Laboratorio 4

Laboratorio: Mejorando el Análisis de Sentimientos con LSTM y Características Adicionales

- Objetivo: Incrementar la precisión en el análisis de sentimientos sobre las críticas de películas utilizando RNNs con unidades LSTM y la incorporación de características (features) adicionales.

Integrantes

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- Gabriel Vicente

1. Importación y Pre-procesamiento (30 puntos)

• Correcta importación del conjunto de datos con 50,000 palabras más frecuentes: 10 puntos.
• Secuenciación y relleno de las críticas: 10 puntos.
• Extracción y adecuada justificación de características adicionales: 10 puntos.

In [ ]:
```
!pip install tensorflow
```

```
Collecting tensorflow
  Obtaining dependency information for tensorflow from https://files.pythonhosted.or
g/packages/1b/66/2f47c39cfedb29188d82555d0184a619a0bf8234fd5e5301940efb0aa464/tensor
flow-2.13.0-cp39-cp39-win_amd64.whl.metadata
  Using cached tensorflow-2.13.0-cp39-cp39-win_amd64.whl.metadata (2.6 kB)
Collecting tensorflow-intel==2.13.0 (from tensorflow)
  Obtaining dependency information for tensorflow-intel==2.13.0 from https://files.p
ythonhosted.org/packages/2b/ad/d3a2e335004d178e0599cf8aff6c2a92cd21eb9789358fb8f3f95
1009930/tensorflow_intel-2.13.0-cp39-cp39-win_amd64.whl.metadata
  Using cached tensorflow_intel-2.13.0-cp39-cp39-win_amd64.whl.metadata (4.1 kB)
Collecting absl-py>=1.0.0 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for absl-py>=1.0.0 from https://files.pythonhoste
d.org/packages/01/e4/dc0a1dcc4e74e08d7abedab278c795eef54a224363bb18f5692f416d834f/ab
sl_py-2.0.0-py3-none-any.whl.metadata
  Downloading absl_py-2.0.0-py3-none-any.whl.metadata (2.3 kB)
Collecting astunparse>=1.6.0 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached astunparse-1.6.3-py2.py3-none-any.whl (12 kB)
Collecting flatbuffers>=23.1.21 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for flatbuffers>=23.1.21 from https://files.pytho
nhosted.org/packages/6f/12/d5c79ee252793ffe845d58a913197bfa02ae9a0b5c9bc3dc4b58d477b
9e7/flatbuffers-23.5.26-py2.py3-none-any.whl.metadata
  Using cached flatbuffers-23.5.26-py2.py3-none-any.whl.metadata (850 bytes)
Collecting gast<=0.4.0,>=0.2.1 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached gast-0.4.0-py3-none-any.whl (9.8 kB)
Collecting google-pasta>=0.1.1 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached google_pasta-0.2.0-py3-none-any.whl (57 kB)
Collecting h5py>=2.9.0 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for h5py>=2.9.0 from https://files.pythonhosted.o
rg/packages/a0/62/9790f98aa125a035cda91be7a41a46bdc76b26ffdd2ad2d3c5b7f7232946/h5py-
3.9.0-cp39-cp39-win_amd64.whl.metadata
  Using cached h5py-3.9.0-cp39-cp39-win_amd64.whl.metadata (2.5 kB)
Collecting libclang>=13.0.0 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for libclang>=13.0.0 from https://files.pythonhos
ted.org/packages/02/8c/dc970bc00867fe290e8c8a7befa1635af716a9ebdfe3fb9dce0ca4b522ce/
libclang-16.0.6-py2.py3-none-win_amd64.whl.metadata
  Using cached libclang-16.0.6-py2.py3-none-win_amd64.whl.metadata (5.3 kB)
Collecting numpy<=1.24.3,>=1.22 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached numpy-1.24.3-cp39-cp39-win_amd64.whl (14.9 MB)
Collecting opt-einsum>=2.3.2 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached opt_einsum-3.3.0-py3-none-any.whl (65 kB)
Requirement already satisfied: packaging in c:\users\andre\onedrive\documentos\githu
b\cc3084_laboratorio4\.venv\lib\site-packages (from tensorflow-intel==2.13.0->tensor
flow) (23.1)
Collecting protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0dev,>
=3.20.3 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!
=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 from https://files.pythonhosted.org/packages/ad/
6d/6cc9491378d35f10b133b2677027eb08e97ca4b5c53edf6342fe8cf58d38/protobuf-4.24.3-cp39
-cp39-win_amd64.whl.metadata
  Downloading protobuf-4.24.3-cp39-cp39-win_amd64.whl.metadata (540 bytes)
Requirement already satisfied: setuptools in c:\users\andre\onedrive\documentos\gith
ub\cc3084_laboratorio4\.venv\lib\site-packages (from tensorflow-intel==2.13.0->tenso
rflow) (58.1.0)
Requirement already satisfied: six>=1.12.0 in c:\users\andre\onedrive\documentos\git
hub\cc3084_laboratorio4\.venv\lib\site-packages (from tensorflow-intel==2.13.0->tens
orflow) (1.16.0)
```

```
Collecting termcolor>=1.1.0 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached termcolor-2.3.0-py3-none-any.whl (6.9 kB)
Collecting typing-extensions<4.6.0,>=3.6.6 (from tensorflow-intel==2.13.0->tensorflo
w)
  Using cached typing_extensions-4.5.0-py3-none-any.whl (27 kB)
Collecting wrapt>=1.11.0 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached wrapt-1.15.0-cp39-cp39-win_amd64.whl (36 kB)
Collecting grpcio<2.0,>=1.24.3 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for grpcio<2.0,>=1.24.3 from https://files.python
hosted.org/packages/f3/b5/f4c2f0495007a955953d88119c428e4b14868caba2db585382e3407407
5f/grpcio-1.58.0-cp39-cp39-win_amd64.whl.metadata
  Downloading grpcio-1.58.0-cp39-cp39-win_amd64.whl.metadata (4.1 kB)
Collecting tensorboard<2.14,>=2.13 (from tensorflow-intel==2.13.0->tensorflow)
  Using cached tensorboard-2.13.0-py3-none-any.whl (5.6 MB)
Collecting tensorflow-estimator<2.14,>=2.13.0 (from tensorflow-intel==2.13.0->tensor
flow)
  Obtaining dependency information for tensorflow-estimator<2.14,>=2.13.0 from http
s://files.pythonhosted.org/packages/72/5c/c318268d96791c6222ad7df1651bbd1b2409139afe
b6f468c0f327177016/tensorflow_estimator-2.13.0-py2.py3-none-any.whl.metadata
  Using cached tensorflow_estimator-2.13.0-py2.py3-none-any.whl.metadata (1.3 kB)
Collecting keras<2.14,>=2.13.1 (from tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for keras<2.14,>=2.13.1 from https://files.python
hosted.org/packages/2e/f3/19da7511b45e80216cbbd9467137b2d28919c58ba1ccb971435cb631e4
70/keras-2.13.1-py3-none-any.whl.metadata
  Using cached keras-2.13.1-py3-none-any.whl.metadata (2.4 kB)
Collecting tensorflow-io-gcs-filesystem>=0.23.1 (from tensorflow-intel==2.13.0->tens
orflow)
  Using cached tensorflow_io_gcs_filesystem-0.31.0-cp39-cp39-win_amd64.whl (1.5 MB)
Collecting wheel<1.0,>=0.23.0 (from astunparse>=1.6.0->tensorflow-intel==2.13.0->ten
sorflow)
  Obtaining dependency information for wheel<1.0,>=0.23.0 from https://files.pythonh
osted.org/packages/b8/8b/31273bf66016be6ad22bb7345c37ff350276cfd46e389a0c2ac5da9d907
3/wheel-0.41.2-py3-none-any.whl.metadata
  Using cached wheel-0.41.2-py3-none-any.whl.metadata (2.2 kB)
Collecting google-auth<3,>=1.6.3 (from tensorboard<2.14,>=2.13->tensorflow-intel==2.
13.0->tensorflow)
  Obtaining dependency information for google-auth<3,>=1.6.3 from https://files.pyth
onhosted.org/packages/9d/44/5a992cb9d7bf8aaae73bc5adaf721ad08731c9d00c1c17999a869140
4b0c/google_auth-2.23.0-py2.py3-none-any.whl.metadata
  Downloading google_auth-2.23.0-py2.py3-none-any.whl.metadata (4.2 kB)
Collecting google-auth-oauthlib<1.1,>=0.5 (from tensorboard<2.14,>=2.13->tensorflow-
intel==2.13.0->tensorflow)
  Using cached google_auth_oauthlib-1.0.0-py2.py3-none-any.whl (18 kB)
Collecting markdown>=2.6.8 (from tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->
tensorflow)
  Obtaining dependency information for markdown>=2.6.8 from https://files.pythonhost
ed.org/packages/1a/b5/228c1cdcfe138f1a8e01ab1b54284c8b83735476cb22b6ba251656ed13ad/M
arkdown-3.4.4-py3-none-any.whl.metadata
  Using cached Markdown-3.4.4-py3-none-any.whl.metadata (6.9 kB)
Collecting requests<3,>=2.21.0 (from tensorboard<2.14,>=2.13->tensorflow-intel==2.1
3.0->tensorflow)
  Obtaining dependency information for requests<3,>=2.21.0 from https://files.python
hosted.org/packages/70/8e/0e2d847013cb52cd35b38c009bb167a1a26b2ce6cd6965bf26b47bc0bf
44/requests-2.31.0-py3-none-any.whl.metadata
  Using cached requests-2.31.0-py3-none-any.whl.metadata (4.6 kB)
Collecting tensorboard-data-server<0.8.0,>=0.7.0 (from tensorboard<2.14,>=2.13->tens
```

```
orflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for tensorboard-data-server<0.8.0,>=0.7.0 from ht
tps://files.pythonhosted.org/packages/da/61/6e9ff8258422d287eec718872fb71e0532435672
2ab658c8afda25f51539/tensorboard_data_server-0.7.1-py3-none-any.whl.metadata
  Using cached tensorboard_data_server-0.7.1-py3-none-any.whl.metadata (1.1 kB)
Collecting werkzeug>=1.0.1 (from tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->
tensorflow)
  Obtaining dependency information for werkzeug>=1.0.1 from https://files.pythonhost
ed.org/packages/9b/59/a7c32e3d8d0e546a206e0552a2c04444544f15c1da4a01df8938d20c6ffc/w
erkzeug-2.3.7-py3-none-any.whl.metadata
  Using cached werkzeug-2.3.7-py3-none-any.whl.metadata (4.1 kB)
Collecting cachetools<6.0,>=2.0.0 (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.
13->tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for cachetools<6.0,>=2.0.0 from https://files.pyt
honhosted.org/packages/a9/c9/c8a7710f2cedcb1db9224fdd4d8307c9e48cbddc46c18b515fefc0f
1abbe/cachetools-5.3.1-py3-none-any.whl.metadata
  Using cached cachetools-5.3.1-py3-none-any.whl.metadata (5.2 kB)
Collecting pyasn1-modules>=0.2.1 (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.1
3->tensorflow-intel==2.13.0->tensorflow)
  Using cached pyasn1_modules-0.3.0-py2.py3-none-any.whl (181 kB)
Collecting rsa<5,>=3.1.4 (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.13->tenso
rflow-intel==2.13.0->tensorflow)
  Using cached rsa-4.9-py3-none-any.whl (34 kB)
Collecting urllib3<2.0 (from google-auth<3,>=1.6.3->tensorboard<2.14,>=2.13->tensorf
low-intel==2.13.0->tensorflow)
  Obtaining dependency information for urllib3<2.0 from https://files.pythonhosted.o
rg/packages/c5/05/c214b32d21c0b465506f95c4f28ccbcba15022e000b043b72b3df7728471/urlli
b3-1.26.16-py2.py3-none-any.whl.metadata
  Using cached urllib3-1.26.16-py2.py3-none-any.whl.metadata (48 kB)
Collecting requests-oauthlib>=0.7.0 (from google-auth-oauthlib<1.1,>=0.5->tensorboar
d<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow)
  Using cached requests_oauthlib-1.3.1-py2.py3-none-any.whl (23 kB)
Requirement already satisfied: importlib-metadata>=4.4 in c:\users\andre\onedrive\do
cumentos\github\cc3084_laboratorio4\.venv\lib\site-packages (from markdown>=2.6.8->t
ensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow) (6.8.0)
Collecting charset-normalizer<4,>=2 (from requests<3,>=2.21.0->tensorboard<2.14,>=2.
13->tensorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for charset-normalizer<4,>=2 from https://files.p
ythonhosted.org/packages/cb/dd/dce14328e6abe0f475e606131298b4c8f628abd62a4e6f27fdfa4
96b9efe/charset_normalizer-3.2.0-cp39-cp39-win_amd64.whl.metadata
  Using cached charset_normalizer-3.2.0-cp39-cp39-win_amd64.whl.metadata (31 kB)
Collecting idna<4,>=2.5 (from requests<3,>=2.21.0->tensorboard<2.14,>=2.13->tensorfl
ow-intel==2.13.0->tensorflow)
  Using cached idna-3.4-py3-none-any.whl (61 kB)
Collecting certifi>=2017.4.17 (from requests<3,>=2.21.0->tensorboard<2.14,>=2.13->te
nsorflow-intel==2.13.0->tensorflow)
  Obtaining dependency information for certifi>=2017.4.17 from https://files.pythonh
osted.org/packages/4c/dd/2234eab22353ffc7d94e8d13177aaa050113286e93e7b40eae01fbf7c3d
9/certifi-2023.7.22-py3-none-any.whl.metadata
  Using cached certifi-2023.7.22-py3-none-any.whl.metadata (2.2 kB)
Collecting MarkupSafe>=2.1.1 (from werkzeug>=1.0.1->tensorboard<2.14,>=2.13->tensorf
low-intel==2.13.0->tensorflow)
  Obtaining dependency information for MarkupSafe>=2.1.1 from https://files.pythonho
sted.org/packages/a2/b2/624042cb58cc6b3529a6c3a7b7d230766e3ecb768cba118ba7befd18ed6
f/MarkupSafe-2.1.3-cp39-cp39-win_amd64.whl.metadata
  Using cached MarkupSafe-2.1.3-cp39-cp39-win_amd64.whl.metadata (3.1 kB)
```

```
Requirement already satisfied: zipp>=0.5 in c:\users\andre\onedrive\documentos\githu
b\cc3084_laboratorio4\.venv\lib\site-packages (from importlib-metadata>=4.4->markdow
n>=2.6.8->tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow) (3.17.0)
Collecting pyasn1<0.6.0,>=0.4.6 (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->
tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow)
  Using cached pyasn1-0.5.0-py2.py3-none-any.whl (83 kB)
Collecting oauthlib>=3.0.0 (from requests-oauthlib>=0.7.0->google-auth-oauthlib<1.1,
>=0.5->tensorboard<2.14,>=2.13->tensorflow-intel==2.13.0->tensorflow)
  Using cached oauthlib-3.2.2-py3-none-any.whl (151 kB)
Using cached tensorflow-2.13.0-cp39-cp39-win_amd64.whl (1.9 kB)
Using cached tensorflow_intel-2.13.0-cp39-cp39-win_amd64.whl (276.5 MB)
Downloading absl_py-2.0.0-py3-none-any.whl (130 kB)
   ---------------------------------------- 0.0/130.2 kB ? eta -:--:--
   --------- ------------------------------ 30.7/130.2 kB 1.3 MB/s eta 0:00:01
   -------------------- ------------------ 71.7/130.2 kB 787.7 kB/s eta 0:00:01
   ----------------------------------- -- 122.9/130.2 kB 901.1 kB/s eta 0:00:01
   -------------------------------------- 130.2/130.2 kB 850.7 kB/s eta 0:00:00
Using cached flatbuffers-23.5.26-py2.py3-none-any.whl (26 kB)
Downloading grpcio-1.58.0-cp39-cp39-win_amd64.whl (4.3 MB)
   ---------------------------------------- 0.0/4.3 MB ? eta -:--:--
   - -------------------------------------- 0.2/4.3 MB 9.0 MB/s eta 0:00:01
   --- ------------------------------------ 0.4/4.3 MB 4.6 MB/s eta 0:00:01
   ---- ----------------------------------- 0.5/4.3 MB 3.8 MB/s eta 0:00:02
   ------ --------------------------------- 0.7/4.3 MB 3.5 MB/s eta 0:00:02
   ------- -------------------------------- 0.8/4.3 MB 4.0 MB/s eta 0:00:01
   ----------- ---------------------------- 1.3/4.3 MB 4.7 MB/s eta 0:00:01
   ---------------- ----------------------- 1.8/4.3 MB 5.5 MB/s eta 0:00:01
   -------------------- ------------------- 2.2/4.3 MB 5.9 MB/s eta 0:00:01
   ------------------------ --------------- 2.6/4.3 MB 6.4 MB/s eta 0:00:01
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   -------------------------- ------------- 2.9/4.3 MB 6.6 MB/s eta 0:00:01
   ------------------------------ --------- 3.3/4.3 MB 6.0 MB/s eta 0:00:01
   ------------------------------------ --- 3.9/4.3 MB 6.4 MB/s eta 0:00:01
   ---------------------------------------  4.3/4.3 MB 6.8 MB/s eta 0:00:01
   ---------------------------------------- 4.3/4.3 MB 6.4 MB/s eta 0:00:00
Using cached h5py-3.9.0-cp39-cp39-win_amd64.whl (2.7 MB)
Using cached keras-2.13.1-py3-none-any.whl (1.7 MB)
Using cached libclang-16.0.6-py2.py3-none-win_amd64.whl (24.4 MB)
Downloading protobuf-4.24.3-cp39-cp39-win_amd64.whl (430 kB)
   ---------------------------------------- 0.0/430.5 kB ? eta -:--:--
   --------------------------------------  430.1/430.5 kB 28.0 MB/s eta 0:00:01
   ---------------------------------------- 430.5/430.5 kB 8.9 MB/s eta 0:00:00
Using cached tensorflow_estimator-2.13.0-py2.py3-none-any.whl (440 kB)
Downloading google_auth-2.23.0-py2.py3-none-any.whl (181 kB)
   ---------------------------------------- 0.0/181.4 kB ? eta -:--:--
   --------------------------------------- 181.4/181.4 kB 10.7 MB/s eta 0:00:00
Using cached Markdown-3.4.4-py3-none-any.whl (94 kB)
Using cached requests-2.31.0-py3-none-any.whl (62 kB)
Using cached tensorboard_data_server-0.7.1-py3-none-any.whl (2.4 kB)
Using cached werkzeug-2.3.7-py3-none-any.whl (242 kB)
Using cached wheel-0.41.2-py3-none-any.whl (64 kB)
Using cached cachetools-5.3.1-py3-none-any.whl (9.3 kB)
Using cached certifi-2023.7.22-py3-none-any.whl (158 kB)
Using cached charset_normalizer-3.2.0-cp39-cp39-win_amd64.whl (96 kB)
Using cached MarkupSafe-2.1.3-cp39-cp39-win_amd64.whl (17 kB)
Using cached urllib3-1.26.16-py2.py3-none-any.whl (143 kB)
```

```
Installing collected packages: libclang, flatbuffers, wrapt, wheel, urllib3, typing-
extensions, termcolor, tensorflow-io-gcs-filesystem, tensorflow-estimator, tensorboa
rd-data-server, pyasn1, protobuf, oauthlib, numpy, MarkupSafe, keras, idna, grpcio,
google-pasta, gast, charset-normalizer, certifi, cachetools, absl-py, werkzeug, rsa,
requests, pyasn1-modules, opt-einsum, markdown, h5py, astunparse, requests-oauthlib,
google-auth, google-auth-oauthlib, tensorboard, tensorflow-intel, tensorflow
  Attempting uninstall: typing-extensions
    Found existing installation: typing_extensions 4.8.0
    Uninstalling typing_extensions-4.8.0:
      Successfully uninstalled typing_extensions-4.8.0
Successfully installed MarkupSafe-2.1.3 absl-py-2.0.0 astunparse-1.6.3 cachetools-5.
3.1 certifi-2023.7.22 charset-normalizer-3.2.0 flatbuffers-23.5.26 gast-0.4.0 google
-auth-2.23.0 google-auth-oauthlib-1.0.0 google-pasta-0.2.0 grpcio-1.58.0 h5py-3.9.0
idna-3.4 keras-2.13.1 libclang-16.0.6 markdown-3.4.4 numpy-1.24.3 oauthlib-3.2.2 opt
-einsum-3.3.0 protobuf-4.24.3 pyasn1-0.5.0 pyasn1-modules-0.3.0 requests-2.31.0 requ
ests-oauthlib-1.3.1 rsa-4.9 tensorboard-2.13.0 tensorboard-data-server-0.7.1 tensorf
low-2.13.0 tensorflow-estimator-2.13.0 tensorflow-intel-2.13.0 tensorflow-io-gcs-fil
esystem-0.31.0 termcolor-2.3.0 typing-extensions-4.5.0 urllib3-1.26.16 werkzeug-2.3.
7 wheel-0.41.2 wrapt-1.15.0
```

In [ ]:
```
""" Tensor flow """

import tensorflow as tf
from tensorflow.keras.preprocessing import sequence
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Embedding
from tensorflow.keras.layers import LSTM
from tensorflow.keras.datasets import imdb
```

In [ ]:
```
print('Cargando los datos...')
(X_train, y_train), (X_test, y_test) = imdb.load_data(num_words=50000)
```

```
Cargando los datos...
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/im
db.npz
17464789/17464789 [==============================] - 2s 0us/step
```

In [ ]:
```
X_train = sequence.pad_sequences(X_train, maxlen = 80)
X_test = sequence.pad_sequences(X_test, maxlen = 80)
```

2. Arquitectura del Modelo (30 puntos)

- Adecuado diseño de la arquitectura LSTM: 10 puntos.
- Incorporación efectiva de características adicionales en el modelo: 10 puntos.
- Uso de técnicas adicionales (e.g., Dropout, capas densamente conectadas): 10 puntos.

modelo original

In [ ]:
```
modelo_original = Sequential()
modelo_original.add(Embedding(50000, 128))
modelo_original.add(LSTM(128, dropout=0.2, recurrent_dropout=0.2))
```

```
modelo_original.add(Dense(1, activation='sigmoid'))
modelo_original.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accur
```

modelo con mejoras

In [ ]:
```
from keras.models import Sequential
from keras.layers import Embedding, LSTM, Dense, Dropout, Conv1D, MaxPooling1D

modelo = Sequential()
modelo.add(Embedding(50000, 128, input_length=80))  # Asegúrate de especificar inpu
modelo.add(Dropout(0.2))  # Regularización Dropout en la capa de embedding

# Capas Convolucionales
modelo.add(Conv1D(64, 5, activation='relu'))
modelo.add(MaxPooling1D(pool_size=4))
modelo.add(Dropout(0.2))  # Regularización Dropout después de las capas convolucion

# Capas LSTM
modelo.add(LSTM(128, dropout=0.2, recurrent_dropout=0.2, return_sequences=True))
modelo.add(Dropout(0.2))
modelo.add(LSTM(128, dropout=0.2, recurrent_dropout=0.2))
modelo.add(Dropout(0.2))

# Capa de salida
modelo.add(Dense(1, activation='sigmoid'))

modelo.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
```

3. Entrenamiento y Evaluación (20 puntos)

• Correcto entrenamiento del modelo sin errores: 10 puntos.
• Evaluación y comparación adecuada con el modelo del ejercicio anterior: 10 puntos.

modelo con cambios

In [ ]:
```
modelo.fit(X_train, y_train,batch_size = 32,epochs = 15,verbose = 2,validation_data
```

```
Epoch 1/15
782/782 - 99s - loss: 0.4218 - accuracy: 0.7992 - val_loss: 0.3412 - val_accuracy:
0.8486 - 99s/epoch - 126ms/step
Epoch 2/15
782/782 - 97s - loss: 0.2089 - accuracy: 0.9201 - val_loss: 0.4141 - val_accuracy:
0.8346 - 97s/epoch - 124ms/step
Epoch 3/15
782/782 - 99s - loss: 0.0925 - accuracy: 0.9671 - val_loss: 0.4574 - val_accuracy:
0.8310 - 99s/epoch - 127ms/step
Epoch 4/15
782/782 - 100s - loss: 0.0429 - accuracy: 0.9857 - val_loss: 0.6319 - val_accuracy:
0.8147 - 100s/epoch - 128ms/step
Epoch 5/15
782/782 - 101s - loss: 0.0242 - accuracy: 0.9920 - val_loss: 0.7781 - val_accuracy:
0.8140 - 101s/epoch - 129ms/step
Epoch 6/15
782/782 - 102s - loss: 0.0174 - accuracy: 0.9939 - val_loss: 0.9336 - val_accuracy:
0.8129 - 102s/epoch - 131ms/step
Epoch 7/15
782/782 - 101s - loss: 0.0161 - accuracy: 0.9944 - val_loss: 1.0608 - val_accuracy:
0.8076 - 101s/epoch - 130ms/step
Epoch 8/15
782/782 - 102s - loss: 0.0122 - accuracy: 0.9953 - val_loss: 1.0909 - val_accuracy:
0.8119 - 102s/epoch - 130ms/step
Epoch 9/15
782/782 - 103s - loss: 0.0150 - accuracy: 0.9952 - val_loss: 0.8440 - val_accuracy:
0.8089 - 103s/epoch - 131ms/step
Epoch 10/15
782/782 - 102s - loss: 0.0100 - accuracy: 0.9968 - val_loss: 0.8796 - val_accuracy:
0.8149 - 102s/epoch - 130ms/step
Epoch 11/15
782/782 - 102s - loss: 0.0079 - accuracy: 0.9976 - val_loss: 0.8964 - val_accuracy:
0.8122 - 102s/epoch - 130ms/step
Epoch 12/15
782/782 - 102s - loss: 0.0090 - accuracy: 0.9972 - val_loss: 0.9523 - val_accuracy:
0.8100 - 102s/epoch - 131ms/step
Epoch 13/15
782/782 - 103s - loss: 0.0053 - accuracy: 0.9985 - val_loss: 1.1967 - val_accuracy:
0.8100 - 103s/epoch - 131ms/step
Epoch 14/15
782/782 - 105s - loss: 0.0056 - accuracy: 0.9983 - val_loss: 1.0177 - val_accuracy:
0.8109 - 105s/epoch - 134ms/step
Epoch 15/15
782/782 - 101s - loss: 0.0060 - accuracy: 0.9977 - val_loss: 1.2729 - val_accuracy:
0.8090 - 101s/epoch - 129ms/step
```

Out[ ]: <keras.src.callbacks.History at 0x1efda7539a0>

modelo original

In [ ]:
```
modelo_original.fit(X_train, y_train,batch_size = 32,epochs = 15,verbose = 2,valida
```

```
Epoch 1/15
782/782 - 140s - loss: 0.3359 - accuracy: 0.8576 - val_loss: 0.3989 - val_accuracy:
0.8208 - 140s/epoch - 180ms/step
Epoch 2/15
782/782 - 139s - loss: 0.1902 - accuracy: 0.9276 - val_loss: 0.4003 - val_accuracy:
0.8291 - 139s/epoch - 178ms/step
Epoch 3/15
782/782 - 140s - loss: 0.1087 - accuracy: 0.9608 - val_loss: 0.5350 - val_accuracy:
0.8223 - 140s/epoch - 180ms/step
Epoch 4/15
782/782 - 140s - loss: 0.0604 - accuracy: 0.9796 - val_loss: 0.6311 - val_accuracy:
0.8126 - 140s/epoch - 179ms/step
Epoch 5/15
782/782 - 140s - loss: 0.0510 - accuracy: 0.9826 - val_loss: 0.6698 - val_accuracy:
0.8051 - 140s/epoch - 179ms/step
Epoch 6/15
782/782 - 143s - loss: 0.0328 - accuracy: 0.9894 - val_loss: 0.9203 - val_accuracy:
0.8107 - 143s/epoch - 183ms/step
Epoch 7/15
782/782 - 143s - loss: 0.0234 - accuracy: 0.9926 - val_loss: 0.8296 - val_accuracy:
0.8128 - 143s/epoch - 183ms/step
Epoch 8/15
782/782 - 140s - loss: 0.0156 - accuracy: 0.9950 - val_loss: 0.9951 - val_accuracy:
0.8115 - 140s/epoch - 178ms/step
Epoch 9/15
782/782 - 138s - loss: 0.0141 - accuracy: 0.9958 - val_loss: 1.1428 - val_accuracy:
0.8054 - 138s/epoch - 176ms/step
Epoch 10/15
782/782 - 135s - loss: 0.0229 - accuracy: 0.9928 - val_loss: 0.9705 - val_accuracy:
0.8050 - 135s/epoch - 172ms/step
Epoch 11/15
782/782 - 133s - loss: 0.0132 - accuracy: 0.9959 - val_loss: 0.9797 - val_accuracy:
0.8113 - 133s/epoch - 171ms/step
Epoch 12/15
782/782 - 134s - loss: 0.0053 - accuracy: 0.9984 - val_loss: 1.1490 - val_accuracy:
0.8096 - 134s/epoch - 171ms/step
Epoch 13/15
782/782 - 134s - loss: 0.0037 - accuracy: 0.9990 - val_loss: 1.2529 - val_accuracy:
0.8090 - 134s/epoch - 171ms/step
Epoch 14/15
782/782 - 134s - loss: 0.0062 - accuracy: 0.9979 - val_loss: 1.0651 - val_accuracy:
0.8054 - 134s/epoch - 171ms/step
Epoch 15/15
782/782 - 134s - loss: 0.0087 - accuracy: 0.9973 - val_loss: 1.2061 - val_accuracy:
0.8023 - 134s/epoch - 171ms/step
```

Out[ ]: <keras.src.callbacks.History at 0x1efe4483370>

modelo con cambios

In [ ]:
```python
from tabulate import tabulate

loss, accuracy = modelo.evaluate(X_test, y_test, batch_size=32, verbose=2)

# Definir los títulos y resultados
headers = ["Métrica", "Resultado"]
```

```
data = [["Loss", f"{loss:.4f}"],
        ["Test Accuracy", f"{accuracy * 100:.2f}%"]]

# Imprimir la tabla utilizando tabulate
table = tabulate(data, headers, tablefmt="fancy_grid")
print(table)
```

```
782/782 - 7s - loss: 1.2729 - accuracy: 0.8090 - 7s/epoch - 9ms/step
```

Métrica	Resultado
Loss	1.2729
Test Accuracy	80.90%

Métrica	Resultado
Loss	1.2729
Test Accuracy	80.90%

modelo original

In [ ]:
```
from tabulate import tabulate

loss, accuracy = modelo_original.evaluate(X_test, y_test, batch_size=32, verbose=2)

# Definir los títulos y resultados
headers = ["Métrica", "Resultado"]
data = [["Loss", f"{loss:.4f}"],
        ["Test Accuracy", f"{accuracy * 100:.2f}%"]]

# Imprimir la tabla utilizando tabulate
table = tabulate(data, headers, tablefmt="fancy_grid")
print(table)
```

```
782/782 - 10s - loss: 1.2061 - accuracy: 0.8023 - 10s/epoch - 12ms/step
```

Métrica	Resultado
Loss	1.2061
Test Accuracy	80.23%

Métrica	Resultado
Loss	1.2061
Test Accuracy	80.23%

In [ ]:
```
modelo.save("Lab4.h5")
```

4. Informe

Clara descripción de características adicionales y su relevancia: 5 puntos.

Se agregaron capas de Dropout después de la capa de embedding, después de las capas convolucionales y después de las capas LSTM para aplicar regularización y reducir el sobreajuste.

Se añadieron capas CNN para capturar patrones locales en el texto antes de las capas LSTM.

Explicación coherente de la arquitectura del modelo: 5 puntos.

El modelo está configurado para minimizar la función de pérdida de entropía cruzada binaria ('binary_crossentropy') utilizando el optimizador 'adam', y evalúa su rendimiento en términos de precisión ('accuracy'). Esta arquitectura combina capas de embedding, convolucionales y LSTM para procesar secuencias de texto y aprender representaciones significativas de las palabras, lo que permite la clasificación binaria de los sentimientos en textos. La regularización y las capas Dropout ayudan a prevenir el sobreajuste durante el entrenamiento.

Presentación de resultados y comparativa efectiva: 10 puntos.

In [ ]:

Como se puede observar en el modelo original se tuvo un menor loss del 1.2061, mientras que el loss del modelo mejora fue de 1.2729; esto se puede deber a diferentes razones como la arquitectura del modelo, los hiperparametros, la inilicacion de pesos o la regularización. Pero por otro lado el accuracy fue mejor para el modelo mejorado ya que obtuvo un 80.90% mientras el modelo original tiene un 80.23%