

```
1 /home/alba/.local/share/virtualenvs/TFM-EF5gitxT/bin/  
python3.7 /home/alba/Documentos/Universidad/TFM/  
2_image_model_training.py  
2 CUDA is available! Training on GPU ...  
3 Generating dataloaders...  
4 Dataloaders info:  
5 # Train samples: 4103  
6 [5008, 887, 5597, 4477, 516, 2480, 139, 4419, 5367, 2893]  
7 # Validation samples: 1025  
8 [3809, 748, 4239, 2346, 4617, 2328, 4516, 5076, 2115, 4626  
  ]  
9 # Test samples: 1282  
10 [5093, 1044, 4827, 2905, 4994, 2458, 5728, 4267, 2751,  
    2899]  
11 Defining and adapting the pre-trained model...  
12  
13 Epoch: 1      Training Loss: 0.391118 Validation Loss: 0  
    .092552  
14 Validation loss decreased (inf --> 0.092552). Saving  
    model ...  
15 Saving the model in path:  
16 data/models/2019-07-29.pth  
17  
18 Epoch: 2      Training Loss: 0.364237 Validation Loss: 0  
    .089187  
19 Validation loss decreased (0.092552 --> 0.089187). Saving  
    model ...  
20 Saving the model in path:  
21 data/models/2019-07-29.pth  
22  
23 Epoch: 3      Training Loss: 0.356979 Validation Loss: 0  
    .087381  
24 Validation loss decreased (0.089187 --> 0.087381). Saving  
    model ...  
25 Saving the model in path:  
26 data/models/2019-07-29.pth  
27  
28 Epoch: 4      Training Loss: 0.349905 Validation Loss: 0  
    .086593  
29 Validation loss decreased (0.087381 --> 0.086593). Saving  
    model ...  
30 Saving the model in path:  
31 data/models/2019-07-29.pth  
32  
33 Epoch: 5      Training Loss: 0.339721 Validation Loss: 0  
    .085426  
34 Validation loss decreased (0.086593 --> 0.085426). Saving  
    model ...  
35 Saving the model in path:  
36 data/models/2019-07-29.pth
```

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37
38 Epoch: 6      Training Loss: 0.334688 Validation Loss: 0
   .084014
39 Validation loss decreased (0.085426 --> 0.084014).  Saving
   model ...
40 Saving the model in path:
41 data/models/2019-07-29.pth
42
43 Epoch: 7      Training Loss: 0.330636 Validation Loss: 0
   .083233
44 Validation loss decreased (0.084014 --> 0.083233).  Saving
   model ...
45 Saving the model in path:
46 data/models/2019-07-29.pth
47
48 Epoch: 8      Training Loss: 0.325795 Validation Loss: 0
   .082938
49 Validation loss decreased (0.083233 --> 0.082938).  Saving
   model ...
50 Saving the model in path:
51 data/models/2019-07-29.pth
52
53 Epoch: 9      Training Loss: 0.321814 Validation Loss: 0
   .082487
54 Validation loss decreased (0.082938 --> 0.082487).  Saving
   model ...
55 Saving the model in path:
56 data/models/2019-07-29.pth
57
58 Epoch: 10     Training Loss: 0.315499 Validation Loss: 0
   .081710
59 Validation loss decreased (0.082487 --> 0.081710).  Saving
   model ...
60 Saving the model in path:
61 data/models/2019-07-29.pth
62
63 Epoch: 11     Training Loss: 0.316847 Validation Loss: 0
   .081417
64 Validation loss decreased (0.081710 --> 0.081417).  Saving
   model ...
65 Saving the model in path:
66 data/models/2019-07-29.pth
67
68 Epoch: 12     Training Loss: 0.313086 Validation Loss: 0
   .081168
69 Validation loss decreased (0.081417 --> 0.081168).  Saving
   model ...
70 Saving the model in path:
71 data/models/2019-07-29.pth
72
```

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73 Epoch: 13   Training Loss: 0.307082 Validation Loss:
    0.080549
74 Validation loss decreased (0.081168 --> 0.080549).
    Saving model ...
75 Saving the model in path:
76 data/models/2019-07-29.pth
77
78 Epoch: 14   Training Loss: 0.305810 Validation Loss:
    0.080239
79 Validation loss decreased (0.080549 --> 0.080239).
    Saving model ...
80 Saving the model in path:
81 data/models/2019-07-29.pth
82
83 Epoch: 15   Training Loss: 0.304776 Validation Loss:
    0.079926
84 Validation loss decreased (0.080239 --> 0.079926).
    Saving model ...
85 Saving the model in path:
86 data/models/2019-07-29.pth
87
88 Epoch: 16   Training Loss: 0.306855 Validation Loss:
    0.079719
89 Validation loss decreased (0.079926 --> 0.079719).
    Saving model ...
90 Saving the model in path:
91 data/models/2019-07-29.pth
92
93 Epoch: 17   Training Loss: 0.301894 Validation Loss:
    0.079453
94 Validation loss decreased (0.079719 --> 0.079453).
    Saving model ...
95 Saving the model in path:
96 data/models/2019-07-29.pth
97
98 Epoch: 18   Training Loss: 0.295304 Validation Loss:
    0.081250
99
100 Epoch: 19   Training Loss: 0.297868 Validation Loss:
    0.078951
101 Validation loss decreased (0.079453 --> 0.078951).
    Saving model ...
102 Saving the model in path:
103 data/models/2019-07-29.pth
104
105 Epoch: 20   Training Loss: 0.290981 Validation Loss:
    0.079013
106
107 Epoch: 21   Training Loss: 0.292198 Validation Loss:
    0.078573
```

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108 Validation loss decreased (0.078951 --> 0.078573).  
    Saving model ...  
109 Saving the model in path:  
110 data/models/2019-07-29.pth  
111  
112 Epoch: 22    Training Loss: 0.287307 Validation Loss:  
    0.078531  
113 Validation loss decreased (0.078573 --> 0.078531).  
    Saving model ...  
114 Saving the model in path:  
115 data/models/2019-07-29.pth  
116  
117 Epoch: 23    Training Loss: 0.286173 Validation Loss:  
    0.078283  
118 Validation loss decreased (0.078531 --> 0.078283).  
    Saving model ...  
119 Saving the model in path:  
120 data/models/2019-07-29.pth  
121  
122 Epoch: 24    Training Loss: 0.290305 Validation Loss:  
    0.078066  
123 Validation loss decreased (0.078283 --> 0.078066).  
    Saving model ...  
124 Saving the model in path:  
125 data/models/2019-07-29.pth  
126  
127 Epoch: 25    Training Loss: 0.283939 Validation Loss:  
    0.077875  
128 Validation loss decreased (0.078066 --> 0.077875).  
    Saving model ...  
129 Saving the model in path:  
130 data/models/2019-07-29.pth  
131  
132 Epoch: 26    Training Loss: 0.280628 Validation Loss:  
    0.078385  
133  
134 Epoch: 27    Training Loss: 0.277420 Validation Loss:  
    0.078908  
135  
136 Epoch: 28    Training Loss: 0.274349 Validation Loss:  
    0.077481  
137 Validation loss decreased (0.077875 --> 0.077481).  
    Saving model ...  
138 Saving the model in path:  
139 data/models/2019-07-29.pth  
140  
141 Epoch: 29    Training Loss: 0.274056 Validation Loss:  
    0.077431  
142 Validation loss decreased (0.077481 --> 0.077431).  
    Saving model ...
```

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143 Saving the model in path:
144 data/models/2019-07-29.pth
145
146 Epoch: 30    Training Loss: 0.275110 Validation Loss:
    0.077664
147
148 Epoch: 31    Training Loss: 0.269797 Validation Loss:
    0.077443
149
150 Epoch: 32    Training Loss: 0.271233 Validation Loss:
    0.077117
151 Validation loss decreased (0.077431 --> 0.077117).
    Saving model ...
152 Saving the model in path:
153 data/models/2019-07-29.pth
154
155 Epoch: 33    Training Loss: 0.270976 Validation Loss:
    0.077651
156
157 Epoch: 34    Training Loss: 0.266139 Validation Loss:
    0.077008
158 Validation loss decreased (0.077117 --> 0.077008).
    Saving model ...
159 Saving the model in path:
160 data/models/2019-07-29.pth
161
162 Epoch: 35    Training Loss: 0.256407 Validation Loss:
    0.077068
163
164 Epoch: 36    Training Loss: 0.255549 Validation Loss:
    0.077157
165
166 Epoch: 37    Training Loss: 0.259679 Validation Loss:
    0.076881
167 Validation loss decreased (0.077008 --> 0.076881).
    Saving model ...
168 Saving the model in path:
169 data/models/2019-07-29.pth
170
171 Epoch: 38    Training Loss: 0.252465 Validation Loss:
    0.077182
172
173 Epoch: 39    Training Loss: 0.252559 Validation Loss:
    0.076734
174 Validation loss decreased (0.076881 --> 0.076734).
    Saving model ...
175 Saving the model in path:
176 data/models/2019-07-29.pth
177
178 Epoch: 40    Training Loss: 0.247470 Validation Loss:
```

```
178 0.077098
179
180 Epoch: 41    Training Loss: 0.246279 Validation Loss:
    0.076874
181
182 Epoch: 42    Training Loss: 0.241362 Validation Loss:
    0.076786
183
184 Epoch: 43    Training Loss: 0.238606 Validation Loss:
    0.076852
185
186 Epoch: 44    Training Loss: 0.237616 Validation Loss:
    0.077036
187
188 Epoch: 45    Training Loss: 0.236304 Validation Loss:
    0.076817
189
190 Epoch: 46    Training Loss: 0.240161 Validation Loss:
    0.077652
191
192 Epoch: 47    Training Loss: 0.236356 Validation Loss:
    0.076877
193
194 Epoch: 48    Training Loss: 0.231295 Validation Loss:
    0.077453
195
196 Epoch: 49    Training Loss: 0.229354 Validation Loss:
    0.076811
197
198 Epoch: 50    Training Loss: 0.223744 Validation Loss:
    0.076866
199
200 Epoch: 51    Training Loss: 0.220639 Validation Loss:
    0.077674
201
202 Epoch: 52    Training Loss: 0.219327 Validation Loss:
    0.076922
203
204 Epoch: 53    Training Loss: 0.218609 Validation Loss:
    0.076849
205
206 Epoch: 54    Training Loss: 0.215266 Validation Loss:
    0.077014
207
208 Epoch: 55    Training Loss: 0.210965 Validation Loss:
    0.077242
209
210 Epoch: 56    Training Loss: 0.208711 Validation Loss:
    0.077344
211
```

212	Epoch: 57	Training Loss: 0.207165	Validation Loss: 0.077331
213			
214	Epoch: 58	Training Loss: 0.205061	Validation Loss: 0.077689
215			
216	Epoch: 59	Training Loss: 0.198424	Validation Loss: 0.077826
217			
218	Epoch: 60	Training Loss: 0.193835	Validation Loss: 0.078401
219			
220	Epoch: 61	Training Loss: 0.196349	Validation Loss: 0.077899
221			
222	Epoch: 62	Training Loss: 0.189711	Validation Loss: 0.078101
223			
224	Epoch: 63	Training Loss: 0.184015	Validation Loss: 0.079020
225			
226	Epoch: 64	Training Loss: 0.180262	Validation Loss: 0.078780
227			
228	Epoch: 65	Training Loss: 0.179897	Validation Loss: 0.079007
229			
230	Epoch: 66	Training Loss: 0.177872	Validation Loss: 0.079109
231			
232	Epoch: 67	Training Loss: 0.175284	Validation Loss: 0.079410
233			
234	Epoch: 68	Training Loss: 0.172033	Validation Loss: 0.079387
235			
236	Epoch: 69	Training Loss: 0.168445	Validation Loss: 0.079766
237			
238	Epoch: 70	Training Loss: 0.162658	Validation Loss: 0.079876
239			
240	Epoch: 71	Training Loss: 0.160302	Validation Loss: 0.080596
241			
242	Epoch: 72	Training Loss: 0.157647	Validation Loss: 0.080553
243			
244	Epoch: 73	Training Loss: 0.152412	Validation Loss: 0.081064

```
245
246 Epoch: 74    Training Loss: 0.150378 Validation Loss:
    0.081671
247
248 Epoch: 75    Training Loss: 0.156308 Validation Loss:
    0.081631
249
250 Epoch: 76    Training Loss: 0.147955 Validation Loss:
    0.082057
251
252 Epoch: 77    Training Loss: 0.137319 Validation Loss:
    0.082527
253
254 Epoch: 78    Training Loss: 0.139788 Validation Loss:
    0.082759
255
256 Epoch: 79    Training Loss: 0.134991 Validation Loss:
    0.082840
257
258 Epoch: 80    Training Loss: 0.132926 Validation Loss:
    0.083068
259
260 Epoch: 81    Training Loss: 0.128216 Validation Loss:
    0.083733
261
262 Epoch: 82    Training Loss: 0.125704 Validation Loss:
    0.083929
263
264 Epoch: 83    Training Loss: 0.119929 Validation Loss:
    0.084389
265
266 Epoch: 84    Training Loss: 0.119617 Validation Loss:
    0.084990
267
268 Epoch: 85    Training Loss: 0.114741 Validation Loss:
    0.086115
269
270 Epoch: 86    Training Loss: 0.118753 Validation Loss:
    0.086259
271
272 Epoch: 87    Training Loss: 0.108456 Validation Loss:
    0.087268
273
274 Epoch: 88    Training Loss: 0.104090 Validation Loss:
    0.087623
275
276 Epoch: 89    Training Loss: 0.104378 Validation Loss:
    0.088442
277
278 Epoch: 90    Training Loss: 0.100652 Validation Loss:
```



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278 0.088630
279
280 Epoch: 91   Training Loss: 0.100012 Validation Loss:
    0.088946
281
282 Epoch: 92   Training Loss: 0.096218 Validation Loss:
    0.089917
283
284 Epoch: 93   Training Loss: 0.090549 Validation Loss:
    0.089845
285
286 Epoch: 94   Training Loss: 0.089834 Validation Loss:
    0.090706
287
288 Epoch: 95   Training Loss: 0.089750 Validation Loss:
    0.090755
289
290 Epoch: 96   Training Loss: 0.087522 Validation Loss:
    0.091616
291
292 Epoch: 97   Training Loss: 0.082768 Validation Loss:
    0.092898
293
294 Epoch: 98   Training Loss: 0.083812 Validation Loss:
    0.091871
295
296 Epoch: 99   Training Loss: 0.080220 Validation Loss:
    0.092418
297
298 Epoch: 100  Training Loss: 0.075816 Validation Loss:
    0.093323
299
300 Epoch: 101  Training Loss: 0.074920 Validation Loss:
    0.093563
301
302 Epoch: 102  Training Loss: 0.069711 Validation Loss:
    0.094408
303
304 Epoch: 103  Training Loss: 0.072238 Validation Loss:
    0.095669
305
306 Epoch: 104  Training Loss: 0.069848 Validation Loss:
    0.096983
307
308 Epoch: 105  Training Loss: 0.060444 Validation Loss:
    0.096574
309
310 Epoch: 106  Training Loss: 0.062374 Validation Loss:
    0.096901
311
```

```
312 Epoch: 107 Training Loss: 0.055197 Validation Loss:
    0.098769
313
314 Epoch: 108 Training Loss: 0.056271 Validation Loss:
    0.098609
315
316 Epoch: 109 Training Loss: 0.059518 Validation Loss:
    0.101035
317
318 Epoch: 110 Training Loss: 0.057339 Validation Loss:
    0.098941
319
320 Epoch: 111 Training Loss: 0.054132 Validation Loss:
    0.099926
321
322 Epoch: 112 Training Loss: 0.051715 Validation Loss:
    0.100611
323
324 Epoch: 113 Training Loss: 0.049699 Validation Loss:
    0.101854
325
326 Epoch: 114 Training Loss: 0.046404 Validation Loss:
    0.102847
327
328 Epoch: 115 Training Loss: 0.048655 Validation Loss:
    0.103393
329
330 Epoch: 116 Training Loss: 0.045223 Validation Loss:
    0.103172
331
332 Epoch: 117 Training Loss: 0.047295 Validation Loss:
    0.102927
333
334 Epoch: 118 Training Loss: 0.045303 Validation Loss:
    0.104172
335
336 Epoch: 119 Training Loss: 0.044850 Validation Loss:
    0.104618
337
338 Epoch: 120 Training Loss: 0.042531 Validation Loss:
    0.107090
339
340 Epoch: 121 Training Loss: 0.040198 Validation Loss:
    0.105482
341
342 Epoch: 122 Training Loss: 0.039152 Validation Loss:
    0.106437
343
344 Epoch: 123 Training Loss: 0.037827 Validation Loss:
    0.109242
```

```
345
346 Epoch: 124 Training Loss: 0.036495 Validation Loss:
    0.108760
347
348 Epoch: 125 Training Loss: 0.033590 Validation Loss:
    0.108827
349
350 Epoch: 126 Training Loss: 0.035226 Validation Loss:
    0.109303
351
352 Epoch: 127 Training Loss: 0.035918 Validation Loss:
    0.110274
353
354 Epoch: 128 Training Loss: 0.033352 Validation Loss:
    0.111261
355
356 Epoch: 129 Training Loss: 0.031456 Validation Loss:
    0.111413
357
358 Epoch: 130 Training Loss: 0.032106 Validation Loss:
    0.111777
359
360 Epoch: 131 Training Loss: 0.031835 Validation Loss:
    0.112245
361
362 Epoch: 132 Training Loss: 0.030201 Validation Loss:
    0.111728
363
364 Epoch: 133 Training Loss: 0.027229 Validation Loss:
    0.113373
365
366 Epoch: 134 Training Loss: 0.025524 Validation Loss:
    0.113321
367
368 Epoch: 135 Training Loss: 0.028728 Validation Loss:
    0.117722
369
370 Epoch: 136 Training Loss: 0.026935 Validation Loss:
    0.115107
371
372 Epoch: 137 Training Loss: 0.026709 Validation Loss:
    0.115568
373
374 Epoch: 138 Training Loss: 0.026146 Validation Loss:
    0.115831
375
376 Epoch: 139 Training Loss: 0.025199 Validation Loss:
    0.116038
377
378 Epoch: 140 Training Loss: 0.022261 Validation Loss:
```

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378 0.116210
379
380 Epoch: 141 Training Loss: 0.021957 Validation Loss:
    0.117461
381
382 Epoch: 142 Training Loss: 0.023796 Validation Loss:
    0.118296
383
384 Epoch: 143 Training Loss: 0.021172 Validation Loss:
    0.117745
385
386 Epoch: 144 Training Loss: 0.020451 Validation Loss:
    0.118457
387
388 Epoch: 145 Training Loss: 0.020852 Validation Loss:
    0.119707
389
390 Epoch: 146 Training Loss: 0.020779 Validation Loss:
    0.120942
391
392 Epoch: 147 Training Loss: 0.020627 Validation Loss:
    0.118940
393
394 Epoch: 148 Training Loss: 0.019649 Validation Loss:
    0.119264
395
396 Epoch: 149 Training Loss: 0.019418 Validation Loss:
    0.120134
397
398 Epoch: 150 Training Loss: 0.018081 Validation Loss:
    0.121101
399
400 Epoch: 151 Training Loss: 0.016724 Validation Loss:
    0.122019
401
402 Epoch: 152 Training Loss: 0.018946 Validation Loss:
    0.122129
403
404 Epoch: 153 Training Loss: 0.016765 Validation Loss:
    0.122295
405
406 Epoch: 154 Training Loss: 0.017955 Validation Loss:
    0.123693
407
408 Epoch: 155 Training Loss: 0.018072 Validation Loss:
    0.125762
409
410 Epoch: 156 Training Loss: 0.016661 Validation Loss:
    0.123871
411
```

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412 Epoch: 157 Training Loss: 0.017879 Validation Loss:
    0.124045
413
414 Epoch: 158 Training Loss: 0.015233 Validation Loss:
    0.125564
415
416 Epoch: 159 Training Loss: 0.017812 Validation Loss:
    0.126513
417
418 Epoch: 160 Training Loss: 0.015814 Validation Loss:
    0.128084
419
420 Epoch: 161 Training Loss: 0.014432 Validation Loss:
    0.127024
421
422 Epoch: 162 Training Loss: 0.015510 Validation Loss:
    0.126304
423
424 Epoch: 163 Training Loss: 0.014923 Validation Loss:
    0.127175
425
426 Epoch: 164 Training Loss: 0.012935 Validation Loss:
    0.127343
427
428 Epoch: 165 Training Loss: 0.012564 Validation Loss:
    0.130117
429
430 Epoch: 166 Training Loss: 0.014184 Validation Loss:
    0.130459
431
432 Epoch: 167 Training Loss: 0.015076 Validation Loss:
    0.130580
433
434 Epoch: 168 Training Loss: 0.014662 Validation Loss:
    0.128388
435
436 Epoch: 169 Training Loss: 0.013922 Validation Loss:
    0.128179
437
438 Epoch: 170 Training Loss: 0.013240 Validation Loss:
    0.129343
439
440 Epoch: 171 Training Loss: 0.012730 Validation Loss:
    0.130889
441
442 Epoch: 172 Training Loss: 0.012823 Validation Loss:
    0.130472
443
444 Epoch: 173 Training Loss: 0.012567 Validation Loss:
    0.131485
```

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445
446 Epoch: 174 Training Loss: 0.011546 Validation Loss:
    0.131101
447
448 Epoch: 175 Training Loss: 0.011680 Validation Loss:
    0.131084
449
450 Epoch: 176 Training Loss: 0.010443 Validation Loss:
    0.133149
451
452 Epoch: 177 Training Loss: 0.012321 Validation Loss:
    0.133158
453
454 Epoch: 178 Training Loss: 0.010933 Validation Loss:
    0.134782
455
456 Epoch: 179 Training Loss: 0.010221 Validation Loss:
    0.133804
457
458 Epoch: 180 Training Loss: 0.011196 Validation Loss:
    0.133721
459
460 Epoch: 181 Training Loss: 0.011767 Validation Loss:
    0.134337
461
462 Epoch: 182 Training Loss: 0.012369 Validation Loss:
    0.134191
463
464 Epoch: 183 Training Loss: 0.009782 Validation Loss:
    0.133902
465
466 Epoch: 184 Training Loss: 0.009940 Validation Loss:
    0.135667
467
468 Epoch: 185 Training Loss: 0.010593 Validation Loss:
    0.137106
469
470 Epoch: 186 Training Loss: 0.010923 Validation Loss:
    0.135225
471
472 Epoch: 187 Training Loss: 0.010199 Validation Loss:
    0.135508
473
474 Epoch: 188 Training Loss: 0.009352 Validation Loss:
    0.136490
475
476 Epoch: 189 Training Loss: 0.009116 Validation Loss:
    0.138383
477
478 Epoch: 190 Training Loss: 0.008855 Validation Loss:
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478 0.136190
479
480 Epoch: 191 Training Loss: 0.008235 Validation Loss:
    0.137235
481
482 Epoch: 192 Training Loss: 0.008184 Validation Loss:
    0.138294
483
484 Epoch: 193 Training Loss: 0.008278 Validation Loss:
    0.138013
485
486 Epoch: 194 Training Loss: 0.008980 Validation Loss:
    0.138575
487
488 Epoch: 195 Training Loss: 0.008631 Validation Loss:
    0.136947
489
490 Epoch: 196 Training Loss: 0.008927 Validation Loss:
    0.139412
491
492 Epoch: 197 Training Loss: 0.009612 Validation Loss:
    0.139203
493
494 Epoch: 198 Training Loss: 0.008048 Validation Loss:
    0.139881
495
496 Epoch: 199 Training Loss: 0.009166 Validation Loss:
    0.138423
497 Traceback (most recent call last):
498   File "/home/alba/Documentos/Universidad/TFM/
    2_image_model_training.py", line 29, in <module>
499     end = time.time()
500   File "/home/alba/Documentos/Universidad/TFM/
    2_image_model_training.py", line 19, in main
501     vgg16, filepath = training_validation(train_loader,
    valid_loader, n_epochs, vgg16, criterion, optimizer,
    use_gpu)
502   File "/home/alba/Documentos/Universidad/TFM/utils/
    pytorch_utils.py", line 272, in training_validation
503     train_losses[epoch] = train_loss
504 IndexError: index 200 is out of bounds for axis 0 with
    size 200
505
506 Process finished with exit code 1
507
```