```
 1 D:\OneDrive\TFG\TFG_Python\venv\Scripts\python.exe C:\
   Users\elias\AppData\Local\JetBrains\Toolbox\apps\PyCharm-P
   \ch-0\183.4284.139\helpers\pydev\pydevconsole.py --mode=
   client --port=55626
 2
 3 import sys; print('Python %s on %s' % (sys.version, sys.
   platform))
 4 sys.path.extend(['D:\\OneDrive\\TFG\\TFG_Python', 'D:/
   OneDrive/TFG/TFG_Python'])
 5
 6 PyDev console: starting.
 7
 8 Python 3.6.7 (v3.6.7:6ec5cf24b7, Oct 20 2018, 13:35:33) [
   MSC v.1900 64 bit (AMD64)] on win32
 9 >>> runfile('D:/OneDrive/TFG/TFG_Python/core/model.py',
   wdir='D:/OneDrive/TFG/TFG_Python/core')
10 Using TensorFlow backend.
11 >>> model_training()
12 ISBINARY: True
13 tipo
14 benign          2510
15 malignant       2510
16 premalignant    2510
17 dtype: int64
18 Valid gen: Img leidas= 0
19 Valid gen: Img leidas= 100
20 Valid gen: Img leidas= 200
21 Valid gen: Img leidas= 300
22 Valid gen: Img leidas= 400
23 Valid gen: Img leidas= 500
24 Valid gen: Img leidas= 600
25 Valid gen: Img leidas= 700
26 Valid gen: Img leidas= 800
27 Valid gen: Img leidas= 900
28 Valid gen: Img leidas= 1000
29 Valid gen: Img leidas= 1100
30 Valid gen: Img leidas= 1200
31 Creando modelo y compilandolo
32 2019-04-14 19:37:05.195883: I tensorflow/core/platform/
   cpu_feature_guard.cc:141] Your CPU supports instructions
   that this TensorFlow binary was not compiled to use: AVX2
33 2019-04-14 19:37:05.441624: I tensorflow/core/
   common_runtime/gpu/gpu_device.cc:1432] Found device 0 with
    properties:
34 name: GeForce GTX 1070 major: 6 minor: 1 memoryClockRate(
```

```
34 GHz): 1.835
35 pciBusID: 0000:26:00.0
36 totalMemory: 8.00GiB freeMemory: 6.64GiB
37 2019-04-14 19:37:05.441804: I tensorflow/core/
   common_runtime/gpu/gpu_device.cc:1511] Adding visible gpu
   devices: 0
38 2019-04-14 19:37:07.625183: I tensorflow/core/
   common_runtime/gpu/gpu_device.cc:982] Device interconnect
   StreamExecutor with strength 1 edge matrix:
39 2019-04-14 19:37:07.625275: I tensorflow/core/
   common_runtime/gpu/gpu_device.cc:988]      0
40 2019-04-14 19:37:07.625325: I tensorflow/core/
   common_runtime/gpu/gpu_device.cc:1001] 0:   N
41 2019-04-14 19:37:07.625500: I tensorflow/core/
   common_runtime/gpu/gpu_device.cc:1115] Created TensorFlow
   device (/job:localhost/replica:0/task:0/device:GPU:0 with
   6397 MB memory) -> physical GPU (device: 0, name: GeForce
   GTX 1070, pci bus id: 0000:26:00.0, compute capability: 6.
   1)
42 Se comienza el entrenamiento del modelo
43 ['loss', 'acc']
44 Epoch 1/40
45 2019-04-14 19:38:34.062278: W tensorflow/core/
   common_runtime/bfc_allocator.cc:211] Allocator (GPU_0_bfc
   ) ran out of memory trying to allocate 2.03GiB. The caller
    indicates that this is not a failure, but may mean that
   there could be performance gains if more memory were
   available.
46 2019-04-14 19:38:34.176416: W tensorflow/core/
   common_runtime/bfc_allocator.cc:211] Allocator (GPU_0_bfc
   ) ran out of memory trying to allocate 2.00GiB. The caller
    indicates that this is not a failure, but may mean that
   there could be performance gains if more memory were
   available.
47 2019-04-14 19:38:34.179535: W tensorflow/core/
   common_runtime/bfc_allocator.cc:211] Allocator (GPU_0_bfc
   ) ran out of memory trying to allocate 2.15GiB. The caller
    indicates that this is not a failure, but may mean that
   there could be performance gains if more memory were
   available.
48  - 78s - loss: 0.7120 - acc: 0.6859 - val_loss: 1.7587 -
   val_acc: 0.6622
49
50 Epoch 00001: val_loss improved from inf to 1.75866, saving
    model to equilibrado.h5
```

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Epoch 2/40
 - 33s - loss: 0.5050 - acc: 0.7766 - val_loss: 1.2239 -
val_acc: 0.7494

Epoch 00002: val_loss improved from 1.75866 to 1.22394,
saving model to equilibrado.h5
Epoch 3/40
 - 46s - loss: 0.4880 - acc: 0.7859 - val_loss: 0.6129 -
val_acc: 0.7793

Epoch 00003: val_loss improved from 1.22394 to 0.61292,
saving model to equilibrado.h5
Epoch 4/40
 - 46s - loss: 0.4608 - acc: 0.7953 - val_loss: 1.2384 -
val_acc: 0.7734

Epoch 00004: val_loss did not improve from 0.61292
Epoch 5/40
 - 48s - loss: 0.4191 - acc: 0.8266 - val_loss: 1.0740 -
val_acc: 0.7378

Epoch 00005: val_loss did not improve from 0.61292
Epoch 6/40
 - 52s - loss: 0.4113 - acc: 0.8266 - val_loss: 0.5051 -
val_acc: 0.8116

Epoch 00006: val_loss improved from 0.61292 to 0.50512,
saving model to equilibrado.h5
Epoch 7/40
 - 50s - loss: 0.3976 - acc: 0.8453 - val_loss: 0.4883 -
val_acc: 0.8075

Epoch 00007: val_loss improved from 0.50512 to 0.48834,
saving model to equilibrado.h5
Epoch 8/40
 - 49s - loss: 0.3736 - acc: 0.8359 - val_loss: 0.3985 -
val_acc: 0.8249

Epoch 00008: val_loss improved from 0.48834 to 0.39849,
saving model to equilibrado.h5
Epoch 9/40
 - 45s - loss: 0.3104 - acc: 0.8750 - val_loss: 0.4315 -
val_acc: 0.8166

Epoch 00009: val_loss did not improve from 0.39849
```

```
 83 Epoch 10/40
 84  - 47s - loss: 0.2976 - acc: 0.8766 - val_loss: 0.3699 -
    val_acc: 0.8432
 85
 86 Epoch 00010: val_loss improved from 0.39849 to 0.36990,
    saving model to equilibrado.h5
 87 Epoch 11/40
 88  - 39s - loss: 0.3052 - acc: 0.8594 - val_loss: 0.6072 -
    val_acc: 0.7668
 89
 90 Epoch 00011: val_loss did not improve from 0.36990
 91 Epoch 12/40
 92  - 51s - loss: 0.3652 - acc: 0.8609 - val_loss: 0.4488 -
    val_acc: 0.8199
 93
 94 Epoch 00012: val_loss did not improve from 0.36990
 95 Epoch 13/40
 96  - 52s - loss: 0.3351 - acc: 0.8766 - val_loss: 0.4119 -
    val_acc: 0.8149
 97
 98 Epoch 00013: val_loss did not improve from 0.36990
 99 Epoch 14/40
100  - 45s - loss: 0.3093 - acc: 0.8656 - val_loss: 0.4105 -
    val_acc: 0.8199
101
102 Epoch 00014: val_loss did not improve from 0.36990
103 Epoch 15/40
104  - 42s - loss: 0.3052 - acc: 0.8813 - val_loss: 0.5470 -
    val_acc: 0.8050
105
106 Epoch 00015: val_loss did not improve from 0.36990
107
108 Epoch 00015: ReduceLROnPlateau reducing learning rate to
    0.00020000000949949026.
109 Epoch 16/40
110  - 38s - loss: 0.2333 - acc: 0.9031 - val_loss: 0.4546 -
    val_acc: 0.8224
111
112 Epoch 00016: val_loss did not improve from 0.36990
113 Epoch 17/40
114  - 46s - loss: 0.2620 - acc: 0.8766 - val_loss: 0.4381 -
    val_acc: 0.8249
115
116 Epoch 00017: val_loss did not improve from 0.36990
117 Epoch 18/40
```

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118  - 40s - loss: 0.2144 - acc: 0.9156 - val_loss: 0.3776 -
    val_acc: 0.8390
119
120 Epoch 00018: val_loss did not improve from 0.36990
121 Epoch 19/40
122  - 42s - loss: 0.1939 - acc: 0.9344 - val_loss: 0.3143 -
    val_acc: 0.8664
123
124 Epoch 00019: val_loss improved from 0.36990 to 0.31426,
    saving model to equilibrado.h5
125 Epoch 20/40
126  - 49s - loss: 0.1708 - acc: 0.9312 - val_loss: 0.3034 -
    val_acc: 0.8664
127
128 Epoch 00020: val_loss improved from 0.31426 to 0.30339,
    saving model to equilibrado.h5
129 Epoch 21/40
130  - 49s - loss: 0.1920 - acc: 0.9234 - val_loss: 0.3107 -
    val_acc: 0.8598
131
132 Epoch 00021: val_loss did not improve from 0.30339
133 Epoch 22/40
134  - 43s - loss: 0.1640 - acc: 0.9406 - val_loss: 0.3026 -
    val_acc: 0.8689
135
136 Epoch 00022: val_loss improved from 0.30339 to 0.30260,
    saving model to equilibrado.h5
137 Epoch 23/40
138  - 45s - loss: 0.1626 - acc: 0.9344 - val_loss: 0.2946 -
    val_acc: 0.8739
139
140 Epoch 00023: val_loss improved from 0.30260 to 0.29462,
    saving model to equilibrado.h5
141 Epoch 24/40
142  - 45s - loss: 0.1330 - acc: 0.9438 - val_loss: 0.2999 -
    val_acc: 0.8689
143
144 Epoch 00024: val_loss did not improve from 0.29462
145 Epoch 25/40
146  - 52s - loss: 0.1883 - acc: 0.9344 - val_loss: 0.3043 -
    val_acc: 0.8797
147
148 Epoch 00025: val_loss did not improve from 0.29462
149 Epoch 26/40
150  - 43s - loss: 0.1422 - acc: 0.9469 - val_loss: 0.3226 -
```

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150 val_acc: 0.8755
151
152 Epoch 00026: val_loss did not improve from 0.29462
153 Epoch 27/40
154  - 39s - loss: 0.1628 - acc: 0.9469 - val_loss: 0.3244 -
    val_acc: 0.8697
155
156 Epoch 00027: val_loss did not improve from 0.29462
157 Epoch 28/40
158  - 47s - loss: 0.1448 - acc: 0.9438 - val_loss: 0.3142 -
    val_acc: 0.8680
159
160 Epoch 00028: val_loss did not improve from 0.29462
161
162 Epoch 00028: ReduceLROnPlateau reducing learning rate to
    2.0000000949949027e-05.
163 Epoch 29/40
164  - 38s - loss: 0.1223 - acc: 0.9547 - val_loss: 0.3135 -
    val_acc: 0.8697
165
166 Epoch 00029: val_loss did not improve from 0.29462
167 Epoch 30/40
168  - 42s - loss: 0.1192 - acc: 0.9547 - val_loss: 0.3118 -
    val_acc: 0.8763
169
170 Epoch 00030: val_loss did not improve from 0.29462
171 Epoch 31/40
172  - 38s - loss: 0.1215 - acc: 0.9563 - val_loss: 0.3086 -
    val_acc: 0.8788
173
174 Epoch 00031: val_loss did not improve from 0.29462
175 Epoch 32/40
176  - 37s - loss: 0.1107 - acc: 0.9656 - val_loss: 0.3071 -
    val_acc: 0.8797
177
178 Epoch 00032: val_loss did not improve from 0.29462
179 Epoch 33/40
180  - 43s - loss: 0.1064 - acc: 0.9688 - val_loss: 0.3053 -
    val_acc: 0.8797
181
182 Epoch 00033: val_loss did not improve from 0.29462
183
184 Epoch 00033: ReduceLROnPlateau reducing learning rate to
    2.0000001313746906e-06.
185 Entrenamiento completado, se procede al test final
```

```
186
187   32/1506 [..............................] - ETA: 11s
188   64/1506 [>.............................] - ETA: 10s
189   96/1506 [>.............................] - ETA: 10s
190  128/1506 [=>............................] - ETA: 9s
191  160/1506 [==>...........................] - ETA: 9s
192  192/1506 [==>...........................] - ETA: 9s
193  224/1506 [===>..........................] - ETA: 8s
194  256/1506 [====>.........................] - ETA: 8s
195  288/1506 [====>.........................] - ETA: 8s
196  320/1506 [=====>........................] - ETA: 8s
197  352/1506 [======>.......................] - ETA: 7s
198  384/1506 [======>.......................] - ETA: 7s
199  416/1506 [=======>......................] - ETA: 7s
200  448/1506 [=======>......................] - ETA: 7s
201  480/1506 [========>.....................] - ETA: 7s
202  512/1506 [=========>....................] - ETA: 6s
203  544/1506 [=========>....................] - ETA: 6s
204  576/1506 [==========>...................] - ETA: 6s
205  608/1506 [===========>..................] - ETA: 6s
206  640/1506 [===========>..................] - ETA: 5s
207  672/1506 [============>.................] - ETA: 5s
208  704/1506 [=============>................] - ETA: 5s
209  736/1506 [=============>................] - ETA: 5s
210  768/1506 [==============>...............] - ETA: 4s
211  800/1506 [==============>...............] - ETA: 4s
212  832/1506 [===============>..............] - ETA: 4s
213  864/1506 [================>.............] - ETA: 4s
214  896/1506 [================>.............] - ETA: 4s
215  928/1506 [=================>............] - ETA: 3s
216  960/1506 [==================>...........] - ETA: 3s
217  992/1506 [==================>...........] - ETA: 3s
218 1024/1506 [===================>..........] - ETA: 3s
219 1056/1506 [====================>.........] - ETA: 3s
220 1088/1506 [====================>.........] - ETA: 2s
221 1120/1506 [=====================>........] - ETA: 2s
222 1152/1506 [=====================>........] - ETA: 2s
223 1184/1506 [======================>.......] - ETA: 2s
224 1216/1506 [======================>.......] - ETA: 1s
225 1248/1506 [=======================>......] - ETA: 1s
226 1280/1506 [========================>.....] - ETA: 1s
227 1312/1506 [========================>.....] - ETA: 1s
228 1344/1506 [=========================>....] - ETA: 1s
229 1376/1506 [=========================>....] - ETA: 0s
230 1408/1506 [==========================>...] - ETA: 0s
```

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231 1440/1506 [===========================>..] - ETA: 0s
232 1472/1506 [============================>.] - ETA: 0s
233 1504/1506 [============================>.] - ETA: 0s
234 1506/1506 [==============================] - 10s 7ms/step
235 ['loss', 'acc']
236 [0.29368904868207607, 0.8745019920318725]
237 Ahora vamos a dibujar la matriz de confusion
238 ['benign', 'premalignant', 'malignant']
239 Normalized confusion matrix
240 [[0.80473373 0.17159763 0.02366864]
241  [0.16015625 0.83398438 0.00585938]
242  [0.00821355 0.00205339 0.98973306]]
243 El entrenamiento ha llevado : 2144.184242248535
244
```