# Model 1

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 30752) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 3936384

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 6) 774

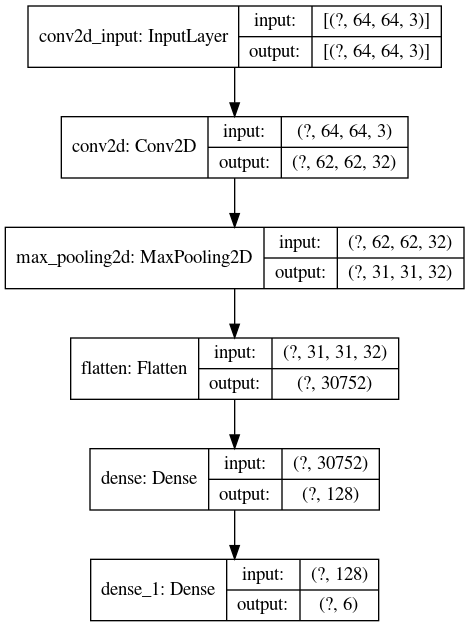
=================================================================

Total params: 3,938,054

Trainable params: 3,938,054

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-1** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu |  | adam | 25 |
| 2 |  |  |  |  |  | 2 | 6 | softmax |  |
| 3 |  |  |  |  |  | 3 |  |  |  |
| 4 |  |  |  |  |  | 4 |  |  |  |



## Proceso de Training

Epoch 1/25

2020-07-11 17:55:04.743545: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-07-11 17:55:05.123259: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 44s 75ms/step - loss: 1.2056 - accuracy: 0.5042 - val\_loss: 0.9864 - val\_accuracy: 0.5778

Epoch 2/25

593/593 [==============================] - 43s 72ms/step - loss: 0.9622 - accuracy: 0.5911 - val\_loss: 0.9372 - val\_accuracy: 0.5922

Epoch 3/25

593/593 [==============================] - 42s 72ms/step - loss: 0.9072 - accuracy: 0.6125 - val\_loss: 0.9597 - val\_accuracy: 0.5793

Epoch 4/25

593/593 [==============================] - 43s 73ms/step - loss: 0.8781 - accuracy: 0.6241 - val\_loss: 0.9186 - val\_accuracy: 0.6107

Epoch 5/25

593/593 [==============================] - 45s 75ms/step - loss: 0.8432 - accuracy: 0.6360 - val\_loss: 0.8958 - val\_accuracy: 0.6147

Epoch 6/25

593/593 [==============================] - 45s 76ms/step - loss: 0.8274 - accuracy: 0.6408 - val\_loss: 0.8822 - val\_accuracy: 0.6105

Epoch 7/25

593/593 [==============================] - 45s 75ms/step - loss: 0.8046 - accuracy: 0.6524 - val\_loss: 0.9203 - val\_accuracy: 0.6147

Epoch 8/25

593/593 [==============================] - 44s 74ms/step - loss: 0.7901 - accuracy: 0.6614 - val\_loss: 0.9339 - val\_accuracy: 0.6023

Epoch 9/25

593/593 [==============================] - 46s 77ms/step - loss: 0.7748 - accuracy: 0.6617 - val\_loss: 0.8680 - val\_accuracy: 0.6284

Epoch 10/25

593/593 [==============================] - 45s 76ms/step - loss: 0.7600 - accuracy: 0.6691 - val\_loss: 0.8710 - val\_accuracy: 0.6295

Epoch 11/25

593/593 [==============================] - 47s 79ms/step - loss: 0.7413 - accuracy: 0.6800 - val\_loss: 0.8426 - val\_accuracy: 0.6276

Epoch 12/25

593/593 [==============================] - 45s 76ms/step - loss: 0.7337 - accuracy: 0.6818 - val\_loss: 0.8648 - val\_accuracy: 0.6238

Epoch 13/25

593/593 [==============================] - 47s 79ms/step - loss: 0.7199 - accuracy: 0.6900 - val\_loss: 0.8605 - val\_accuracy: 0.6307

Epoch 14/25

593/593 [==============================] - 46s 77ms/step - loss: 0.7075 - accuracy: 0.6947 - val\_loss: 0.9179 - val\_accuracy: 0.6350

Epoch 15/25

593/593 [==============================] - 47s 78ms/step - loss: 0.7056 - accuracy: 0.6939 - val\_loss: 0.8654 - val\_accuracy: 0.6255

Epoch 16/25

593/593 [==============================] - 46s 77ms/step - loss: 0.6910 - accuracy: 0.7007 - val\_loss: 0.8689 - val\_accuracy: 0.6320

Epoch 17/25

593/593 [==============================] - 48s 80ms/step - loss: 0.6745 - accuracy: 0.7100 - val\_loss: 0.8808 - val\_accuracy: 0.6255

Epoch 18/25

593/593 [==============================] - 47s 79ms/step - loss: 0.6693 - accuracy: 0.7103 - val\_loss: 0.9015 - val\_accuracy: 0.6090

Epoch 19/25

593/593 [==============================] - 47s 79ms/step - loss: 0.6549 - accuracy: 0.7182 - val\_loss: 0.8883 - val\_accuracy: 0.6295

Epoch 20/25

593/593 [==============================] - 46s 77ms/step - loss: 0.6409 - accuracy: 0.7232 - val\_loss: 0.9100 - val\_accuracy: 0.6432

Epoch 21/25

593/593 [==============================] - 46s 78ms/step - loss: 0.6460 - accuracy: 0.7232 - val\_loss: 0.9141 - val\_accuracy: 0.6364

Epoch 22/25

593/593 [==============================] - 46s 77ms/step - loss: 0.6329 - accuracy: 0.7304 - val\_loss: 0.8914 - val\_accuracy: 0.6358

Epoch 23/25

593/593 [==============================] - 49s 83ms/step - loss: 0.6229 - accuracy: 0.7346 - val\_loss: 0.9150 - val\_accuracy: 0.6274

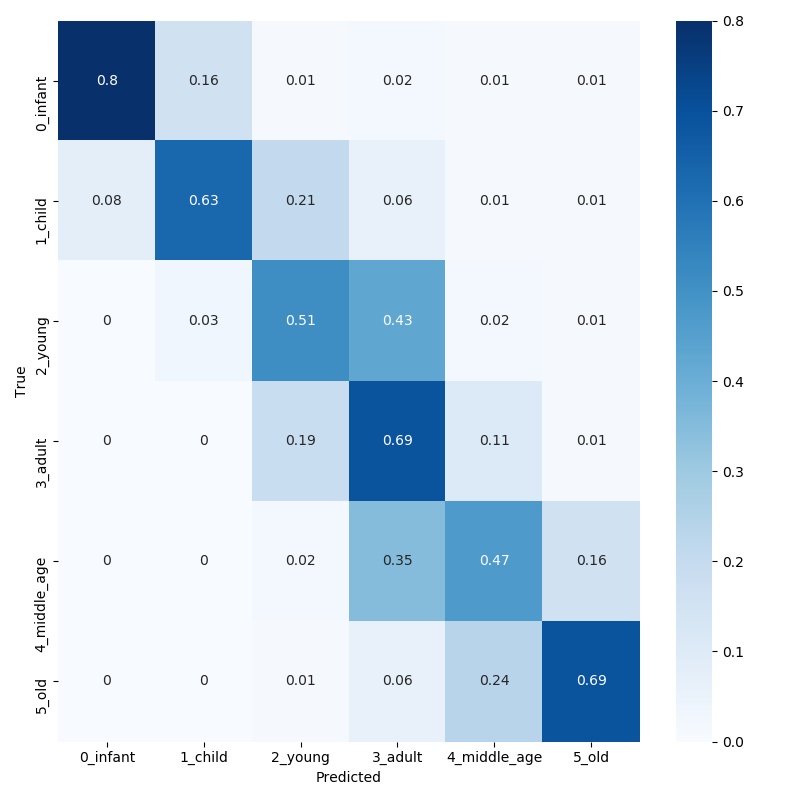
Epoch 24/25

593/593 [==============================] - 48s 80ms/step - loss: 0.6076 - accuracy: 0.7392 - val\_loss: 0.9001 - val\_accuracy: 0.6409

Epoch 25/25

593/593 [==============================] - 46s 78ms/step - loss: 0.6015 - accuracy: 0.7428 - val\_loss: 0.9370 - val\_accuracy: 0.6217

## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.91 | 0.80 | 0.85 | 379 |
| **1\_child** | 0.68 | 0.63 | 0.66 | 304 |
| **2\_young** | 0.50 | 0.51 | 0.50 | 845 |
| **3\_adult** | 0.64 | 0.69 | 0.66 | 1873 |
| **4\_middle\_age** | 0.54 | 0.47 | 0.50 | 862 |
| **5\_old** | 0.65 | 0.69 | 0.67 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.62 | 4742 |
| **macro\_avg** | 0.65 | 0.63 | 0.64 | 4742 |
| **weighted\_avg** | 0.62 | 0.62 | 0.62 | 4742 |

## Observaciones

Precisión training: 0.74

Pérdida training: 0.6

Precisión validación/test: 0.62

Pérdida test: 0.94

- Overfitting

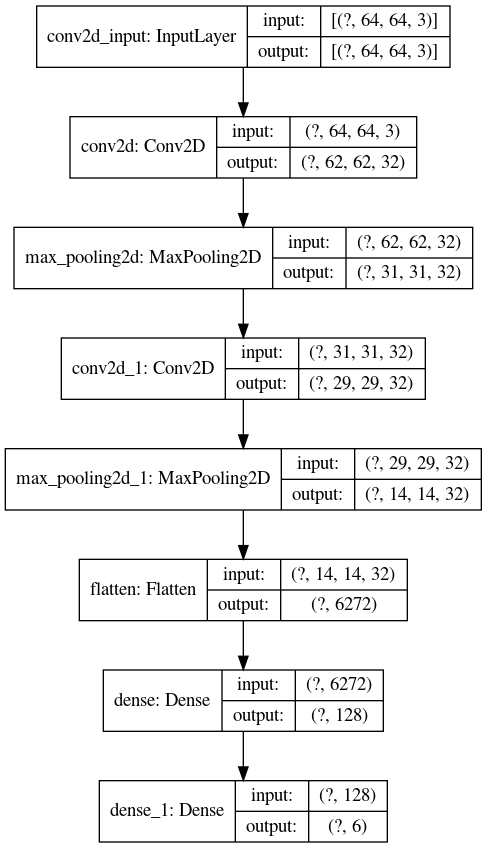
- Baja tasa de acierto

# Model 2

## Arquitectura y configuración de hiperparámetros

* 1. Model: "sequential"
  2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. Layer (type) Output Shape Param #
  4. =================================================================
  5. conv2d (Conv2D) (None, 62, 62, 32) 896
  6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  7. max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0
  8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  9. conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248
  10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  11. max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0
  12. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  13. flatten (Flatten) (None, 6272) 0
  14. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  15. dense (Dense) (None, 128) 802944
  16. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  17. dense\_1 (Dense) (None, 6) 774
  18. =================================================================
  19. Total params: 813,862
  20. Trainable params: 813,862
  21. Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-2** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu |  | adam | 25 |
| 2 | **32** | **3x3** | **--** | **relu** | **2x2** | 2 | 6 | softmax |  |
| 3 |  |  |  |  |  | 3 |  |  |  |
| 4 |  |  |  |  |  | 4 |  |  |  |



## Proceso de Training

Epoch 1/25

2020-09-08 21:45:52.564303: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-09-08 21:45:52.928735: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 40s 67ms/step - loss: 1.1977 - accuracy: 0.5062 - val\_loss: 1.0233 - val\_accuracy: 0.5519

Epoch 2/25

593/593 [==============================] - 38s 64ms/step - loss: 0.9723 - accuracy: 0.5840 - val\_loss: 0.9295 - val\_accuracy: 0.6008

Epoch 3/25

593/593 [==============================] - 37s 63ms/step - loss: 0.9044 - accuracy: 0.6125 - val\_loss: 0.9259 - val\_accuracy: 0.6014

Epoch 4/25

593/593 [==============================] - 38s 63ms/step - loss: 0.8591 - accuracy: 0.6301 - val\_loss: 0.9206 - val\_accuracy: 0.5981

Epoch 5/25

593/593 [==============================] - 38s 64ms/step - loss: 0.8350 - accuracy: 0.6397 - val\_loss: 0.8322 - val\_accuracy: 0.6362

Epoch 6/25

593/593 [==============================] - 38s 65ms/step - loss: 0.8071 - accuracy: 0.6524 - val\_loss: 0.8130 - val\_accuracy: 0.6360

Epoch 7/25

593/593 [==============================] - 38s 64ms/step - loss: 0.7847 - accuracy: 0.6583 - val\_loss: 0.8326 - val\_accuracy: 0.6293

Epoch 8/25

593/593 [==============================] - 39s 66ms/step - loss: 0.7766 - accuracy: 0.6660 - val\_loss: 0.8034 - val\_accuracy: 0.6449

Epoch 9/25

593/593 [==============================] - 39s 66ms/step - loss: 0.7467 - accuracy: 0.6764 - val\_loss: 0.8386 - val\_accuracy: 0.6432

Epoch 10/25

593/593 [==============================] - 39s 66ms/step - loss: 0.7362 - accuracy: 0.6753 - val\_loss: 0.8164 - val\_accuracy: 0.6312

Epoch 11/25

593/593 [==============================] - 39s 66ms/step - loss: 0.7241 - accuracy: 0.6849 - val\_loss: 0.8254 - val\_accuracy: 0.6451

Epoch 12/25

593/593 [==============================] - 40s 67ms/step - loss: 0.7093 - accuracy: 0.6889 - val\_loss: 0.7877 - val\_accuracy: 0.6590

Epoch 13/25

593/593 [==============================] - 39s 66ms/step - loss: 0.6972 - accuracy: 0.6973 - val\_loss: 0.8238 - val\_accuracy: 0.6286

Epoch 14/25

593/593 [==============================] - 39s 66ms/step - loss: 0.6828 - accuracy: 0.7077 - val\_loss: 0.8089 - val\_accuracy: 0.6413

Epoch 15/25

593/593 [==============================] - 39s 67ms/step - loss: 0.6784 - accuracy: 0.7039 - val\_loss: 0.7902 - val\_accuracy: 0.6601

Epoch 16/25

593/593 [==============================] - 40s 67ms/step - loss: 0.6612 - accuracy: 0.7109 - val\_loss: 0.7880 - val\_accuracy: 0.6639

Epoch 17/25

593/593 [==============================] - 40s 67ms/step - loss: 0.6524 - accuracy: 0.7174 - val\_loss: 0.8046 - val\_accuracy: 0.6495

Epoch 18/25

593/593 [==============================] - 40s 67ms/step - loss: 0.6367 - accuracy: 0.7257 - val\_loss: 0.8242 - val\_accuracy: 0.6512

Epoch 19/25

593/593 [==============================] - 40s 68ms/step - loss: 0.6301 - accuracy: 0.7277 - val\_loss: 0.8402 - val\_accuracy: 0.6457

Epoch 20/25

593/593 [==============================] - 40s 67ms/step - loss: 0.6208 - accuracy: 0.7328 - val\_loss: 0.8174 - val\_accuracy: 0.6516

Epoch 21/25

593/593 [==============================] - 41s 69ms/step - loss: 0.6060 - accuracy: 0.7352 - val\_loss: 0.8076 - val\_accuracy: 0.6529

Epoch 22/25

593/593 [==============================] - 40s 68ms/step - loss: 0.6008 - accuracy: 0.7385 - val\_loss: 0.8186 - val\_accuracy: 0.6430

Epoch 23/25

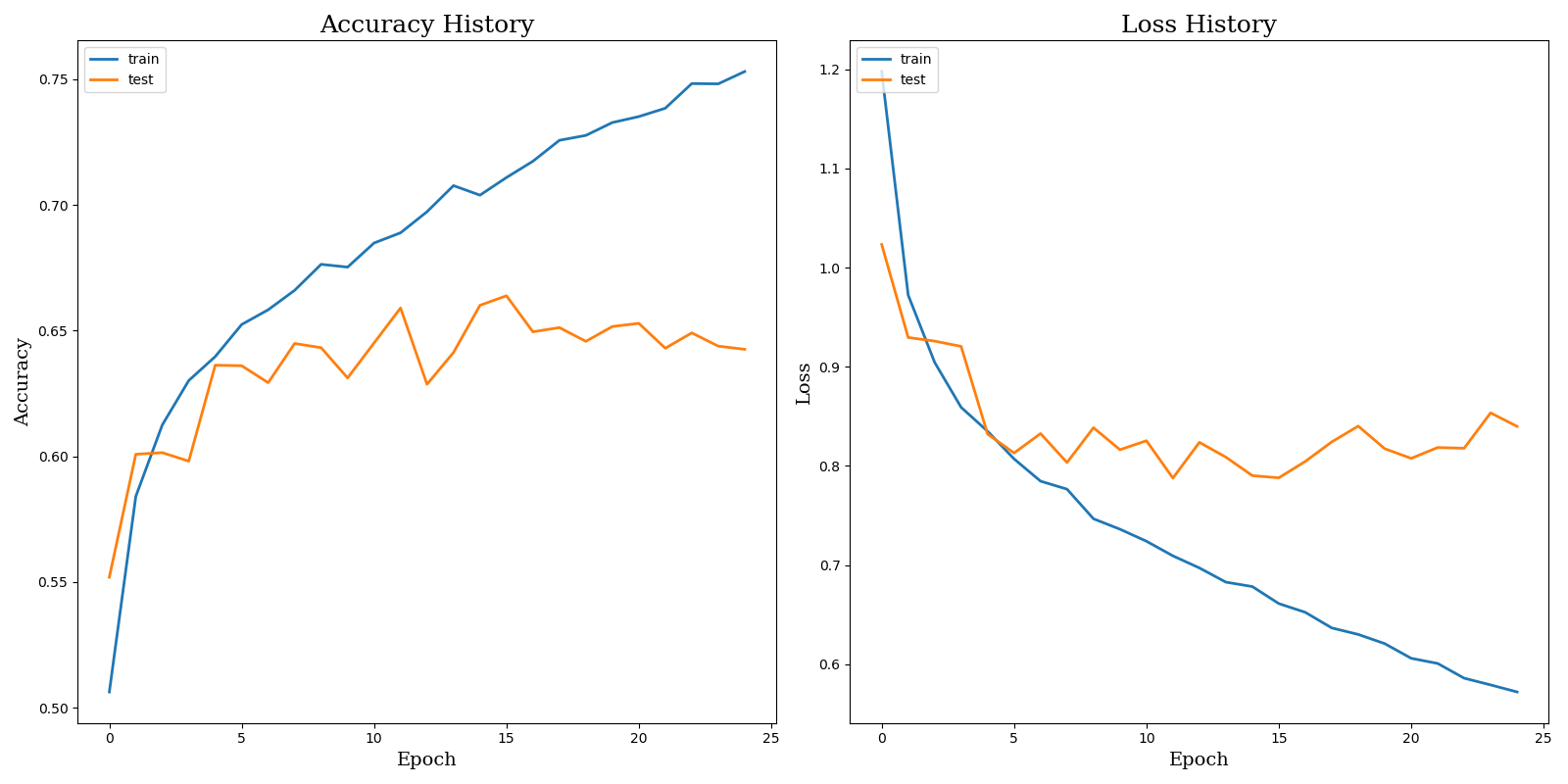
593/593 [==============================] - 40s 67ms/step - loss: 0.5860 - accuracy: 0.7483 - val\_loss: 0.8178 - val\_accuracy: 0.6491

Epoch 24/25

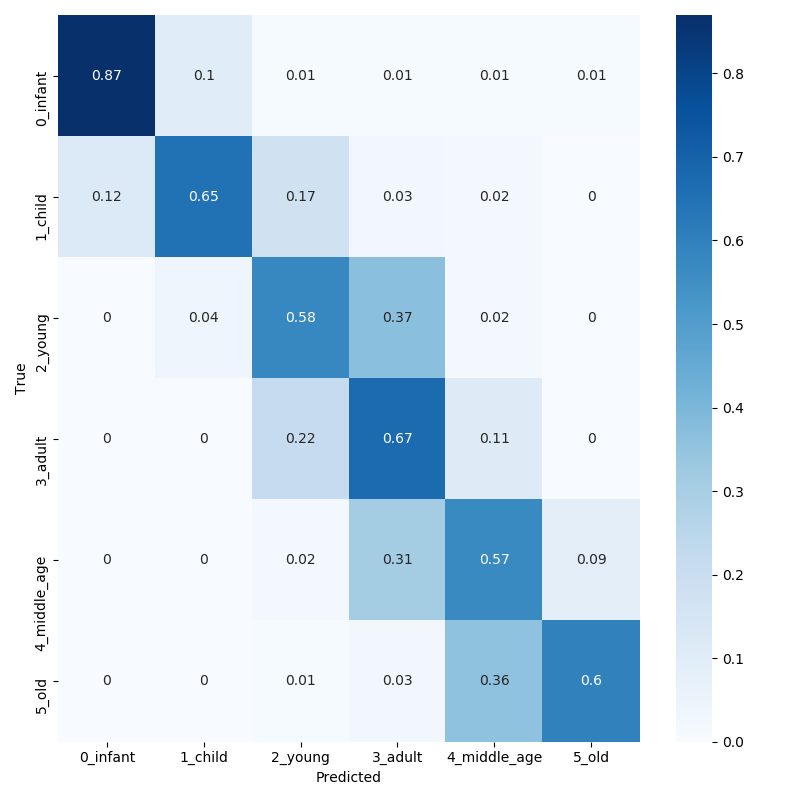
593/593 [==============================] - 40s 68ms/step - loss: 0.5792 - accuracy: 0.7482 - val\_loss: 0.8535 - val\_accuracy: 0.6438

Epoch 25/25

593/593 [==============================] - 40s 67ms/step - loss: 0.5721 - accuracy: 0.7531 - val\_loss: 0.8399 - val\_accuracy: 0.6426



## Matriz de Confusión

* 1. 

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.88 | 0.87 | 0.88 | 379 |
| **1\_child** | 0.73 | 0.65 | 0.69 | 304 |
| **2\_young** | 0.50 | 0.58 | 0.54 | 845 |
| **3\_adult** | 0.67 | 0.67 | 0.67 | 1873 |
| **4\_middle\_age** | 0.55 | 0.57 | 0.56 | 862 |
| **5\_old** | 0.77 | 0.60 | 0.68 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.64 | 4742 |
| **macro\_avg** | 0.68 | 0.66 | 0.67 | 4742 |
| **weighted\_avg** | 0.65 | 0.64 | 0.64 | 4742 |

## Observaciones

Precisión training: 0.7531

Pérdida training: 0.5721

Precisión validación/test: 0.6426

Pérdida validación: 0.8399

- Overfitting

- Accuracy mejorable

# Model 3

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 6272) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 802944

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dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 6) 774

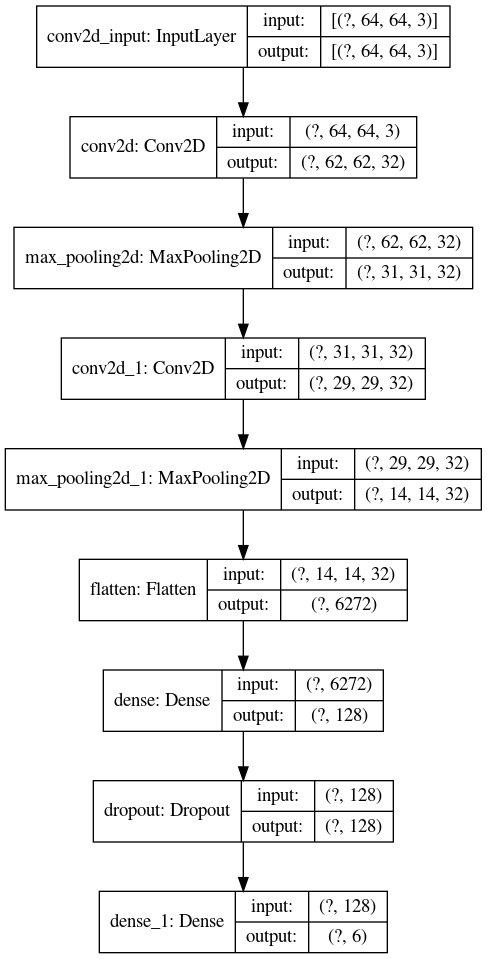
=================================================================

Total params: 813,862

Trainable params: 813,862

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-3** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | **0.3** | adam | 25 |
| 2 | 32 | 3x3 | -- | relu | 2x2 | 2 | 6 | softmax |  |
| 3 |  |  |  |  |  | 3 |  |  |  |
| 4 |  |  |  |  |  | 4 |  |  |  |



## Proceso de Training

Epoch 1/25

2020-07-12 18:52:13.253582: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-07-12 18:52:13.651463: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 42s 71ms/step - loss: 1.2725 - accuracy: 0.4812 - val\_loss: 1.0947 - val\_accuracy: 0.5261

Epoch 2/25

593/593 [==============================] - 38s 65ms/step - loss: 1.0339 - accuracy: 0.5546 - val\_loss: 0.9540 - val\_accuracy: 0.5768

Epoch 3/25

593/593 [==============================] - 39s 66ms/step - loss: 0.9678 - accuracy: 0.5811 - val\_loss: 0.8973 - val\_accuracy: 0.6025

Epoch 4/25

593/593 [==============================] - 38s 65ms/step - loss: 0.9166 - accuracy: 0.6023 - val\_loss: 0.8710 - val\_accuracy: 0.6179

Epoch 5/25

593/593 [==============================] - 40s 67ms/step - loss: 0.8903 - accuracy: 0.6154 - val\_loss: 0.8606 - val\_accuracy: 0.6158

Epoch 6/25

593/593 [==============================] - 50s 84ms/step - loss: 0.8638 - accuracy: 0.6254 - val\_loss: 0.8370 - val\_accuracy: 0.6341

Epoch 7/25

593/593 [==============================] - 39s 66ms/step - loss: 0.8483 - accuracy: 0.6351 - val\_loss: 0.8336 - val\_accuracy: 0.6326

Epoch 8/25

593/593 [==============================] - 39s 66ms/step - loss: 0.8333 - accuracy: 0.6345 - val\_loss: 0.8230 - val\_accuracy: 0.6286

Epoch 9/25

593/593 [==============================] - 39s 65ms/step - loss: 0.8160 - accuracy: 0.6402 - val\_loss: 0.8043 - val\_accuracy: 0.6480

Epoch 10/25

593/593 [==============================] - 40s 68ms/step - loss: 0.8054 - accuracy: 0.6443 - val\_loss: 0.7996 - val\_accuracy: 0.6470

Epoch 11/25

593/593 [==============================] - 41s 69ms/step - loss: 0.7904 - accuracy: 0.6537 - val\_loss: 0.8034 - val\_accuracy: 0.6504

Epoch 12/25

593/593 [==============================] - 42s 70ms/step - loss: 0.7829 - accuracy: 0.6543 - val\_loss: 0.8024 - val\_accuracy: 0.6474

Epoch 13/25

593/593 [==============================] - 44s 74ms/step - loss: 0.7693 - accuracy: 0.6650 - val\_loss: 0.7913 - val\_accuracy: 0.6520

Epoch 14/25

593/593 [==============================] - 43s 73ms/step - loss: 0.7607 - accuracy: 0.6665 - val\_loss: 0.8178 - val\_accuracy: 0.6423

Epoch 15/25

593/593 [==============================] - 42s 71ms/step - loss: 0.7505 - accuracy: 0.6684 - val\_loss: 0.7836 - val\_accuracy: 0.6577

Epoch 16/25

593/593 [==============================] - 43s 72ms/step - loss: 0.7497 - accuracy: 0.6655 - val\_loss: 0.8064 - val\_accuracy: 0.6476

Epoch 17/25

593/593 [==============================] - 40s 68ms/step - loss: 0.7399 - accuracy: 0.6740 - val\_loss: 0.7806 - val\_accuracy: 0.6531

Epoch 18/25

593/593 [==============================] - 40s 67ms/step - loss: 0.7350 - accuracy: 0.6773 - val\_loss: 0.7878 - val\_accuracy: 0.6419

Epoch 19/25

593/593 [==============================] - 42s 71ms/step - loss: 0.7305 - accuracy: 0.6758 - val\_loss: 0.7856 - val\_accuracy: 0.6563

Epoch 20/25

593/593 [==============================] - 42s 71ms/step - loss: 0.7168 - accuracy: 0.6845 - val\_loss: 0.7818 - val\_accuracy: 0.6489

Epoch 21/25

593/593 [==============================] - 40s 68ms/step - loss: 0.7081 - accuracy: 0.6888 - val\_loss: 0.7885 - val\_accuracy: 0.6558

Epoch 22/25

593/593 [==============================] - 44s 74ms/step - loss: 0.7117 - accuracy: 0.6858 - val\_loss: 0.7905 - val\_accuracy: 0.6653

Epoch 23/25

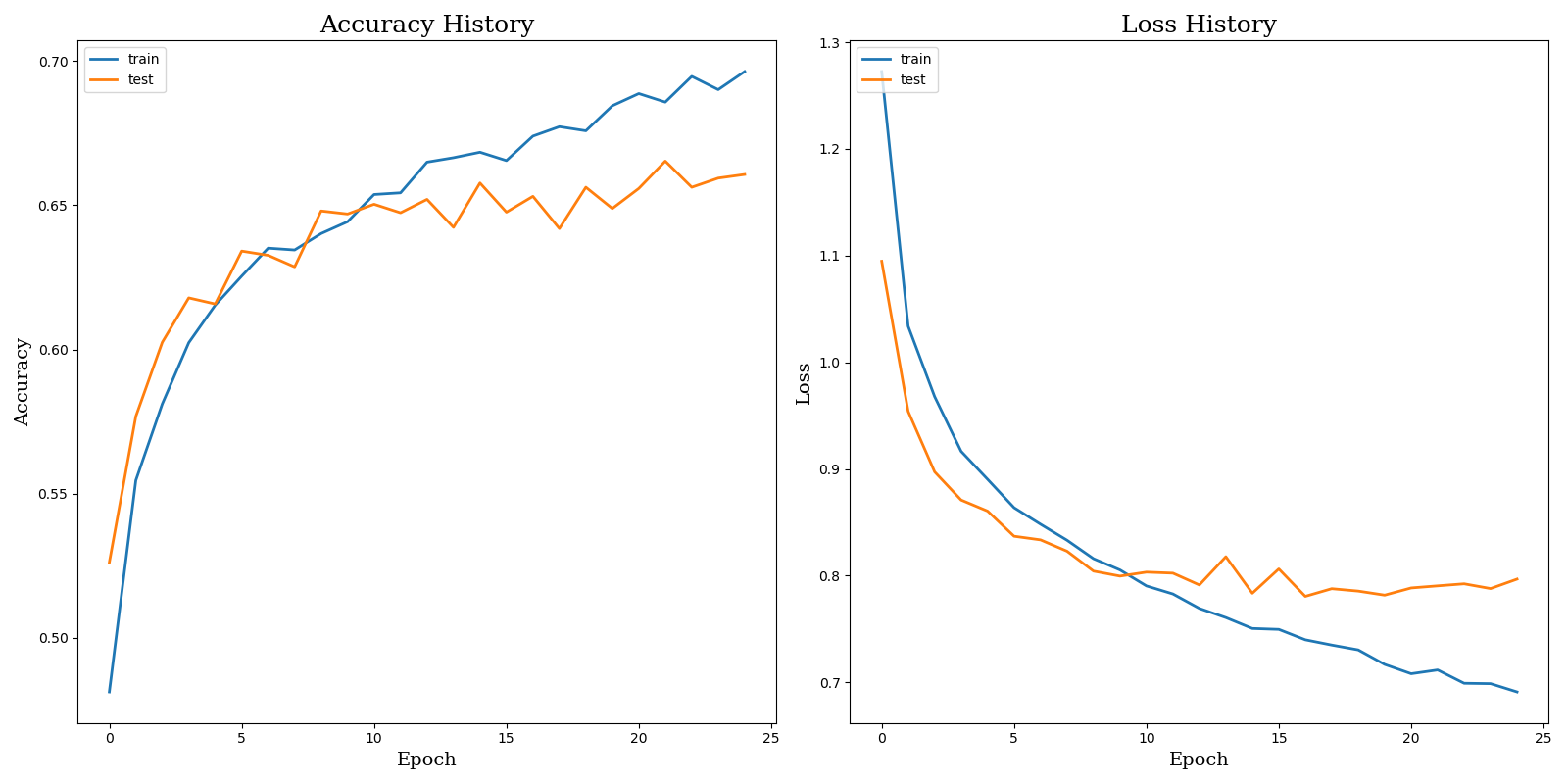
593/593 [==============================] - 43s 72ms/step - loss: 0.6992 - accuracy: 0.6947 - val\_loss: 0.7924 - val\_accuracy: 0.6563

Epoch 24/25

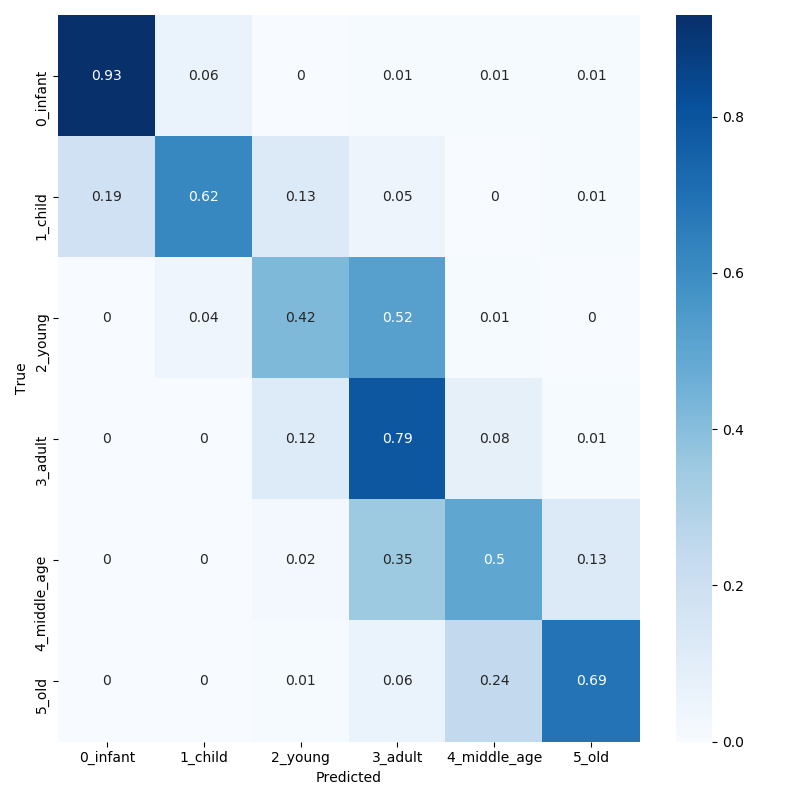
593/593 [==============================] - 41s 70ms/step - loss: 0.6988 - accuracy: 0.6901 - val\_loss: 0.7879 - val\_accuracy: 0.6594

Epoch 25/25

593/593 [==============================] - 41s 69ms/step - loss: 0.6911 - accuracy: 0.6964 - val\_loss: 0.7968 - val\_accuracy: 0.6607



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.85 | 0.93 | 0.89 | 379 |
| **1\_child** | 0.75 | 0.62 | 0.68 | 304 |
| **2\_young** | 055 | 0.42 | 0.48 | 845 |
| **3\_adult** | 0.65 | 0.79 | 0.71 | 1873 |
| **4\_middle\_age** | 0.61 | 0.50 | 0.55 | 862 |
| **5\_old** | 0.71 | 0.69 | 0.70 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.66 | 4742 |
| **macro\_avg** | 0.69 | 0.66 | 0.67 | 4742 |
| **weighted\_avg** | 0.66 | 0.66 | 0.65 | 4742 |

## Observaciones

Precisión training: 0.6964

Pérdida training: 0.6911

Precisión validación/test: 0.6607

Pérdida test: 0.7968

# Model 4

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 6272) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 802944

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 6) 390

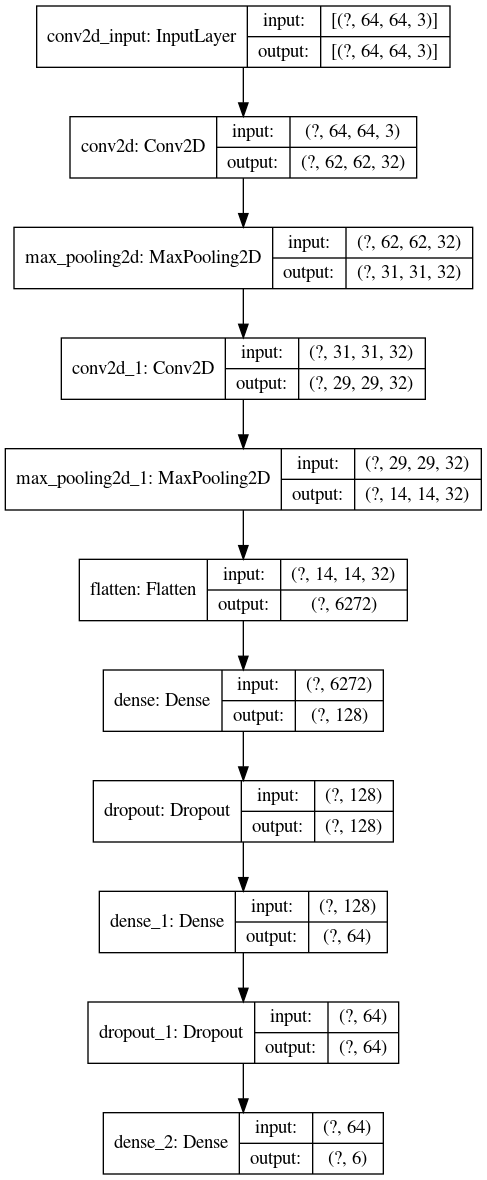
=================================================================

Total params: 821,734

Trainable params: 821,734

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-4** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | 25 |
| 2 | 32 | 3x3 | -- | relu | 2x2 | 2 | **64** | **relu** | **0.3** |
| 3 |  |  |  |  |  | 3 | 6 | softmax |  |
| 4 |  |  |  |  |  | 4 |  |  |  |

* 1. 

## Proceso de Training

Epoch 1/25

2020-07-12 20:02:10.049413: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-07-12 20:02:10.229117: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 37s 63ms/step - loss: 1.2997 - accuracy: 0.4654 - val\_loss: 1.0309 - val\_accuracy: 0.5506

Epoch 2/25

593/593 [==============================] - 39s 65ms/step - loss: 1.0516 - accuracy: 0.5510 - val\_loss: 0.9480 - val\_accuracy: 0.5909

Epoch 3/25

593/593 [==============================] - 39s 65ms/step - loss: 0.9776 - accuracy: 0.5792 - val\_loss: 0.8851 - val\_accuracy: 0.6107

Epoch 4/25

593/593 [==============================] - 39s 65ms/step - loss: 0.9353 - accuracy: 0.5945 - val\_loss: 0.9230 - val\_accuracy: 0.5936

Epoch 5/25

593/593 [==============================] - 39s 65ms/step - loss: 0.9046 - accuracy: 0.6030 - val\_loss: 0.8818 - val\_accuracy: 0.6229

Epoch 6/25

593/593 [==============================] - 39s 65ms/step - loss: 0.8846 - accuracy: 0.6139 - val\_loss: 0.8494 - val\_accuracy: 0.6240

Epoch 7/25

593/593 [==============================] - 39s 66ms/step - loss: 0.8651 - accuracy: 0.6246 - val\_loss: 0.8326 - val\_accuracy: 0.6369

Epoch 8/25

593/593 [==============================] - 43s 72ms/step - loss: 0.8430 - accuracy: 0.6346 - val\_loss: 0.8420 - val\_accuracy: 0.6276

Epoch 9/25

593/593 [==============================] - 42s 71ms/step - loss: 0.8310 - accuracy: 0.6366 - val\_loss: 0.8320 - val\_accuracy: 0.6383

Epoch 10/25

593/593 [==============================] - 40s 68ms/step - loss: 0.8136 - accuracy: 0.6476 - val\_loss: 0.8404 - val\_accuracy: 0.6388

Epoch 11/25

593/593 [==============================] - 40s 68ms/step - loss: 0.8142 - accuracy: 0.6456 - val\_loss: 0.8023 - val\_accuracy: 0.6508

Epoch 12/25

593/593 [==============================] - 39s 65ms/step - loss: 0.7973 - accuracy: 0.6513 - val\_loss: 0.8340 - val\_accuracy: 0.6445

Epoch 13/25

593/593 [==============================] - 39s 67ms/step - loss: 0.7865 - accuracy: 0.6572 - val\_loss: 0.7984 - val\_accuracy: 0.6525

Epoch 14/25

593/593 [==============================] - 40s 68ms/step - loss: 0.7822 - accuracy: 0.6575 - val\_loss: 0.7989 - val\_accuracy: 0.6542

Epoch 15/25

593/593 [==============================] - 39s 67ms/step - loss: 0.7669 - accuracy: 0.6606 - val\_loss: 0.8129 - val\_accuracy: 0.6504

Epoch 16/25

593/593 [==============================] - 40s 67ms/step - loss: 0.7651 - accuracy: 0.6645 - val\_loss: 0.8062 - val\_accuracy: 0.6470

Epoch 17/25

593/593 [==============================] - 41s 69ms/step - loss: 0.7511 - accuracy: 0.6687 - val\_loss: 0.8010 - val\_accuracy: 0.6472

Epoch 18/25

593/593 [==============================] - 42s 70ms/step - loss: 0.7489 - accuracy: 0.6735 - val\_loss: 0.8085 - val\_accuracy: 0.6482

Epoch 19/25

593/593 [==============================] - 41s 70ms/step - loss: 0.7399 - accuracy: 0.6776 - val\_loss: 0.7960 - val\_accuracy: 0.6552

Epoch 20/25

593/593 [==============================] - 43s 73ms/step - loss: 0.7380 - accuracy: 0.6780 - val\_loss: 0.7990 - val\_accuracy: 0.6563

Epoch 21/25

593/593 [==============================] - 41s 69ms/step - loss: 0.7278 - accuracy: 0.6805 - val\_loss: 0.8028 - val\_accuracy: 0.6464

Epoch 22/25

593/593 [==============================] - 40s 67ms/step - loss: 0.7243 - accuracy: 0.6794 - val\_loss: 0.8270 - val\_accuracy: 0.6453

Epoch 23/25

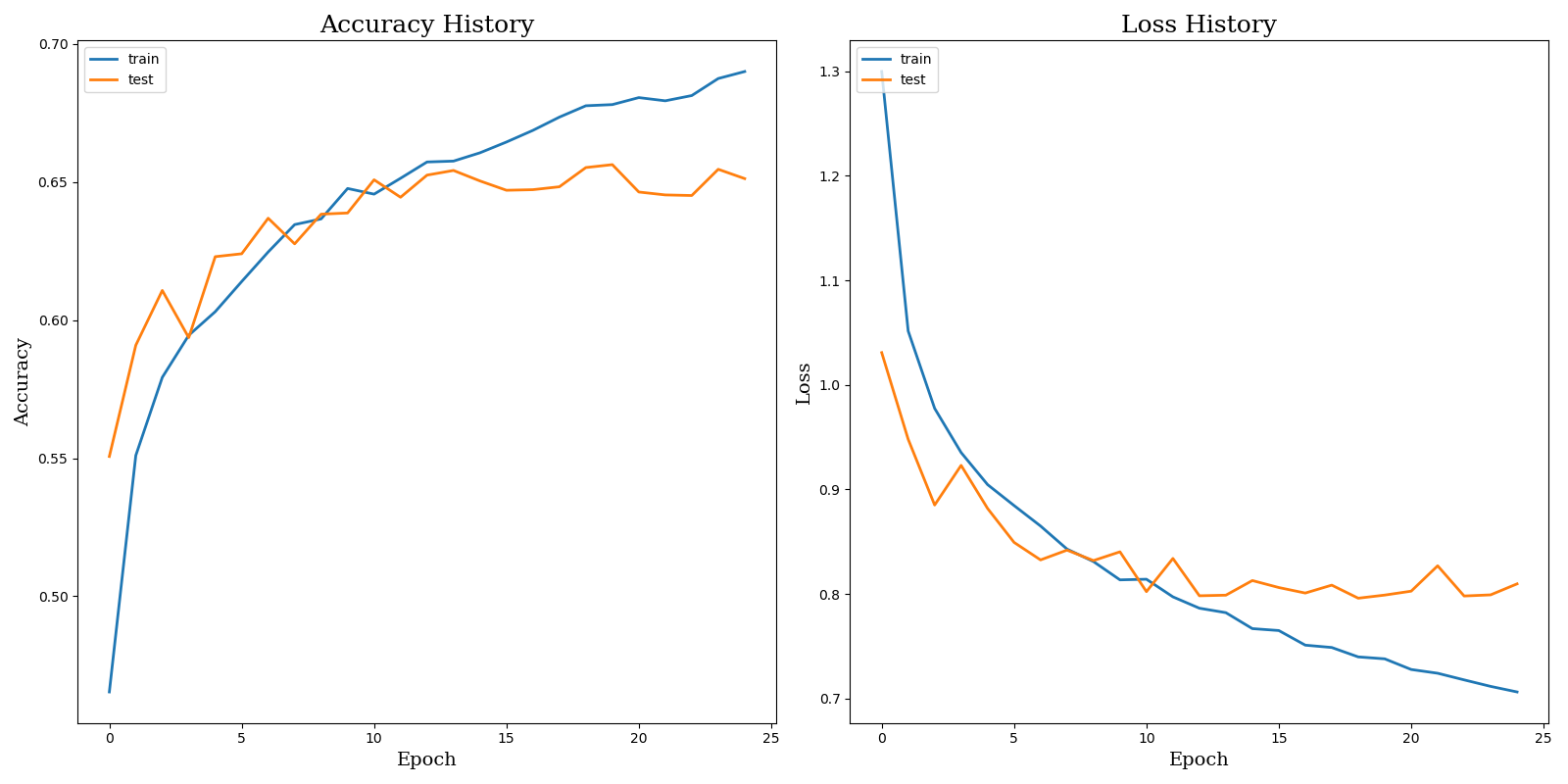
593/593 [==============================] - 39s 66ms/step - loss: 0.7179 - accuracy: 0.6813 - val\_loss: 0.7981 - val\_accuracy: 0.6451

Epoch 24/25

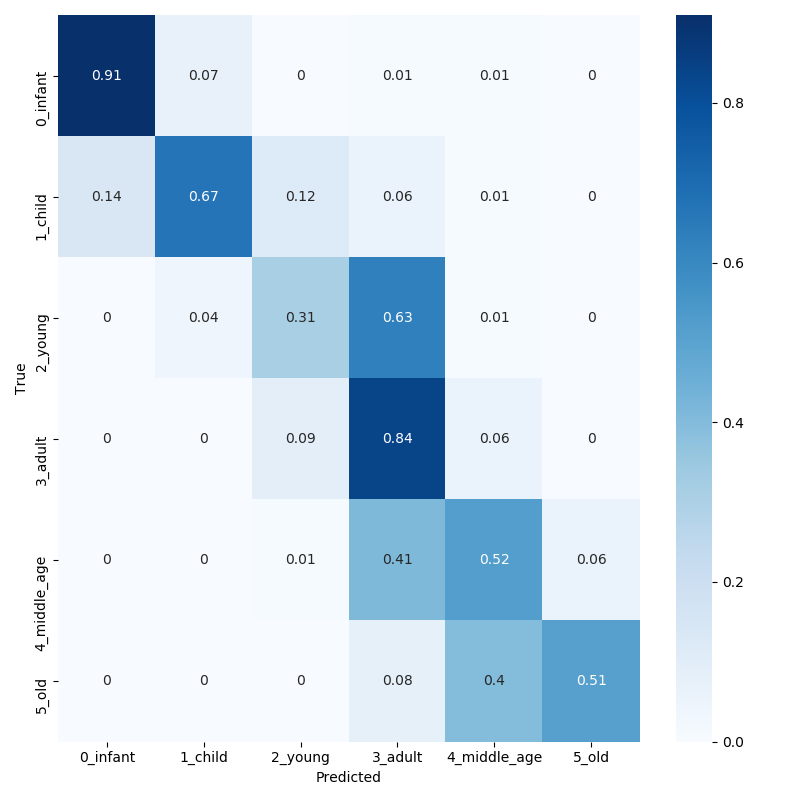
593/593 [==============================] - 40s 68ms/step - loss: 0.7117 - accuracy: 0.6874 - val\_loss: 0.7992 - val\_accuracy: 0.6546

Epoch 25/25

593/593 [==============================] - 39s 66ms/step - loss: 0.7064 - accuracy: 0.6900 - val\_loss: 0.8097 - val\_accuracy: 0.6512



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.88 | 0.91 | 0.90 | 379 |
| **1\_child** | 0.74 | 0.67 | 0.70 | 304 |
| **2\_young** | 0.56 | 0.31 | 0.40 | 845 |
| **3\_adult** | 0.63 | 0.84 | 0.72 | 1873 |
| **4\_middle\_age** | 0.58 | 0.52 | 0.55 | 862 |
| **5\_old** | 0.81 | 0.51 | 0.63 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.65 | 4742 |
| **macro\_avg** | 0.70 | 0.63 | 0.65 | 4742 |
| **weighted\_avg** | 0.65 | 0.65 | 0.64 | 4742 |

## Observaciones

Precisión training: 0.6900

Pérdida training: 0.7064

Precisión validación/test: 0.6512

Pérdida test: 0.8097

-

-

# Model 5

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 2304) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 295040

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 6) 390

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

Total params: 332,326

Trainable params: 332,326

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-5** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | 25 |
| 2 | 32 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | **64** | **3x3** | **--** | **relu** | **2x2** | 3 | 6 | softmax |  |
| 4 |  |  |  |  |  | 4 |  |  |  |

## Proceso de Training

Epoch 1/25

2020-07-12 20:31:05.631457: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-07-12 20:31:05.801441: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 38s 65ms/step - loss: 1.3431 - accuracy: 0.4529 - val\_loss: 1.0670 - val\_accuracy: 0.5342

Epoch 2/25

593/593 [==============================] - 41s 69ms/step - loss: 1.0918 - accuracy: 0.5333 - val\_loss: 0.9984 - val\_accuracy: 0.5704

Epoch 3/25

593/593 [==============================] - 40s 67ms/step - loss: 1.0161 - accuracy: 0.5595 - val\_loss: 0.9453 - val\_accuracy: 0.5856

Epoch 4/25

593/593 [==============================] - 40s 67ms/step - loss: 0.9774 - accuracy: 0.5734 - val\_loss: 0.9338 - val\_accuracy: 0.5841

Epoch 5/25

593/593 [==============================] - 43s 73ms/step - loss: 0.9364 - accuracy: 0.5958 - val\_loss: 0.9025 - val\_accuracy: 0.5995

Epoch 6/25

593/593 [==============================] - 43s 72ms/step - loss: 0.9130 - accuracy: 0.6011 - val\_loss: 0.9174 - val\_accuracy: 0.6027

Epoch 7/25

593/593 [==============================] - 43s 73ms/step - loss: 0.8935 - accuracy: 0.6065 - val\_loss: 0.8818 - val\_accuracy: 0.6067

Epoch 8/25

593/593 [==============================] - 43s 72ms/step - loss: 0.8790 - accuracy: 0.6150 - val\_loss: 0.8662 - val\_accuracy: 0.6208

Epoch 9/25

593/593 [==============================] - 43s 72ms/step - loss: 0.8642 - accuracy: 0.6194 - val\_loss: 0.8756 - val\_accuracy: 0.6202

Epoch 10/25

593/593 [==============================] - 45s 75ms/step - loss: 0.8474 - accuracy: 0.6260 - val\_loss: 0.8478 - val\_accuracy: 0.6331

Epoch 11/25

593/593 [==============================] - 43s 73ms/step - loss: 0.8373 - accuracy: 0.6291 - val\_loss: 0.8330 - val\_accuracy: 0.6350

Epoch 12/25

593/593 [==============================] - 41s 69ms/step - loss: 0.8253 - accuracy: 0.6338 - val\_loss: 0.8112 - val\_accuracy: 0.6388

Epoch 13/25

593/593 [==============================] - 42s 70ms/step - loss: 0.8195 - accuracy: 0.6409 - val\_loss: 0.8560 - val\_accuracy: 0.6314

Epoch 14/25

593/593 [==============================] - 43s 73ms/step - loss: 0.8108 - accuracy: 0.6443 - val\_loss: 0.8144 - val\_accuracy: 0.6411

Epoch 15/25

593/593 [==============================] - 45s 76ms/step - loss: 0.8061 - accuracy: 0.6474 - val\_loss: 0.8143 - val\_accuracy: 0.6358

Epoch 16/25

593/593 [==============================] - 46s 78ms/step - loss: 0.7920 - accuracy: 0.6502 - val\_loss: 0.8189 - val\_accuracy: 0.6381

Epoch 17/25

593/593 [==============================] - 45s 76ms/step - loss: 0.7884 - accuracy: 0.6498 - val\_loss: 0.8183 - val\_accuracy: 0.6432

Epoch 18/25

593/593 [==============================] - 44s 74ms/step - loss: 0.7925 - accuracy: 0.6522 - val\_loss: 0.8007 - val\_accuracy: 0.6457

Epoch 19/25

593/593 [==============================] - 45s 76ms/step - loss: 0.7765 - accuracy: 0.6574 - val\_loss: 0.8006 - val\_accuracy: 0.6539

Epoch 20/25

593/593 [==============================] - 46s 78ms/step - loss: 0.7756 - accuracy: 0.6606 - val\_loss: 0.8108 - val\_accuracy: 0.6430

Epoch 21/25

593/593 [==============================] - 46s 77ms/step - loss: 0.7781 - accuracy: 0.6549 - val\_loss: 0.7929 - val\_accuracy: 0.6423

Epoch 22/25

593/593 [==============================] - 48s 82ms/step - loss: 0.7573 - accuracy: 0.6719 - val\_loss: 0.7975 - val\_accuracy: 0.6516

Epoch 23/25

593/593 [==============================] - 47s 80ms/step - loss: 0.7660 - accuracy: 0.6572 - val\_loss: 0.8032 - val\_accuracy: 0.6472

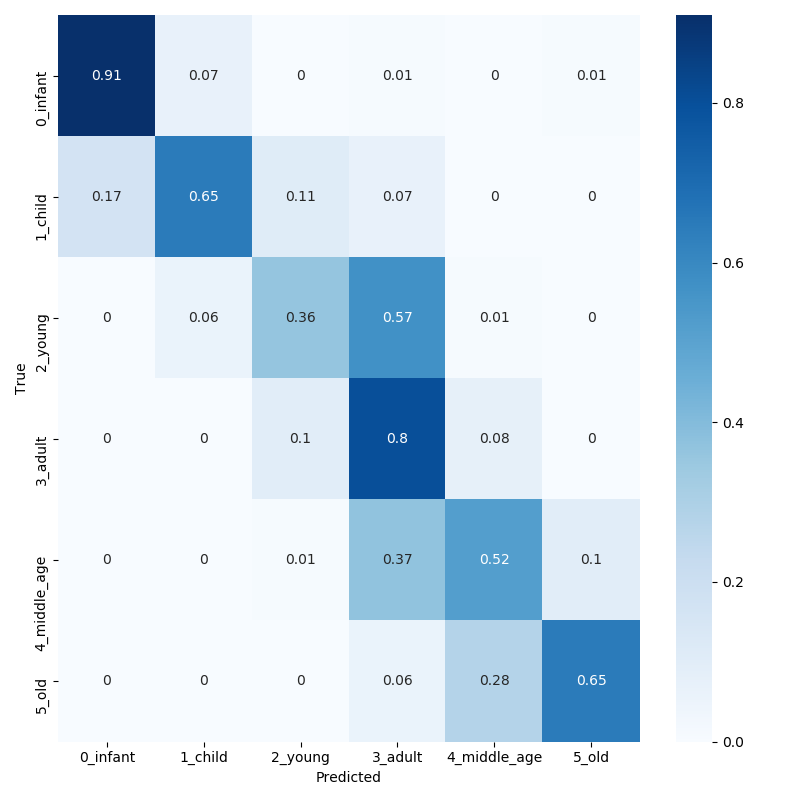
Epoch 24/25

593/593 [==============================] - 47s 80ms/step - loss: 0.7563 - accuracy: 0.6656 - val\_loss: 0.7906 - val\_accuracy: 0.6464

Epoch 25/25

593/593 [==============================] - 47s 80ms/step - loss: 0.7490 - accuracy: 0.6685 - val\_loss: 0.7856 - val\_accuracy: 0.6554

## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.85 | 0.91 | 0.88 | 379 |
| **1\_child** | 0.70 | 0.65 | 0.67 | 304 |
| **2\_young** | 0.56 | 0.36 | 0.44 | 845 |
| **3\_adult** | 0.64 | 0.80 | 0.71 | 1873 |
| **4\_middle\_age** | 0.60 | 0.52 | 0.55 | 862 |
| **5\_old** | 0.76 | 0.65 | 0.70 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.66 | 4742 |
| **macro\_avg** | 0.68 | 0.65 | 0.66 | 4742 |
| **weighted\_avg** | 0.65 | 0.66 | 0.64 | 4742 |

## Observaciones

Precisión training: 0.6685

Pérdida training: 0.7490

Precisión validación/test: 0.6554

Pérdida test: 0.7856

# Model 6

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 2304) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 295040

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dropout (Dropout) (None, 128) 0

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dense\_1 (Dense) (None, 64) 8256

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dropout\_1 (Dropout) (None, 64) 0

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dense\_2 (Dense) (None, 32) 2080

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

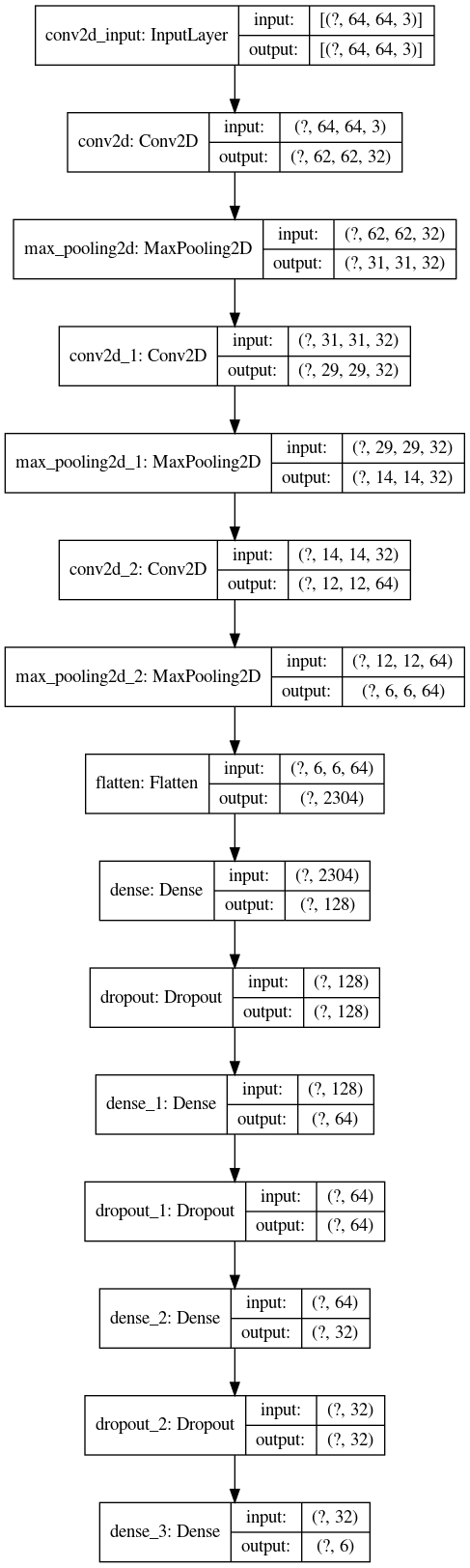
=================================================================

Total params: 334,214

Trainable params: 334,214

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-6** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | 25 |
| 2 | 32 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | 64 | 3x3 | -- | relu | 2x2 | 3 | **32** | **relu** | **0.3** |
| 4 |  |  |  |  |  | 4 | 6 | softmax |  |



## Proceso de Training

Epoch 1/25

2020-07-12 21:10:08.088763: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-07-12 21:10:08.297802: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 40s 67ms/step - loss: 1.4532 - accuracy: 0.4152 - val\_loss: 1.1551 - val\_accuracy: 0.4987

Epoch 2/25

593/593 [==============================] - 39s 66ms/step - loss: 1.1613 - accuracy: 0.5096 - val\_loss: 1.0480 - val\_accuracy: 0.5415

Epoch 3/25

593/593 [==============================] - 42s 71ms/step - loss: 1.0720 - accuracy: 0.5420 - val\_loss: 1.0090 - val\_accuracy: 0.5662

Epoch 4/25

593/593 [==============================] - 43s 72ms/step - loss: 1.0221 - accuracy: 0.5636 - val\_loss: 0.9341 - val\_accuracy: 0.5924

Epoch 5/25

593/593 [==============================] - 42s 70ms/step - loss: 0.9831 - accuracy: 0.5778 - val\_loss: 0.9484 - val\_accuracy: 0.5974

Epoch 6/25

593/593 [==============================] - 40s 68ms/step - loss: 0.9541 - accuracy: 0.5891 - val\_loss: 0.9195 - val\_accuracy: 0.6027

Epoch 7/25

593/593 [==============================] - 40s 68ms/step - loss: 0.9379 - accuracy: 0.5959 - val\_loss: 0.8715 - val\_accuracy: 0.6145

Epoch 8/25

593/593 [==============================] - 40s 68ms/step - loss: 0.9139 - accuracy: 0.6015 - val\_loss: 0.8731 - val\_accuracy: 0.6170

Epoch 9/25

593/593 [==============================] - 41s 69ms/step - loss: 0.8912 - accuracy: 0.6080 - val\_loss: 0.8693 - val\_accuracy: 0.6208

Epoch 10/25

593/593 [==============================] - 40s 68ms/step - loss: 0.8872 - accuracy: 0.6106 - val\_loss: 0.8493 - val\_accuracy: 0.6288

Epoch 11/25

593/593 [==============================] - 41s 69ms/step - loss: 0.8798 - accuracy: 0.6178 - val\_loss: 0.8424 - val\_accuracy: 0.6208

Epoch 12/25

593/593 [==============================] - 43s 72ms/step - loss: 0.8725 - accuracy: 0.6173 - val\_loss: 0.8359 - val\_accuracy: 0.6343

Epoch 13/25

593/593 [==============================] - 41s 70ms/step - loss: 0.8606 - accuracy: 0.6216 - val\_loss: 0.8486 - val\_accuracy: 0.6236

Epoch 14/25

593/593 [==============================] - 41s 69ms/step - loss: 0.8462 - accuracy: 0.6243 - val\_loss: 0.8202 - val\_accuracy: 0.6442

Epoch 15/25

593/593 [==============================] - 42s 71ms/step - loss: 0.8382 - accuracy: 0.6309 - val\_loss: 0.8326 - val\_accuracy: 0.6263

Epoch 16/25

593/593 [==============================] - 42s 70ms/step - loss: 0.8417 - accuracy: 0.6305 - val\_loss: 0.8282 - val\_accuracy: 0.6316

Epoch 17/25

593/593 [==============================] - 43s 73ms/step - loss: 0.8307 - accuracy: 0.6349 - val\_loss: 0.8160 - val\_accuracy: 0.6419

Epoch 18/25

593/593 [==============================] - 43s 72ms/step - loss: 0.8247 - accuracy: 0.6422 - val\_loss: 0.8336 - val\_accuracy: 0.6278

Epoch 19/25

593/593 [==============================] - 42s 71ms/step - loss: 0.8184 - accuracy: 0.6395 - val\_loss: 0.7973 - val\_accuracy: 0.6455

Epoch 20/25

593/593 [==============================] - 41s 70ms/step - loss: 0.8109 - accuracy: 0.6481 - val\_loss: 0.8202 - val\_accuracy: 0.6464

Epoch 21/25

593/593 [==============================] - 42s 70ms/step - loss: 0.8133 - accuracy: 0.6474 - val\_loss: 0.8244 - val\_accuracy: 0.6455

Epoch 22/25

593/593 [==============================] - 41s 68ms/step - loss: 0.8059 - accuracy: 0.6458 - val\_loss: 0.8186 - val\_accuracy: 0.6415

Epoch 23/25

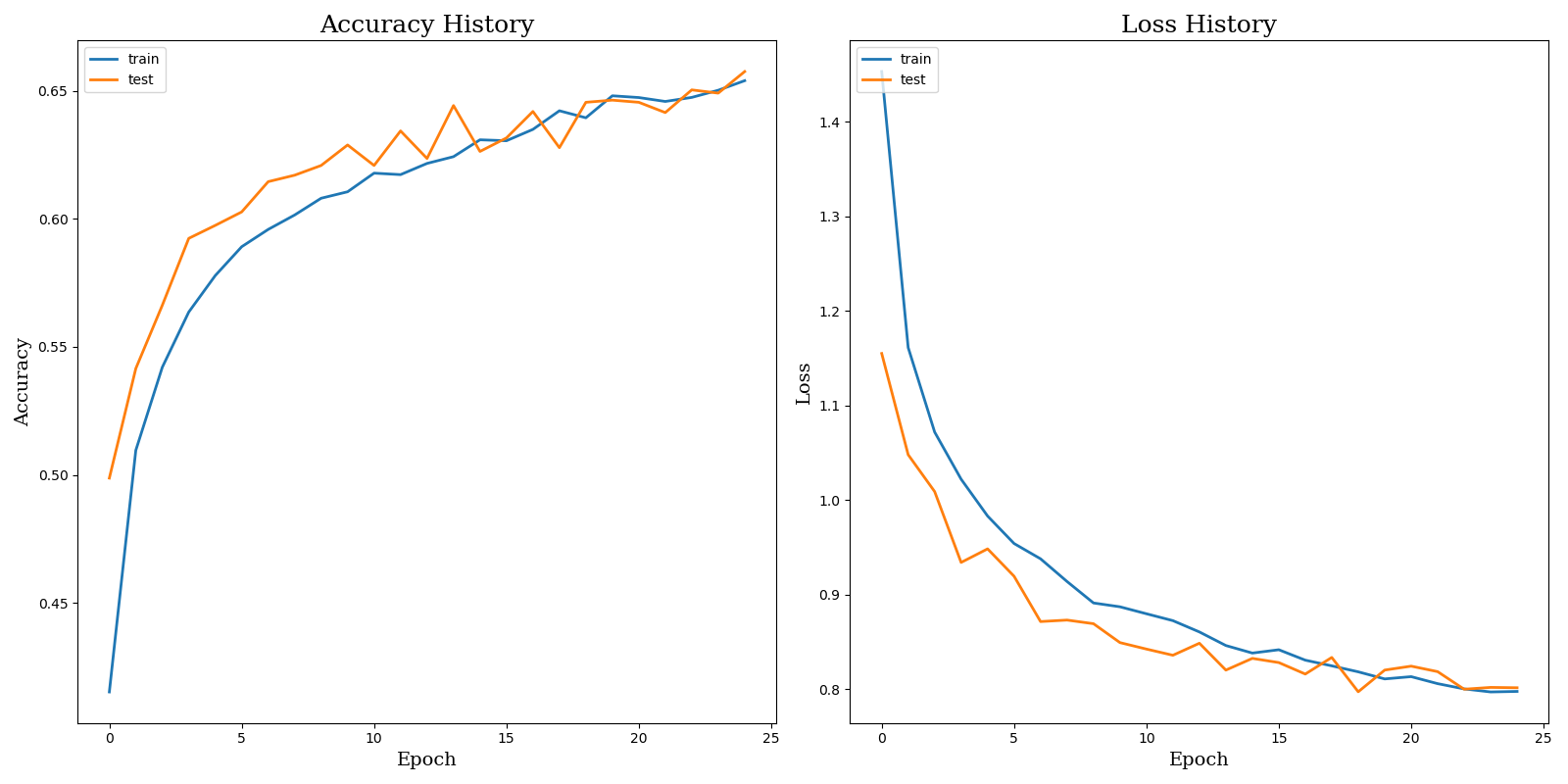
593/593 [==============================] - 42s 70ms/step - loss: 0.8003 - accuracy: 0.6474 - val\_loss: 0.8000 - val\_accuracy: 0.6504

Epoch 24/25

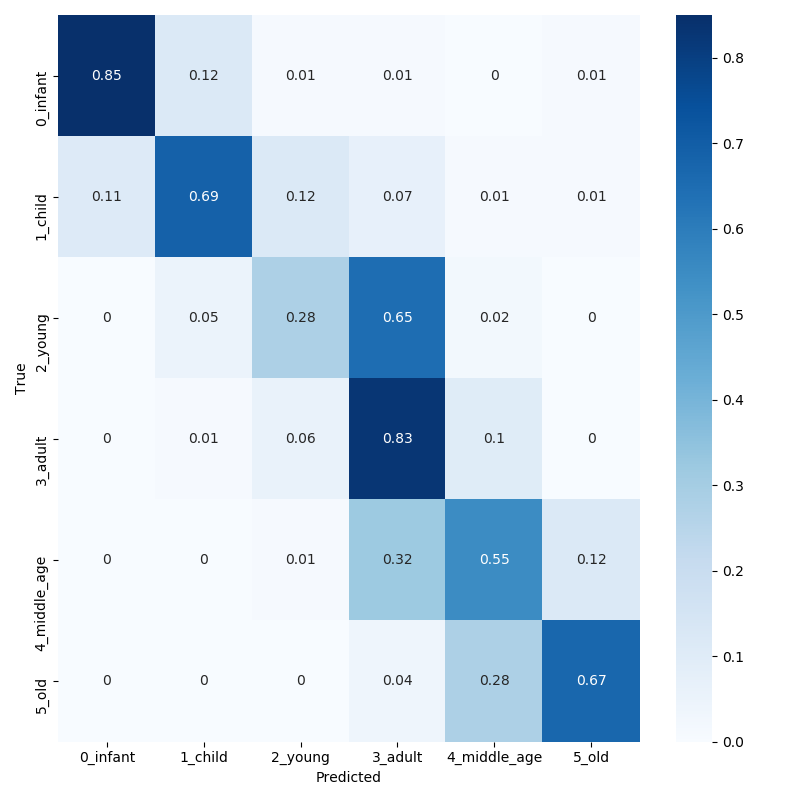
593/593 [==============================] - 43s 73ms/step - loss: 0.7971 - accuracy: 0.6502 - val\_loss: 0.8019 - val\_accuracy: 0.6491

Epoch 25/25

593/593 [==============================] - 43s 73ms/step - loss: 0.7977 - accuracy: 0.6540 - val\_loss: 0.8015 - val\_accuracy: 0.6575



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.90 | 0.85 | 0.88 | 379 |
| **1\_child** | 0.68 | 0.69 | 0.69 | 304 |
| **2\_young** | 0.59 | 0.28 | 0.38 | 845 |
| **3\_adult** | 0.64 | 0.83 | 0.72 | 1873 |
| **4\_middle\_age** | 0.58 | 0.55 | 0.57 | 862 |
| **5\_old** | 0.74 | 0.67 | 0.70 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.66 | 4742 |
| **macro\_avg** | 0.69 | 0.65 | 0.66 | 4742 |
| **weighted\_avg** | 0.65 | 0.66 | 0.64 | 4742 |

## Observaciones

Precisión training: 0.6540

Pérdida training: 0.7977

Precisión validación/test: 0.6575

Pérdida test: 0.8015

- Precisión se mantiene en línea con la precisión de los modelos anteriores, en torno al 65% - 66%

- No se aprecia overfitting en el modelo, lo que podría considerarse bueno.

- Tanto las gráficas de Accuracy como Loss para el proceso de entrenamiento muestran unas tendencias similares en train como en test.

- El ratio de acierto en la clase Young es extremadamente bajo (28%), siendo el 65% de los ejemplos clasificados como Adult. Consultar matriz de confusión.

# Model 7

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 64) 18496

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max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 128) 73856

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 4608) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 589952

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dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 32) 2080

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

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

Total params: 693,734

Trainable params: 693,734

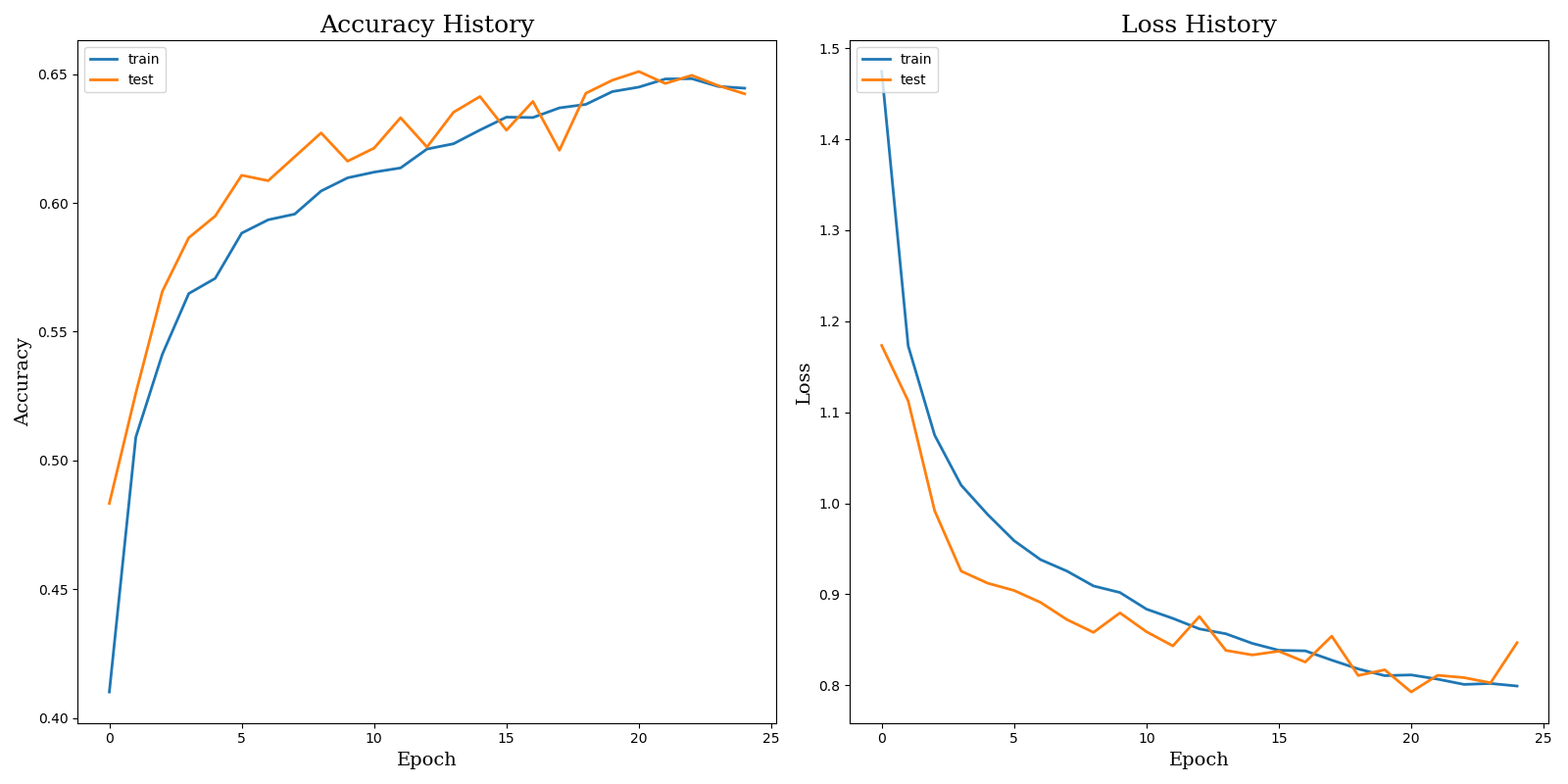
Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-7** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | 25 |
| 2 | **64** | **3x3** | **--** | **relu** | **2x2** | 2 | 64 | relu | 0.3 |
| 3 | **128** | **3x3** | **--** | **relu** | **2x2** | 3 | 32 | relu | 0.3 |
| 4 |  |  |  |  |  | 4 | 6 | softmax |  |

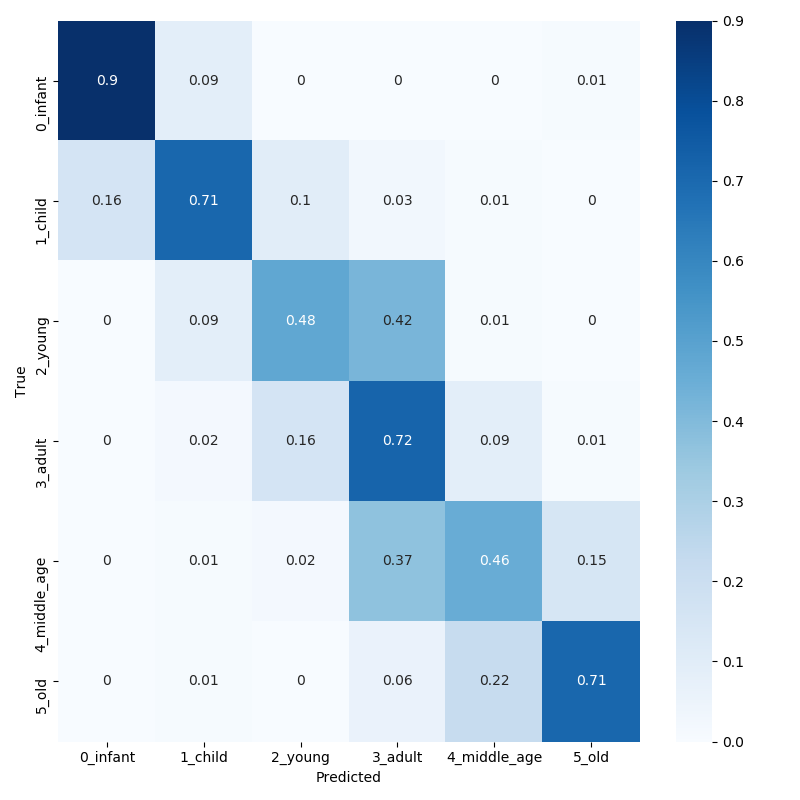


## Proceso de Training

* 1. Epoch 1/25
  2. 2020-07-12 21:55:37.389972: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10
  3. 2020-07-12 21:55:37.554525: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7
  4. 593/593 [==============================] - 40s 68ms/step - loss: 1.4744 - accuracy: 0.4102 - val\_loss: 1.1734 - val\_accuracy: 0.4833
  5. Epoch 2/25
  6. 593/593 [==============================] - 44s 74ms/step - loss: 1.1730 - accuracy: 0.5091 - val\_loss: 1.1125 - val\_accuracy: 0.5261
  7. Epoch 3/25
  8. 593/593 [==============================] - 43s 72ms/step - loss: 1.0749 - accuracy: 0.5412 - val\_loss: 0.9918 - val\_accuracy: 0.5656
  9. Epoch 4/25
  10. 593/593 [==============================] - 45s 76ms/step - loss: 1.0199 - accuracy: 0.5648 - val\_loss: 0.9255 - val\_accuracy: 0.5865
  11. Epoch 5/25
  12. 593/593 [==============================] - 41s 70ms/step - loss: 0.9878 - accuracy: 0.5707 - val\_loss: 0.9123 - val\_accuracy: 0.5949
  13. Epoch 6/25
  14. 593/593 [==============================] - 41s 70ms/step - loss: 0.9590 - accuracy: 0.5883 - val\_loss: 0.9042 - val\_accuracy: 0.6107
  15. Epoch 7/25
  16. 593/593 [==============================] - 41s 70ms/step - loss: 0.9381 - accuracy: 0.5934 - val\_loss: 0.8911 - val\_accuracy: 0.6086
  17. Epoch 8/25
  18. 593/593 [==============================] - 41s 69ms/step - loss: 0.9255 - accuracy: 0.5956 - val\_loss: 0.8722 - val\_accuracy: 0.6179
  19. Epoch 9/25
  20. 593/593 [==============================] - 41s 70ms/step - loss: 0.9092 - accuracy: 0.6046 - val\_loss: 0.8582 - val\_accuracy: 0.6272
  21. Epoch 10/25
  22. 593/593 [==============================] - 41s 69ms/step - loss: 0.9020 - accuracy: 0.6097 - val\_loss: 0.8796 - val\_accuracy: 0.6162
  23. Epoch 11/25
  24. 593/593 [==============================] - 42s 71ms/step - loss: 0.8837 - accuracy: 0.6119 - val\_loss: 0.8589 - val\_accuracy: 0.6213
  25. Epoch 12/25
  26. 593/593 [==============================] - 43s 72ms/step - loss: 0.8735 - accuracy: 0.6136 - val\_loss: 0.8433 - val\_accuracy: 0.6331
  27. Epoch 13/25
  28. 593/593 [==============================] - 43s 73ms/step - loss: 0.8620 - accuracy: 0.6209 - val\_loss: 0.8756 - val\_accuracy: 0.6217
  29. Epoch 14/25
  30. 593/593 [==============================] - 42s 71ms/step - loss: 0.8566 - accuracy: 0.6230 - val\_loss: 0.8384 - val\_accuracy: 0.6352
  31. Epoch 15/25
  32. 593/593 [==============================] - 42s 70ms/step - loss: 0.8461 - accuracy: 0.6283 - val\_loss: 0.8334 - val\_accuracy: 0.6413
  33. Epoch 16/25
  34. 593/593 [==============================] - 42s 70ms/step - loss: 0.8385 - accuracy: 0.6333 - val\_loss: 0.8375 - val\_accuracy: 0.6282
  35. Epoch 17/25
  36. 593/593 [==============================] - 41s 69ms/step - loss: 0.8379 - accuracy: 0.6331 - val\_loss: 0.8256 - val\_accuracy: 0.6394
  37. Epoch 18/25
  38. 593/593 [==============================] - 41s 70ms/step - loss: 0.8277 - accuracy: 0.6369 - val\_loss: 0.8540 - val\_accuracy: 0.6204
  39. Epoch 19/25
  40. 593/593 [==============================] - 42s 70ms/step - loss: 0.8180 - accuracy: 0.6382 - val\_loss: 0.8108 - val\_accuracy: 0.6426
  41. Epoch 20/25
  42. 593/593 [==============================] - 42s 70ms/step - loss: 0.8106 - accuracy: 0.6432 - val\_loss: 0.8171 - val\_accuracy: 0.6476
  43. Epoch 21/25
  44. 593/593 [==============================] - 42s 71ms/step - loss: 0.8114 - accuracy: 0.6449 - val\_loss: 0.7927 - val\_accuracy: 0.6510
  45. Epoch 22/25
  46. 593/593 [==============================] - 42s 70ms/step - loss: 0.8068 - accuracy: 0.6481 - val\_loss: 0.8111 - val\_accuracy: 0.6464
  47. Epoch 23/25
  48. 593/593 [==============================] - 41s 70ms/step - loss: 0.8010 - accuracy: 0.6482 - val\_loss: 0.8084 - val\_accuracy: 0.6495
  49. Epoch 24/25
  50. 593/593 [==============================] - 43s 72ms/step - loss: 0.8020 - accuracy: 0.6452 - val\_loss: 0.8028 - val\_accuracy: 0.6455
  51. Epoch 25/25
  52. 593/593 [==============================] - 42s 70ms/step - loss: 0.7992 - accuracy: 0.6445 - val\_loss: 0.8468 - val\_accuracy: 0.6423



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.86 | 0.90 | 0.88 | 379 |
| **1\_child** | 0.59 | 0.71 | 0.65 | 304 |
| **2\_young** | 0.53 | 0.48 | 0.50 | 845 |
| **3\_adult** | 0.66 | 0.72 | 0.69 | 1873 |
| **4\_middle\_age** | 0.58 | 0.46 | 0.51 | 862 |
| **5\_old** | 0.70 | 0.71 | 0.71 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.64 | 4742 |
| **macro\_avg** | 0.65 | 0.66 | 0.66 | 4742 |
| **weighted\_avg** | 0.64 | 0.64 | 0.64 | 4742 |

## Observaciones

Precisión training: 0.6445

Pérdida training: 0.7992

Precisión validación/test: 0.6423

Pérdida test: 0.8468

- Precisión más baja que en modelo anterior

- No overfitting

- Tasa acierto en Young algo más alta, pero continúa la alta confusión con la clase Adult.

- Aumentar duración del training (epochs), aparentemente la tendencia de Loss sigue a la baja y la de aprendizaje en incremento.

# Model 8

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 64) 18496

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max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 128) 73856

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 4608) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 589952

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dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

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dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 32) 2080

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

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

Total params: 693,734

Trainable params: 693,734

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-08** | **0.3** | **0.1** | **[0.9, 1.2]** | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | **35** |
| 2 | 64 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | 128 | 3x3 | -- | relu | 2x2 | 3 | 32 | relu | 0.3 |
| 4 |  |  |  |  |  | 4 | 6 | softmax | -- |



## Proceso de Training

Epoch 1/35

2020-07-13 14:31:35.631707: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-07-13 14:31:35.994838: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 38s 64ms/step - loss: 1.4443 - accuracy: 0.4239 - val\_loss: 1.1714 - val\_accuracy: 0.4840

Epoch 2/35

593/593 [==============================] - 37s 63ms/step - loss: 1.1662 - accuracy: 0.5055 - val\_loss: 1.0170 - val\_accuracy: 0.5597

Epoch 3/35

593/593 [==============================] - 39s 66ms/step - loss: 1.0714 - accuracy: 0.5381 - val\_loss: 0.9525 - val\_accuracy: 0.5848

Epoch 4/35

593/593 [==============================] - 38s 64ms/step - loss: 1.0185 - accuracy: 0.5655 - val\_loss: 0.9633 - val\_accuracy: 0.5801

Epoch 5/35

593/593 [==============================] - 39s 66ms/step - loss: 0.9803 - accuracy: 0.5815 - val\_loss: 0.9304 - val\_accuracy: 0.5936

Epoch 6/35

593/593 [==============================] - 39s 66ms/step - loss: 0.9593 - accuracy: 0.5877 - val\_loss: 0.9062 - val\_accuracy: 0.6122

Epoch 7/35

593/593 [==============================] - 39s 66ms/step - loss: 0.9402 - accuracy: 0.5971 - val\_loss: 0.8754 - val\_accuracy: 0.6208

Epoch 8/35

593/593 [==============================] - 38s 65ms/step - loss: 0.9187 - accuracy: 0.6035 - val\_loss: 0.8617 - val\_accuracy: 0.6219

Epoch 9/35

593/593 [==============================] - 39s 65ms/step - loss: 0.9044 - accuracy: 0.6057 - val\_loss: 0.8771 - val\_accuracy: 0.6099

Epoch 10/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8906 - accuracy: 0.6124 - val\_loss: 0.9122 - val\_accuracy: 0.6033

Epoch 11/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8858 - accuracy: 0.6188 - val\_loss: 0.8410 - val\_accuracy: 0.6354

Epoch 12/35

593/593 [==============================] - 39s 65ms/step - loss: 0.8696 - accuracy: 0.6202 - val\_loss: 0.8429 - val\_accuracy: 0.6225

Epoch 13/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8610 - accuracy: 0.6244 - val\_loss: 0.8247 - val\_accuracy: 0.6352

Epoch 14/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8517 - accuracy: 0.6269 - val\_loss: 0.8310 - val\_accuracy: 0.6341

Epoch 15/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8445 - accuracy: 0.6324 - val\_loss: 0.8274 - val\_accuracy: 0.6396

Epoch 16/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8371 - accuracy: 0.6360 - val\_loss: 0.7986 - val\_accuracy: 0.6400

Epoch 17/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8344 - accuracy: 0.6321 - val\_loss: 0.8086 - val\_accuracy: 0.6455

Epoch 18/35

593/593 [==============================] - 40s 67ms/step - loss: 0.8305 - accuracy: 0.6354 - val\_loss: 0.8087 - val\_accuracy: 0.6411

Epoch 19/35

593/593 [==============================] - 40s 67ms/step - loss: 0.8253 - accuracy: 0.6347 - val\_loss: 0.8112 - val\_accuracy: 0.6434

Epoch 20/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8182 - accuracy: 0.6467 - val\_loss: 0.8514 - val\_accuracy: 0.6185

Epoch 21/35

593/593 [==============================] - 39s 67ms/step - loss: 0.8124 - accuracy: 0.6434 - val\_loss: 0.8087 - val\_accuracy: 0.6402

Epoch 22/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8076 - accuracy: 0.6456 - val\_loss: 0.8192 - val\_accuracy: 0.6352

Epoch 23/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7993 - accuracy: 0.6512 - val\_loss: 0.7948 - val\_accuracy: 0.6394

Epoch 24/35

593/593 [==============================] - 39s 66ms/step - loss: 0.8058 - accuracy: 0.6468 - val\_loss: 0.7957 - val\_accuracy: 0.6501

Epoch 25/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7927 - accuracy: 0.6539 - val\_loss: 0.7760 - val\_accuracy: 0.6569

Epoch 26/35

593/593 [==============================] - 39s 66ms/step - loss: 0.7913 - accuracy: 0.6530 - val\_loss: 0.7939 - val\_accuracy: 0.6430

Epoch 27/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7962 - accuracy: 0.6505 - val\_loss: 0.7965 - val\_accuracy: 0.6561

Epoch 28/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7775 - accuracy: 0.6590 - val\_loss: 0.7907 - val\_accuracy: 0.6554

Epoch 29/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7749 - accuracy: 0.6585 - val\_loss: 0.7932 - val\_accuracy: 0.6485

Epoch 30/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7753 - accuracy: 0.6622 - val\_loss: 0.7997 - val\_accuracy: 0.6531

Epoch 31/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7736 - accuracy: 0.6611 - val\_loss: 0.7924 - val\_accuracy: 0.6516

Epoch 32/35

593/593 [==============================] - 40s 67ms/step - loss: 0.7671 - accuracy: 0.6640 - val\_loss: 0.7910 - val\_accuracy: 0.6516

Epoch 33/35

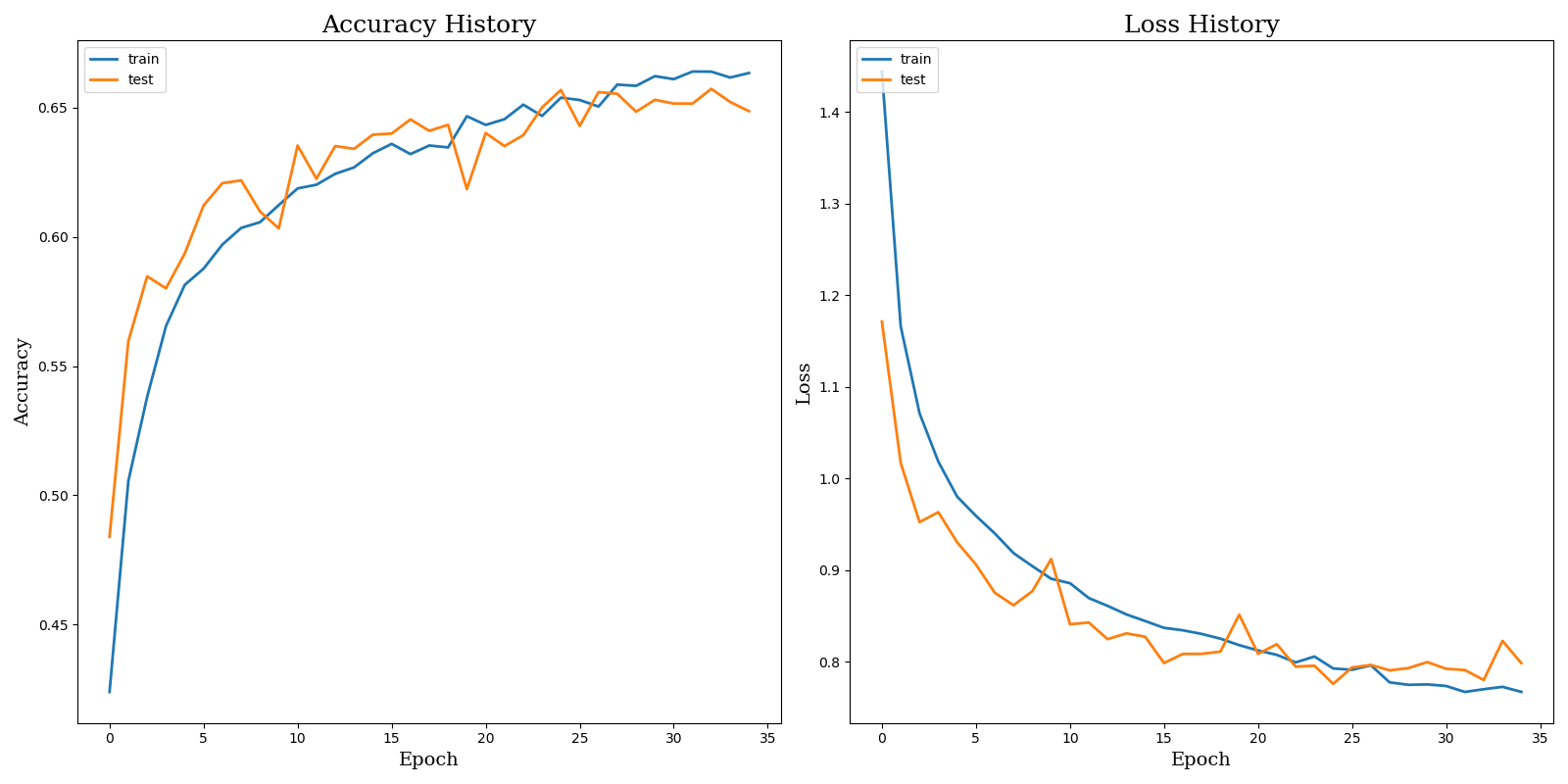
593/593 [==============================] - 40s 67ms/step - loss: 0.7701 - accuracy: 0.6640 - val\_loss: 0.7802 - val\_accuracy: 0.6573

Epoch 34/35

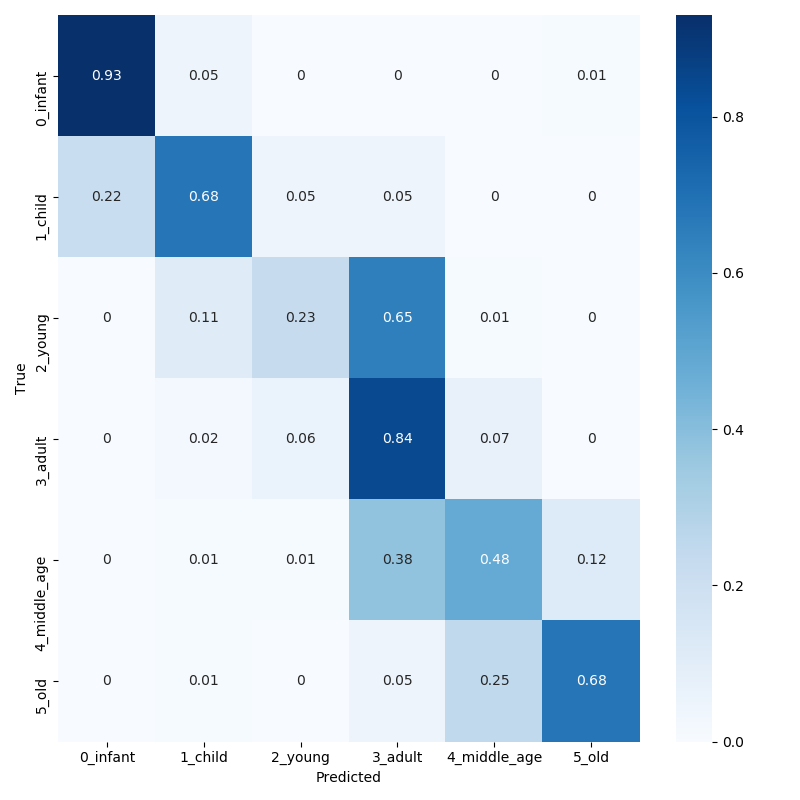
593/593 [==============================] - 40s 67ms/step - loss: 0.7727 - accuracy: 0.6617 - val\_loss: 0.8228 - val\_accuracy: 0.6523

Epoch 35/35

593/593 [==============================] - 40s 68ms/step - loss: 0.7672 - accuracy: 0.6635 - val\_loss: 0.7985 - val\_accuracy: 0.6487



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.83 | 0.93 | 0.88 | 379 |
| **1\_child** | 0.57 | 0.68 | 0.62 | 304 |
| **2\_young** | 0.58 | 0.68 | 0.62 | 845 |
| **3\_adult** | 0.63 | 0.84 | 0.72 | 1873 |
| **4\_middle\_age** | 0.61 | 0.48 | 0.54 | 862 |
| **5\_old** | 0.74 | 0.68 | 0.71 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.65 | 4742 |
| **macro\_avg** | 0.66 | 0.64 | 0.63 | 4742 |
| **weighted\_avg** | 0.64 | 0.65 | 0.62 | 4742 |

## Observaciones

Precisión training: 0.6635

Pérdida training: 0.7672

Precisión validación/test: 0.6487

Pérdida test: 0.7985

loss: 0.7672 - accuracy: 0.6635 - val\_loss: 0.7985 - val\_accuracy: 0.6487

# Model 9

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 128) 73856

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 4608) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 589952

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 32) 2080

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

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

Total params: 693,734

Trainable params: 693,734

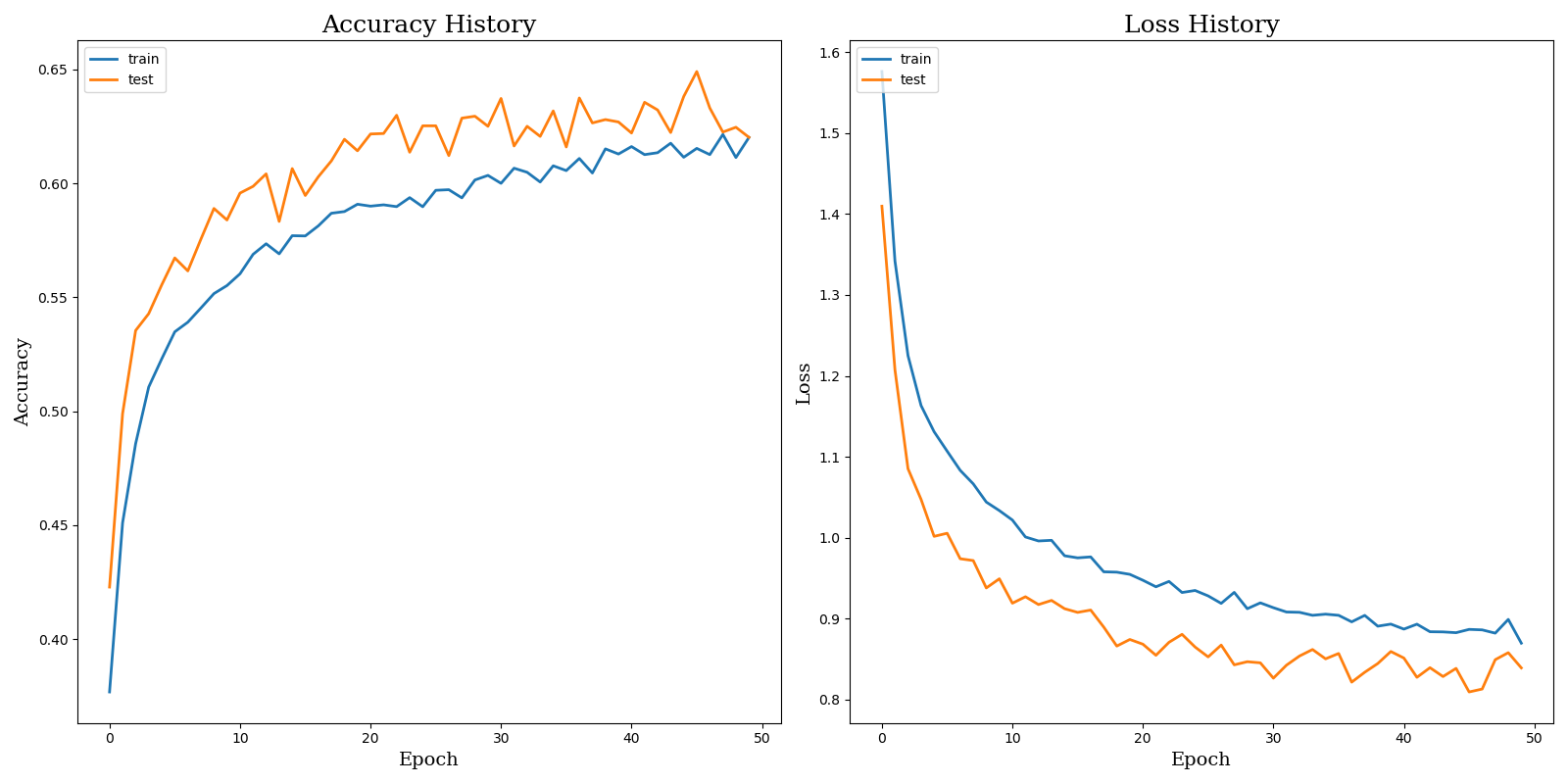
Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-09** | 0.3 | 0.1 | [0.9, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | **0.5** | adam | **50** |
| 2 | 64 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | **0.5** |
| 3 | 128 | 3x3 | -- | relu | 2x2 | 3 | 32 | relu | **0.5** |
| 4 |  |  |  |  |  | 4 | 6 | softmax | -- |

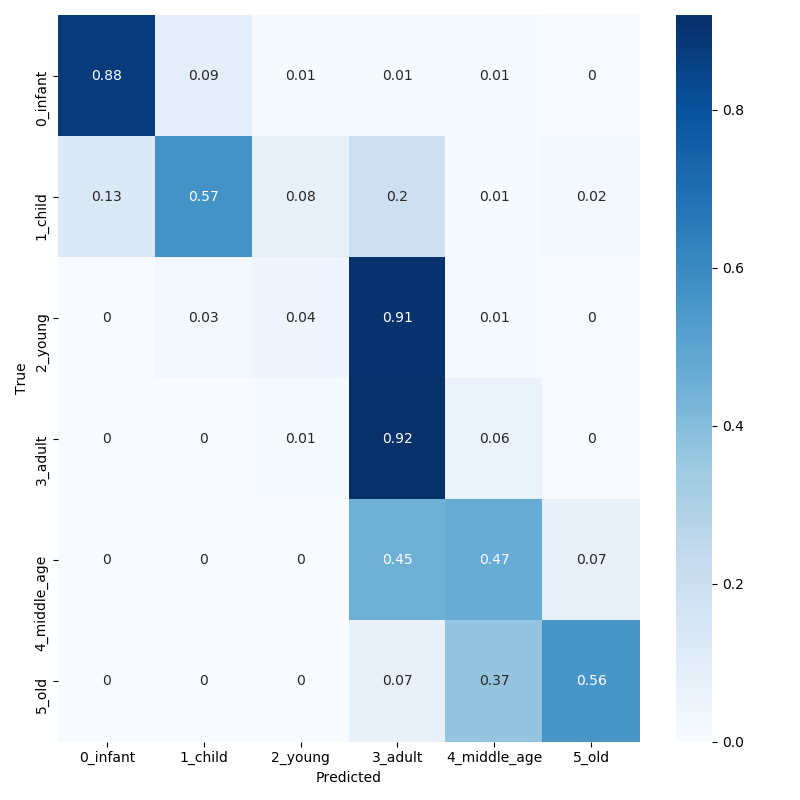


## Proceso de Training

* 1. Epoch 1/50
  2. 2020-09-05 19:48:07.156296: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10
  3. 2020-09-05 19:48:07.552062: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7
  4. 593/593 [==============================] - 42s 71ms/step - loss: 1.5760 - accuracy: 0.3768 - val\_loss: 1.4096 - val\_accuracy: 0.4228
  5. Epoch 2/50
  6. 593/593 [==============================] - 40s 68ms/step - loss: 1.3419 - accuracy: 0.4510 - val\_loss: 1.2075 - val\_accuracy: 0.4989
  7. Epoch 3/50
  8. 593/593 [==============================] - 41s 70ms/step - loss: 1.2250 - accuracy: 0.4858 - val\_loss: 1.0853 - val\_accuracy: 0.5354
  9. Epoch 4/50
  10. 593/593 [==============================] - 42s 70ms/step - loss: 1.1634 - accuracy: 0.5106 - val\_loss: 1.0475 - val\_accuracy: 0.5428
  11. Epoch 5/50
  12. 593/593 [==============================] - 43s 73ms/step - loss: 1.1310 - accuracy: 0.5230 - val\_loss: 1.0018 - val\_accuracy: 0.5555
  13. Epoch 6/50
  14. 593/593 [==============================] - 41s 70ms/step - loss: 1.1070 - accuracy: 0.5349 - val\_loss: 1.0056 - val\_accuracy: 0.5673
  15. Epoch 7/50
  16. 593/593 [==============================] - 42s 70ms/step - loss: 1.0833 - accuracy: 0.5391 - val\_loss: 0.9741 - val\_accuracy: 0.5616
  17. Epoch 8/50
  18. 593/593 [==============================] - 42s 71ms/step - loss: 1.0666 - accuracy: 0.5453 - val\_loss: 0.9719 - val\_accuracy: 0.5755
  19. Epoch 9/50
  20. 593/593 [==============================] - 42s 71ms/step - loss: 1.0441 - accuracy: 0.5516 - val\_loss: 0.9381 - val\_accuracy: 0.5890
  21. Epoch 10/50
  22. 593/593 [==============================] - 42s 71ms/step - loss: 1.0336 - accuracy: 0.5552 - val\_loss: 0.9494 - val\_accuracy: 0.5839
  23. Epoch 11/50
  24. 593/593 [==============================] - 43s 72ms/step - loss: 1.0219 - accuracy: 0.5603 - val\_loss: 0.9192 - val\_accuracy: 0.5957
  25. Epoch 12/50
  26. 593/593 [==============================] - 43s 72ms/step - loss: 1.0010 - accuracy: 0.5689 - val\_loss: 0.9272 - val\_accuracy: 0.5987
  27. Epoch 13/50
  28. 593/593 [==============================] - 44s 73ms/step - loss: 0.9961 - accuracy: 0.5735 - val\_loss: 0.9175 - val\_accuracy: 0.6042
  29. Epoch 14/50
  30. 593/593 [==============================] - 43s 72ms/step - loss: 0.9969 - accuracy: 0.5691 - val\_loss: 0.9226 - val\_accuracy: 0.5833
  31. Epoch 15/50
  32. 593/593 [==============================] - 43s 73ms/step - loss: 0.9778 - accuracy: 0.5770 - val\_loss: 0.9124 - val\_accuracy: 0.6065
  33. Epoch 16/50
  34. 593/593 [==============================] - 43s 73ms/step - loss: 0.9752 - accuracy: 0.5769 - val\_loss: 0.9079 - val\_accuracy: 0.5947
  35. Epoch 17/50
  36. 593/593 [==============================] - 43s 73ms/step - loss: 0.9764 - accuracy: 0.5814 - val\_loss: 0.9107 - val\_accuracy: 0.6029
  37. Epoch 18/50
  38. 593/593 [==============================] - 43s 72ms/step - loss: 0.9580 - accuracy: 0.5869 - val\_loss: 0.8897 - val\_accuracy: 0.6099
  39. Epoch 19/50
  40. 593/593 [==============================] - 43s 73ms/step - loss: 0.9575 - accuracy: 0.5876 - val\_loss: 0.8663 - val\_accuracy: 0.6194
  41. Epoch 20/50
  42. 593/593 [==============================] - 43s 73ms/step - loss: 0.9548 - accuracy: 0.5908 - val\_loss: 0.8744 - val\_accuracy: 0.6143
  43. Epoch 21/50
  44. 593/593 [==============================] - 44s 74ms/step - loss: 0.9475 - accuracy: 0.5900 - val\_loss: 0.8686 - val\_accuracy: 0.6217
  45. Epoch 22/50
  46. 593/593 [==============================] - 44s 74ms/step - loss: 0.9395 - accuracy: 0.5906 - val\_loss: 0.8549 - val\_accuracy: 0.6219
  47. Epoch 23/50
  48. 593/593 [==============================] - 44s 74ms/step - loss: 0.9461 - accuracy: 0.5898 - val\_loss: 0.8709 - val\_accuracy: 0.6299
  49. Epoch 24/50
  50. 593/593 [==============================] - 44s 74ms/step - loss: 0.9324 - accuracy: 0.5937 - val\_loss: 0.8808 - val\_accuracy: 0.6137
  51. Epoch 25/50
  52. 593/593 [==============================] - 44s 74ms/step - loss: 0.9349 - accuracy: 0.5897 - val\_loss: 0.8651 - val\_accuracy: 0.6253
  53. Epoch 26/50
  54. 593/593 [==============================] - 44s 75ms/step - loss: 0.9282 - accuracy: 0.5970 - val\_loss: 0.8529 - val\_accuracy: 0.6253
  55. Epoch 27/50
  56. 593/593 [==============================] - 45s 75ms/step - loss: 0.9190 - accuracy: 0.5972 - val\_loss: 0.8675 - val\_accuracy: 0.6122
  57. Epoch 28/50
  58. 593/593 [==============================] - 45s 76ms/step - loss: 0.9326 - accuracy: 0.5936 - val\_loss: 0.8430 - val\_accuracy: 0.6286
  59. Epoch 29/50
  60. 593/593 [==============================] - 45s 76ms/step - loss: 0.9124 - accuracy: 0.6015 - val\_loss: 0.8469 - val\_accuracy: 0.6295
  61. Epoch 30/50
  62. 593/593 [==============================] - 46s 77ms/step - loss: 0.9196 - accuracy: 0.6035 - val\_loss: 0.8455 - val\_accuracy: 0.6251
  63. Epoch 31/50
  64. 593/593 [==============================] - 45s 76ms/step - loss: 0.9137 - accuracy: 0.6000 - val\_loss: 0.8266 - val\_accuracy: 0.6373
  65. Epoch 32/50
  66. 593/593 [==============================] - 46s 77ms/step - loss: 0.9083 - accuracy: 0.6067 - val\_loss: 0.8426 - val\_accuracy: 0.6164
  67. Epoch 33/50
  68. 593/593 [==============================] - 45s 76ms/step - loss: 0.9079 - accuracy: 0.6049 - val\_loss: 0.8539 - val\_accuracy: 0.6251
  69. Epoch 34/50
  70. 593/593 [==============================] - 46s 77ms/step - loss: 0.9042 - accuracy: 0.6006 - val\_loss: 0.8620 - val\_accuracy: 0.6206
  71. Epoch 35/50
  72. 593/593 [==============================] - 46s 77ms/step - loss: 0.9057 - accuracy: 0.6077 - val\_loss: 0.8505 - val\_accuracy: 0.6318
  73. Epoch 36/50
  74. 593/593 [==============================] - 46s 77ms/step - loss: 0.9042 - accuracy: 0.6056 - val\_loss: 0.8571 - val\_accuracy: 0.6160
  75. Epoch 37/50
  76. 593/593 [==============================] - 46s 77ms/step - loss: 0.8962 - accuracy: 0.6109 - val\_loss: 0.8217 - val\_accuracy: 0.6375
  77. Epoch 38/50
  78. 593/593 [==============================] - 46s 78ms/step - loss: 0.9041 - accuracy: 0.6046 - val\_loss: 0.8339 - val\_accuracy: 0.6265
  79. Epoch 39/50
  80. 593/593 [==============================] - 46s 78ms/step - loss: 0.8908 - accuracy: 0.6152 - val\_loss: 0.8447 - val\_accuracy: 0.6280
  81. Epoch 40/50
  82. 593/593 [==============================] - 46s 78ms/step - loss: 0.8934 - accuracy: 0.6129 - val\_loss: 0.8595 - val\_accuracy: 0.6270
  83. Epoch 41/50
  84. 593/593 [==============================] - 46s 78ms/step - loss: 0.8872 - accuracy: 0.6162 - val\_loss: 0.8515 - val\_accuracy: 0.6221
  85. Epoch 42/50
  86. 593/593 [==============================] - 46s 77ms/step - loss: 0.8933 - accuracy: 0.6126 - val\_loss: 0.8276 - val\_accuracy: 0.6356
  87. Epoch 43/50
  88. 593/593 [==============================] - 46s 77ms/step - loss: 0.8839 - accuracy: 0.6135 - val\_loss: 0.8395 - val\_accuracy: 0.6322
  89. Epoch 44/50
  90. 593/593 [==============================] - 46s 78ms/step - loss: 0.8837 - accuracy: 0.6176 - val\_loss: 0.8286 - val\_accuracy: 0.6223
  91. Epoch 45/50
  92. 593/593 [==============================] - 46s 78ms/step - loss: 0.8828 - accuracy: 0.6115 - val\_loss: 0.8387 - val\_accuracy: 0.6381
  93. Epoch 46/50
  94. 593/593 [==============================] - 47s 79ms/step - loss: 0.8868 - accuracy: 0.6154 - val\_loss: 0.8096 - val\_accuracy: 0.6491
  95. Epoch 47/50
  96. 593/593 [==============================] - 46s 78ms/step - loss: 0.8862 - accuracy: 0.6126 - val\_loss: 0.8132 - val\_accuracy: 0.6331
  97. Epoch 48/50
  98. 593/593 [==============================] - 47s 79ms/step - loss: 0.8822 - accuracy: 0.6215 - val\_loss: 0.8494 - val\_accuracy: 0.6225
  99. Epoch 49/50
  100. 593/593 [==============================] - 46s 78ms/step - loss: 0.8992 - accuracy: 0.6114 - val\_loss: 0.8581 - val\_accuracy: 0.6246
  101. Epoch 50/50
  102. 593/593 [==============================] - 47s 79ms/step - loss: 0.8698 - accuracy: 0.6202 - val\_loss: 0.8393 - val\_accuracy: 0.6202



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.84 | 0.92 | 0.88 | 379 |
| **1\_child** | 0.63 | 0.62 | 0.63 | 304 |
| **2\_young** | 0.57 | 0.12 | 0.20 | 845 |
| **3\_adult** | 0.61 | 0.82 | 0.70 | 1873 |
| **4\_middle\_age** | 0.52 | 0.50 | 0.51 | 862 |
| **5\_old** | 0.66 | 0.68 | 0.67 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.62 | 4742 |
| **macro\_avg** | 0.64 | 0.61 | 0.60 | 4742 |
| **weighted\_avg** | 0.61 | 0.62 | 0.58 | 4742 |

## Observaciones

Precisión training: 0.6202

Pérdida training: 0.8698

Precisión validación/test: 0.6202

Pérdida test: 0.8393

-

-

# Model 10

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 2304) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 295040

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 6) 390

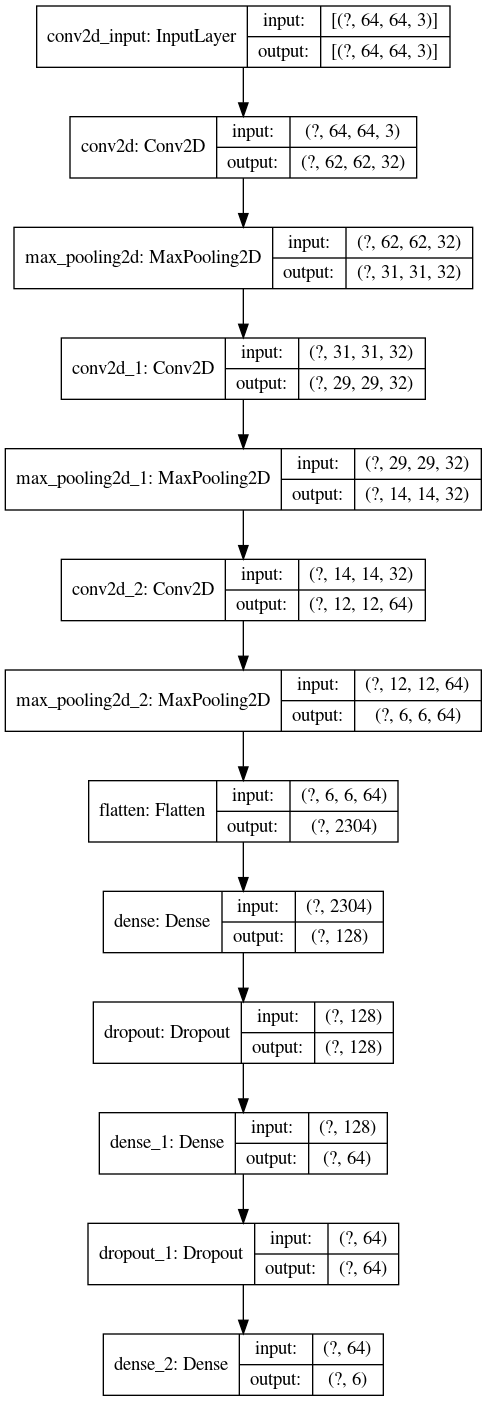
=================================================================

Total params: 332,326

Trainable params: 332,326

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-10** | **0.3** | **0.1** | **[0.9, 1.2]** | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | **0.4** | adam | **40** |
| 2 | 32 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | **0.4** |
| 3 | 64 | 3x3 | -- | relu | 2x2 | 3 | 6 | softmax | -- |
| 4 |  |  |  |  |  | 4 |  |  |  |



## Proceso de Training

Epoch 1/40

2020-09-05 21:26:10.613359: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-09-05 21:26:10.803347: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 41s 69ms/step - loss: 1.4203 - accuracy: 0.4305 - val\_loss: 1.2260 - val\_accuracy: 0.4667

Epoch 2/40

593/593 [==============================] - 42s 70ms/step - loss: 1.1858 - accuracy: 0.5030 - val\_loss: 1.0625 - val\_accuracy: 0.5299

Epoch 3/40

593/593 [==============================] - 42s 71ms/step - loss: 1.0933 - accuracy: 0.5331 - val\_loss: 0.9876 - val\_accuracy: 0.5690

Epoch 4/40

593/593 [==============================] - 43s 73ms/step - loss: 1.0455 - accuracy: 0.5537 - val\_loss: 0.9438 - val\_accuracy: 0.5835

Epoch 5/40

593/593 [==============================] - 43s 73ms/step - loss: 1.0031 - accuracy: 0.5676 - val\_loss: 0.9297 - val\_accuracy: 0.5928

Epoch 6/40

593/593 [==============================] - 45s 75ms/step - loss: 0.9797 - accuracy: 0.5784 - val\_loss: 0.9080 - val\_accuracy: 0.6025

Epoch 7/40

593/593 [==============================] - 44s 74ms/step - loss: 0.9576 - accuracy: 0.5882 - val\_loss: 0.9043 - val\_accuracy: 0.6107

Epoch 8/40

593/593 [==============================] - 44s 74ms/step - loss: 0.9325 - accuracy: 0.5908 - val\_loss: 0.8758 - val\_accuracy: 0.6179

Epoch 9/40

593/593 [==============================] - 44s 74ms/step - loss: 0.9214 - accuracy: 0.5954 - val\_loss: 0.8895 - val\_accuracy: 0.6177

Epoch 10/40

593/593 [==============================] - 44s 75ms/step - loss: 0.9104 - accuracy: 0.6046 - val\_loss: 0.8635 - val\_accuracy: 0.6244

Epoch 11/40

593/593 [==============================] - 44s 75ms/step - loss: 0.9003 - accuracy: 0.6078 - val\_loss: 0.8567 - val\_accuracy: 0.6232

Epoch 12/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8955 - accuracy: 0.6079 - val\_loss: 0.8547 - val\_accuracy: 0.6312

Epoch 13/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8797 - accuracy: 0.6159 - val\_loss: 0.8517 - val\_accuracy: 0.6223

Epoch 14/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8728 - accuracy: 0.6204 - val\_loss: 0.8367 - val\_accuracy: 0.6339

Epoch 15/40

593/593 [==============================] - 45s 75ms/step - loss: 0.8607 - accuracy: 0.6195 - val\_loss: 0.8445 - val\_accuracy: 0.6238

Epoch 16/40

593/593 [==============================] - 44s 74ms/step - loss: 0.8572 - accuracy: 0.6242 - val\_loss: 0.8425 - val\_accuracy: 0.6354

Epoch 17/40

593/593 [==============================] - 45s 75ms/step - loss: 0.8569 - accuracy: 0.6223 - val\_loss: 0.8377 - val\_accuracy: 0.6274

Epoch 18/40

593/593 [==============================] - 44s 74ms/step - loss: 0.8535 - accuracy: 0.6228 - val\_loss: 0.8463 - val\_accuracy: 0.6316

Epoch 19/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8454 - accuracy: 0.6318 - val\_loss: 0.8291 - val\_accuracy: 0.6303

Epoch 20/40

593/593 [==============================] - 44s 74ms/step - loss: 0.8353 - accuracy: 0.6312 - val\_loss: 0.8248 - val\_accuracy: 0.6358

Epoch 21/40

593/593 [==============================] - 45s 76ms/step - loss: 0.8355 - accuracy: 0.6344 - val\_loss: 0.8190 - val\_accuracy: 0.6413

Epoch 22/40

593/593 [==============================] - 45s 75ms/step - loss: 0.8280 - accuracy: 0.6356 - val\_loss: 0.8307 - val\_accuracy: 0.6409

Epoch 23/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8208 - accuracy: 0.6406 - val\_loss: 0.8274 - val\_accuracy: 0.6396

Epoch 24/40

593/593 [==============================] - 45s 75ms/step - loss: 0.8198 - accuracy: 0.6351 - val\_loss: 0.8219 - val\_accuracy: 0.6442

Epoch 25/40

593/593 [==============================] - 45s 76ms/step - loss: 0.8154 - accuracy: 0.6400 - val\_loss: 0.8266 - val\_accuracy: 0.6364

Epoch 26/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8129 - accuracy: 0.6416 - val\_loss: 0.8267 - val\_accuracy: 0.6428

Epoch 27/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8110 - accuracy: 0.6436 - val\_loss: 0.8283 - val\_accuracy: 0.6404

Epoch 28/40

593/593 [==============================] - 44s 75ms/step - loss: 0.8063 - accuracy: 0.6433 - val\_loss: 0.8155 - val\_accuracy: 0.6447

Epoch 29/40

593/593 [==============================] - 45s 75ms/step - loss: 0.8040 - accuracy: 0.6462 - val\_loss: 0.8024 - val\_accuracy: 0.6516

Epoch 30/40

593/593 [==============================] - 45s 75ms/step - loss: 0.7914 - accuracy: 0.6523 - val\_loss: 0.8169 - val\_accuracy: 0.6404

Epoch 31/40

593/593 [==============================] - 45s 76ms/step - loss: 0.8010 - accuracy: 0.6440 - val\_loss: 0.8138 - val\_accuracy: 0.6419

Epoch 32/40

593/593 [==============================] - 45s 75ms/step - loss: 0.8025 - accuracy: 0.6468 - val\_loss: 0.8176 - val\_accuracy: 0.6449

Epoch 33/40

593/593 [==============================] - 45s 75ms/step - loss: 0.7955 - accuracy: 0.6481 - val\_loss: 0.8267 - val\_accuracy: 0.6447

Epoch 34/40

593/593 [==============================] - 45s 76ms/step - loss: 0.7917 - accuracy: 0.6517 - val\_loss: 0.8317 - val\_accuracy: 0.6411

Epoch 35/40

593/593 [==============================] - 45s 75ms/step - loss: 0.7872 - accuracy: 0.6514 - val\_loss: 0.8125 - val\_accuracy: 0.6468

Epoch 36/40

593/593 [==============================] - 44s 75ms/step - loss: 0.7870 - accuracy: 0.6551 - val\_loss: 0.8230 - val\_accuracy: 0.6383

Epoch 37/40

593/593 [==============================] - 45s 76ms/step - loss: 0.7814 - accuracy: 0.6536 - val\_loss: 0.8142 - val\_accuracy: 0.6487

Epoch 38/40

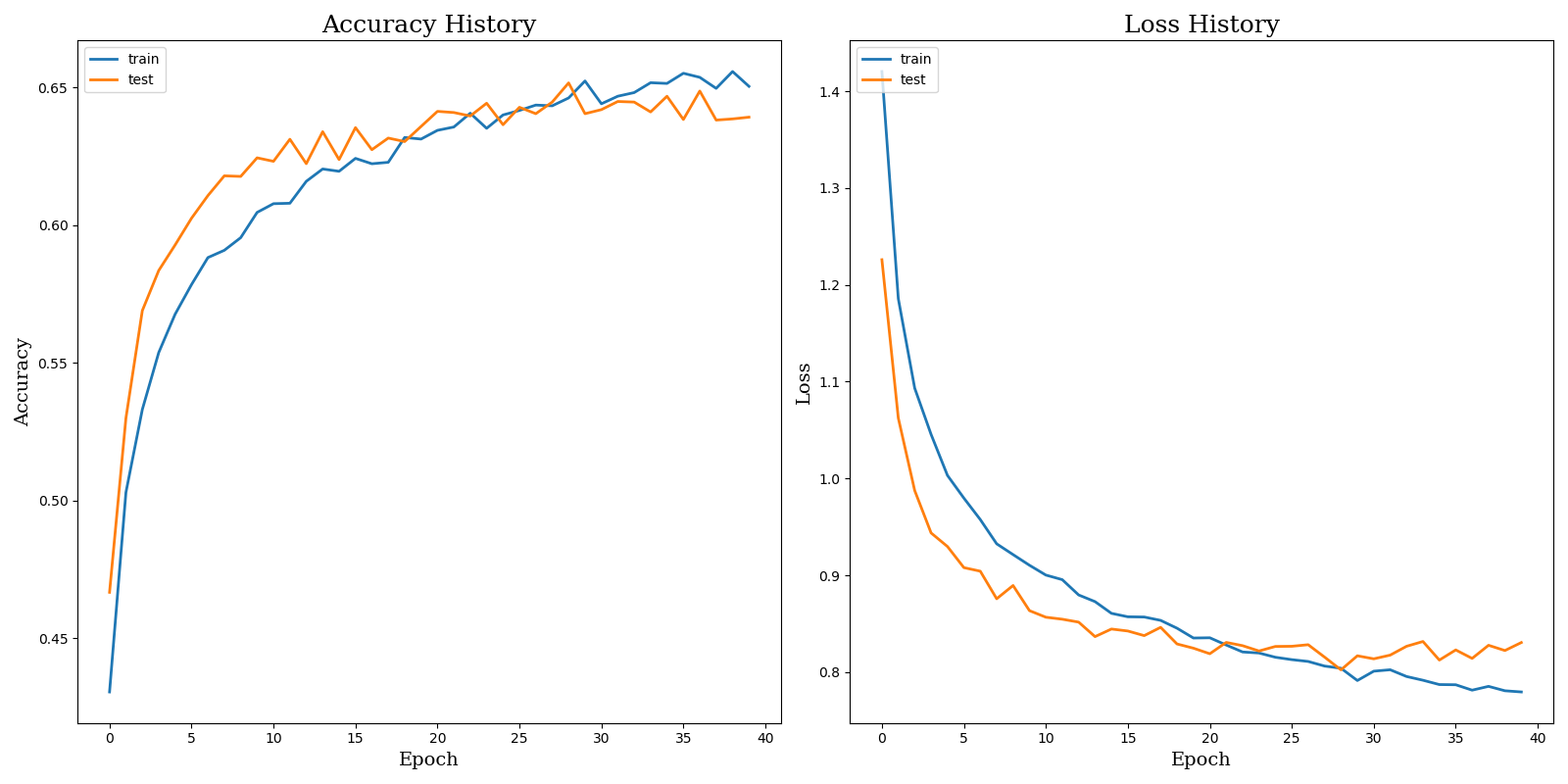
593/593 [==============================] - 44s 75ms/step - loss: 0.7853 - accuracy: 0.6496 - val\_loss: 0.8278 - val\_accuracy: 0.6381

Epoch 39/40

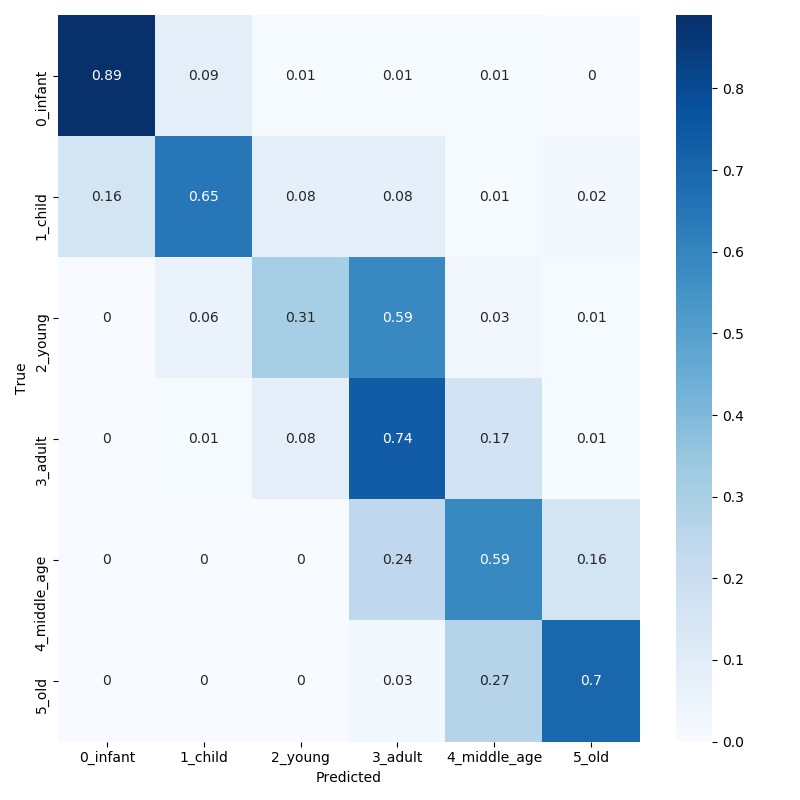
593/593 [==============================] - 44s 75ms/step - loss: 0.7808 - accuracy: 0.6558 - val\_loss: 0.8223 - val\_accuracy: 0.6385

Epoch 40/40

593/593 [==============================] - 45s 75ms/step - loss: 0.7796 - accuracy: 0.6504 - val\_loss: 0.8306 - val\_accuracy: 0.6392



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.87 | 0.89 | 0.88 | 379 |
| **1\_child** | 0.67 | 0.65 | 0.66 | 304 |
| **2\_young** | 0.61 | 0.31 | 0.41 | 845 |
| **3\_adult** | 0.65 | 0.74 | 0.69 | 1873 |
| **4\_middle\_age** | 0.52 | 0.59 | 0.55 | 862 |
| **5\_old** | 0.68 | 0.70 | 0.69 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.64 | 4742 |
| **macro\_avg** | 0.66 | 0.65 | 0.65 | 4742 |
| **weighted\_avg** | 0.64 | 0.64 | 0.63 | 4742 |

## Observaciones

Precisión training: 0.6504

Pérdida training: 0.7796

Precisión validación/test: 0.6392

Pérdida test: 0.8306

# Model 11

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 128) 73856

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 4608) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 589952

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 32) 2080

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

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

Total params: 693,734

Trainable params: 693,734

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-11** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | **30** |
| 2 | 64 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | 128 | 3x3 | -- | relu | 2x2 | 3 | 32 | relu | 0.3 |
| 4 |  |  |  |  |  | 4 | 6 | softmax | -- |



## Proceso de Training

2020-09-09 21:00:59,064|INFO|log|2857|140583461558080|classifier.py|train|MODEL-11 - Training model

Epoch 1/30

2020-09-09 21:00:59.819974: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-09-09 21:01:00.180881: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 39s 65ms/step - loss: 1.4739 - accuracy: 0.4119 - val\_loss: 1.1938 - val\_accuracy: 0.4861

Epoch 2/30

593/593 [==============================] - 37s 63ms/step - loss: 1.1724 - accuracy: 0.5066 - val\_loss: 1.0372 - val\_accuracy: 0.5510

Epoch 3/30

593/593 [==============================] - 38s 64ms/step - loss: 1.0656 - accuracy: 0.5472 - val\_loss: 0.9797 - val\_accuracy: 0.5820

Epoch 4/30

593/593 [==============================] - 38s 63ms/step - loss: 1.0118 - accuracy: 0.5644 - val\_loss: 0.9176 - val\_accuracy: 0.5974

Epoch 5/30

593/593 [==============================] - 38s 65ms/step - loss: 0.9844 - accuracy: 0.5767 - val\_loss: 0.9199 - val\_accuracy: 0.6004

Epoch 6/30

593/593 [==============================] - 38s 65ms/step - loss: 0.9572 - accuracy: 0.5850 - val\_loss: 0.8889 - val\_accuracy: 0.6122

Epoch 7/30

593/593 [==============================] - 38s 65ms/step - loss: 0.9330 - accuracy: 0.5963 - val\_loss: 0.8875 - val\_accuracy: 0.6160

Epoch 8/30

593/593 [==============================] - 39s 66ms/step - loss: 0.9105 - accuracy: 0.6024 - val\_loss: 0.8668 - val\_accuracy: 0.6128

Epoch 9/30

593/593 [==============================] - 39s 65ms/step - loss: 0.8910 - accuracy: 0.6112 - val\_loss: 0.8873 - val\_accuracy: 0.6187

Epoch 10/30

593/593 [==============================] - 39s 65ms/step - loss: 0.8895 - accuracy: 0.6146 - val\_loss: 0.8396 - val\_accuracy: 0.6326

Epoch 11/30

593/593 [==============================] - 39s 65ms/step - loss: 0.8738 - accuracy: 0.6206 - val\_loss: 0.8307 - val\_accuracy: 0.6362

Epoch 12/30

593/593 [==============================] - 39s 65ms/step - loss: 0.8660 - accuracy: 0.6244 - val\_loss: 0.8444 - val\_accuracy: 0.6331

Epoch 13/30

593/593 [==============================] - 38s 65ms/step - loss: 0.8593 - accuracy: 0.6252 - val\_loss: 0.8615 - val\_accuracy: 0.6274

Epoch 14/30

593/593 [==============================] - 39s 65ms/step - loss: 0.8450 - accuracy: 0.6323 - val\_loss: 0.8277 - val\_accuracy: 0.6461

Epoch 15/30

593/593 [==============================] - 39s 66ms/step - loss: 0.8332 - accuracy: 0.6368 - val\_loss: 0.8252 - val\_accuracy: 0.6407

Epoch 16/30

593/593 [==============================] - 39s 65ms/step - loss: 0.8336 - accuracy: 0.6383 - val\_loss: 0.8446 - val\_accuracy: 0.6354

Epoch 17/30

593/593 [==============================] - 39s 66ms/step - loss: 0.8264 - accuracy: 0.6397 - val\_loss: 0.8113 - val\_accuracy: 0.6499

Epoch 18/30

593/593 [==============================] - 39s 66ms/step - loss: 0.8199 - accuracy: 0.6401 - val\_loss: 0.8117 - val\_accuracy: 0.6434

Epoch 19/30

593/593 [==============================] - 39s 66ms/step - loss: 0.8118 - accuracy: 0.6446 - val\_loss: 0.8168 - val\_accuracy: 0.6438

Epoch 20/30

593/593 [==============================] - 39s 66ms/step - loss: 0.8102 - accuracy: 0.6474 - val\_loss: 0.7952 - val\_accuracy: 0.6464

Epoch 21/30

593/593 [==============================] - 39s 66ms/step - loss: 0.8110 - accuracy: 0.6436 - val\_loss: 0.8017 - val\_accuracy: 0.6468

Epoch 22/30

593/593 [==============================] - 39s 66ms/step - loss: 0.7947 - accuracy: 0.6535 - val\_loss: 0.8133 - val\_accuracy: 0.6506

Epoch 23/30

593/593 [==============================] - 39s 66ms/step - loss: 0.7928 - accuracy: 0.6541 - val\_loss: 0.8061 - val\_accuracy: 0.6470

Epoch 24/30

593/593 [==============================] - 39s 65ms/step - loss: 0.7892 - accuracy: 0.6559 - val\_loss: 0.8012 - val\_accuracy: 0.6470

Epoch 25/30

593/593 [==============================] - 39s 66ms/step - loss: 0.7891 - accuracy: 0.6514 - val\_loss: 0.8058 - val\_accuracy: 0.6506

Epoch 26/30

593/593 [==============================] - 39s 66ms/step - loss: 0.7749 - accuracy: 0.6591 - val\_loss: 0.7936 - val\_accuracy: 0.6525

Epoch 27/30

593/593 [==============================] - 39s 66ms/step - loss: 0.7675 - accuracy: 0.6634 - val\_loss: 0.7923 - val\_accuracy: 0.6554

Epoch 28/30

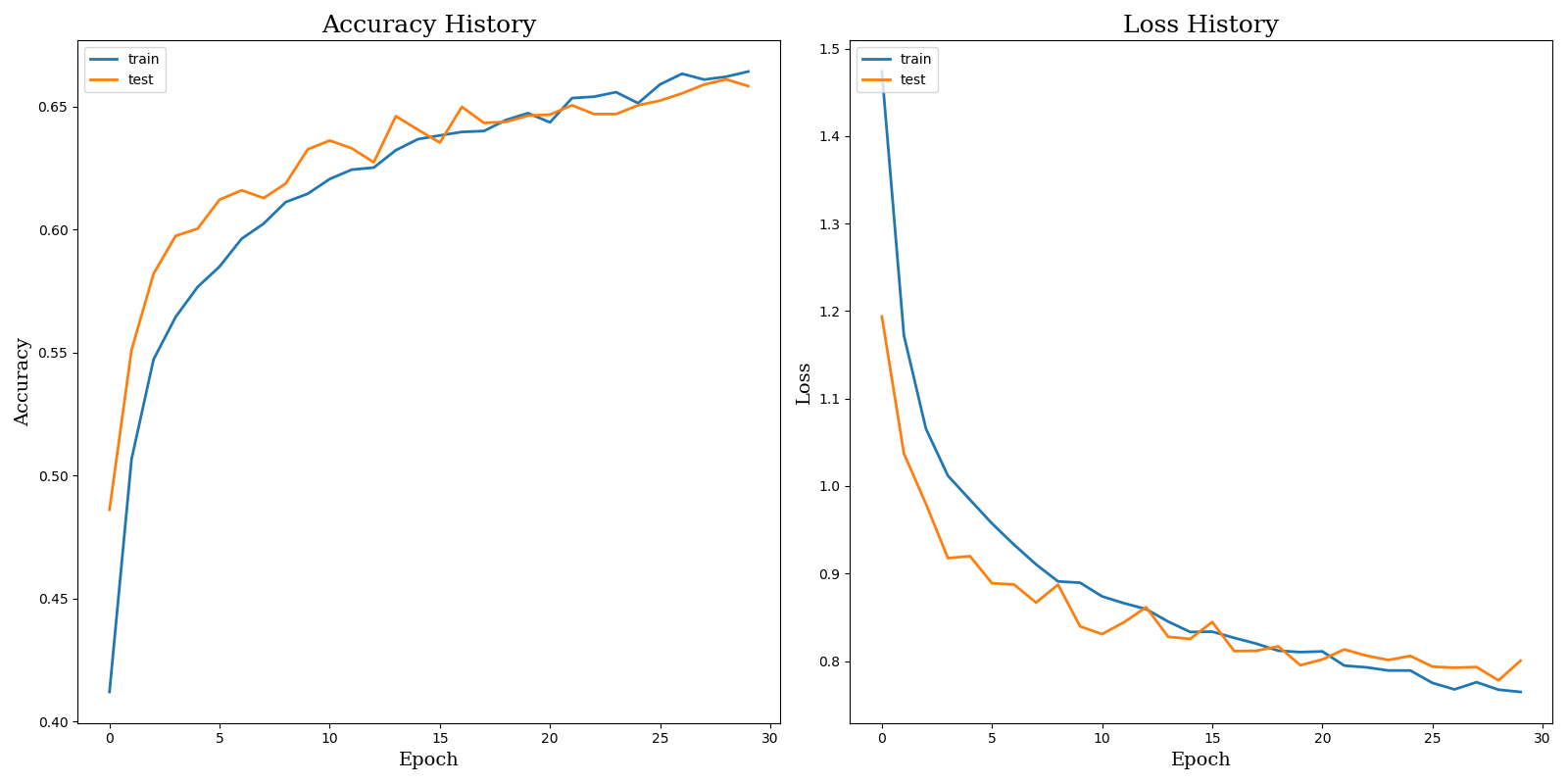
593/593 [==============================] - 39s 66ms/step - loss: 0.7758 - accuracy: 0.6610 - val\_loss: 0.7931 - val\_accuracy: 0.6590

Epoch 29/30

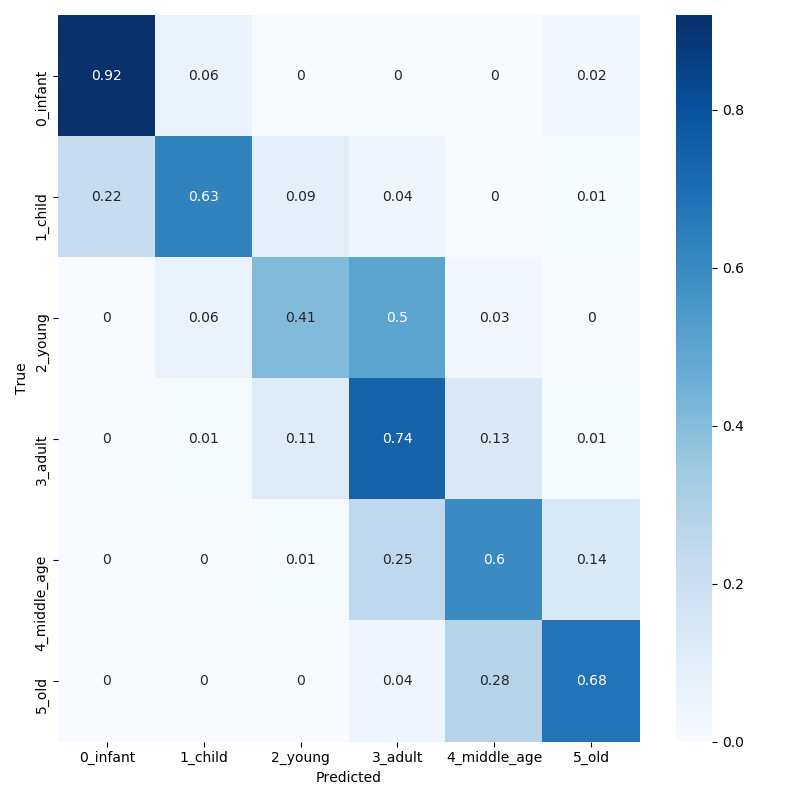
593/593 [==============================] - 39s 66ms/step - loss: 0.7672 - accuracy: 0.6622 - val\_loss: 0.7778 - val\_accuracy: 0.6611

Epoch 30/30

593/593 [==============================] - 39s 66ms/step - loss: 0.7646 - accuracy: 0.6643 - val\_loss: 0.8004 - val\_accuracy: 0.6584



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.83 | 0.92 | 0.87 | 379 |
| **1\_child** | 0.68 | 0.63 | 0.66 | 304 |
| **2\_young** | 0.58 | 0.41 | 0.48 | 845 |
| **3\_adult** | 0.68 | 0.74 | 0.71 | 1873 |
| **4\_middle\_age** | 0.57 | 0.60 | 0.58 | 862 |
| **5\_old** | 0.69 | 0.68 | 0.68 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.66 | 4742 |
| **macro\_avg** | 0.67 | 0.66 | 0.66 | 4742 |
| **weighted\_avg** | 0.65 | 0.66 | 0.66 | 4742 |

## Observaciones

Precisión training: 0.6643

Pérdida training: 0.7646

Precisión validación/test: 0.6584

Pérdida test: 0.8004

# Model 12

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 64) 18496

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max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 64) 0

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conv2d\_2 (Conv2D) (None, 12, 12, 128) 73856

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max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 4608) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 589952

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dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

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dropout\_1 (Dropout) (None, 64) 0

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dense\_2 (Dense) (None, 32) 2080

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dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

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

Total params: 693,734

Trainable params: 693,734

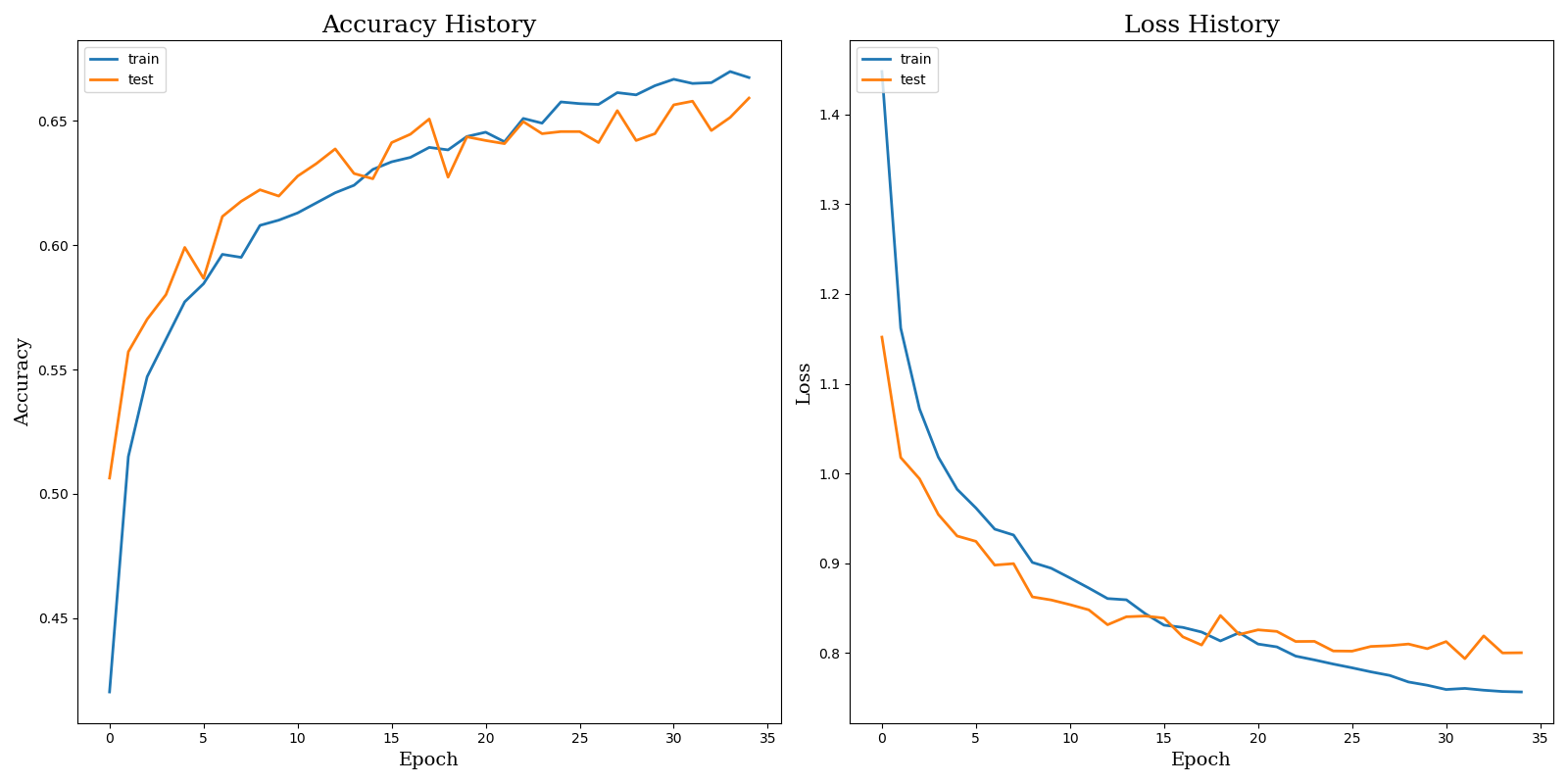
Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-12** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | **35** |
| 2 | 64 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | 128 | 3x3 | -- | relu | 2x2 | 3 | 32 | relu | 0.3 |
| 4 |  |  |  |  |  | 4 | 6 | softmax | -- |

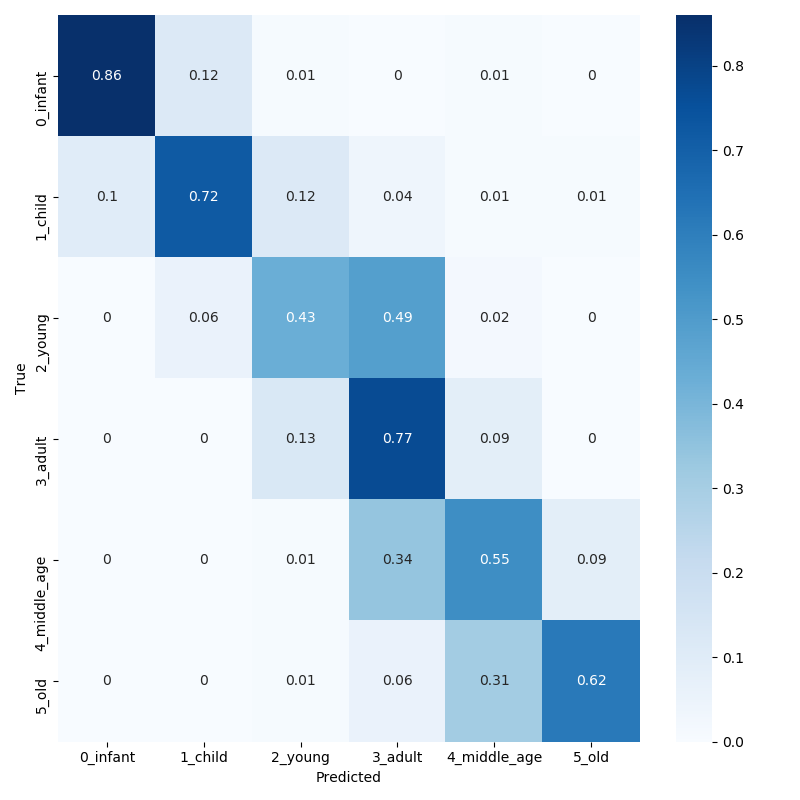


## Proceso de Training

* 1. Epoch 1/35
  2. 2020-09-09 22:07:54.404511: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10
  3. 2020-09-09 22:07:54.562477: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7
  4. 593/593 [==============================] - 36s 61ms/step - loss: 1.4480 - accuracy: 0.4203 - val\_loss: 1.1519 - val\_accuracy: 0.5063
  5. Epoch 2/35
  6. 593/593 [==============================] - 37s 63ms/step - loss: 1.1620 - accuracy: 0.5150 - val\_loss: 1.0177 - val\_accuracy: 0.5571
  7. Epoch 3/35
  8. 593/593 [==============================] - 38s 64ms/step - loss: 1.0719 - accuracy: 0.5471 - val\_loss: 0.9940 - val\_accuracy: 0.5702
  9. Epoch 4/35
  10. 593/593 [==============================] - 38s 65ms/step - loss: 1.0181 - accuracy: 0.5622 - val\_loss: 0.9542 - val\_accuracy: 0.5801
  11. Epoch 5/35
  12. 593/593 [==============================] - 38s 65ms/step - loss: 0.9823 - accuracy: 0.5772 - val\_loss: 0.9302 - val\_accuracy: 0.5991
  13. Epoch 6/35
  14. 593/593 [==============================] - 39s 65ms/step - loss: 0.9614 - accuracy: 0.5845 - val\_loss: 0.9243 - val\_accuracy: 0.5867
  15. Epoch 7/35
  16. 593/593 [==============================] - 39s 66ms/step - loss: 0.9378 - accuracy: 0.5963 - val\_loss: 0.8978 - val\_accuracy: 0.6116
  17. Epoch 8/35
  18. 593/593 [==============================] - 39s 66ms/step - loss: 0.9313 - accuracy: 0.5951 - val\_loss: 0.8994 - val\_accuracy: 0.6177
  19. Epoch 9/35
  20. 593/593 [==============================] - 40s 67ms/step - loss: 0.9008 - accuracy: 0.6080 - val\_loss: 0.8623 - val\_accuracy: 0.6223
  21. Epoch 10/35
  22. 593/593 [==============================] - 39s 66ms/step - loss: 0.8943 - accuracy: 0.6101 - val\_loss: 0.8589 - val\_accuracy: 0.6198
  23. Epoch 11/35
  24. 593/593 [==============================] - 40s 67ms/step - loss: 0.8835 - accuracy: 0.6130 - val\_loss: 0.8537 - val\_accuracy: 0.6278
  25. Epoch 12/35
  26. 593/593 [==============================] - 40s 67ms/step - loss: 0.8722 - accuracy: 0.6171 - val\_loss: 0.8479 - val\_accuracy: 0.6329
  27. Epoch 13/35
  28. 593/593 [==============================] - 40s 67ms/step - loss: 0.8605 - accuracy: 0.6211 - val\_loss: 0.8313 - val\_accuracy: 0.6388
  29. Epoch 14/35
  30. 593/593 [==============================] - 40s 67ms/step - loss: 0.8591 - accuracy: 0.6241 - val\_loss: 0.8402 - val\_accuracy: 0.6288
  31. Epoch 15/35
  32. 593/593 [==============================] - 40s 68ms/step - loss: 0.8437 - accuracy: 0.6305 - val\_loss: 0.8410 - val\_accuracy: 0.6267
  33. Epoch 16/35
  34. 593/593 [==============================] - 40s 68ms/step - loss: 0.8308 - accuracy: 0.6336 - val\_loss: 0.8387 - val\_accuracy: 0.6413
  35. Epoch 17/35
  36. 593/593 [==============================] - 40s 67ms/step - loss: 0.8283 - accuracy: 0.6353 - val\_loss: 0.8178 - val\_accuracy: 0.6447
  37. Epoch 18/35
  38. 593/593 [==============================] - 40s 68ms/step - loss: 0.8231 - accuracy: 0.6394 - val\_loss: 0.8087 - val\_accuracy: 0.6508
  39. Epoch 19/35
  40. 593/593 [==============================] - 40s 68ms/step - loss: 0.8132 - accuracy: 0.6384 - val\_loss: 0.8416 - val\_accuracy: 0.6274
  41. Epoch 20/35
  42. 593/593 [==============================] - 40s 68ms/step - loss: 0.8224 - accuracy: 0.6437 - val\_loss: 0.8204 - val\_accuracy: 0.6436
  43. Epoch 21/35
  44. 593/593 [==============================] - 40s 68ms/step - loss: 0.8098 - accuracy: 0.6455 - val\_loss: 0.8256 - val\_accuracy: 0.6421
  45. Epoch 22/35
  46. 593/593 [==============================] - 40s 68ms/step - loss: 0.8066 - accuracy: 0.6416 - val\_loss: 0.8239 - val\_accuracy: 0.6409
  47. Epoch 23/35
  48. 593/593 [==============================] - 41s 68ms/step - loss: 0.7963 - accuracy: 0.6510 - val\_loss: 0.8126 - val\_accuracy: 0.6497
  49. Epoch 24/35
  50. 593/593 [==============================] - 41s 68ms/step - loss: 0.7921 - accuracy: 0.6491 - val\_loss: 0.8128 - val\_accuracy: 0.6449
  51. Epoch 25/35
  52. 593/593 [==============================] - 41s 69ms/step - loss: 0.7875 - accuracy: 0.6577 - val\_loss: 0.8020 - val\_accuracy: 0.6457
  53. Epoch 26/35
  54. 593/593 [==============================] - 41s 69ms/step - loss: 0.7833 - accuracy: 0.6570 - val\_loss: 0.8018 - val\_accuracy: 0.6457
  55. Epoch 27/35
  56. 593/593 [==============================] - 41s 69ms/step - loss: 0.7788 - accuracy: 0.6566 - val\_loss: 0.8071 - val\_accuracy: 0.6413
  57. Epoch 28/35
  58. 593/593 [==============================] - 42s 70ms/step - loss: 0.7748 - accuracy: 0.6614 - val\_loss: 0.8079 - val\_accuracy: 0.6542
  59. Epoch 29/35
  60. 593/593 [==============================] - 41s 69ms/step - loss: 0.7675 - accuracy: 0.6605 - val\_loss: 0.8098 - val\_accuracy: 0.6421
  61. Epoch 30/35
  62. 593/593 [==============================] - 41s 69ms/step - loss: 0.7638 - accuracy: 0.6642 - val\_loss: 0.8046 - val\_accuracy: 0.6449
  63. Epoch 31/35
  64. 593/593 [==============================] - 41s 69ms/step - loss: 0.7591 - accuracy: 0.6668 - val\_loss: 0.8125 - val\_accuracy: 0.6565
  65. Epoch 32/35
  66. 593/593 [==============================] - 40s 68ms/step - loss: 0.7603 - accuracy: 0.6651 - val\_loss: 0.7934 - val\_accuracy: 0.6580
  67. Epoch 33/35
  68. 593/593 [==============================] - 40s 68ms/step - loss: 0.7583 - accuracy: 0.6654 - val\_loss: 0.8189 - val\_accuracy: 0.6461
  69. Epoch 34/35
  70. 593/593 [==============================] - 40s 68ms/step - loss: 0.7569 - accuracy: 0.6699 - val\_loss: 0.7998 - val\_accuracy: 0.6514
  71. Epoch 35/35
  72. 593/593 [==============================] - 41s 69ms/step - loss: 0.7564 - accuracy: 0.6675 - val\_loss: 0.8001 - val\_accuracy: 0.6592



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.91 | 0.86 | 0.88 | 379 |
| **1\_child** | 0.67 | 0.72 | 0.70 | 304 |
| **2\_young** | 0.55 | 0.43 | 0.48 | 845 |
| **3\_adult** | 0.66 | 0.77 | 0.71 | 1873 |
| **4\_middle\_age** | 0.58 | 0.55 | 0.57 | 862 |
| **5\_old** | 0.77 | 0.62 | 0.69 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.66 | 4742 |
| **macro\_avg** | 0.69 | 0.66 | 0.67 | 4742 |
| **weighted\_avg** | 0.66 | 0.66 | 0.65 | 4742 |

## Observaciones

Precisión training: 0.6675

Pérdida training: 0.7564

Precisión validación/test: 0.6592

Pérdida test: 0.8001

# Model 13

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 64) 18496

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max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 64) 0

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conv2d\_2 (Conv2D) (None, 12, 12, 128) 73856

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max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 4608) 0

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dense (Dense) (None, 128) 589952

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dropout (Dropout) (None, 128) 0

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dense\_1 (Dense) (None, 64) 8256

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dropout\_1 (Dropout) (None, 64) 0

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dense\_2 (Dense) (None, 32) 2080

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dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

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

Total params: 693,734

Trainable params: 693,734

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-13** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | **64** | 64x64 | **64** | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | **30** |
| 2 | 64 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | 128 | 3x3 | -- | relu | 2x2 | 3 | 32 | relu | 0.3 |
| 4 |  |  |  |  |  | 4 | 6 | softmax | -- |



## Proceso de Training

Epoch 1/30

2020-09-14 19:49:57.943932: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-09-14 19:49:58.286506: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

297/297 [==============================] - 38s 129ms/step - loss: 1.5348 - accuracy: 0.3900 - val\_loss: 1.2159 - val\_accuracy: 0.4781

Epoch 2/30

297/297 [==============================] - 37s 124ms/step - loss: 1.2241 - accuracy: 0.4908 - val\_loss: 1.0680 - val\_accuracy: 0.5356

Epoch 3/30

297/297 [==============================] - 38s 127ms/step - loss: 1.1041 - accuracy: 0.5350 - val\_loss: 1.0177 - val\_accuracy: 0.5563

Epoch 4/30

297/297 [==============================] - 37s 126ms/step - loss: 1.0427 - accuracy: 0.5541 - val\_loss: 0.9619 - val\_accuracy: 0.5960

Epoch 5/30

297/297 [==============================] - 38s 128ms/step - loss: 1.0028 - accuracy: 0.5667 - val\_loss: 0.9426 - val\_accuracy: 0.5799

Epoch 6/30

297/297 [==============================] - 38s 129ms/step - loss: 0.9765 - accuracy: 0.5784 - val\_loss: 0.9147 - val\_accuracy: 0.5991

Epoch 7/30

297/297 [==============================] - 38s 128ms/step - loss: 0.9392 - accuracy: 0.5878 - val\_loss: 0.8773 - val\_accuracy: 0.6187

Epoch 8/30

297/297 [==============================] - 39s 130ms/step - loss: 0.9307 - accuracy: 0.5991 - val\_loss: 0.8767 - val\_accuracy: 0.6092

Epoch 9/30

297/297 [==============================] - 39s 130ms/step - loss: 0.9083 - accuracy: 0.6085 - val\_loss: 0.8627 - val\_accuracy: 0.6259

Epoch 10/30

297/297 [==============================] - 39s 131ms/step - loss: 0.8872 - accuracy: 0.6136 - val\_loss: 0.8617 - val\_accuracy: 0.6339

Epoch 11/30

297/297 [==============================] - 39s 130ms/step - loss: 0.8788 - accuracy: 0.6147 - val\_loss: 0.8593 - val\_accuracy: 0.6213

Epoch 12/30

297/297 [==============================] - 39s 132ms/step - loss: 0.8694 - accuracy: 0.6184 - val\_loss: 0.8241 - val\_accuracy: 0.6402

Epoch 13/30

297/297 [==============================] - 39s 132ms/step - loss: 0.8487 - accuracy: 0.6263 - val\_loss: 0.8211 - val\_accuracy: 0.6394

Epoch 14/30

297/297 [==============================] - 39s 133ms/step - loss: 0.8411 - accuracy: 0.6311 - val\_loss: 0.8095 - val\_accuracy: 0.6464

Epoch 15/30

297/297 [==============================] - 39s 133ms/step - loss: 0.8317 - accuracy: 0.6370 - val\_loss: 0.8158 - val\_accuracy: 0.6409

Epoch 16/30

297/297 [==============================] - 39s 132ms/step - loss: 0.8241 - accuracy: 0.6404 - val\_loss: 0.8358 - val\_accuracy: 0.6423

Epoch 17/30

297/297 [==============================] - 40s 133ms/step - loss: 0.8219 - accuracy: 0.6410 - val\_loss: 0.8219 - val\_accuracy: 0.6518

Epoch 18/30

297/297 [==============================] - 40s 133ms/step - loss: 0.8119 - accuracy: 0.6453 - val\_loss: 0.8273 - val\_accuracy: 0.6407

Epoch 19/30

297/297 [==============================] - 40s 133ms/step - loss: 0.8071 - accuracy: 0.6429 - val\_loss: 0.8019 - val\_accuracy: 0.6440

Epoch 20/30

297/297 [==============================] - 40s 133ms/step - loss: 0.7933 - accuracy: 0.6502 - val\_loss: 0.7921 - val\_accuracy: 0.6436

Epoch 21/30

297/297 [==============================] - 40s 134ms/step - loss: 0.7850 - accuracy: 0.6535 - val\_loss: 0.7960 - val\_accuracy: 0.6390

Epoch 22/30

297/297 [==============================] - 40s 133ms/step - loss: 0.7846 - accuracy: 0.6535 - val\_loss: 0.7933 - val\_accuracy: 0.6497

Epoch 23/30

297/297 [==============================] - 40s 133ms/step - loss: 0.7792 - accuracy: 0.6591 - val\_loss: 0.7916 - val\_accuracy: 0.6601

Epoch 24/30

297/297 [==============================] - 40s 134ms/step - loss: 0.7743 - accuracy: 0.6606 - val\_loss: 0.7814 - val\_accuracy: 0.6605

Epoch 25/30

297/297 [==============================] - 40s 134ms/step - loss: 0.7613 - accuracy: 0.6616 - val\_loss: 0.7961 - val\_accuracy: 0.6476

Epoch 26/30

297/297 [==============================] - 40s 135ms/step - loss: 0.7667 - accuracy: 0.6614 - val\_loss: 0.7876 - val\_accuracy: 0.6558

Epoch 27/30

297/297 [==============================] - 40s 133ms/step - loss: 0.7589 - accuracy: 0.6633 - val\_loss: 0.7918 - val\_accuracy: 0.6561

Epoch 28/30

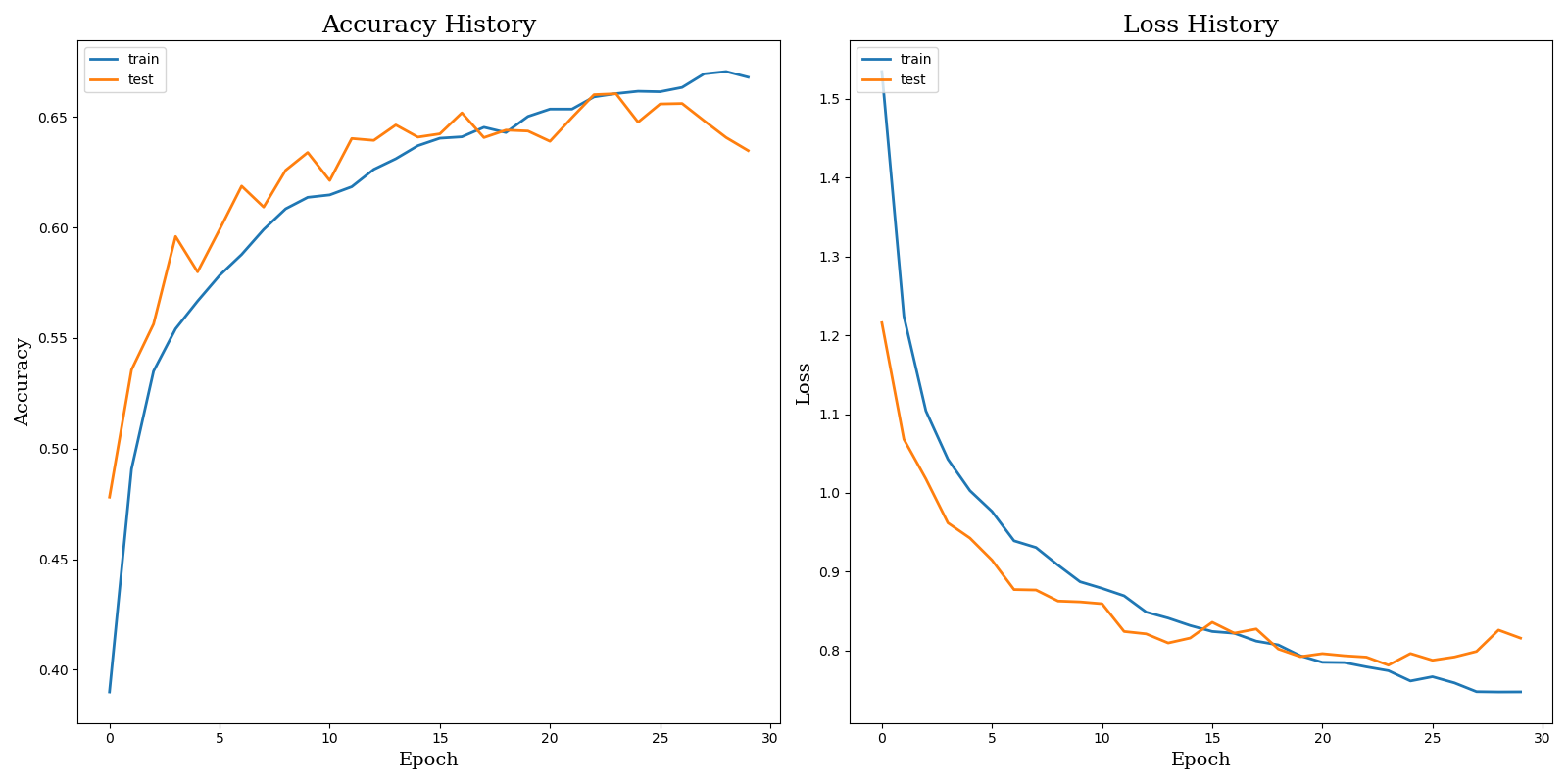
297/297 [==============================] - 40s 134ms/step - loss: 0.7477 - accuracy: 0.6695 - val\_loss: 0.7988 - val\_accuracy: 0.6482

Epoch 29/30

297/297 [==============================] - 40s 134ms/step - loss: 0.7474 - accuracy: 0.6705 - val\_loss: 0.8259 - val\_accuracy: 0.6407

Epoch 30/30

297/297 [==============================] - 40s 133ms/step - loss: 0.7475 - accuracy: 0.6679 - val\_loss: 0.8157 - val\_accuracy: 0.6348



## Matriz de Confusión

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.90 | 0.89 | 0.89 | 379 |
| **1\_child** | 0.60 | 0.76 | 0.67 | 304 |
| **2\_young** | 0.59 | 0.20 | 0.30 | 845 |
| **3\_adult** | 0.63 | 0.80 | 0.71 | 1873 |
| **4\_middle\_age** | 0.56 | 0.46 | 0.50 | 862 |
| **5\_old** | 0.61 | 0.78 | 0.69 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.63 | 4742 |
| **macro\_avg** | 0.65 | 0.65 | 0.63 | 4742 |
| **weighted\_avg** | 0.63 | 0.63 | 0.61 | 4742 |

## Observaciones

Precisión training: 0.6679

Pérdida training: 0.7475

Precisión validación/test: 0.6348

Pérdida test: 0.8157

# Model 14

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

conv2d (Conv2D) (None, 62, 62, 32) 896

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 29, 29, 32) 9248

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 14, 14, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 12, 12, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 6, 6, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 2304) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 295040

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 6) 390

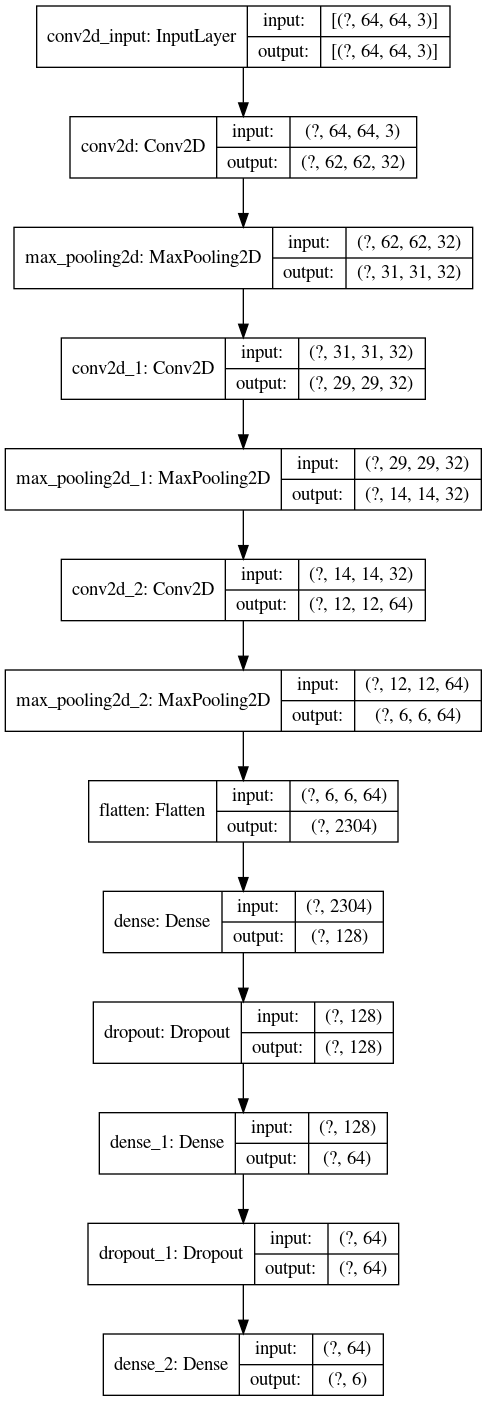
=================================================================

Total params: 332,326

Trainable params: 332,326

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-14** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | 64x64 | 32 | 64x64 | 32 | 1 | 32 | 3x3 | 64x64x3 | relu | 2x2 | 1 | 128 | relu | **0.35** | adam | **45** |
| 2 | 32 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | **0.35** |
| 3 | 64 | 3x3 | -- | relu | 2x2 | 3 | 6 | softmax | -- |
| 4 |  |  |  |  |  | 4 |  |  |  |



## Proceso de Training

2020-09-15 21:23:58,098|INFO|log|2513|139779491354432|classifier.py|train|MODEL-14 - Training model

Epoch 1/45

2020-09-15 21:23:58.781742: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-09-15 21:23:59.155944: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

593/593 [==============================] - 39s 65ms/step - loss: 1.4265 - accuracy: 0.4245 - val\_loss: 1.1408 - val\_accuracy: 0.5103

Epoch 2/45

593/593 [==============================] - 37s 62ms/step - loss: 1.1448 - accuracy: 0.5183 - val\_loss: 1.0601 - val\_accuracy: 0.5493

Epoch 3/45

593/593 [==============================] - 37s 62ms/step - loss: 1.0410 - accuracy: 0.5530 - val\_loss: 0.9530 - val\_accuracy: 0.5909

Epoch 4/45

593/593 [==============================] - 37s 63ms/step - loss: 0.9825 - accuracy: 0.5766 - val\_loss: 0.9162 - val\_accuracy: 0.5945

Epoch 5/45

593/593 [==============================] - 38s 65ms/step - loss: 0.9455 - accuracy: 0.5897 - val\_loss: 0.8777 - val\_accuracy: 0.6067

Epoch 6/45

593/593 [==============================] - 38s 64ms/step - loss: 0.9121 - accuracy: 0.6059 - val\_loss: 0.8793 - val\_accuracy: 0.6248

Epoch 7/45

593/593 [==============================] - 38s 64ms/step - loss: 0.8935 - accuracy: 0.6083 - val\_loss: 0.8449 - val\_accuracy: 0.6310

Epoch 8/45

593/593 [==============================] - 38s 64ms/step - loss: 0.8727 - accuracy: 0.6230 - val\_loss: 0.8260 - val\_accuracy: 0.6364

Epoch 9/45

593/593 [==============================] - 38s 64ms/step - loss: 0.8563 - accuracy: 0.6222 - val\_loss: 0.8390 - val\_accuracy: 0.6312

Epoch 10/45

593/593 [==============================] - 38s 65ms/step - loss: 0.8484 - accuracy: 0.6307 - val\_loss: 0.8304 - val\_accuracy: 0.6354

Epoch 11/45

593/593 [==============================] - 38s 64ms/step - loss: 0.8384 - accuracy: 0.6349 - val\_loss: 0.8336 - val\_accuracy: 0.6388

Epoch 12/45

593/593 [==============================] - 39s 66ms/step - loss: 0.8259 - accuracy: 0.6425 - val\_loss: 0.8090 - val\_accuracy: 0.6369

Epoch 13/45

593/593 [==============================] - 38s 65ms/step - loss: 0.8145 - accuracy: 0.6425 - val\_loss: 0.8010 - val\_accuracy: 0.6438

Epoch 14/45

593/593 [==============================] - 38s 64ms/step - loss: 0.8131 - accuracy: 0.6441 - val\_loss: 0.7933 - val\_accuracy: 0.6493

Epoch 15/45

593/593 [==============================] - 38s 64ms/step - loss: 0.8034 - accuracy: 0.6481 - val\_loss: 0.8822 - val\_accuracy: 0.6244

Epoch 16/45

593/593 [==============================] - 39s 65ms/step - loss: 0.7943 - accuracy: 0.6487 - val\_loss: 0.8269 - val\_accuracy: 0.6371

Epoch 17/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7991 - accuracy: 0.6491 - val\_loss: 0.7996 - val\_accuracy: 0.6501

Epoch 18/45

593/593 [==============================] - 39s 65ms/step - loss: 0.7814 - accuracy: 0.6533 - val\_loss: 0.7900 - val\_accuracy: 0.6451

Epoch 19/45

593/593 [==============================] - 39s 65ms/step - loss: 0.7816 - accuracy: 0.6558 - val\_loss: 0.8010 - val\_accuracy: 0.6417

Epoch 20/45

593/593 [==============================] - 39s 65ms/step - loss: 0.7722 - accuracy: 0.6623 - val\_loss: 0.7967 - val\_accuracy: 0.6525

Epoch 21/45

593/593 [==============================] - 39s 65ms/step - loss: 0.7690 - accuracy: 0.6646 - val\_loss: 0.7858 - val\_accuracy: 0.6571

Epoch 22/45

593/593 [==============================] - 38s 64ms/step - loss: 0.7652 - accuracy: 0.6665 - val\_loss: 0.7878 - val\_accuracy: 0.6518

Epoch 23/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7576 - accuracy: 0.6668 - val\_loss: 0.7925 - val\_accuracy: 0.6478

Epoch 24/45

593/593 [==============================] - 38s 65ms/step - loss: 0.7577 - accuracy: 0.6682 - val\_loss: 0.7870 - val\_accuracy: 0.6489

Epoch 25/45

593/593 [==============================] - 38s 64ms/step - loss: 0.7560 - accuracy: 0.6686 - val\_loss: 0.7819 - val\_accuracy: 0.6594

Epoch 26/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7525 - accuracy: 0.6676 - val\_loss: 0.7803 - val\_accuracy: 0.6497

Epoch 27/45

593/593 [==============================] - 38s 65ms/step - loss: 0.7527 - accuracy: 0.6705 - val\_loss: 0.8077 - val\_accuracy: 0.6388

Epoch 28/45

593/593 [==============================] - 38s 65ms/step - loss: 0.7389 - accuracy: 0.6744 - val\_loss: 0.7753 - val\_accuracy: 0.6558

Epoch 29/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7482 - accuracy: 0.6718 - val\_loss: 0.7961 - val\_accuracy: 0.6535

Epoch 30/45

593/593 [==============================] - 38s 65ms/step - loss: 0.7415 - accuracy: 0.6753 - val\_loss: 0.7982 - val\_accuracy: 0.6499

Epoch 31/45

593/593 [==============================] - 38s 64ms/step - loss: 0.7334 - accuracy: 0.6785 - val\_loss: 0.7968 - val\_accuracy: 0.6514

Epoch 32/45

593/593 [==============================] - 38s 64ms/step - loss: 0.7318 - accuracy: 0.6786 - val\_loss: 0.8120 - val\_accuracy: 0.6504

Epoch 33/45

593/593 [==============================] - 39s 65ms/step - loss: 0.7281 - accuracy: 0.6831 - val\_loss: 0.7929 - val\_accuracy: 0.6575

Epoch 34/45

593/593 [==============================] - 38s 65ms/step - loss: 0.7293 - accuracy: 0.6802 - val\_loss: 0.7781 - val\_accuracy: 0.6605

Epoch 35/45

593/593 [==============================] - 41s 70ms/step - loss: 0.7258 - accuracy: 0.6844 - val\_loss: 0.7943 - val\_accuracy: 0.6588

Epoch 36/45

593/593 [==============================] - 40s 67ms/step - loss: 0.7193 - accuracy: 0.6842 - val\_loss: 0.7704 - val\_accuracy: 0.6672

Epoch 37/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7175 - accuracy: 0.6864 - val\_loss: 0.7774 - val\_accuracy: 0.6592

Epoch 38/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7114 - accuracy: 0.6893 - val\_loss: 0.7817 - val\_accuracy: 0.6563

Epoch 39/45

593/593 [==============================] - 40s 68ms/step - loss: 0.7125 - accuracy: 0.6921 - val\_loss: 0.7824 - val\_accuracy: 0.6563

Epoch 40/45

593/593 [==============================] - 40s 67ms/step - loss: 0.7092 - accuracy: 0.6951 - val\_loss: 0.7735 - val\_accuracy: 0.6590

Epoch 41/45

593/593 [==============================] - 39s 66ms/step - loss: 0.7054 - accuracy: 0.6920 - val\_loss: 0.7716 - val\_accuracy: 0.6632

Epoch 42/45

593/593 [==============================] - 40s 67ms/step - loss: 0.7000 - accuracy: 0.6947 - val\_loss: 0.7633 - val\_accuracy: 0.6645

Epoch 43/45

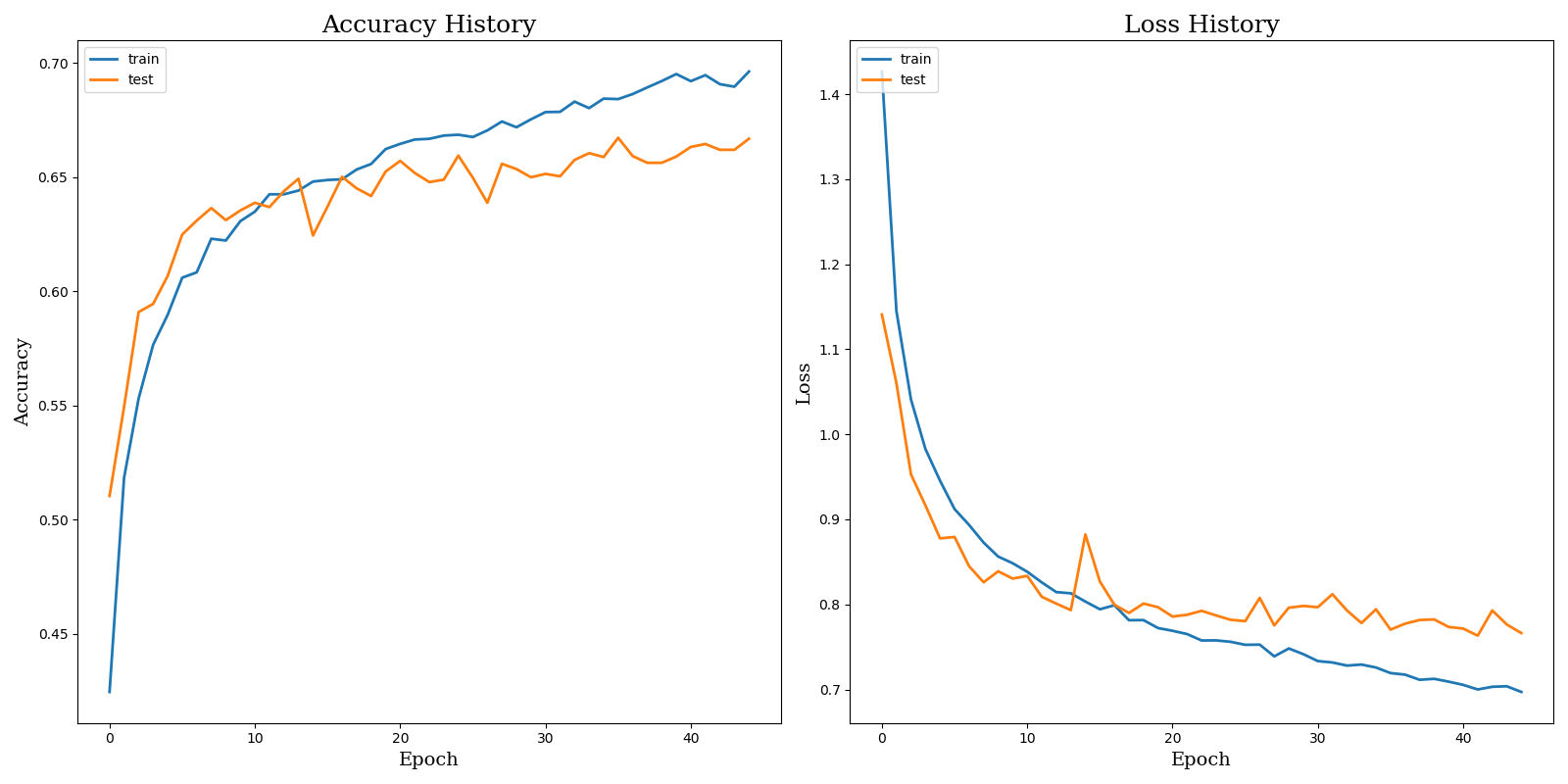
593/593 [==============================] - 39s 67ms/step - loss: 0.7032 - accuracy: 0.6907 - val\_loss: 0.7930 - val\_accuracy: 0.6620

Epoch 44/45

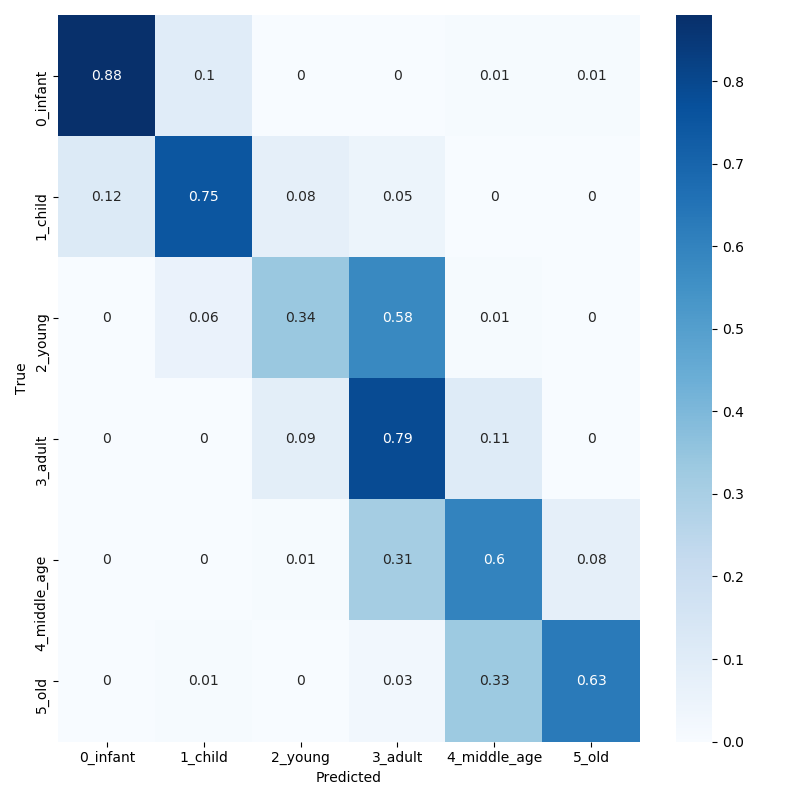
593/593 [==============================] - 38s 65ms/step - loss: 0.7038 - accuracy: 0.6896 - val\_loss: 0.7764 - val\_accuracy: 0.6620

Epoch 45/45

593/593 [==============================] - 39s 66ms/step - loss: 0.6971 - accuracy: 0.6962 - val\_loss: 0.7663 - val\_accuracy: 0.6668



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.89 | 0.88 | 0.89 | 379 |
| **1\_child** | 0.69 | 0.75 | 0.72 | 304 |
| **2\_young** | 0.59 | 0.34 | 0.44 | 845 |
| **3\_adult** | 0.66 | 0.79 | 0.72 | 1873 |
| **4\_middle\_age** | 0.58 | 0.60 | 0.59 | 862 |
| **5\_old** | 0.80 | 0.63 | 0.71 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.67 | 4742 |
| **macro\_avg** | 0.70 | 0.67 | 0.68 | 4742 |
| **weighted\_avg** | 0.67 | 0.67 | 0.66 | 4742 |

## Observaciones

Precisión training: 0.6971

Pérdida training: 0.6962

Precisión validación/test: 0.6668

Pérdida test: 0.7663

# Model 15

## Arquitectura y configuración de hiperparámetros

Model: "sequential"

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Layer (type) Output Shape Param #

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

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_1 (Conv2D) (None, 61, 61, 64) 18496

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_1 (MaxPooling2 (None, 30, 30, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

conv2d\_2 (Conv2D) (None, 28, 28, 128) 73856

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

max\_pooling2d\_2 (MaxPooling2 (None, 14, 14, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

flatten (Flatten) (None, 25088) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense (Dense) (None, 128) 3211392

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout (Dropout) (None, 128) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_1 (Dense) (None, 64) 8256

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_1 (Dropout) (None, 64) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_2 (Dense) (None, 32) 2080

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dropout\_2 (Dropout) (None, 32) 0

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dense\_3 (Dense) (None, 6) 198

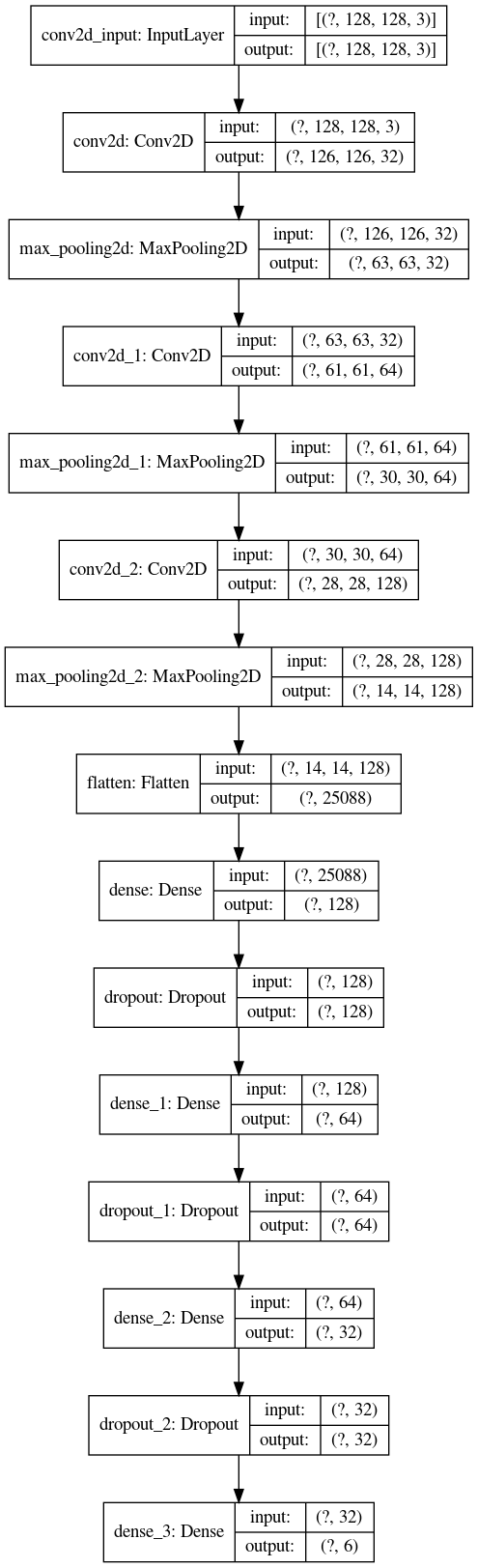
=================================================================

Total params: 3,315,174

Trainable params: 3,315,174

Non-trainable params: 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model-15** | 0.2 | 0.05 | [0.95, 1.2] | TRUE | **128x128** | 32 | **128x128** | 32 | 1 | 32 | 3x3 | **128x128x3** | relu | 2x2 | 1 | 128 | relu | 0.3 | adam | **35** |
| 2 | 64 | 3x3 | -- | relu | 2x2 | 2 | 64 | relu | 0.3 |
| 3 | 128 | 3x3 | -- | relu | 2x2 | 3 | 32 | relu | 0.3 |
| 4 |  |  |  |  |  | 4 | 6 | softmax | -- |



## Proceso de Training

Epoch 1/35

2020-09-21 19:16:40.198919: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcublas.so.10

2020-09-21 19:16:40.533920: I tensorflow/stream\_executor/platform/default/dso\_loader.cc:44] Successfully opened dynamic library libcudnn.so.7

2020-09-21 19:16:42.143858: I tensorflow/stream\_executor/cuda/cuda\_driver.cc:763] failed to allocate 916.44M (960954368 bytes) from device: CUDA\_ERROR\_OUT\_OF\_MEMORY: out of memory

593/593 [==============================] - 85s 143ms/step - loss: 1.3926 - accuracy: 0.4372 - val\_loss: 1.1148 - val\_accuracy: 0.5316

Epoch 2/35

593/593 [==============================] - 87s 146ms/step - loss: 1.1189 - accuracy: 0.5224 - val\_loss: 0.9722 - val\_accuracy: 0.5616

Epoch 3/35

593/593 [==============================] - 89s 149ms/step - loss: 1.0330 - accuracy: 0.5549 - val\_loss: 0.9255 - val\_accuracy: 0.5911

Epoch 4/35

593/593 [==============================] - 89s 151ms/step - loss: 0.9712 - accuracy: 0.5787 - val\_loss: 0.8900 - val\_accuracy: 0.6194

Epoch 5/35

593/593 [==============================] - 91s 153ms/step - loss: 0.9367 - accuracy: 0.5973 - val\_loss: 0.8765 - val\_accuracy: 0.6158

Epoch 6/35

593/593 [==============================] - 91s 154ms/step - loss: 0.9040 - accuracy: 0.6098 - val\_loss: 0.9068 - val\_accuracy: 0.6021

Epoch 7/35

593/593 [==============================] - 91s 154ms/step - loss: 0.8877 - accuracy: 0.6131 - val\_loss: 0.8314 - val\_accuracy: 0.6343

Epoch 8/35

593/593 [==============================] - 92s 155ms/step - loss: 0.8594 - accuracy: 0.6275 - val\_loss: 0.8372 - val\_accuracy: 0.6263

Epoch 9/35

593/593 [==============================] - 92s 156ms/step - loss: 0.8467 - accuracy: 0.6300 - val\_loss: 0.8412 - val\_accuracy: 0.6242

Epoch 10/35

593/593 [==============================] - 93s 156ms/step - loss: 0.8435 - accuracy: 0.6351 - val\_loss: 0.8321 - val\_accuracy: 0.6375

Epoch 11/35

593/593 [==============================] - 101s 171ms/step - loss: 0.8197 - accuracy: 0.6396 - val\_loss: 0.7958 - val\_accuracy: 0.6449

Epoch 12/35

593/593 [==============================] - 93s 157ms/step - loss: 0.8094 - accuracy: 0.6462 - val\_loss: 0.7975 - val\_accuracy: 0.6592

Epoch 13/35

593/593 [==============================] - 94s 159ms/step - loss: 0.8031 - accuracy: 0.6541 - val\_loss: 0.7971 - val\_accuracy: 0.6426

Epoch 14/35

593/593 [==============================] - 95s 160ms/step - loss: 0.7826 - accuracy: 0.6593 - val\_loss: 0.7996 - val\_accuracy: 0.6436

Epoch 15/35

593/593 [==============================] - 95s 160ms/step - loss: 0.7883 - accuracy: 0.6568 - val\_loss: 0.7989 - val\_accuracy: 0.6440

Epoch 16/35

593/593 [==============================] - 96s 162ms/step - loss: 0.7650 - accuracy: 0.6712 - val\_loss: 0.8197 - val\_accuracy: 0.6455

Epoch 17/35

593/593 [==============================] - 97s 163ms/step - loss: 0.7610 - accuracy: 0.6688 - val\_loss: 0.7878 - val\_accuracy: 0.6651

Epoch 18/35

593/593 [==============================] - 95s 161ms/step - loss: 0.7475 - accuracy: 0.6713 - val\_loss: 0.7829 - val\_accuracy: 0.6689

Epoch 19/35

593/593 [==============================] - 96s 162ms/step - loss: 0.7531 - accuracy: 0.6785 - val\_loss: 0.7731 - val\_accuracy: 0.6628

Epoch 20/35

593/593 [==============================] - 97s 164ms/step - loss: 0.7526 - accuracy: 0.6724 - val\_loss: 0.7828 - val\_accuracy: 0.6639

Epoch 21/35

593/593 [==============================] - 96s 163ms/step - loss: 0.7334 - accuracy: 0.6833 - val\_loss: 0.7677 - val\_accuracy: 0.6643

Epoch 22/35

593/593 [==============================] - 96s 163ms/step - loss: 0.7264 - accuracy: 0.6821 - val\_loss: 0.7722 - val\_accuracy: 0.6630

Epoch 23/35

593/593 [==============================] - 97s 164ms/step - loss: 0.7234 - accuracy: 0.6873 - val\_loss: 0.8043 - val\_accuracy: 0.6561

Epoch 24/35

593/593 [==============================] - 97s 163ms/step - loss: 0.7271 - accuracy: 0.6884 - val\_loss: 0.7717 - val\_accuracy: 0.6622

Epoch 25/35

593/593 [==============================] - 97s 163ms/step - loss: 0.7135 - accuracy: 0.6926 - val\_loss: 0.7746 - val\_accuracy: 0.6677

Epoch 26/35

593/593 [==============================] - 97s 163ms/step - loss: 0.7115 - accuracy: 0.6930 - val\_loss: 0.7876 - val\_accuracy: 0.6580

Epoch 27/35

593/593 [==============================] - 97s 164ms/step - loss: 0.7044 - accuracy: 0.6930 - val\_loss: 0.8004 - val\_accuracy: 0.6702

Epoch 28/35

593/593 [==============================] - 98s 165ms/step - loss: 0.7023 - accuracy: 0.6929 - val\_loss: 0.7851 - val\_accuracy: 0.6647

Epoch 29/35

593/593 [==============================] - 99s 166ms/step - loss: 0.6880 - accuracy: 0.7035 - val\_loss: 0.7761 - val\_accuracy: 0.6717

Epoch 30/35

593/593 [==============================] - 98s 166ms/step - loss: 0.6944 - accuracy: 0.6996 - val\_loss: 0.7871 - val\_accuracy: 0.6674

Epoch 31/35

593/593 [==============================] - 99s 167ms/step - loss: 0.6862 - accuracy: 0.7015 - val\_loss: 0.8103 - val\_accuracy: 0.6672

Epoch 32/35

593/593 [==============================] - 98s 165ms/step - loss: 0.6803 - accuracy: 0.7103 - val\_loss: 0.7959 - val\_accuracy: 0.6683

Epoch 33/35

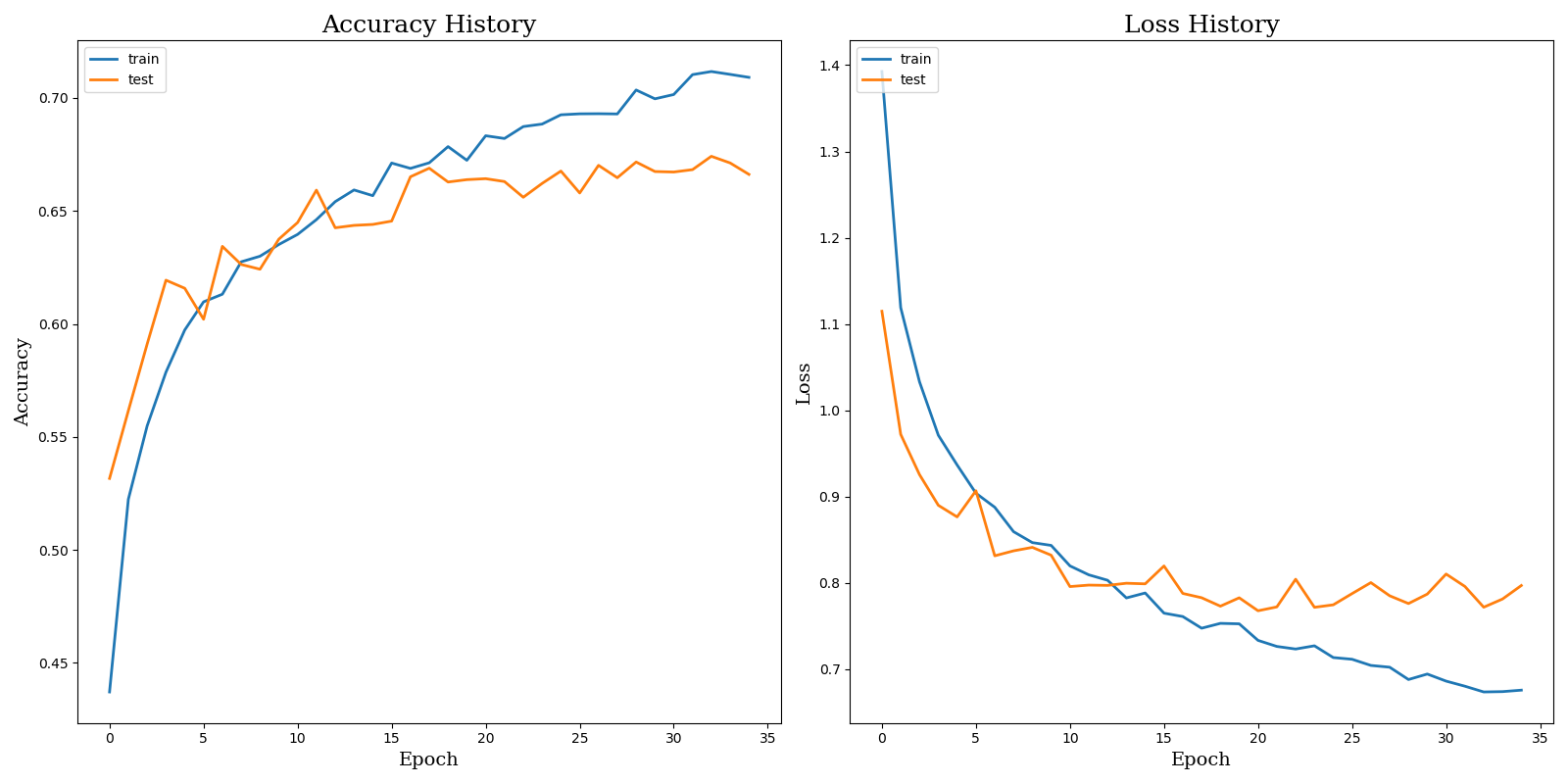
593/593 [==============================] - 98s 165ms/step - loss: 0.6737 - accuracy: 0.7117 - val\_loss: 0.7719 - val\_accuracy: 0.6742

Epoch 34/35

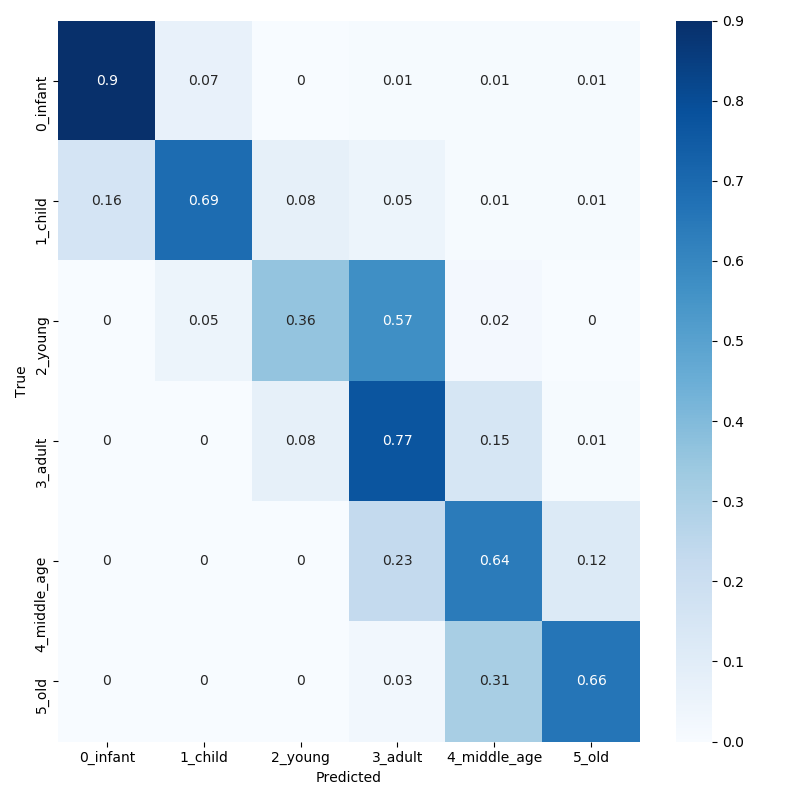
593/593 [==============================] - 99s 166ms/step - loss: 0.6741 - accuracy: 0.7104 - val\_loss: 0.7814 - val\_accuracy: 0.6712

Epoch 35/35

593/593 [==============================] - 98s 166ms/step - loss: 0.6758 - accuracy: 0.7091 - val\_loss: 0.7970 - val\_accuracy: 0.6662



## Matriz de Confusión



## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** | 0.86 | 0.90 | 0.88 | 379 |
| **1\_child** | 0.74 | 0.69 | 0.71 | 304 |
| **2\_young** | 0.63 | 0.36 | 0.46 | 845 |
| **3\_adult** | 0.67 | 0.77 | 0.71 | 1873 |
| **4\_middle\_age** | 0.55 | 0.64 | 0.60 | 862 |
| **5\_old** | 0.72 | 0.66 | 0.69 | 479 |
|  |  |  |  |  |
| **accuracy** | -- | -- | 0.67 | 4742 |
| **macro\_avg** | 0.70 | 0.67 | 0.68 | 4742 |
| **weighted\_avg** | 0.67 | 0.67 | 0.66 | 4742 |

## Observaciones

Precisión training: 0.7091

Pérdida training: 0.6758

Precisión validación/test: 0.6662

Pérdida test: 0.7970

# Model 16

## Arquitectura y configuración de hiperparámetros

## Proceso de Training

## Matriz de Confusión

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** |  |  |  |  |
| **1\_child** |  |  |  |  |
| **2\_young** |  |  |  |  |
| **3\_adult** |  |  |  |  |
| **4\_middle\_age** |  |  |  |  |
| **5\_old** |  |  |  |  |
|  |  |  |  |  |
| **accuracy** |  |  |  |  |
| **macro\_avg** |  |  |  |  |
| **weighted\_avg** |  |  |  |  |

## Observaciones

Precisión training:

Pérdida training:

Precisión validación/test:

Pérdida test:

# Model 17

## Arquitectura y configuración de hiperparámetros

## Proceso de Training

## Matriz de Confusión

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** |  |  |  |  |
| **1\_child** |  |  |  |  |
| **2\_young** |  |  |  |  |
| **3\_adult** |  |  |  |  |
| **4\_middle\_age** |  |  |  |  |
| **5\_old** |  |  |  |  |
|  |  |  |  |  |
| **accuracy** |  |  |  |  |
| **macro\_avg** |  |  |  |  |
| **weighted\_avg** |  |  |  |  |

## Observaciones

Precisión training:

Pérdida training:

Precisión validación/test:

Pérdida test:

# Model 18

## Arquitectura y configuración de hiperparámetros

## Proceso de Training

## Matriz de Confusión

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** |  |  |  |  |
| **1\_child** |  |  |  |  |
| **2\_young** |  |  |  |  |
| **3\_adult** |  |  |  |  |
| **4\_middle\_age** |  |  |  |  |
| **5\_old** |  |  |  |  |
|  |  |  |  |  |
| **accuracy** |  |  |  |  |
| **macro\_avg** |  |  |  |  |
| **weighted\_avg** |  |  |  |  |

## Observaciones

Precisión training:

Pérdida training:

Precisión validación/test:

Pérdida test:

# Model 19

## Arquitectura y configuración de hiperparámetros

## Proceso de Training

## Matriz de Confusión

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** |  |  |  |  |
| **1\_child** |  |  |  |  |
| **2\_young** |  |  |  |  |
| **3\_adult** |  |  |  |  |
| **4\_middle\_age** |  |  |  |  |
| **5\_old** |  |  |  |  |
|  |  |  |  |  |
| **accuracy** |  |  |  |  |
| **macro\_avg** |  |  |  |  |
| **weighted\_avg** |  |  |  |  |

## Observaciones

Precisión training:

Pérdida training:

Precisión validación/test:

Pérdida test:

# Model 20

## Arquitectura y configuración de hiperparámetros

## Proceso de Training

## Matriz de Confusión

## Classification Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **precision** | **recall** | **f1-score** | **support** |
| **0\_infant** |  |  |  |  |
| **1\_child** |  |  |  |  |
| **2\_young** |  |  |  |  |
| **3\_adult** |  |  |  |  |
| **4\_middle\_age** |  |  |  |  |
| **5\_old** |  |  |  |  |
|  |  |  |  |  |
| **accuracy** |  |  |  |  |
| **macro\_avg** |  |  |  |  |
| **weighted\_avg** |  |  |  |  |

## Observaciones

Precisión training:

Pérdida training:

Precisión validación/test:

Pérdida test: