Segundo Informe tarea 4 Keras

Fernando López Soriano – Redes neuronales

(b) Hacer 3 experimentos mas para intentar mejorar la eficiencia de la red. Es decir, aumenta capas o neuronas, puedes cambiar funciones de activación y optimizador. Es cuestión de tu creatividad. No usar regularización en este ejercicio. En cada experimento que hagas realiza un commit y sube el experimento a github con un comentario explicando si mejoró la eficiencia de la red o no. En el reporte explicar los experimentos y comentar su eficiencia.

Primer experimento – Aumento de capas

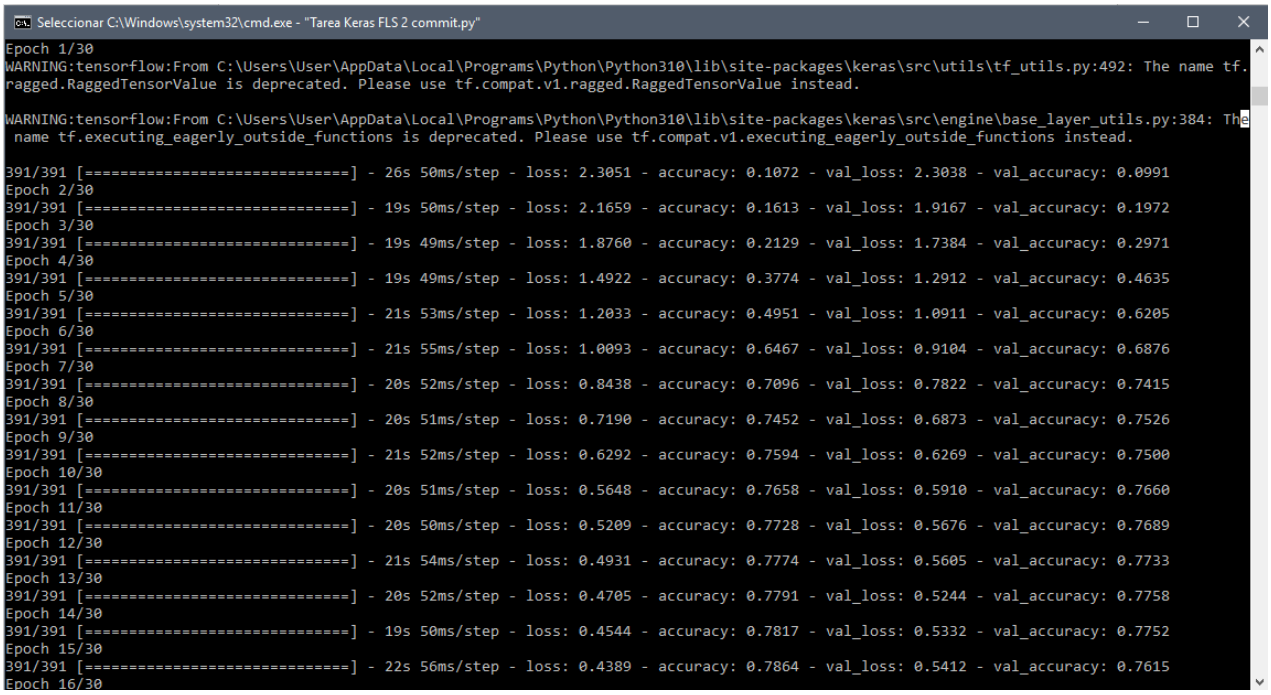
Para el primer experimento, aumentaré el número de capas de 1 a 3.

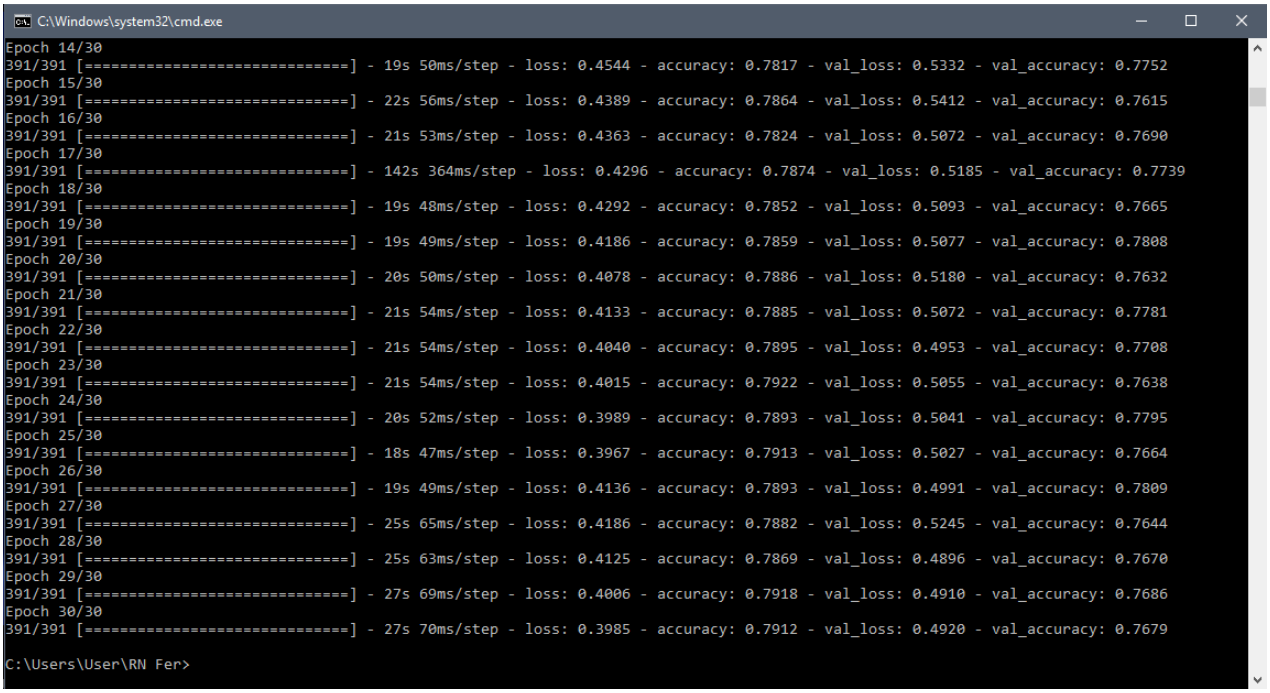
Con una densidad de 750, 250 y 100 neuronas, y continua con el mismo optimizador ADAM con el que se hizo originalmente esta nueva red.

En este primer experimento, es notable la cantidad de tiempo que tarda ahora la red, ya que pasó de un promedio de entre 6 a 7 segundos a un tiempo de 20 segundos aproximadamente, y un rendimiento considerablemente menor, tal y como se muestra en la imagen.

La exactitud de esta nueva red inicialmente es considerablemente baja, ya que comienza con un 10% aproximadamente, pero con un crecimiento considerable.

Finalmente, la exactitud de la red quedo en aprox 80%, con oscilaciones bastante presentes, quizás sea una saturación de la red, o lo más seguro es que no terminé de comprender cómo colocar correctamente las capas extra a la red.


Seleccionar C:\Windows\system32\cmd.exe - "Tarea Keras FLS 2 commit.py"
Epoch 1/30
WARNING:tensorflow:From C:\Users\User\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\src\utils\tf_utils.py:492: The name tf.ragged.RaggedTensorValue is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.
WARNING:tensorflow:From C:\Users\User\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\src\engine\base_layer_utils.py:384: The name tf.executing_eagerly_outside_functions is deprecated. Please use tf.compat.v1.executing_eagerly_outside_functions instead.
391/391 [==========] - 26s 50ms/step - loss: 2.3051 - accuracy: 0.1072 - val_loss: 2.3038 - val_accuracy: 0.0991
Epoch 2/30
391/391 [==========] - 19s 50ms/step - loss: 2.1659 - accuracy: 0.1613 - val_loss: 1.9167 - val_accuracy: 0.1972
Epoch 3/30
391/391 [==========] - 19s 49ms/step - loss: 1.8760 - accuracy: 0.2129 - val_loss: 1.7384 - val_accuracy: 0.2971
Epoch 4/30
391/391 [==========] - 19s 49ms/step - loss: 1.4922 - accuracy: 0.3774 - val_loss: 1.2912 - val_accuracy: 0.4635
Epoch 5/30
391/391 [==========] - 21s 53ms/step - loss: 1.2033 - accuracy: 0.4951 - val_loss: 1.0911 - val_accuracy: 0.6205
Epoch 6/30
391/391 [==========] - 21s 55ms/step - loss: 1.0093 - accuracy: 0.6467 - val_loss: 0.9104 - val_accuracy: 0.6876
Epoch 7/30
391/391 [==========] - 20s 52ms/step - loss: 0.8438 - accuracy: 0.7096 - val_loss: 0.7822 - val_accuracy: 0.7415
Epoch 8/30
391/391 [==========] - 20s 51ms/step - loss: 0.7190 - accuracy: 0.7452 - val_loss: 0.6873 - val_accuracy: 0.7526
Epoch 9/30
391/391 [==========] - 21s 52ms/step - loss: 0.6292 - accuracy: 0.7594 - val_loss: 0.6269 - val_accuracy: 0.7500
Epoch 10/30
391/391 [==========] - 20s 51ms/step - loss: 0.5648 - accuracy: 0.7658 - val_loss: 0.5910 - val_accuracy: 0.7660
Epoch 11/30
391/391 [==========] - 20s 50ms/step - loss: 0.5209 - accuracy: 0.7728 - val_loss: 0.5676 - val_accuracy: 0.7689
Epoch 12/30
391/391 [==========] - 21s 54ms/step - loss: 0.4931 - accuracy: 0.7774 - val_loss: 0.5605 - val_accuracy: 0.7733
Epoch 13/30
391/391 [==========] - 20s 52ms/step - loss: 0.4705 - accuracy: 0.7791 - val_loss: 0.5244 - val_accuracy: 0.7758
Epoch 14/30
391/391 [==========] - 19s 50ms/step - loss: 0.4544 - accuracy: 0.7817 - val_loss: 0.5332 - val_accuracy: 0.7752
Epoch 15/30
391/391 [==========] - 22s 56ms/step - loss: 0.4389 - accuracy: 0.7864 - val_loss: 0.5412 - val_accuracy: 0.7615
Epoch 16/30

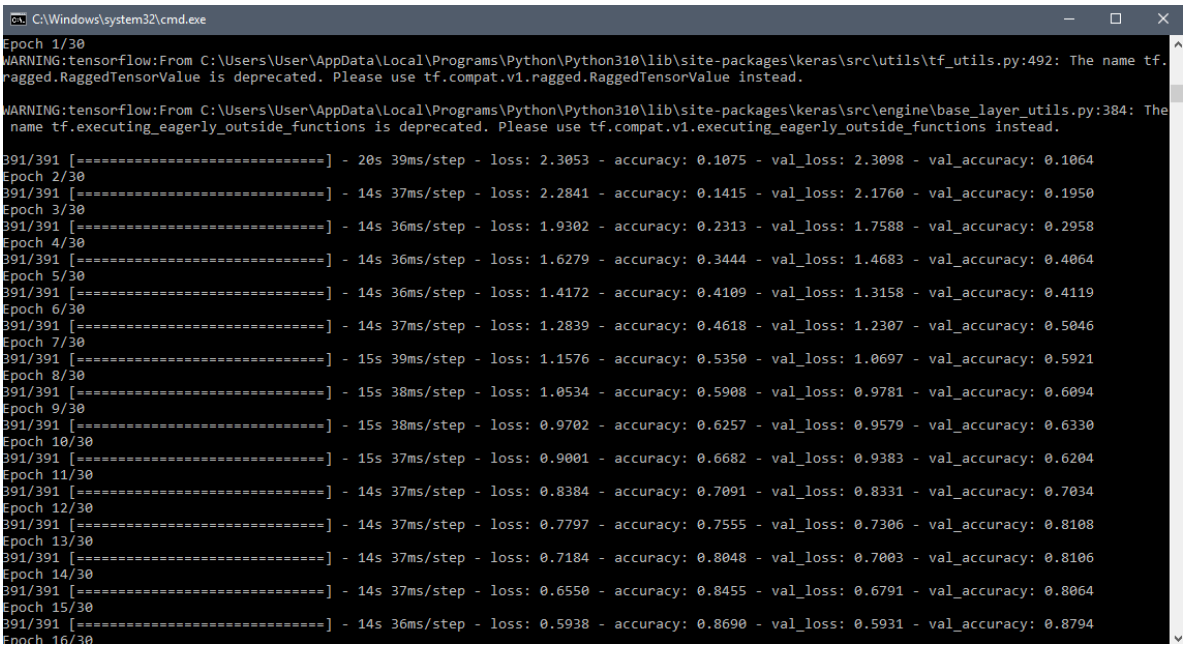

C:\Windows\system32\cmd.exe
Epoch 14/30
391/391 [==========] - 19s 50ms/step - loss: 0.4544 - accuracy: 0.7817 - val_loss: 0.5332 - val_accuracy: 0.7752
Epoch 15/30
391/391 [==========] - 22s 56ms/step - loss: 0.4389 - accuracy: 0.7864 - val_loss: 0.5412 - val_accuracy: 0.7615
Epoch 16/30
391/391 [==========] - 21s 53ms/step - loss: 0.4363 - accuracy: 0.7824 - val_loss: 0.5072 - val_accuracy: 0.7690
Epoch 17/30
391/391 [==========] - 142s 364ms/step - loss: 0.4296 - accuracy: 0.7874 - val_loss: 0.5185 - val_accuracy: 0.7739
Epoch 18/30
391/391 [==========] - 19s 48ms/step - loss: 0.4292 - accuracy: 0.7852 - val_loss: 0.5093 - val_accuracy: 0.7665
Epoch 19/30
391/391 [==========] - 19s 49ms/step - loss: 0.4186 - accuracy: 0.7859 - val_loss: 0.5077 - val_accuracy: 0.7808
Epoch 20/30
391/391 [==========] - 20s 50ms/step - loss: 0.4078 - accuracy: 0.7886 - val_loss: 0.5180 - val_accuracy: 0.7632
Epoch 21/30
391/391 [==========] - 21s 54ms/step - loss: 0.4133 - accuracy: 0.7885 - val_loss: 0.5072 - val_accuracy: 0.7781
Epoch 22/30
391/391 [==========] - 21s 54ms/step - loss: 0.4040 - accuracy: 0.7895 - val_loss: 0.4953 - val_accuracy: 0.7708
Epoch 23/30
391/391 [==========] - 21s 54ms/step - loss: 0.4015 - accuracy: 0.7922 - val_loss: 0.5055 - val_accuracy: 0.7638
Epoch 24/30
391/391 [==========] - 20s 52ms/step - loss: 0.3989 - accuracy: 0.7893 - val_loss: 0.5041 - val_accuracy: 0.7795
Epoch 25/30
391/391 [==========] - 18s 47ms/step - loss: 0.3967 - accuracy: 0.7913 - val_loss: 0.5027 - val_accuracy: 0.7664
Epoch 26/30
391/391 [==========] - 19s 49ms/step - loss: 0.4136 - accuracy: 0.7893 - val_loss: 0.4991 - val_accuracy: 0.7809
Epoch 27/30
391/391 [==========] - 25s 65ms/step - loss: 0.4186 - accuracy: 0.7882 - val_loss: 0.5245 - val_accuracy: 0.7644
Epoch 28/30
391/391 [==========] - 25s 63ms/step - loss: 0.4125 - accuracy: 0.7869 - val_loss: 0.4896 - val_accuracy: 0.7670
Epoch 29/30
391/391 [==========] - 27s 69ms/step - loss: 0.4006 - accuracy: 0.7918 - val_loss: 0.4910 - val_accuracy: 0.7686
Epoch 30/30
391/391 [==========] - 27s 70ms/step - loss: 0.3985 - accuracy: 0.7912 - val_loss: 0.4920 - val_accuracy: 0.7679
C:\Users\User\RN Fer>

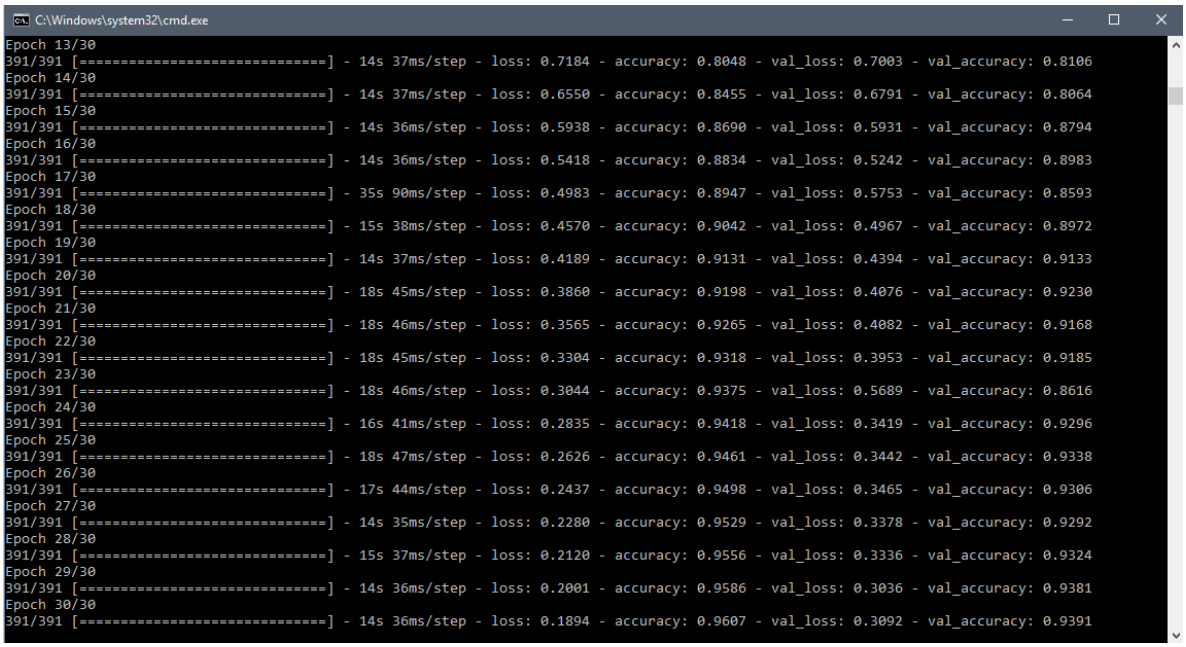
Segundo experimento – Dos capas de neuronas y cambio de optimizador

Para el segundo experimento bajé la cantidad de capas a 2 y opté por cambiar el optimizador de ADAM a RMSprop.

Para la primera capa la dejé con 250 neuronas y una de 100 neuronas, optimizador RMSprop.

Al igual que el anterior, empieza muy bajo, con apenas el 10% de aciertos, sin embargo, crece mejor manera, para que al final en de las epocas 20´s, se pueda ver un acierto del 96% con apenas el doble del tiempo que la red original, os ea un promedio de 14 segundos y 6 segundos menos de lo mostrado en la anterior de 3 capas.


C:\Windows\system32\cmd.exe
Epoch 1/30
WARNING:tensorflow:From C:\Users\User\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\src\utils\tf_utils.py:492: The name tf.ragged.RaggedTensorValue is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.
WARNING:tensorflow:From C:\Users\User\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\src\engine\base_layer_utils.py:384: The name tf.executing_eagerly_outside_functions is deprecated. Please use tf.compat.v1.executing_eagerly_outside_functions instead.
391/391 [==============================] - 20s 39ms/step - loss: 2.3053 - accuracy: 0.1075 - val_loss: 2.3098 - val_accuracy: 0.1064
Epoch 2/30
391/391 [==============================] - 14s 37ms/step - loss: 2.2841 - accuracy: 0.1415 - val_loss: 2.1760 - val_accuracy: 0.1950
Epoch 3/30
391/391 [==============================] - 14s 36ms/step - loss: 1.9302 - accuracy: 0.2313 - val_loss: 1.7588 - val_accuracy: 0.2958
Epoch 4/30
391/391 [==============================] - 14s 36ms/step - loss: 1.6279 - accuracy: 0.3444 - val_loss: 1.4683 - val_accuracy: 0.4064
Epoch 5/30
391/391 [==============================] - 14s 36ms/step - loss: 1.4172 - accuracy: 0.4109 - val_loss: 1.3158 - val_accuracy: 0.4119
Epoch 6/30
391/391 [==============================] - 14s 37ms/step - loss: 1.2839 - accuracy: 0.4618 - val_loss: 1.2307 - val_accuracy: 0.5046
Epoch 7/30
391/391 [==============================] - 15s 39ms/step - loss: 1.1576 - accuracy: 0.5350 - val_loss: 1.0697 - val_accuracy: 0.5921
Epoch 8/30
391/391 [==============================] - 15s 38ms/step - loss: 1.0534 - accuracy: 0.5908 - val_loss: 0.9781 - val_accuracy: 0.6094
Epoch 9/30
391/391 [==============================] - 15s 38ms/step - loss: 0.9702 - accuracy: 0.6257 - val_loss: 0.9579 - val_accuracy: 0.6330
Epoch 10/30
391/391 [==============================] - 15s 37ms/step - loss: 0.9001 - accuracy: 0.6682 - val_loss: 0.9383 - val_accuracy: 0.6204
Epoch 11/30
391/391 [==============================] - 14s 37ms/step - loss: 0.8384 - accuracy: 0.7091 - val_loss: 0.8331 - val_accuracy: 0.7034
Epoch 12/30
391/391 [==============================] - 14s 37ms/step - loss: 0.7797 - accuracy: 0.7555 - val_loss: 0.7306 - val_accuracy: 0.8108
Epoch 13/30
391/391 [==============================] - 14s 37ms/step - loss: 0.7184 - accuracy: 0.8048 - val_loss: 0.7003 - val_accuracy: 0.8106
Epoch 14/30
391/391 [==============================] - 14s 37ms/step - loss: 0.6550 - accuracy: 0.8455 - val_loss: 0.6791 - val_accuracy: 0.8064
Epoch 15/30
391/391 [==============================] - 14s 36ms/step - loss: 0.5938 - accuracy: 0.8690 - val_loss: 0.5931 - val_accuracy: 0.8794
Epoch 16/30

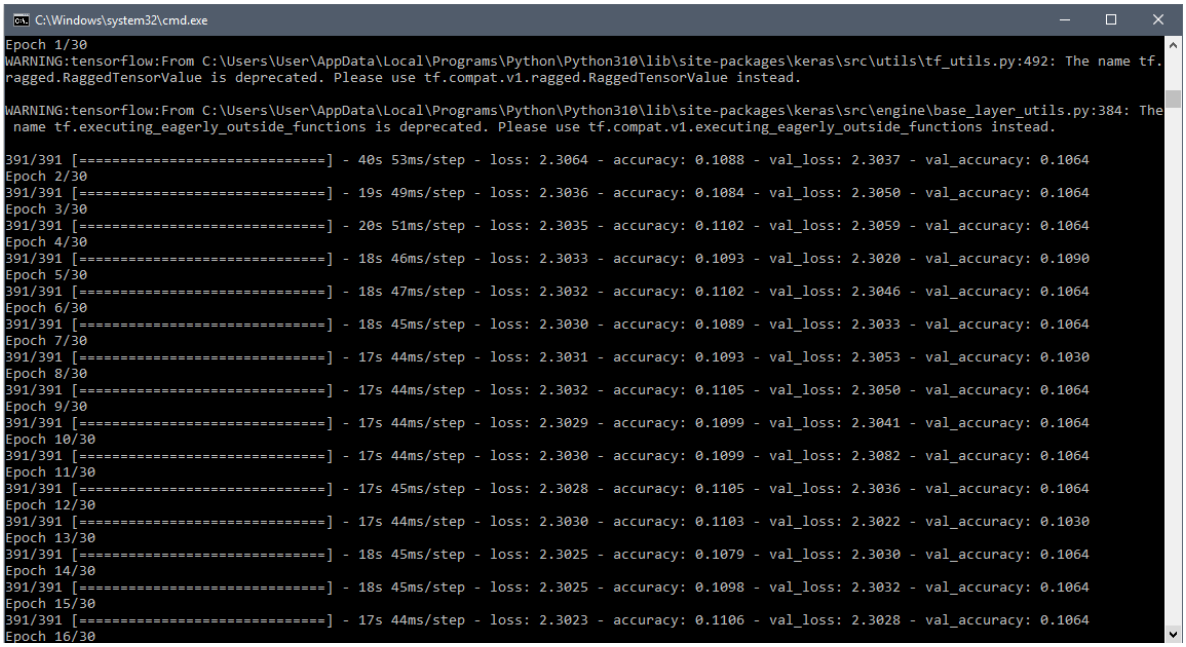

C:\Windows\system32\cmd.exe
Epoch 13/30
391/391 [==============================] - 14s 37ms/step - loss: 0.7184 - accuracy: 0.8048 - val_loss: 0.7003 - val_accuracy: 0.8106
Epoch 14/30
391/391 [==============================] - 14s 37ms/step - loss: 0.6550 - accuracy: 0.8455 - val_loss: 0.6791 - val_accuracy: 0.8064
Epoch 15/30
391/391 [==============================] - 14s 36ms/step - loss: 0.5938 - accuracy: 0.8690 - val_loss: 0.5931 - val_accuracy: 0.8794
Epoch 16/30
391/391 [==============================] - 14s 36ms/step - loss: 0.5418 - accuracy: 0.8834 - val_loss: 0.5242 - val_accuracy: 0.8983
Epoch 17/30
391/391 [==============================] - 35s 90ms/step - loss: 0.4983 - accuracy: 0.8947 - val_loss: 0.5753 - val_accuracy: 0.8593
Epoch 18/30
391/391 [==============================] - 15s 38ms/step - loss: 0.4570 - accuracy: 0.9042 - val_loss: 0.4967 - val_accuracy: 0.8972
Epoch 19/30
391/391 [==============================] - 14s 37ms/step - loss: 0.4189 - accuracy: 0.9131 - val_loss: 0.4394 - val_accuracy: 0.9133
Epoch 20/30
391/391 [==============================] - 18s 45ms/step - loss: 0.3860 - accuracy: 0.9198 - val_loss: 0.4076 - val_accuracy: 0.9230
Epoch 21/30
391/391 [==============================] - 18s 46ms/step - loss: 0.3565 - accuracy: 0.9265 - val_loss: 0.4082 - val_accuracy: 0.9168
Epoch 22/30
391/391 [==============================] - 18s 45ms/step - loss: 0.3304 - accuracy: 0.9318 - val_loss: 0.3953 - val_accuracy: 0.9185
Epoch 23/30
391/391 [==============================] - 18s 46ms/step - loss: 0.3044 - accuracy: 0.9375 - val_loss: 0.5689 - val_accuracy: 0.8616
Epoch 24/30
391/391 [==============================] - 16s 41ms/step - loss: 0.2835 - accuracy: 0.9418 - val_loss: 0.3419 - val_accuracy: 0.9296
Epoch 25/30
391/391 [==============================] - 18s 47ms/step - loss: 0.2626 - accuracy: 0.9461 - val_loss: 0.3442 - val_accuracy: 0.9338
Epoch 26/30
391/391 [==============================] - 17s 44ms/step - loss: 0.2437 - accuracy: 0.9498 - val_loss: 0.3465 - val_accuracy: 0.9306
Epoch 27/30
391/391 [==============================] - 14s 35ms/step - loss: 0.2280 - accuracy: 0.9529 - val_loss: 0.3378 - val_accuracy: 0.9292
Epoch 28/30
391/391 [==============================] - 15s 37ms/step - loss: 0.2120 - accuracy: 0.9556 - val_loss: 0.3336 - val_accuracy: 0.9324
Epoch 29/30
391/391 [==============================] - 14s 36ms/step - loss: 0.2001 - accuracy: 0.9586 - val_loss: 0.3036 - val_accuracy: 0.9381
Epoch 30/30
391/391 [==============================] - 14s 36ms/step - loss: 0.1894 - accuracy: 0.9607 - val_loss: 0.3092 - val_accuracy: 0.9391

Tercer experimento – Cambio de optimizador y aumento a 4 capas de neuronas.

Para el tercer experimento, cambié el optimizador a NADAM, que entiendo es una mezcla de ADAM y RMSprop, que debería acelerar considerablemente la implementación de ADAM.

Se aplicaron 4 capas de neuronas, la primera de 500, la segunda de 250, la tercera de 100 y la última de 50.

Honestamente, no sé qué esperar de esta nueva configuración o siquiera si correrá…

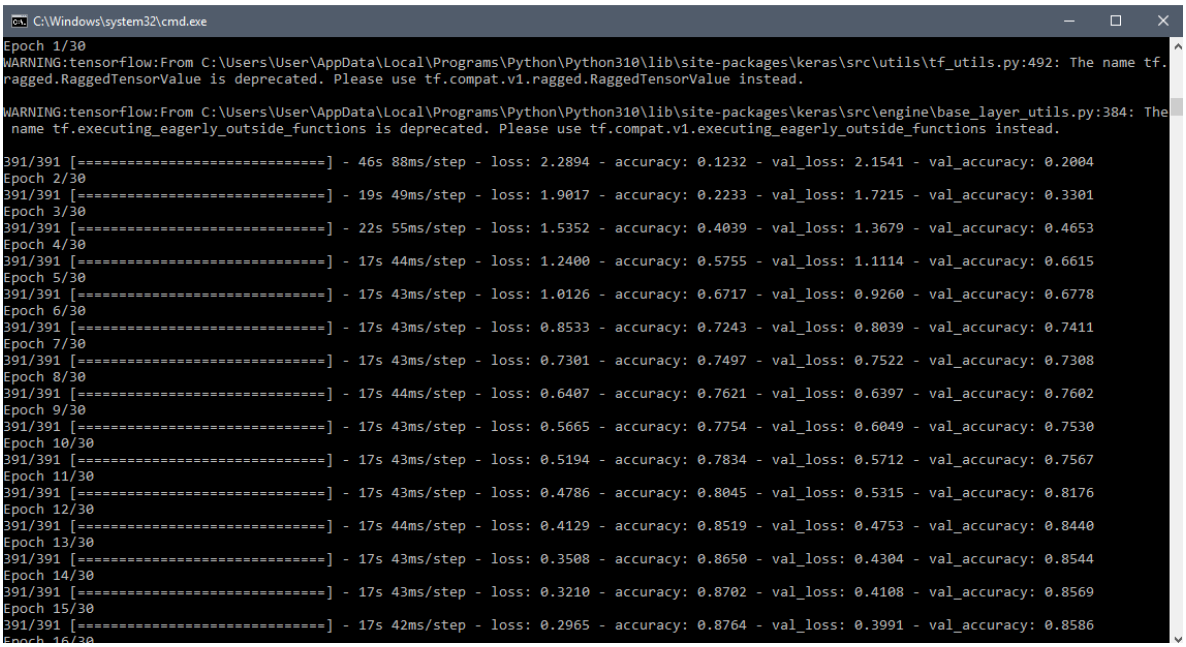


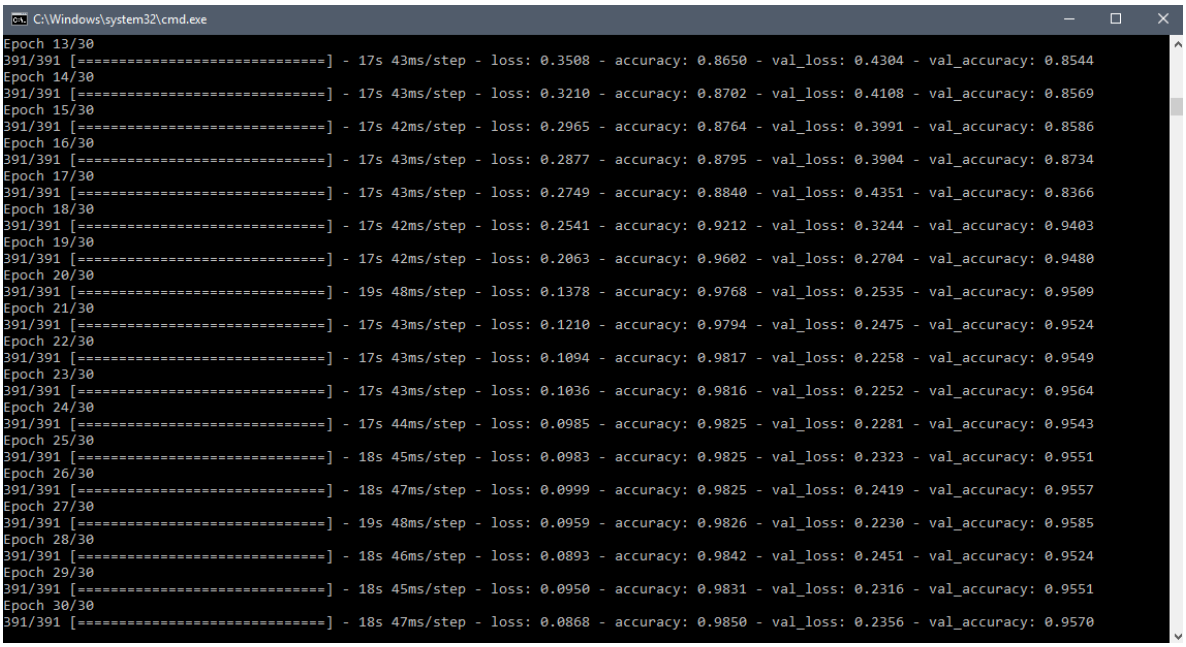
Corrió, pero no funcionó JAJAJA, bajaré la cantidad de capas, quizás sea eso…

Borré la última capa de la red (50 neuronas), y me sorprendió lo bien que resultó.

Para ser de 3 capas, esta red mejoró mucho en comparación a la rmsprop, que tardó mucho y no daba buenos resultados, el nadam mostró un buen rendimiento y con tiempos promedio de 17 segundos, claramente mejor a los 20 segundos que tomaba en el rmsprop.

También hay una mejora significativa en aciertos, ya que ahora tenemos un crecimiento en aprendizaje y en exactitud de los datos.


C:\Windows\system32\cmd.exe
Epoch 1/30
WARNING:tensorflow:From C:\Users\User\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\src\utils\tf_utils.py:492: The name tf.ragged.RaggedTensorValue is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.
WARNING:tensorflow:From C:\Users\User\AppData\Local\Programs\Python\Python310\lib\site-packages\keras\src\engine\base_layer_utils.py:384: The name tf.executing_eagerly_outside_functions is deprecated. Please use tf.compat.v1.executing_eagerly_outside_functions instead.
391/391 [==============================] - 46s 88ms/step - loss: 2.2894 - accuracy: 0.1232 - val_loss: 2.1541 - val_accuracy: 0.2004
Epoch 2/30
391/391 [==============================] - 19s 49ms/step - loss: 1.9017 - accuracy: 0.2233 - val_loss: 1.7215 - val_accuracy: 0.3301
Epoch 3/30
391/391 [==============================] - 22s 55ms/step - loss: 1.5352 - accuracy: 0.4039 - val_loss: 1.3679 - val_accuracy: 0.4653
Epoch 4/30
391/391 [==============================] - 17s 44ms/step - loss: 1.2400 - accuracy: 0.5755 - val_loss: 1.1114 - val_accuracy: 0.6615
Epoch 5/30
391/391 [==============================] - 17s 43ms/step - loss: 1.0126 - accuracy: 0.6717 - val_loss: 0.9260 - val_accuracy: 0.6778
Epoch 6/30
391/391 [==============================] - 17s 43ms/step - loss: 0.8533 - accuracy: 0.7243 - val_loss: 0.8039 - val_accuracy: 0.7411
Epoch 7/30
391/391 [==============================] - 17s 43ms/step - loss: 0.7301 - accuracy: 0.7497 - val_loss: 0.7522 - val_accuracy: 0.7308
Epoch 8/30
391/391 [==============================] - 17s 44ms/step - loss: 0.6407 - accuracy: 0.7621 - val_loss: 0.6397 - val_accuracy: 0.7602
Epoch 9/30
391/391 [==============================] - 17s 43ms/step - loss: 0.5665 - accuracy: 0.7754 - val_loss: 0.6049 - val_accuracy: 0.7530
Epoch 10/30
391/391 [==============================] - 17s 43ms/step - loss: 0.5194 - accuracy: 0.7834 - val_loss: 0.5712 - val_accuracy: 0.7567
Epoch 11/30
391/391 [==============================] - 17s 43ms/step - loss: 0.4786 - accuracy: 0.8045 - val_loss: 0.5315 - val_accuracy: 0.8176
Epoch 12/30
391/391 [==============================] - 17s 44ms/step - loss: 0.4129 - accuracy: 0.8519 - val_loss: 0.4753 - val_accuracy: 0.8440
Epoch 13/30
391/391 [==============================] - 17s 43ms/step - loss: 0.3508 - accuracy: 0.8650 - val_loss: 0.4304 - val_accuracy: 0.8544
Epoch 14/30
391/391 [==============================] - 17s 43ms/step - loss: 0.3210 - accuracy: 0.8702 - val_loss: 0.4108 - val_accuracy: 0.8569
Epoch 15/30
391/391 [==============================] - 17s 42ms/step - loss: 0.2965 - accuracy: 0.8764 - val_loss: 0.3991 - val_accuracy: 0.8586


C:\Windows\system32\cmd.exe
Epoch 13/30
391/391 [==============================] - 17s 43ms/step - loss: 0.3508 - accuracy: 0.8650 - val_loss: 0.4304 - val_accuracy: 0.8544
Epoch 14/30
391/391 [==============================] - 17s 43ms/step - loss: 0.3210 - accuracy: 0.8702 - val_loss: 0.4108 - val_accuracy: 0.8569
Epoch 15/30
391/391 [==============================] - 17s 42ms/step - loss: 0.2965 - accuracy: 0.8764 - val_loss: 0.3991 - val_accuracy: 0.8586
Epoch 16/30
391/391 [==============================] - 17s 43ms/step - loss: 0.2877 - accuracy: 0.8795 - val_loss: 0.3904 - val_accuracy: 0.8734
Epoch 17/30
391/391 [==============================] - 17s 43ms/step - loss: 0.2749 - accuracy: 0.8840 - val_loss: 0.4351 - val_accuracy: 0.8366
Epoch 18/30
391/391 [==============================] - 17s 42ms/step - loss: 0.2541 - accuracy: 0.9212 - val_loss: 0.3244 - val_accuracy: 0.9403
Epoch 19/30
391/391 [==============================] - 17s 42ms/step - loss: 0.2063 - accuracy: 0.9602 - val_loss: 0.2704 - val_accuracy: 0.9480
Epoch 20/30
391/391 [==============================] - 19s 48ms/step - loss: 0.1378 - accuracy: 0.9768 - val_loss: 0.2535 - val_accuracy: 0.9509
Epoch 21/30
391/391 [==============================] - 17s 43ms/step - loss: 0.1210 - accuracy: 0.9794 - val_loss: 0.2475 - val_accuracy: 0.9524
Epoch 22/30
391/391 [==============================] - 17s 43ms/step - loss: 0.1094 - accuracy: 0.9817 - val_loss: 0.2258 - val_accuracy: 0.9549
Epoch 23/30
391/391 [==============================] - 17s 43ms/step - loss: 0.1036 - accuracy: 0.9816 - val_loss: 0.2252 - val_accuracy: 0.9564
Epoch 24/30
391/391 [==============================] - 17s 44ms/step - loss: 0.0985 - accuracy: 0.9825 - val_loss: 0.2281 - val_accuracy: 0.9543
Epoch 25/30
391/391 [==============================] - 18s 45ms/step - loss: 0.0983 - accuracy: 0.9825 - val_loss: 0.2323 - val_accuracy: 0.9551
Epoch 26/30
391/391 [==============================] - 18s 47ms/step - loss: 0.0999 - accuracy: 0.9825 - val_loss: 0.2419 - val_accuracy: 0.9557
Epoch 27/30
391/391 [==============================] - 19s 48ms/step - loss: 0.0959 - accuracy: 0.9826 - val_loss: 0.2230 - val_accuracy: 0.9585
Epoch 28/30
391/391 [==============================] - 18s 46ms/step - loss: 0.0893 - accuracy: 0.9842 - val_loss: 0.2451 - val_accuracy: 0.9524
Epoch 29/30
391/391 [==============================] - 18s 45ms/step - loss: 0.0950 - accuracy: 0.9831 - val_loss: 0.2316 - val_accuracy: 0.9551
Epoch 30/30
391/391 [==============================] - 18s 47ms/step - loss: 0.0868 - accuracy: 0.9850 - val_loss: 0.2356 - val_accuracy: 0.9570