```
=========================================================
Experimento VGG16-13
experimento = Experimento VGG16-13
model = <keras.engine.training.Model object at 0x7fa477b22dd8>
samples_per_class = 1000
number_of_classes = 102
optimizador = rmsprop
clasificador = VGG16-1
batch_size = 128
epochs = 10
run_experiment = True
---------------------------------------------------------
Creando sub-conjunto de datos con  102  clases y  1000 muestras por clase
number_of_classes: 102
Sub-conjunto con 102 clases creado.
Cantidad de muestras: 9145
Creando datos de train, validate y test ...
Datos de train, validate y test creados.

Split de Entrenamiento, Validación y prueba: 6401, 1372, 1372
Número de clases: 102
Número de muestras: 1000
Usando rmsprop
Train on 6401 samples, validate on 1372 samples
Epoch 1/10
6401/6401 [==============================] - 10s 2ms/step - loss: 2.5945 - acc: 0.4701 - val_loss: 2.4618 - val_acc: 0.3673
Epoch 2/10
6401/6401 [==============================] - 7s 1ms/step - loss: 1.1124 - acc: 0.7385 - val_loss: 1.0358 - val_acc: 0.7449
Epoch 3/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.6895 - acc: 0.8236 - val_loss: 0.9725 - val_acc: 0.7573
Epoch 4/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.4501 - acc: 0.8885 - val_loss: 0.7728 - val_acc: 0.7996
Epoch 5/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.3012 - acc: 0.9228 - val_loss: 0.9242 - val_acc: 0.7464
Epoch 6/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.2001 - acc: 0.9525 - val_loss: 0.9517 - val_acc: 0.7485
Epoch 7/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.1441 - acc: 0.9659 - val_loss: 0.7266 - val_acc: 0.8069
Epoch 8/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.0971 - acc: 0.9758 - val_loss: 0.6652 - val_acc: 0.8178
Epoch 9/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.0760 - acc: 0.9852 - val_loss: 1.3219 - val_acc: 0.7034
Epoch 10/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.0609 - acc: 0.9873 - val_loss: 0.6825 - val_acc: 0.8287
```
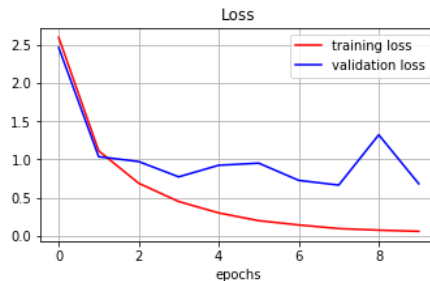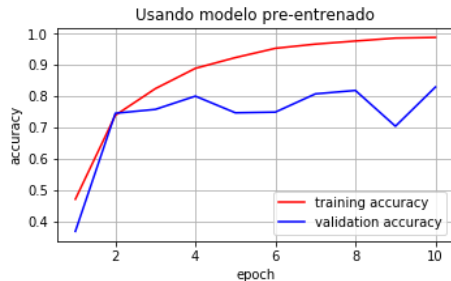


```
Exactitud en subconjunto de test:
Test loss: 0.7028732294591453
Test accuracy: 0.8155976681598074

Exactitud en todo el dataset:
Test loss: 0.21974906740972527
Test accuracy: 0.9457627118644067
=========================================================
Experimento VGG16-14
experimento = Experimento VGG16-14
model = <keras.engine.training.Model object at 0x7fa477b22dd8>
samples_per_class = 1000
number_of_classes = 102
optimizador = rmsprop
clasificador = VGG16-2
batch_size = 128
epochs = 10
run_experiment = True
---------------------------------------------------------
Número de clases: 102
Número de muestras: 1000
Usando rmsprop
Train on 6401 samples, validate on 1372 samples
Epoch 1/10
6401/6401 [==============================] - 9s 1ms/step - loss: 5.8968 - acc: 0.3137 - val_loss: 6.9013 - val_acc: 0.1494
Epoch 2/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.4978 - acc: 0.6351 - val_loss: 1.4330 - val_acc: 0.6217
Epoch 3/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.9208 - acc: 0.7474 - val_loss: 0.9346 - val_acc: 0.7464
Epoch 4/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.6068 - acc: 0.8258 - val_loss: 0.9995 - val_acc: 0.7310
Epoch 5/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.4731 - acc: 0.8681 - val_loss: 0.7863 - val_acc: 0.7894
Epoch 6/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.2859 - acc: 0.9163 - val_loss: 0.9752 - val_acc: 0.7646
Epoch 7/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.2042 - acc: 0.9388 - val_loss: 4.3967 - val_acc: 0.4964
```
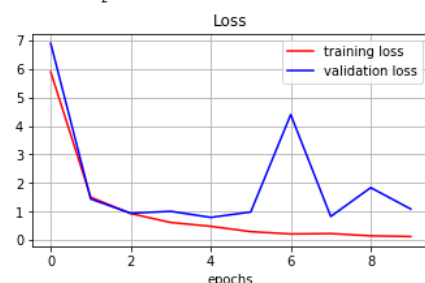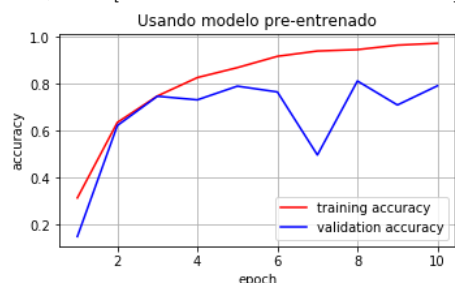
```
Epoch 8/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.2181 - acc: 0.9447 - val_loss: 0.8176 - val_acc: 0.8112
Epoch 9/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.1382 - acc: 0.9638 - val_loss: 1.8315 - val_acc: 0.7092
Epoch 10/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.1142 - acc: 0.9717 - val_loss: 1.0803 - val_acc: 0.7908
```



```
Exactitud en subconjunto de test:
Test loss: 1.0624303404165774
Test accuracy: 0.7937317789469794

Exactitud en todo el dataset:
Test loss: 0.3945462338942102
Test accuracy: 0.917550574084199
=========================================================
Experimento VGG16-15
experimento = Experimento VGG16-15
model = <keras.engine.training.Model object at 0x7fa477b22dd8>
samples_per_class = 1000
number_of_classes = 102
optimizador = rmsprop
clasificador = VGG16-3
batch_size = 128
epochs = 10
run_experiment = True
---------------------------------------------------------
Número de clases: 102
Número de muestras: 1000
Usando rmsprop
Train on 6401 samples, validate on 1372 samples
Epoch 1/10
6401/6401 [==============================] - 9s 1ms/step - loss: 2.8153 - acc: 0.4202 - val_loss: 7.0124 - val_acc: 0.1203
Epoch 2/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.3867 - acc: 0.6743 - val_loss: 1.1569 - val_acc: 0.6939
Epoch 3/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.8336 - acc: 0.7797 - val_loss: 7.4051 - val_acc: 0.2208
Epoch 4/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.6569 - acc: 0.8422 - val_loss: 1.3927 - val_acc: 0.6742
Epoch 5/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.4096 - acc: 0.8827 - val_loss: 0.8248 - val_acc: 0.7762
Epoch 6/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.3043 - acc: 0.9163 - val_loss: 0.9985 - val_acc: 0.7529
Epoch 7/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.1993 - acc: 0.9455 - val_loss: 1.1176 - val_acc: 0.7507
Epoch 8/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.1883 - acc: 0.9486 - val_loss: 1.2993 - val_acc: 0.7223
Epoch 9/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.1109 - acc: 0.9689 - val_loss: 0.7869 - val_acc: 0.8141
Epoch 10/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.1326 - acc: 0.9711 - val_loss: 0.9099 - val_acc: 0.8083
```
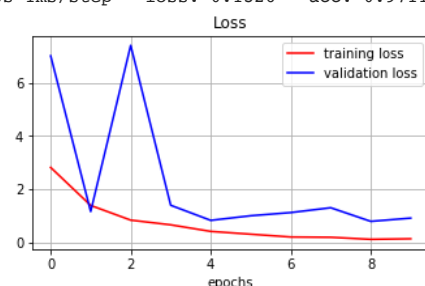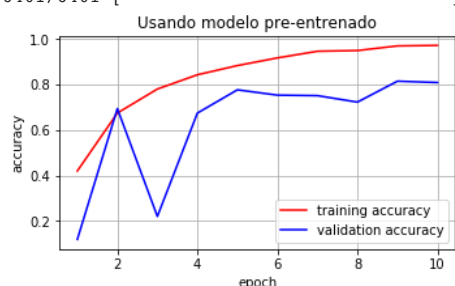


```
Exactitud en subconjunto de test:
Test loss: 0.9987950467507276
Test accuracy: 0.8017492716583496

Exactitud en todo el dataset:
Test loss: 0.3397126568907954
Test accuracy: 0.9267359212684527
=========================================================
Experimento VGG16-16
experimento = Experimento VGG16-16
model = <keras.engine.training.Model object at 0x7fa477b22dd8>
samples_per_class = 1000
number_of_classes = 102
optimizador = Adam
clasificador = VGG16-1
batch_size = 128
epochs = 10
run_experiment = True
---------------------------------------------------------
Número de clases: 102
```

```
Número de clases: 102
Número de muestras: 1000
Usando Adam
Train on 6401 samples, validate on 1372 samples
Epoch 1/10
6401/6401 [==============================] - 9s 1ms/step - loss: 3.5392 - acc: 0.2837 - val_loss: 2.7939 - val_acc: 0.4315
Epoch 2/10
6401/6401 [==============================] - 7s 1ms/step - loss: 2.2937 - acc: 0.5182 - val_loss: 2.1030 - val_acc: 0.5583
Epoch 3/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.6589 - acc: 0.6688 - val_loss: 1.6837 - val_acc: 0.6516
Epoch 4/10
6401/6401 [==============================] - 7s 1ms/step - loss: 1.3170 - acc: 0.7385 - val_loss: 1.4345 - val_acc: 0.7012
Epoch 5/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.0676 - acc: 0.7943 - val_loss: 1.2508 - val_acc: 0.7420
Epoch 6/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.8808 - acc: 0.8392 - val_loss: 1.1437 - val_acc: 0.7478
Epoch 7/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.7825 - acc: 0.8541 - val_loss: 1.0447 - val_acc: 0.7733
Epoch 8/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.7063 - acc: 0.8646 - val_loss: 0.9902 - val_acc: 0.7711
Epoch 9/10
6401/6401 [==============================] - 7s 1ms/step - loss: 0.5929 - acc: 0.8975 - val_loss: 0.9262 - val_acc: 0.7857
Epoch 10/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.5260 - acc: 0.9152 - val_loss: 0.8830 - val_acc: 0.7945
```



```
Exactitud en subconjunto de test:
Test loss: 0.8999717419766129
Test accuracy: 0.7959183669993898

Exactitud en todo el dataset:
Test loss: 0.6024823693804007
Test accuracy: 0.8861673044793393
===========================================================
Experimento VGG16-17
experimento = Experimento VGG16-17
model = <keras.engine.training.Model object at 0x7fa477b22dd8>
samples_per_class = 1000
number_of_classes = 102
optimizador = Adam
clasificador = VGG16-2
batch_size = 128
epochs = 10
run_experiment = True
----------------------------------------------------------
Número de clases: 102
Número de muestras: 1000
Usando Adam
Train on 6401 samples, validate on 1372 samples
Epoch 1/10
6401/6401 [==============================] - 10s 1ms/step - loss: 2.9433 - acc: 0.3893 - val_loss: 2.0590 - val_acc: 0.5452
Epoch 2/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.4285 - acc: 0.6910 - val_loss: 1.3880 - val_acc: 0.6582
Epoch 3/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.9204 - acc: 0.7977 - val_loss: 1.1420 - val_acc: 0.6917
Epoch 4/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.7440 - acc: 0.8411 - val_loss: 0.9973 - val_acc: 0.7383
Epoch 5/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.6046 - acc: 0.8735 - val_loss: 0.8876 - val_acc: 0.7726
Epoch 6/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.5611 - acc: 0.8881 - val_loss: 0.8006 - val_acc: 0.8112
Epoch 7/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.3298 - acc: 0.9458 - val_loss: 0.7307 - val_acc: 0.8120
Epoch 8/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.2595 - acc: 0.9588 - val_loss: 0.8046 - val_acc: 0.7792
Epoch 9/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.3957 - acc: 0.9231 - val_loss: 0.7643 - val_acc: 0.8185
Epoch 10/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.2917 - acc: 0.9531 - val_loss: 0.7111 - val_acc: 0.8200
```
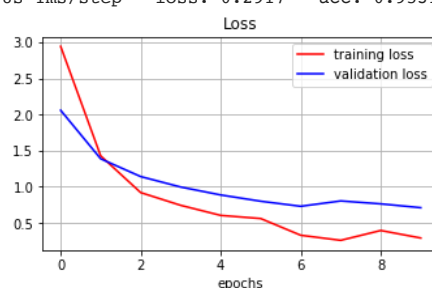


```
Exactitud en subconjunto de test:
Test loss: 0.7267025877713462
```

```
Test accuracy: 0.8163265302646959

Exactitud en todo el dataset:
Test loss: 0.35525160919673265
Test accuracy: 0.9285948605795517
=========================================================
Experimento VGG16-18
experimento = Experimento VGG16-18
model = <keras.engine.training.Model object at 0x7fa477b22dd8>
samples_per_class = 1000
number_of_classes = 102
optimizador = Adam
clasificador = VGG16-3
batch_size = 128
epochs = 10
run_experiment = True
---------------------------------------------------------
Número de clases: 102
Número de muestras: 1000
Usando Adam
Train on 6401 samples, validate on 1372 samples
Epoch 1/10
6401/6401 [==============================] - 9s 1ms/step - loss: 3.3246 - acc: 0.3201 - val_loss: 2.5558 - val_acc: 0.4599
Epoch 2/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.9780 - acc: 0.5849 - val_loss: 1.7229 - val_acc: 0.6421
Epoch 3/10
6401/6401 [==============================] - 8s 1ms/step - loss: 1.2791 - acc: 0.7383 - val_loss: 1.3545 - val_acc: 0.6706
Epoch 4/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.9981 - acc: 0.7921 - val_loss: 1.1205 - val_acc: 0.7347
Epoch 5/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.7894 - acc: 0.8296 - val_loss: 0.9940 - val_acc: 0.7711
Epoch 6/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.6434 - acc: 0.8653 - val_loss: 0.9014 - val_acc: 0.7857
Epoch 7/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.5115 - acc: 0.9045 - val_loss: 0.8407 - val_acc: 0.8061
Epoch 8/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.4310 - acc: 0.9200 - val_loss: 0.7814 - val_acc: 0.8090
Epoch 9/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.3610 - acc: 0.9406 - val_loss: 0.7382 - val_acc: 0.8163
Epoch 10/10
6401/6401 [==============================] - 8s 1ms/step - loss: 0.3090 - acc: 0.9516 - val_loss: 0.7447 - val_acc: 0.8141
```
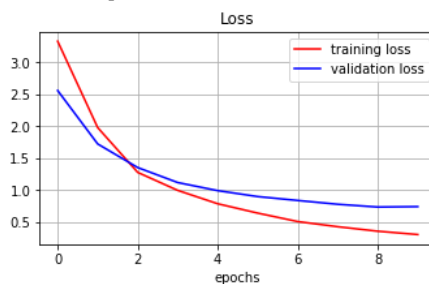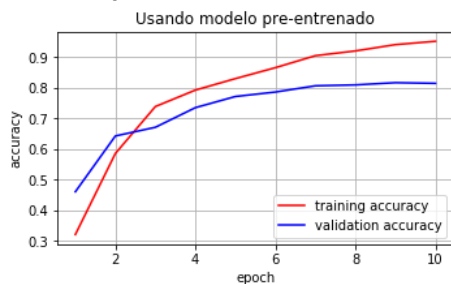


```
Exactitud en subconjunto de test:
Test loss: 0.7602043952955796
Test accuracy: 0.8112244899696929

Exactitud en todo el dataset:
Test loss: 0.4203305921796862
Test accuracy: 0.9171131765992345
```

Resultados VGG16

Experimento	Muestras*Clase	Optimizador	Clasificador	Batch Size	epocas	Tiempo Entrenamiento	Exac. Test	Exact. Full	Loss Test	Loss Full
VGG16-1	100	**rmsprop**	**VGG16-1**	128	10	51seg.	**79%**	90%	**0.83**	**0.42**
VGG16-2	100	rmsprop	VGG16-2	128	10	51seg.	79%	**91%**	0.96	0.43
VGG16-3	100	rmsprop	VGG16-3	128	10	50seg.	79%	89%	0.88	0.48
VGG16-4	100	Adam	VGG16-1	128	10	50seg.	78%	86%	1.09	0.77
VGG16-5	100	**Adam**	**VGG16-2**	128	10	51seg.	**79%**	90%	**0.78**	**0.45**
VGG16-6	100	Adam	VGG16-3	128	10	51seg.	79%	89%	0.89	0.54

Experimento	Muestras*Clase	Optimizador	Clasificador	Batch Size	epocas	Tiempo Entrenamiento	Exac. Test	Exact. Full	Loss Test	Loss Full
VGG16-7	30	rmsprop	VGG16-1	128	10	22seg.	64%	70%	1.46	1.23
VGG16-8	30	rmsprop	VGG16-2	128	10	21seg.	52	53	3.00	2.67
VGG16-9	30	**rmsprop**	**VGG16-3**	128	10	21seg.	**72**	**76**	**1.09**	**1.00**
VGG16-10	30	Adam	VGG16-1	128	10	22seg.	68	71	1.65	1.61
VGG16-11	30	**Adam**	**VGG16-2**	128	10	31seg.	**73**	**76**	**1.09**	**1.04**
VGG16-12	30	Adam	VGG16-3	128	10	28seg.	68	73	1.35	1.24