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Fold 1/5

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Found 799 validated image filenames belonging to 10 classes.

Found 200 validated image filenames belonging to 10 classes.

Model: "sequential"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━┓

┃ Layer (type) ┃ Output Shape ┃ Param # ┃

┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━┩

│ conv2d (Conv2D) │ (None, 126, 126, 32) │ 896 │

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│ max\_pooling2d (MaxPooling2D) │ (None, 63, 63, 32) │ 0 │

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│ conv2d\_1 (Conv2D) │ (None, 61, 61, 64) │ 18,496 │

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│ max\_pooling2d\_1 (MaxPooling2D) │ (None, 30, 30, 64) │ 0 │

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│ conv2d\_2 (Conv2D) │ (None, 28, 28, 128) │ 73,856 │

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│ max\_pooling2d\_2 (MaxPooling2D) │ (None, 14, 14, 128) │ 0 │

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│ flatten (Flatten) │ (None, 25088) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense (Dense) │ (None, 128) │ 3,211,392 │

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│ dropout (Dropout) │ (None, 128) │ 0 │

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│ dense\_1 (Dense) │ (None, 10) │ 1,290 │

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Total params: 3,305,930 (12.61 MB)

Trainable params: 3,305,930 (12.61 MB)

Non-trainable params: 0 (0.00 B)

/home/diego/tensorflow/lib/python3.10/site-packages/keras/src/trainers/data\_adapters/py\_dataset\_adapter.py:121: UserWarning: Your `PyDataset` class should call `super().\_\_init\_\_(\*\*kwargs)` in its constructor. `\*\*kwargs` can include `workers`, `use\_multiprocessing`, `max\_queue\_size`. Do not pass these arguments to `fit()`, as they will be ignored.

self.\_warn\_if\_super\_not\_called()

Epoch 1/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 253ms/step - accuracy: 0.1391 - loss: 2.2905 - precision: 0.0000e+00 - recall: 0.0000e+00 - val\_accuracy: 0.1700 - val\_loss: 2.2121 - val\_precision: 0.6667 - val\_recall: 0.0200

Epoch 2/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 186ms/step - accuracy: 0.2077 - loss: 2.0955 - precision: 0.6487 - recall: 0.0274 - val\_accuracy: 0.3550 - val\_loss: 1.9511 - val\_precision: 1.0000 - val\_recall: 0.0150

Epoch 3/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 238ms/step - accuracy: 0.3256 - loss: 1.9084 - precision: 0.6738 - recall: 0.0696 - val\_accuracy: 0.3550 - val\_loss: 1.7853 - val\_precision: 0.9500 - val\_recall: 0.0950

Epoch 4/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 262ms/step - accuracy: 0.3789 - loss: 1.7597 - precision: 0.7217 - recall: 0.0903 - val\_accuracy: 0.4250 - val\_loss: 1.6447 - val\_precision: 0.8529 - val\_recall: 0.1450

Epoch 5/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.4217 - loss: 1.6303 - precision: 0.6879 - recall: 0.1589 - val\_accuracy: 0.4050 - val\_loss: 1.6729 - val\_precision: 0.7419 - val\_recall: 0.1150

Epoch 6/50

Epoch 6/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 218ms/step - accuracy: 0.4574 - loss: 1.5302 - precision: 0.6892 - recall: 0.1992 - val\_accuracy: 0.4850 - val\_loss: 1.5011 - val\_precision: 0.8085 - val\_recall: 0.1900

Epoch 7/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.5186 - loss: 1.3478 - precision: 0.8025 - recall: 0.2729 - val\_accuracy: 0.4200 - val\_loss: 1.4536 - val\_precision: 0.7179 - val\_recall: 0.1400

Epoch 8/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 222ms/step - accuracy: 0.5234 - loss: 1.2643 - precision: 0.7494 - recall: 0.2794 - val\_accuracy: 0.5050 - val\_loss: 1.4257 - val\_precision: 0.6753 - val\_recall: 0.2600

Epoch 9/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 239ms/step - accuracy: 0.5629 - loss: 1.1820 - precision: 0.7936 - recall: 0.3455 - val\_accuracy: 0.5350 - val\_loss: 1.3187 - val\_precision: 0.6822 - val\_recall: 0.3650

Epoch 10/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.6105 - loss: 1.1387 - precision: 0.7510 - recall: 0.4038 - val\_accuracy: 0.5300 - val\_loss: 1.3250 - val\_precision: 0.7204 - val\_recall: 0.3350

Epoch 11/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 239ms/step - accuracy: 0.6766 - loss: 0.9905 - precision: 0.8048 - recall: 0.4731 - val\_accuracy: 0.5550 - val\_loss: 1.3301 - val\_precision: 0.6852 - val\_recall: 0.3700

Epoch 12/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.6291 - loss: 1.0526 - precision: 0.7736 - recall: 0.4635 - val\_accuracy: 0.5550 - val\_loss: 1.3449 - val\_precision: 0.7273 - val\_recall: 0.3200

Epoch 13/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 224ms/step - accuracy: 0.6638 - loss: 1.0089 - precision: 0.7840 - recall: 0.4456 - val\_accuracy: 0.5600 - val\_loss: 1.3023 - val\_precision: 0.7025 - val\_recall: 0.4250

Epoch 14/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 210ms/step - accuracy: 0.6878 - loss: 0.8908 - precision: 0.8161 - recall: 0.5630 - val\_accuracy: 0.5350 - val\_loss: 1.2859 - val\_precision: 0.6777 - val\_recall: 0.4100

Epoch 15/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 221ms/step - accuracy: 0.7416 - loss: 0.7484 - precision: 0.8381 - recall: 0.6058 - val\_accuracy: 0.5650 - val\_loss: 1.2963 - val\_precision: 0.6949 - val\_recall: 0.4100

Epoch 16/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.7363 - loss: 0.7478 - precision: 0.8637 - recall: 0.5935 - val\_accuracy: 0.5900 - val\_loss: 1.2675 - val\_precision: 0.6963 - val\_recall: 0.4700

Epoch 17/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 230ms/step - accuracy: 0.7576 - loss: 0.6776 - precision: 0.8573 - recall: 0.6551 - val\_accuracy: 0.5950 - val\_loss: 1.2283 - val\_precision: 0.7143 - val\_recall: 0.5000

Epoch 18/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 222ms/step - accuracy: 0.7782 - loss: 0.6371 - precision: 0.8732 - recall: 0.6967 - val\_accuracy: 0.6100 - val\_loss: 1.3212 - val\_precision: 0.6928 - val\_recall: 0.5300

Epoch 19/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 227ms/step - accuracy: 0.8106 - loss: 0.5329 - precision: 0.8844 - recall: 0.7328 - val\_accuracy: 0.5750 - val\_loss: 1.3616 - val\_precision: 0.6733 - val\_recall: 0.5050

Epoch 20/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 218ms/step - accuracy: 0.7813 - loss: 0.6245 - precision: 0.8646 - recall: 0.7023 - val\_accuracy: 0.6300 - val\_loss: 1.3436 - val\_precision: 0.7059 - val\_recall: 0.5400

Epoch 21/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.8315 - loss: 0.4830 - precision: 0.8912 - recall: 0.7784 - val\_accuracy: 0.5450 - val\_loss: 1.3338 - val\_precision: 0.6299 - val\_recall: 0.4850

Epoch 22/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 204ms/step - accuracy: 0.8500 - loss: 0.4114 - precision: 0.9262 - recall: 0.7921 - val\_accuracy: 0.5850 - val\_loss: 1.4346 - val\_precision: 0.6303 - val\_recall: 0.5200

Epoch 23/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 213ms/step - accuracy: 0.8792 - loss: 0.3701 - precision: 0.9248 - recall: 0.8139 - val\_accuracy: 0.6050 - val\_loss: 1.4349 - val\_precision: 0.6587 - val\_recall: 0.5500

Epoch 24/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.8961 - loss: 0.3199 - precision: 0.9328 - recall: 0.8601 - val\_accuracy: 0.5950 - val\_loss: 1.4164 - val\_precision: 0.6145 - val\_recall: 0.5100

Epoch 25/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 223ms/step - accuracy: 0.8991 - loss: 0.2863 - precision: 0.9350 - recall: 0.8652 - val\_accuracy: 0.6500 - val\_loss: 1.3504 - val\_precision: 0.7024 - val\_recall: 0.5900

Epoch 26/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.9256 - loss: 0.2521 - precision: 0.9499 - recall: 0.8962 - val\_accuracy: 0.6100 - val\_loss: 1.4927 - val\_precision: 0.6591 - val\_recall: 0.5800

Epoch 27/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9499 - loss: 0.1859 - precision: 0.9666 - recall: 0.9297 - val\_accuracy: 0.6050 - val\_loss: 1.6270 - val\_precision: 0.6319 - val\_recall: 0.5750

Epoch 28/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.9204 - loss: 0.2129 - precision: 0.9483 - recall: 0.9027 - val\_accuracy: 0.6200 - val\_loss: 1.6315 - val\_precision: 0.6532 - val\_recall: 0.5650

Epoch 29/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 208ms/step - accuracy: 0.9391 - loss: 0.1926 - precision: 0.9666 - recall: 0.9204 - val\_accuracy: 0.6150 - val\_loss: 1.6311 - val\_precision: 0.6575 - val\_recall: 0.5950

Epoch 30/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.9339 - loss: 0.1980 - precision: 0.9479 - recall: 0.9063 - val\_accuracy: 0.5950 - val\_loss: 1.5946 - val\_precision: 0.6534 - val\_recall: 0.5750

Epoch 31/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 218ms/step - accuracy: 0.9416 - loss: 0.1656 - precision: 0.9605 - recall: 0.9330 - val\_accuracy: 0.6000 - val\_loss: 1.6559 - val\_precision: 0.6162 - val\_recall: 0.5700

Epoch 32/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 215ms/step - accuracy: 0.9485 - loss: 0.1855 - precision: 0.9600 - recall: 0.9318 - val\_accuracy: 0.5650 - val\_loss: 2.0525 - val\_precision: 0.5866 - val\_recall: 0.5250

Epoch 33/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 217ms/step - accuracy: 0.9284 - loss: 0.2216 - precision: 0.9461 - recall: 0.9061 - val\_accuracy: 0.6250 - val\_loss: 1.7822 - val\_precision: 0.6724 - val\_recall: 0.5850

Epoch 34/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 217ms/step - accuracy: 0.9784 - loss: 0.1179 - precision: 0.9822 - recall: 0.9676 - val\_accuracy: 0.5900 - val\_loss: 1.8568 - val\_precision: 0.6552 - val\_recall: 0.5700

Epoch 35/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 227ms/step - accuracy: 0.9738 - loss: 0.0934 - precision: 0.9857 - recall: 0.9610 - val\_accuracy: 0.6150 - val\_loss: 1.8239 - val\_precision: 0.6517 - val\_recall: 0.5800

Tiempo de entrenamiento fold 1: 195.06 s

7/7 ━━━━━━━━━━━━━━━━━━━━ 1s 104ms/step

F1-score fold 1: 0.6474

Métricas adicionales: Accuracy=0.6500 Precision=0.7024 Recall=0.5900

Mejor modelo actualizado y guardado.

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Fold 2/5

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Found 799 validated image filenames belonging to 10 classes.

Found 200 validated image filenames belonging to 10 classes.

Model: "sequential\_1"

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┃ Layer (type) ┃ Output Shape ┃ Param # ┃

┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━┩

│ conv2d\_3 (Conv2D) │ (None, 126, 126, 32) │ 896 │

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│ max\_pooling2d\_3 (MaxPooling2D) │ (None, 63, 63, 32) │ 0 │

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│ conv2d\_4 (Conv2D) │ (None, 61, 61, 64) │ 18,496 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ max\_pooling2d\_4 (MaxPooling2D) │ (None, 30, 30, 64) │ 0 │

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│ conv2d\_5 (Conv2D) │ (None, 28, 28, 128) │ 73,856 │

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│ max\_pooling2d\_5 (MaxPooling2D) │ (None, 14, 14, 128) │ 0 │

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│ flatten\_1 (Flatten) │ (None, 25088) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_2 (Dense) │ (None, 128) │ 3,211,392 │

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│ dropout\_1 (Dropout) │ (None, 128) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_3 (Dense) │ (None, 10) │ 1,290 │

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Total params: 3,305,930 (12.61 MB)

Trainable params: 3,305,930 (12.61 MB)

Non-trainable params: 0 (0.00 B)

/home/diego/tensorflow/lib/python3.10/site-packages/keras/src/trainers/data\_adapters/py\_dataset\_adapter.py:121: UserWarning: Your `PyDataset` class should call `super().\_\_init\_\_(\*\*kwargs)` in its constructor. `\*\*kwargs` can include `workers`, `use\_multiprocessing`, `max\_queue\_size`. Do not pass these arguments to `fit()`, as they will be ignored.

self.\_warn\_if\_super\_not\_called()

Epoch 1/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 226ms/step - accuracy: 0.1272 - loss: 2.3306 - precision: 0.0769 - recall: 9.6274e-05 - val\_accuracy: 0.1950 - val\_loss: 2.1693 - val\_precision: 0.0000e+00 - val\_recall: 0.0000e+00

Epoch 2/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.2159 - loss: 2.1389 - precision: 0.2864 - recall: 0.0093 - val\_accuracy: 0.3000 - val\_loss: 1.8958 - val\_precision: 0.7692 - val\_recall: 0.1000

Epoch 3/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 231ms/step - accuracy: 0.2977 - loss: 1.9317 - precision: 0.6709 - recall: 0.0698 - val\_accuracy: 0.3900 - val\_loss: 1.7430 - val\_precision: 0.8000 - val\_recall: 0.1000

Epoch 4/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 222ms/step - accuracy: 0.3487 - loss: 1.8592 - precision: 0.6302 - recall: 0.0883 - val\_accuracy: 0.4550 - val\_loss: 1.6482 - val\_precision: 0.8947 - val\_recall: 0.0850

Epoch 5/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 226ms/step - accuracy: 0.3911 - loss: 1.6840 - precision: 0.7584 - recall: 0.1294 - val\_accuracy: 0.4850 - val\_loss: 1.5249 - val\_precision: 0.8750 - val\_recall: 0.1050

Epoch 6/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 211ms/step - accuracy: 0.4030 - loss: 1.6008 - precision: 0.7412 - recall: 0.1710 - val\_accuracy: 0.4000 - val\_loss: 1.5922 - val\_precision: 0.8276 - val\_recall: 0.1200

Epoch 7/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 209ms/step - accuracy: 0.4779 - loss: 1.5424 - precision: 0.7483 - recall: 0.1776 - val\_accuracy: 0.4350 - val\_loss: 1.4669 - val\_precision: 0.7222 - val\_recall: 0.1950

Epoch 8/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 221ms/step - accuracy: 0.4768 - loss: 1.4828 - precision: 0.6787 - recall: 0.2422 - val\_accuracy: 0.4900 - val\_loss: 1.4006 - val\_precision: 0.8136 - val\_recall: 0.2400

Epoch 9/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 226ms/step - accuracy: 0.4778 - loss: 1.4077 - precision: 0.6576 - recall: 0.2337 - val\_accuracy: 0.5100 - val\_loss: 1.3302 - val\_precision: 0.7586 - val\_recall: 0.3300

Epoch 10/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.5777 - loss: 1.2226 - precision: 0.7537 - recall: 0.3764 - val\_accuracy: 0.4450 - val\_loss: 1.4943 - val\_precision: 0.6064 - val\_recall: 0.2850

Epoch 11/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 217ms/step - accuracy: 0.5570 - loss: 1.3001 - precision: 0.7273 - recall: 0.3411 - val\_accuracy: 0.5000 - val\_loss: 1.3344 - val\_precision: 0.7308 - val\_recall: 0.2850

Epoch 12/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 236ms/step - accuracy: 0.5711 - loss: 1.1830 - precision: 0.7576 - recall: 0.3629 - val\_accuracy: 0.5400 - val\_loss: 1.2708 - val\_precision: 0.6637 - val\_recall: 0.3750

Epoch 13/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 225ms/step - accuracy: 0.6494 - loss: 1.0103 - precision: 0.7914 - recall: 0.4920 - val\_accuracy: 0.6000 - val\_loss: 1.1494 - val\_precision: 0.7757 - val\_recall: 0.4150

Epoch 14/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 9s 165ms/step - accuracy: 0.6404 - loss: 1.0819 - precision: 0.7661 - recall: 0.4527 - val\_accuracy: 0.5100 - val\_loss: 1.2747 - val\_precision: 0.7143 - val\_recall: 0.3750

Epoch 15/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 310ms/step - accuracy: 0.6363 - loss: 0.9972 - precision: 0.8093 - recall: 0.4665 - val\_accuracy: 0.5400 - val\_loss: 1.2112 - val\_precision: 0.7016 - val\_recall: 0.4350

Epoch 16/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 252ms/step - accuracy: 0.6822 - loss: 0.9437 - precision: 0.7851 - recall: 0.5280 - val\_accuracy: 0.5600 - val\_loss: 1.1841 - val\_precision: 0.7077 - val\_recall: 0.4600

Epoch 17/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 258ms/step - accuracy: 0.6871 - loss: 0.9039 - precision: 0.7989 - recall: 0.5473 - val\_accuracy: 0.5850 - val\_loss: 1.1453 - val\_precision: 0.6967 - val\_recall: 0.4250

Epoch 18/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.7346 - loss: 0.7526 - precision: 0.8246 - recall: 0.6059 - val\_accuracy: 0.5550 - val\_loss: 1.2419 - val\_precision: 0.6500 - val\_recall: 0.4550

Epoch 19/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 212ms/step - accuracy: 0.7653 - loss: 0.7161 - precision: 0.8660 - recall: 0.6602 - val\_accuracy: 0.5750 - val\_loss: 1.1422 - val\_precision: 0.7246 - val\_recall: 0.5000

Epoch 20/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 225ms/step - accuracy: 0.7750 - loss: 0.7087 - precision: 0.8590 - recall: 0.6675 - val\_accuracy: 0.5800 - val\_loss: 1.2819 - val\_precision: 0.6978 - val\_recall: 0.4850

Epoch 21/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.7910 - loss: 0.6283 - precision: 0.8728 - recall: 0.6877 - val\_accuracy: 0.6150 - val\_loss: 1.0714 - val\_precision: 0.7429 - val\_recall: 0.5200

Epoch 22/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 231ms/step - accuracy: 0.7983 - loss: 0.5485 - precision: 0.8856 - recall: 0.7374 - val\_accuracy: 0.5750 - val\_loss: 1.3334 - val\_precision: 0.6597 - val\_recall: 0.4750

Epoch 23/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 236ms/step - accuracy: 0.7970 - loss: 0.6341 - precision: 0.8817 - recall: 0.7152 - val\_accuracy: 0.5750 - val\_loss: 1.1984 - val\_precision: 0.6966 - val\_recall: 0.5050

Epoch 24/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 227ms/step - accuracy: 0.8217 - loss: 0.5141 - precision: 0.8663 - recall: 0.7440 - val\_accuracy: 0.6400 - val\_loss: 1.1050 - val\_precision: 0.7241 - val\_recall: 0.5250

Epoch 25/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 230ms/step - accuracy: 0.8219 - loss: 0.4899 - precision: 0.8935 - recall: 0.7584 - val\_accuracy: 0.6150 - val\_loss: 1.1770 - val\_precision: 0.7063 - val\_recall: 0.5650

Epoch 26/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 5s 218ms/step - accuracy: 0.8417 - loss: 0.4394 - precision: 0.9191 - recall: 0.8088 - val\_accuracy: 0.6200 - val\_loss: 1.1676 - val\_precision: 0.6859 - val\_recall: 0.5350

Epoch 27/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 234ms/step - accuracy: 0.8676 - loss: 0.4146 - precision: 0.9116 - recall: 0.8006 - val\_accuracy: 0.6600 - val\_loss: 1.1822 - val\_precision: 0.7099 - val\_recall: 0.5750

Epoch 28/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.8920 - loss: 0.3310 - precision: 0.9331 - recall: 0.8449 - val\_accuracy: 0.5950 - val\_loss: 1.2099 - val\_precision: 0.7070 - val\_recall: 0.5550

Epoch 29/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 221ms/step - accuracy: 0.9093 - loss: 0.3182 - precision: 0.9439 - recall: 0.8460 - val\_accuracy: 0.5850 - val\_loss: 1.5417 - val\_precision: 0.6433 - val\_recall: 0.5500

Epoch 30/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 226ms/step - accuracy: 0.8768 - loss: 0.3679 - precision: 0.8986 - recall: 0.8396 - val\_accuracy: 0.6400 - val\_loss: 1.2053 - val\_precision: 0.7041 - val\_recall: 0.5950

Epoch 31/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 228ms/step - accuracy: 0.9144 - loss: 0.2857 - precision: 0.9384 - recall: 0.8831 - val\_accuracy: 0.6550 - val\_loss: 1.2758 - val\_precision: 0.6928 - val\_recall: 0.5750

Epoch 32/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 222ms/step - accuracy: 0.9107 - loss: 0.2673 - precision: 0.9391 - recall: 0.8832 - val\_accuracy: 0.6150 - val\_loss: 1.3183 - val\_precision: 0.6766 - val\_recall: 0.5650

Epoch 33/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 229ms/step - accuracy: 0.9204 - loss: 0.2504 - precision: 0.9447 - recall: 0.8972 - val\_accuracy: 0.6400 - val\_loss: 1.4279 - val\_precision: 0.6705 - val\_recall: 0.5900

Epoch 34/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.9354 - loss: 0.1980 - precision: 0.9620 - recall: 0.9181 - val\_accuracy: 0.6400 - val\_loss: 1.3290 - val\_precision: 0.6743 - val\_recall: 0.5900

Epoch 35/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 229ms/step - accuracy: 0.9460 - loss: 0.1779 - precision: 0.9649 - recall: 0.9142 - val\_accuracy: 0.6150 - val\_loss: 1.4824 - val\_precision: 0.6647 - val\_recall: 0.5750

Epoch 36/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 236ms/step - accuracy: 0.9369 - loss: 0.2090 - precision: 0.9589 - recall: 0.9137 - val\_accuracy: 0.6650 - val\_loss: 1.3280 - val\_precision: 0.6944 - val\_recall: 0.6250

Epoch 37/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 225ms/step - accuracy: 0.9383 - loss: 0.1561 - precision: 0.9525 - recall: 0.9297 - val\_accuracy: 0.5850 - val\_loss: 1.6770 - val\_precision: 0.6437 - val\_recall: 0.5600

Epoch 38/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 224ms/step - accuracy: 0.9327 - loss: 0.2111 - precision: 0.9492 - recall: 0.9100 - val\_accuracy: 0.6250 - val\_loss: 1.3597 - val\_precision: 0.6821 - val\_recall: 0.5900

Epoch 39/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 225ms/step - accuracy: 0.9577 - loss: 0.1388 - precision: 0.9790 - recall: 0.9463 - val\_accuracy: 0.6300 - val\_loss: 1.6372 - val\_precision: 0.6575 - val\_recall: 0.5950

Epoch 40/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 224ms/step - accuracy: 0.9399 - loss: 0.1721 - precision: 0.9544 - recall: 0.9255 - val\_accuracy: 0.6350 - val\_loss: 1.4432 - val\_precision: 0.6910 - val\_recall: 0.6150

Epoch 41/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 221ms/step - accuracy: 0.9651 - loss: 0.1210 - precision: 0.9697 - recall: 0.9603 - val\_accuracy: 0.6500 - val\_loss: 1.3475 - val\_precision: 0.7059 - val\_recall: 0.6000

Epoch 42/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 220ms/step - accuracy: 0.9695 - loss: 0.1204 - precision: 0.9786 - recall: 0.9659 - val\_accuracy: 0.6050 - val\_loss: 1.4062 - val\_precision: 0.6784 - val\_recall: 0.5800

Epoch 43/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 233ms/step - accuracy: 0.9713 - loss: 0.0996 - precision: 0.9790 - recall: 0.9691 - val\_accuracy: 0.6200 - val\_loss: 1.4930 - val\_precision: 0.6667 - val\_recall: 0.5900

Epoch 44/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 222ms/step - accuracy: 0.9748 - loss: 0.0742 - precision: 0.9831 - recall: 0.9737 - val\_accuracy: 0.6400 - val\_loss: 1.5059 - val\_precision: 0.6831 - val\_recall: 0.6250

Epoch 45/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 221ms/step - accuracy: 0.9561 - loss: 0.0965 - precision: 0.9685 - recall: 0.9551 - val\_accuracy: 0.6400 - val\_loss: 1.5170 - val\_precision: 0.6851 - val\_recall: 0.6200

Epoch 46/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.9518 - loss: 0.1243 - precision: 0.9586 - recall: 0.9389 - val\_accuracy: 0.6100 - val\_loss: 1.7934 - val\_precision: 0.6257 - val\_recall: 0.5850

Tiempo de entrenamiento fold 2: 267.58 s

7/7 ━━━━━━━━━━━━━━━━━━━━ 1s 109ms/step

F1-score fold 2: 0.6617

Métricas adicionales: Accuracy=0.6650 Precision=0.6944 Recall=0.6250

Mejor modelo actualizado y guardado.

============================

Fold 3/5

============================

Found 799 validated image filenames belonging to 10 classes.

Found 200 validated image filenames belonging to 10 classes.

Model: "sequential\_2"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━┓

┃ Layer (type) ┃ Output Shape ┃ Param # ┃

┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━┩

│ conv2d\_6 (Conv2D) │ (None, 126, 126, 32) │ 896 │

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│ max\_pooling2d\_6 (MaxPooling2D) │ (None, 63, 63, 32) │ 0 │

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│ conv2d\_7 (Conv2D) │ (None, 61, 61, 64) │ 18,496 │

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│ max\_pooling2d\_7 (MaxPooling2D) │ (None, 30, 30, 64) │ 0 │

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│ conv2d\_8 (Conv2D) │ (None, 28, 28, 128) │ 73,856 │

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│ max\_pooling2d\_8 (MaxPooling2D) │ (None, 14, 14, 128) │ 0 │

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│ flatten\_2 (Flatten) │ (None, 25088) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_4 (Dense) │ (None, 128) │ 3,211,392 │

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│ dropout\_2 (Dropout) │ (None, 128) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_5 (Dense) │ (None, 10) │ 1,290 │

└──────────────────────────────────────┴─────────────────────────────┴─────────────────┘

Total params: 3,305,930 (12.61 MB)

Trainable params: 3,305,930 (12.61 MB)

Non-trainable params: 0 (0.00 B)

/home/diego/tensorflow/lib/python3.10/site-packages/keras/src/trainers/data\_adapters/py\_dataset\_adapter.py:121: UserWarning: Your `PyDataset` class should call `super().\_\_init\_\_(\*\*kwargs)` in its constructor. `\*\*kwargs` can include `workers`, `use\_multiprocessing`, `max\_queue\_size`. Do not pass these arguments to `fit()`, as they will be ignored.

self.\_warn\_if\_super\_not\_called()

Epoch 1/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 235ms/step - accuracy: 0.1241 - loss: 2.3209 - precision: 0.0385 - recall: 9.6274e-05 - val\_accuracy: 0.2550 - val\_loss: 2.0814 - val\_precision: 0.3333 - val\_recall: 0.0050

Epoch 2/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 258ms/step - accuracy: 0.2723 - loss: 2.0584 - precision: 0.5392 - recall: 0.0278 - val\_accuracy: 0.2850 - val\_loss: 1.9340 - val\_precision: 0.7778 - val\_recall: 0.0350

Epoch 3/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 261ms/step - accuracy: 0.2861 - loss: 1.9138 - precision: 0.5992 - recall: 0.0492 - val\_accuracy: 0.3250 - val\_loss: 1.8638 - val\_precision: 0.5246 - val\_recall: 0.1600

Epoch 4/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 274ms/step - accuracy: 0.3260 - loss: 1.7916 - precision: 0.6678 - recall: 0.1167 - val\_accuracy: 0.4000 - val\_loss: 1.6629 - val\_precision: 0.6774 - val\_recall: 0.1050

Epoch 5/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 261ms/step - accuracy: 0.3873 - loss: 1.6428 - precision: 0.7573 - recall: 0.1088 - val\_accuracy: 0.4650 - val\_loss: 1.5148 - val\_precision: 0.6889 - val\_recall: 0.1550

Epoch 6/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 274ms/step - accuracy: 0.4704 - loss: 1.4807 - precision: 0.7476 - recall: 0.2426 - val\_accuracy: 0.5100 - val\_loss: 1.4290 - val\_precision: 0.7647 - val\_recall: 0.1300

Epoch 7/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 265ms/step - accuracy: 0.5281 - loss: 1.3612 - precision: 0.7490 - recall: 0.2792 - val\_accuracy: 0.4800 - val\_loss: 1.4201 - val\_precision: 0.6329 - val\_recall: 0.2500

Epoch 8/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 257ms/step - accuracy: 0.5090 - loss: 1.3333 - precision: 0.7563 - recall: 0.3020 - val\_accuracy: 0.5100 - val\_loss: 1.3261 - val\_precision: 0.7273 - val\_recall: 0.2800

Epoch 9/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 260ms/step - accuracy: 0.5435 - loss: 1.2629 - precision: 0.7581 - recall: 0.3214 - val\_accuracy: 0.5700 - val\_loss: 1.2561 - val\_precision: 0.7564 - val\_recall: 0.2950

Epoch 10/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 281ms/step - accuracy: 0.6026 - loss: 1.1245 - precision: 0.7960 - recall: 0.3968 - val\_accuracy: 0.6050 - val\_loss: 1.2708 - val\_precision: 0.7453 - val\_recall: 0.3950

Epoch 11/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 276ms/step - accuracy: 0.6079 - loss: 1.0533 - precision: 0.7893 - recall: 0.4498 - val\_accuracy: 0.5700 - val\_loss: 1.2710 - val\_precision: 0.6574 - val\_recall: 0.3550

Epoch 12/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 296ms/step - accuracy: 0.5852 - loss: 1.0789 - precision: 0.7379 - recall: 0.4407 - val\_accuracy: 0.5550 - val\_loss: 1.2680 - val\_precision: 0.7426 - val\_recall: 0.3750

Epoch 13/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 310ms/step - accuracy: 0.6132 - loss: 1.0414 - precision: 0.8031 - recall: 0.4487 - val\_accuracy: 0.5800 - val\_loss: 1.2991 - val\_precision: 0.6522 - val\_recall: 0.3750

Epoch 14/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 321ms/step - accuracy: 0.6620 - loss: 0.9297 - precision: 0.8621 - recall: 0.5169 - val\_accuracy: 0.5850 - val\_loss: 1.2348 - val\_precision: 0.7040 - val\_recall: 0.4400

Epoch 15/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 331ms/step - accuracy: 0.6976 - loss: 0.8910 - precision: 0.7903 - recall: 0.5556 - val\_accuracy: 0.5650 - val\_loss: 1.2018 - val\_precision: 0.6860 - val\_recall: 0.4150

Epoch 16/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 309ms/step - accuracy: 0.7093 - loss: 0.8286 - precision: 0.8481 - recall: 0.5527 - val\_accuracy: 0.6100 - val\_loss: 1.1828 - val\_precision: 0.6923 - val\_recall: 0.4950

Epoch 17/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 296ms/step - accuracy: 0.7383 - loss: 0.7612 - precision: 0.8262 - recall: 0.6056 - val\_accuracy: 0.5800 - val\_loss: 1.2570 - val\_precision: 0.6786 - val\_recall: 0.4750

Epoch 18/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 297ms/step - accuracy: 0.7380 - loss: 0.6923 - precision: 0.8693 - recall: 0.6490 - val\_accuracy: 0.5800 - val\_loss: 1.2123 - val\_precision: 0.6923 - val\_recall: 0.4950

Epoch 19/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 245ms/step - accuracy: 0.7993 - loss: 0.6388 - precision: 0.8729 - recall: 0.6990 - val\_accuracy: 0.5700 - val\_loss: 1.2065 - val\_precision: 0.6667 - val\_recall: 0.4800

Epoch 20/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 226ms/step - accuracy: 0.8209 - loss: 0.5617 - precision: 0.8902 - recall: 0.7283 - val\_accuracy: 0.6000 - val\_loss: 1.2079 - val\_precision: 0.6987 - val\_recall: 0.5450

Epoch 21/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 247ms/step - accuracy: 0.8333 - loss: 0.5205 - precision: 0.8938 - recall: 0.7416 - val\_accuracy: 0.5850 - val\_loss: 1.2602 - val\_precision: 0.6471 - val\_recall: 0.4950

Epoch 22/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.7934 - loss: 0.5879 - precision: 0.8785 - recall: 0.7127 - val\_accuracy: 0.5850 - val\_loss: 1.2903 - val\_precision: 0.6527 - val\_recall: 0.5450

Epoch 23/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 245ms/step - accuracy: 0.8523 - loss: 0.4584 - precision: 0.9061 - recall: 0.7818 - val\_accuracy: 0.6100 - val\_loss: 1.3907 - val\_precision: 0.6532 - val\_recall: 0.5650

Epoch 24/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 249ms/step - accuracy: 0.8369 - loss: 0.4661 - precision: 0.9041 - recall: 0.7685 - val\_accuracy: 0.5700 - val\_loss: 1.4147 - val\_precision: 0.6605 - val\_recall: 0.5350

Epoch 25/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 247ms/step - accuracy: 0.8280 - loss: 0.4914 - precision: 0.8789 - recall: 0.7670 - val\_accuracy: 0.6000 - val\_loss: 1.2682 - val\_precision: 0.6708 - val\_recall: 0.5400

Epoch 26/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 236ms/step - accuracy: 0.8853 - loss: 0.3733 - precision: 0.9263 - recall: 0.8305 - val\_accuracy: 0.5900 - val\_loss: 1.3934 - val\_precision: 0.6607 - val\_recall: 0.5550

Tiempo de entrenamiento fold 3: 176.42 s

7/7 ━━━━━━━━━━━━━━━━━━━━ 1s 120ms/step

F1-score fold 3: 0.5944

Métricas adicionales: Accuracy=0.6100 Precision=0.6923 Recall=0.4950

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Fold 4/5

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Found 799 validated image filenames belonging to 10 classes.

Found 200 validated image filenames belonging to 10 classes.

Model: "sequential\_3"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━┓

┃ Layer (type) ┃ Output Shape ┃ Param # ┃

┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━┩

│ conv2d\_9 (Conv2D) │ (None, 126, 126, 32) │ 896 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ max\_pooling2d\_9 (MaxPooling2D) │ (None, 63, 63, 32) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ conv2d\_10 (Conv2D) │ (None, 61, 61, 64) │ 18,496 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ max\_pooling2d\_10 (MaxPooling2D) │ (None, 30, 30, 64) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ conv2d\_11 (Conv2D) │ (None, 28, 28, 128) │ 73,856 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ max\_pooling2d\_11 (MaxPooling2D) │ (None, 14, 14, 128) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ flatten\_3 (Flatten) │ (None, 25088) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_6 (Dense) │ (None, 128) │ 3,211,392 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dropout\_3 (Dropout) │ (None, 128) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_7 (Dense) │ (None, 10) │ 1,290 │

└──────────────────────────────────────┴─────────────────────────────┴─────────────────┘

Total params: 3,305,930 (12.61 MB)

Trainable params: 3,305,930 (12.61 MB)

Non-trainable params: 0 (0.00 B)

/home/diego/tensorflow/lib/python3.10/site-packages/keras/src/trainers/data\_adapters/py\_dataset\_adapter.py:121: UserWarning: Your `PyDataset` class should call `super().\_\_init\_\_(\*\*kwargs)` in its constructor. `\*\*kwargs` can include `workers`, `use\_multiprocessing`, `max\_queue\_size`. Do not pass these arguments to `fit()`, as they will be ignored.

self.\_warn\_if\_super\_not\_called()

Epoch 1/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 250ms/step - accuracy: 0.1056 - loss: 2.2982 - precision: 0.0000e+00 - recall: 0.0000e+00 - val\_accuracy: 0.2150 - val\_loss: 2.0277 - val\_precision: 0.0000e+00 - val\_recall: 0.0000e+00

Epoch 2/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 284ms/step - accuracy: 0.2229 - loss: 1.9874 - precision: 0.6433 - recall: 0.0382 - val\_accuracy: 0.3500 - val\_loss: 1.9089 - val\_precision: 0.5952 - val\_recall: 0.1250

Epoch 3/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 264ms/step - accuracy: 0.3149 - loss: 1.8506 - precision: 0.6811 - recall: 0.1143 - val\_accuracy: 0.4450 - val\_loss: 1.7044 - val\_precision: 0.7000 - val\_recall: 0.1400

Epoch 4/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 250ms/step - accuracy: 0.4031 - loss: 1.7215 - precision: 0.7101 - recall: 0.1308 - val\_accuracy: 0.4400 - val\_loss: 1.6410 - val\_precision: 0.7941 - val\_recall: 0.1350

Epoch 5/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 234ms/step - accuracy: 0.4200 - loss: 1.5975 - precision: 0.7814 - recall: 0.1635 - val\_accuracy: 0.4050 - val\_loss: 1.6079 - val\_precision: 0.7209 - val\_recall: 0.1550

Epoch 6/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 238ms/step - accuracy: 0.4337 - loss: 1.5323 - precision: 0.7847 - recall: 0.1775 - val\_accuracy: 0.4800 - val\_loss: 1.4612 - val\_precision: 0.6515 - val\_recall: 0.2150

Epoch 7/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 245ms/step - accuracy: 0.4545 - loss: 1.5288 - precision: 0.7145 - recall: 0.2047 - val\_accuracy: 0.4400 - val\_loss: 1.5461 - val\_precision: 0.8824 - val\_recall: 0.1500

Epoch 8/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 253ms/step - accuracy: 0.4561 - loss: 1.5101 - precision: 0.7239 - recall: 0.1942 - val\_accuracy: 0.5200 - val\_loss: 1.3414 - val\_precision: 0.7429 - val\_recall: 0.2600

Epoch 9/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 233ms/step - accuracy: 0.5264 - loss: 1.3563 - precision: 0.7457 - recall: 0.2506 - val\_accuracy: 0.5200 - val\_loss: 1.3782 - val\_precision: 0.7073 - val\_recall: 0.2900

Epoch 10/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 258ms/step - accuracy: 0.5392 - loss: 1.3134 - precision: 0.7641 - recall: 0.3029 - val\_accuracy: 0.5250 - val\_loss: 1.3262 - val\_precision: 0.6633 - val\_recall: 0.3250

Epoch 11/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 237ms/step - accuracy: 0.5554 - loss: 1.1899 - precision: 0.7474 - recall: 0.3690 - val\_accuracy: 0.5200 - val\_loss: 1.2227 - val\_precision: 0.8000 - val\_recall: 0.3800

Epoch 12/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 262ms/step - accuracy: 0.6203 - loss: 1.0940 - precision: 0.7856 - recall: 0.4379 - val\_accuracy: 0.5500 - val\_loss: 1.2678 - val\_precision: 0.7653 - val\_recall: 0.3750

Epoch 13/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 262ms/step - accuracy: 0.6213 - loss: 1.0517 - precision: 0.8028 - recall: 0.4319 - val\_accuracy: 0.5950 - val\_loss: 1.1781 - val\_precision: 0.7544 - val\_recall: 0.4300

Epoch 14/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 244ms/step - accuracy: 0.6442 - loss: 1.0194 - precision: 0.7900 - recall: 0.5047 - val\_accuracy: 0.5800 - val\_loss: 1.1565 - val\_precision: 0.7179 - val\_recall: 0.4200

Epoch 15/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 284ms/step - accuracy: 0.6747 - loss: 0.9289 - precision: 0.8009 - recall: 0.5244 - val\_accuracy: 0.6350 - val\_loss: 1.0799 - val\_precision: 0.7581 - val\_recall: 0.4700

Epoch 16/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 243ms/step - accuracy: 0.6964 - loss: 0.8148 - precision: 0.8207 - recall: 0.5781 - val\_accuracy: 0.6100 - val\_loss: 1.0996 - val\_precision: 0.7188 - val\_recall: 0.4600

Epoch 17/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 250ms/step - accuracy: 0.7020 - loss: 0.8428 - precision: 0.8155 - recall: 0.5462 - val\_accuracy: 0.5700 - val\_loss: 1.2128 - val\_precision: 0.6957 - val\_recall: 0.4800

Epoch 18/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 281ms/step - accuracy: 0.7291 - loss: 0.7276 - precision: 0.8762 - recall: 0.6457 - val\_accuracy: 0.6200 - val\_loss: 1.0749 - val\_precision: 0.7464 - val\_recall: 0.5150

Epoch 19/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 234ms/step - accuracy: 0.8015 - loss: 0.6228 - precision: 0.8797 - recall: 0.6996 - val\_accuracy: 0.6350 - val\_loss: 1.0392 - val\_precision: 0.7181 - val\_recall: 0.5350

Epoch 20/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 253ms/step - accuracy: 0.8269 - loss: 0.5380 - precision: 0.9090 - recall: 0.7289 - val\_accuracy: 0.6100 - val\_loss: 1.0256 - val\_precision: 0.7333 - val\_recall: 0.5500

Epoch 21/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 236ms/step - accuracy: 0.8077 - loss: 0.5538 - precision: 0.8951 - recall: 0.7325 - val\_accuracy: 0.6150 - val\_loss: 1.2158 - val\_precision: 0.6709 - val\_recall: 0.5300

Epoch 22/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 236ms/step - accuracy: 0.8114 - loss: 0.5460 - precision: 0.8763 - recall: 0.7233 - val\_accuracy: 0.6150 - val\_loss: 1.0731 - val\_precision: 0.6846 - val\_recall: 0.5100

Epoch 23/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 247ms/step - accuracy: 0.8554 - loss: 0.4244 - precision: 0.9134 - recall: 0.7860 - val\_accuracy: 0.5950 - val\_loss: 1.2912 - val\_precision: 0.6731 - val\_recall: 0.5250

Epoch 24/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 261ms/step - accuracy: 0.8656 - loss: 0.4383 - precision: 0.9147 - recall: 0.8137 - val\_accuracy: 0.6550 - val\_loss: 1.1045 - val\_precision: 0.7070 - val\_recall: 0.5550

Epoch 25/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 241ms/step - accuracy: 0.8641 - loss: 0.3987 - precision: 0.9101 - recall: 0.8243 - val\_accuracy: 0.6200 - val\_loss: 1.0185 - val\_precision: 0.7081 - val\_recall: 0.5700

Epoch 26/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 237ms/step - accuracy: 0.8991 - loss: 0.3173 - precision: 0.9373 - recall: 0.8446 - val\_accuracy: 0.6350 - val\_loss: 1.1063 - val\_precision: 0.6744 - val\_recall: 0.5800

Epoch 27/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 262ms/step - accuracy: 0.9291 - loss: 0.2282 - precision: 0.9557 - recall: 0.8991 - val\_accuracy: 0.6300 - val\_loss: 1.2988 - val\_precision: 0.6739 - val\_recall: 0.6200

Epoch 28/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 253ms/step - accuracy: 0.8944 - loss: 0.2753 - precision: 0.9177 - recall: 0.8754 - val\_accuracy: 0.6450 - val\_loss: 1.1289 - val\_precision: 0.6864 - val\_recall: 0.5800

Epoch 29/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 317ms/step - accuracy: 0.9096 - loss: 0.2620 - precision: 0.9448 - recall: 0.8679 - val\_accuracy: 0.6300 - val\_loss: 1.2906 - val\_precision: 0.6763 - val\_recall: 0.5850

Epoch 30/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 8s 333ms/step - accuracy: 0.9065 - loss: 0.2559 - precision: 0.9512 - recall: 0.8886 - val\_accuracy: 0.6600 - val\_loss: 1.2328 - val\_precision: 0.7126 - val\_recall: 0.6200

Epoch 31/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 250ms/step - accuracy: 0.9597 - loss: 0.1817 - precision: 0.9674 - recall: 0.9370 - val\_accuracy: 0.5950 - val\_loss: 1.3823 - val\_precision: 0.6554 - val\_recall: 0.5800

Epoch 32/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 238ms/step - accuracy: 0.9448 - loss: 0.2024 - precision: 0.9556 - recall: 0.9055 - val\_accuracy: 0.6100 - val\_loss: 1.3148 - val\_precision: 0.6743 - val\_recall: 0.5900

Epoch 33/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 226ms/step - accuracy: 0.9409 - loss: 0.1528 - precision: 0.9592 - recall: 0.9271 - val\_accuracy: 0.6050 - val\_loss: 1.5244 - val\_precision: 0.6354 - val\_recall: 0.5750

Epoch 34/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 228ms/step - accuracy: 0.9585 - loss: 0.1377 - precision: 0.9800 - recall: 0.9402 - val\_accuracy: 0.6350 - val\_loss: 1.3351 - val\_precision: 0.6720 - val\_recall: 0.6250

Epoch 35/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 231ms/step - accuracy: 0.9619 - loss: 0.1324 - precision: 0.9652 - recall: 0.9450 - val\_accuracy: 0.6450 - val\_loss: 1.2437 - val\_precision: 0.6831 - val\_recall: 0.6250

Epoch 36/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 233ms/step - accuracy: 0.9716 - loss: 0.1177 - precision: 0.9777 - recall: 0.9560 - val\_accuracy: 0.6500 - val\_loss: 1.1932 - val\_precision: 0.6758 - val\_recall: 0.6150

Epoch 37/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.9482 - loss: 0.1531 - precision: 0.9492 - recall: 0.9415 - val\_accuracy: 0.6500 - val\_loss: 1.1781 - val\_precision: 0.6914 - val\_recall: 0.6050

Epoch 38/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 234ms/step - accuracy: 0.9783 - loss: 0.0867 - precision: 0.9820 - recall: 0.9713 - val\_accuracy: 0.6350 - val\_loss: 1.2595 - val\_precision: 0.6774 - val\_recall: 0.6300

Epoch 39/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 244ms/step - accuracy: 0.9862 - loss: 0.0667 - precision: 0.9873 - recall: 0.9812 - val\_accuracy: 0.6750 - val\_loss: 1.3674 - val\_precision: 0.6862 - val\_recall: 0.6450

Epoch 40/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 231ms/step - accuracy: 0.9878 - loss: 0.0672 - precision: 0.9910 - recall: 0.9818 - val\_accuracy: 0.6750 - val\_loss: 1.1884 - val\_precision: 0.6995 - val\_recall: 0.6400

Epoch 41/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 231ms/step - accuracy: 0.9845 - loss: 0.0559 - precision: 0.9885 - recall: 0.9810 - val\_accuracy: 0.6450 - val\_loss: 1.4300 - val\_precision: 0.6774 - val\_recall: 0.6300

Epoch 42/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 230ms/step - accuracy: 0.9835 - loss: 0.0648 - precision: 0.9864 - recall: 0.9801 - val\_accuracy: 0.5800 - val\_loss: 1.5867 - val\_precision: 0.6196 - val\_recall: 0.5700

Epoch 43/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 235ms/step - accuracy: 0.9855 - loss: 0.0628 - precision: 0.9859 - recall: 0.9769 - val\_accuracy: 0.6650 - val\_loss: 1.5694 - val\_precision: 0.6825 - val\_recall: 0.6450

Epoch 44/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 227ms/step - accuracy: 0.9905 - loss: 0.0434 - precision: 0.9907 - recall: 0.9891 - val\_accuracy: 0.6300 - val\_loss: 1.5295 - val\_precision: 0.6649 - val\_recall: 0.6250

Epoch 45/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 238ms/step - accuracy: 0.9900 - loss: 0.0454 - precision: 0.9900 - recall: 0.9834 - val\_accuracy: 0.6000 - val\_loss: 1.8003 - val\_precision: 0.6085 - val\_recall: 0.5750

Epoch 46/50

Epoch 46/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 239ms/step - accuracy: 0.9847 - loss: 0.0711 - precision: 0.9887 - recall: 0.9812 - val\_accuracy: 0.6400 - val\_loss: 1.3492 - val\_precision: 0.6740 - val\_recall: 0.6100

Epoch 47/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 239ms/step - accuracy: 0.9789 - loss: 0.0849 - precision: 0.9825 - recall: 0.9725 - val\_accuracy: 0.6400 - val\_loss: 1.6661 - val\_precision: 0.6543 - val\_recall: 0.6150

Epoch 48/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 243ms/step - accuracy: 0.9840 - loss: 0.0543 - precision: 0.9886 - recall: 0.9840 - val\_accuracy: 0.6250 - val\_loss: 1.7558 - val\_precision: 0.6387 - val\_recall: 0.6100

Epoch 49/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 249ms/step - accuracy: 0.9710 - loss: 0.0887 - precision: 0.9767 - recall: 0.9683 - val\_accuracy: 0.6050 - val\_loss: 1.6868 - val\_precision: 0.6310 - val\_recall: 0.5900

Tiempo de entrenamiento fold 4: 307.17 s

7/7 ━━━━━━━━━━━━━━━━━━━━ 1s 113ms/step

F1-score fold 4: 0.6660

Métricas adicionales: Accuracy=0.6750 Precision=0.6862 Recall=0.6450

Mejor modelo actualizado y guardado.

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Fold 5/5

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Found 800 validated image filenames belonging to 10 classes.

Found 199 validated image filenames belonging to 10 classes.

Model: "sequential\_4"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━┓

┃ Layer (type) ┃ Output Shape ┃ Param # ┃

┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━┩

│ conv2d\_12 (Conv2D) │ (None, 126, 126, 32) │ 896 │

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│ max\_pooling2d\_12 (MaxPooling2D) │ (None, 63, 63, 32) │ 0 │

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│ conv2d\_13 (Conv2D) │ (None, 61, 61, 64) │ 18,496 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ max\_pooling2d\_13 (MaxPooling2D) │ (None, 30, 30, 64) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ conv2d\_14 (Conv2D) │ (None, 28, 28, 128) │ 73,856 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ max\_pooling2d\_14 (MaxPooling2D) │ (None, 14, 14, 128) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ flatten\_4 (Flatten) │ (None, 25088) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_8 (Dense) │ (None, 128) │ 3,211,392 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dropout\_4 (Dropout) │ (None, 128) │ 0 │

├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤

│ dense\_9 (Dense) │ (None, 10) │ 1,290 │

└──────────────────────────────────────┴─────────────────────────────┴─────────────────┘

Total params: 3,305,930 (12.61 MB)

Trainable params: 3,305,930 (12.61 MB)

Non-trainable params: 0 (0.00 B)

/home/diego/tensorflow/lib/python3.10/site-packages/keras/src/trainers/data\_adapters/py\_dataset\_adapter.py:121: UserWarning: Your `PyDataset` class should call `super().\_\_init\_\_(\*\*kwargs)` in its constructor. `\*\*kwargs` can include `workers`, `use\_multiprocessing`, `max\_queue\_size`. Do not pass these arguments to `fit()`, as they will be ignored.

self.\_warn\_if\_super\_not\_called()

Epoch 1/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 254ms/step - accuracy: 0.1323 - loss: 2.2960 - precision: 0.0000e+00 - recall: 0.0000e+00 - val\_accuracy: 0.1859 - val\_loss: 2.1107 - val\_precision: 0.0000e+00 - val\_recall: 0.0000e+00

Epoch 2/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 263ms/step - accuracy: 0.2231 - loss: 2.0861 - precision: 0.3314 - recall: 0.0106 - val\_accuracy: 0.3166 - val\_loss: 1.9334 - val\_precision: 1.0000 - val\_recall: 0.0402

Epoch 3/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 247ms/step - accuracy: 0.3240 - loss: 1.8968 - precision: 0.5948 - recall: 0.0572 - val\_accuracy: 0.2864 - val\_loss: 1.8813 - val\_precision: 0.7576 - val\_recall: 0.1256

Epoch 4/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 266ms/step - accuracy: 0.3522 - loss: 1.8151 - precision: 0.6672 - recall: 0.1131 - val\_accuracy: 0.4121 - val\_loss: 1.6763 - val\_precision: 0.7222 - val\_recall: 0.1307

Epoch 5/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 248ms/step - accuracy: 0.4444 - loss: 1.6057 - precision: 0.7452 - recall: 0.1749 - val\_accuracy: 0.4372 - val\_loss: 1.5628 - val\_precision: 0.7333 - val\_recall: 0.1658

Epoch 6/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 246ms/step - accuracy: 0.4251 - loss: 1.5595 - precision: 0.7235 - recall: 0.1880 - val\_accuracy: 0.4774 - val\_loss: 1.5117 - val\_precision: 0.7031 - val\_recall: 0.2261

Epoch 7/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 244ms/step - accuracy: 0.4790 - loss: 1.4696 - precision: 0.7323 - recall: 0.2611 - val\_accuracy: 0.4925 - val\_loss: 1.4369 - val\_precision: 0.7377 - val\_recall: 0.2261

Epoch 8/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 255ms/step - accuracy: 0.4910 - loss: 1.3375 - precision: 0.7090 - recall: 0.3130 - val\_accuracy: 0.5025 - val\_loss: 1.3918 - val\_precision: 0.7222 - val\_recall: 0.2613

Epoch 9/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 241ms/step - accuracy: 0.5077 - loss: 1.3332 - precision: 0.7009 - recall: 0.3037 - val\_accuracy: 0.5276 - val\_loss: 1.3884 - val\_precision: 0.8026 - val\_recall: 0.3065

Epoch 10/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 277ms/step - accuracy: 0.5862 - loss: 1.1639 - precision: 0.7616 - recall: 0.3411 - val\_accuracy: 0.5377 - val\_loss: 1.2285 - val\_precision: 0.7889 - val\_recall: 0.3568

Epoch 11/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 259ms/step - accuracy: 0.5878 - loss: 1.1420 - precision: 0.7684 - recall: 0.4106 - val\_accuracy: 0.5477 - val\_loss: 1.2529 - val\_precision: 0.7677 - val\_recall: 0.3819

Epoch 12/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 255ms/step - accuracy: 0.6693 - loss: 1.0070 - precision: 0.8027 - recall: 0.4770 - val\_accuracy: 0.5578 - val\_loss: 1.2051 - val\_precision: 0.7573 - val\_recall: 0.3920

Epoch 13/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 249ms/step - accuracy: 0.6615 - loss: 0.9734 - precision: 0.8064 - recall: 0.4770 - val\_accuracy: 0.5879 - val\_loss: 1.1478 - val\_precision: 0.7500 - val\_recall: 0.4221

Epoch 14/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 268ms/step - accuracy: 0.6687 - loss: 0.9231 - precision: 0.8180 - recall: 0.5183 - val\_accuracy: 0.5930 - val\_loss: 1.2153 - val\_precision: 0.7377 - val\_recall: 0.4523

Epoch 15/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 251ms/step - accuracy: 0.7087 - loss: 0.8384 - precision: 0.7952 - recall: 0.5500 - val\_accuracy: 0.6080 - val\_loss: 1.1925 - val\_precision: 0.7717 - val\_recall: 0.4925

Epoch 16/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 232ms/step - accuracy: 0.6860 - loss: 0.8389 - precision: 0.8350 - recall: 0.5741 - val\_accuracy: 0.5729 - val\_loss: 1.1897 - val\_precision: 0.7348 - val\_recall: 0.4874

Epoch 17/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 252ms/step - accuracy: 0.7356 - loss: 0.7525 - precision: 0.8368 - recall: 0.6349 - val\_accuracy: 0.6131 - val\_loss: 1.1964 - val\_precision: 0.7092 - val\_recall: 0.5025

Epoch 18/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 252ms/step - accuracy: 0.7864 - loss: 0.6587 - precision: 0.8757 - recall: 0.6942 - val\_accuracy: 0.6281 - val\_loss: 1.1733 - val\_precision: 0.7571 - val\_recall: 0.5327

Epoch 19/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 234ms/step - accuracy: 0.7934 - loss: 0.6497 - precision: 0.8845 - recall: 0.6650 - val\_accuracy: 0.6080 - val\_loss: 1.1553 - val\_precision: 0.7297 - val\_recall: 0.5427

Epoch 20/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 247ms/step - accuracy: 0.7936 - loss: 0.5988 - precision: 0.8765 - recall: 0.6900 - val\_accuracy: 0.6583 - val\_loss: 1.0841 - val\_precision: 0.7342 - val\_recall: 0.5829

Epoch 21/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 238ms/step - accuracy: 0.8140 - loss: 0.5543 - precision: 0.9004 - recall: 0.7436 - val\_accuracy: 0.6030 - val\_loss: 1.2795 - val\_precision: 0.6855 - val\_recall: 0.5477

Epoch 22/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 247ms/step - accuracy: 0.8306 - loss: 0.4596 - precision: 0.8826 - recall: 0.7588 - val\_accuracy: 0.6432 - val\_loss: 1.1234 - val\_precision: 0.7296 - val\_recall: 0.5829

Epoch 23/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 241ms/step - accuracy: 0.8743 - loss: 0.4319 - precision: 0.9277 - recall: 0.8138 - val\_accuracy: 0.6080 - val\_loss: 1.3237 - val\_precision: 0.6667 - val\_recall: 0.5628

Epoch 24/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 244ms/step - accuracy: 0.8590 - loss: 0.4411 - precision: 0.9010 - recall: 0.8049 - val\_accuracy: 0.6281 - val\_loss: 1.2039 - val\_precision: 0.7107 - val\_recall: 0.5678

Epoch 25/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 254ms/step - accuracy: 0.8429 - loss: 0.4475 - precision: 0.8963 - recall: 0.7763 - val\_accuracy: 0.6633 - val\_loss: 1.1634 - val\_precision: 0.7186 - val\_recall: 0.6030

Epoch 26/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 254ms/step - accuracy: 0.8754 - loss: 0.3344 - precision: 0.9200 - recall: 0.8332 - val\_accuracy: 0.6482 - val\_loss: 1.2254 - val\_precision: 0.7059 - val\_recall: 0.6030

Epoch 27/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 269ms/step - accuracy: 0.9080 - loss: 0.3050 - precision: 0.9484 - recall: 0.8633 - val\_accuracy: 0.6533 - val\_loss: 1.2629 - val\_precision: 0.6971 - val\_recall: 0.6131

Epoch 28/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 272ms/step - accuracy: 0.9107 - loss: 0.2798 - precision: 0.9429 - recall: 0.8763 - val\_accuracy: 0.6482 - val\_loss: 1.3650 - val\_precision: 0.7069 - val\_recall: 0.6181

Epoch 29/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 284ms/step - accuracy: 0.8856 - loss: 0.3362 - precision: 0.9180 - recall: 0.8370 - val\_accuracy: 0.6332 - val\_loss: 1.2512 - val\_precision: 0.6901 - val\_recall: 0.5930

Epoch 30/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 282ms/step - accuracy: 0.8895 - loss: 0.2849 - precision: 0.9198 - recall: 0.8678 - val\_accuracy: 0.6382 - val\_loss: 1.3749 - val\_precision: 0.6886 - val\_recall: 0.5779

Epoch 31/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 267ms/step - accuracy: 0.9087 - loss: 0.2753 - precision: 0.9190 - recall: 0.8761 - val\_accuracy: 0.6131 - val\_loss: 1.3314 - val\_precision: 0.6627 - val\_recall: 0.5628

Epoch 32/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 7s 261ms/step - accuracy: 0.9268 - loss: 0.2516 - precision: 0.9484 - recall: 0.8989 - val\_accuracy: 0.6382 - val\_loss: 1.3731 - val\_precision: 0.6927 - val\_recall: 0.6231

Epoch 33/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 228ms/step - accuracy: 0.9443 - loss: 0.2028 - precision: 0.9552 - recall: 0.9067 - val\_accuracy: 0.6432 - val\_loss: 1.3038 - val\_precision: 0.6703 - val\_recall: 0.6131

Epoch 34/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 237ms/step - accuracy: 0.9519 - loss: 0.1791 - precision: 0.9707 - recall: 0.9392 - val\_accuracy: 0.6583 - val\_loss: 1.3477 - val\_precision: 0.7111 - val\_recall: 0.6432

Epoch 35/50

25/25 ━━━━━━━━━━━━━━━━━━━━ 6s 229ms/step - accuracy: 0.9345 - loss: 0.1783 - precision: 0.9534 - recall: 0.9065 - val\_accuracy: 0.6281 - val\_loss: 1.3184 - val\_precision: 0.6648 - val\_recall: 0.5980

Tiempo de entrenamiento fold 5: 223.27 s

7/7 ━━━━━━━━━━━━━━━━━━━━ 1s 107ms/step

F1-score fold 5: 0.6653

Métricas adicionales: Accuracy=0.6633 Precision=0.7186 Recall=0.6030

Resultados finales del mejor modelo seleccionado:

Accuracy=0.6750 Precision=0.6862 Recall=0.6450

F1-score=0.6660

7/7 ━━━━━━━━━━━━━━━━━━━━ 1s 78ms/step

Classification report del mejor modelo:

precision recall f1-score support

blues 0.46 0.85 0.60 20

classical 0.76 0.80 0.78 20

country 0.44 0.40 0.42 20

disco 0.68 0.75 0.71 20

hiphop 0.74 0.70 0.72 20

jazz 0.78 0.35 0.48 20

metal 0.87 1.00 0.93 20

pop 0.82 0.90 0.86 20

reggae 0.71 0.50 0.59 20

rock 0.67 0.50 0.57 20

accuracy 0.68 200

macro avg 0.69 0.68 0.67 200

weighted avg 0.69 0.68 0.67 200

Classification report guardado como 'classification\_report\_modelo\_cross\_val.txt'