

classification-with-tensorflow-1

March 21, 2024

```
[ ]: !pip install tensorflow==2.8.0
      !pip install tensorflow-hub==0.12.0
      !pip install tensorflow-datasets==4.8.0
```

Collecting tensorflow==2.8.0

Downloading tensorflow-2.8.0-cp310-cp310-manylinux2010_x86_64.whl (497.6 MB)
497.6/497.6

MB 3.0 MB/s eta 0:00:00

Requirement already satisfied: absl-py>=0.4.0 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (1.4.0)
Requirement already satisfied: astunparse>=1.6.0 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (1.6.3)
Requirement already satisfied: flatbuffers>=1.12 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (24.3.7)
Requirement already satisfied: gast>=0.2.1 in /usr/local/lib/python3.10/dist-
packages (from tensorflow==2.8.0) (0.5.4)
Requirement already satisfied: google-pasta>=0.1.1 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (0.2.0)
Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.10/dist-
packages (from tensorflow==2.8.0) (3.9.0)

Collecting keras-preprocessing>=1.1.1 (from tensorflow==2.8.0)

Downloading Keras_Preprocessing-1.1.2-py2.py3-none-any.whl (42 kB)
42.6/42.6 kB

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Requirement already satisfied: libclang>=9.0.1 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (16.0.6)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-
packages (from tensorflow==2.8.0) (1.25.2)
Requirement already satisfied: opt-einsum>=2.3.2 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (3.3.0)
Requirement already satisfied: protobuf>=3.9.2 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (3.20.3)
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-
packages (from tensorflow==2.8.0) (67.7.2)
Requirement already satisfied: six>=1.12.0 in /usr/local/lib/python3.10/dist-
packages (from tensorflow==2.8.0) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in

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/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (2.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (4.10.0)
Requirement already satisfied: wrapt>=1.11.0 in /usr/local/lib/python3.10/dist-
packages (from tensorflow==2.8.0) (1.14.1)
Collecting tensorboard<2.9,>=2.8 (from tensorflow==2.8.0)
  Downloading tensorboard-2.8.0-py3-none-any.whl (5.8 MB)
      5.8/5.8 MB
72.7 MB/s eta 0:00:00
Collecting tf-estimator-nightly==2.8.0.dev2021122109 (from
tensorflow==2.8.0)
  Downloading tf_estimator_nightly-2.8.0.dev2021122109-py2.py3-none-any.whl (462
kB)
      462.5/462.5
kB 35.8 MB/s eta 0:00:00
Collecting keras<2.9,>=2.8.0rc0 (from tensorflow==2.8.0)
  Downloading keras-2.8.0-py2.py3-none-any.whl (1.4 MB)
      1.4/1.4 MB
61.1 MB/s eta 0:00:00
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (0.36.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in
/usr/local/lib/python3.10/dist-packages (from tensorflow==2.8.0) (1.62.1)
Requirement already satisfied: wheel<1.0,>=0.23.0 in
/usr/local/lib/python3.10/dist-packages (from
astunparse>=1.6.0->tensorflow==2.8.0) (0.43.0)
Requirement already satisfied: google-auth<3,>=1.6.3 in
/usr/local/lib/python3.10/dist-packages (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0) (2.27.0)
Collecting google-auth-oauthlib<0.5,>=0.4.1 (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0)
  Downloading google_auth_oauthlib-0.4.6-py2.py3-none-any.whl (18 kB)
Requirement already satisfied: markdown>=2.6.8 in
/usr/local/lib/python3.10/dist-packages (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0) (3.6)
Requirement already satisfied: requests<3,>=2.21.0 in
/usr/local/lib/python3.10/dist-packages (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0) (2.31.0)
Collecting tensorboard-data-server<0.7.0,>=0.6.0 (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0)
  Downloading tensorboard_data_server-0.6.1-py3-none-manylinux2010_x86_64.whl
(4.9 MB)
      4.9/4.9 MB
77.1 MB/s eta 0:00:00
Collecting tensorboard-plugin-wit>=1.6.0 (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0)
  Downloading tensorboard_plugin_wit-1.8.1-py3-none-any.whl (781 kB)

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781.3/781.3

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Requirement already satisfied: werkzeug>=0.11.15 in
/usr/local/lib/python3.10/dist-packages (from
tensorboard<2.9,>=2.8->tensorflow==2.8.0) (3.0.1)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in
/usr/local/lib/python3.10/dist-packages (from google-
auth<3,>=1.6.3->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (5.3.3)
Requirement already satisfied: pyasn1-modules>=0.2.1 in
/usr/local/lib/python3.10/dist-packages (from google-
auth<3,>=1.6.3->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (0.3.0)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.10/dist-
packages (from google-auth<3,>=1.6.3->tensorboard<2.9,>=2.8->tensorflow==2.8.0)
(4.9)
Requirement already satisfied: requests-oauthlib>=0.7.0 in
/usr/local/lib/python3.10/dist-packages (from google-auth-
oauthlib<0.5,>=0.4.1->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (1.4.0)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from
requests<3,>=2.21.0->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-
packages (from requests<3,>=2.21.0->tensorboard<2.9,>=2.8->tensorflow==2.8.0)
(3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from
requests<3,>=2.21.0->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from
requests<3,>=2.21.0->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (2024.2.2)
Requirement already satisfied: MarkupSafe>=2.1.1 in
/usr/local/lib/python3.10/dist-packages (from
werkzeug>=0.11.15->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (2.1.5)
Requirement already satisfied: pyasn1<0.6.0,>=0.4.6 in
/usr/local/lib/python3.10/dist-packages (from pyasn1-modules>=0.2.1->google-
auth<3,>=1.6.3->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (0.5.1)
Requirement already satisfied: oauthlib>=3.0.0 in
/usr/local/lib/python3.10/dist-packages (from requests-oauthlib>=0.7.0->google-
auth-oauthlib<0.5,>=0.4.1->tensorboard<2.9,>=2.8->tensorflow==2.8.0) (3.2.2)
Installing collected packages: tf-estimator-nightly, tensorboard-plugin-wit,
keras, tensorboard-data-server, keras-preprocessing, google-auth-oauthlib,
tensorboard, tensorflow
 Attempting uninstall: keras
 Found existing installation: keras 2.15.0
 Uninstalling keras-2.15.0:
 Successfully uninstalled keras-2.15.0
 Attempting uninstall: tensorboard-data-server
 Found existing installation: tensorboard-data-server 0.7.2

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Uninstalling tensorboard-data-server-0.7.2:
  Successfully uninstalled tensorboard-data-server-0.7.2
Attempting uninstall: google-auth-oauthlib
  Found existing installation: google-auth-oauthlib 1.2.0
  Uninstalling google-auth-oauthlib-1.2.0:
    Successfully uninstalled google-auth-oauthlib-1.2.0
Attempting uninstall: tensorboard
  Found existing installation: tensorboard 2.15.2
  Uninstalling tensorboard-2.15.2:
    Successfully uninstalled tensorboard-2.15.2
Attempting uninstall: tensorflow
  Found existing installation: tensorflow 2.15.0
  Uninstalling tensorflow-2.15.0:
    Successfully uninstalled tensorflow-2.15.0
ERROR: pip's dependency resolver does not currently take into account all
the packages that are installed. This behaviour is the source of the following
dependency conflicts.

pandas-gbq 0.19.2 requires google-auth-oauthlib>=0.7.0, but you have google-
auth-oauthlib 0.4.6 which is incompatible.

tf-keras 2.15.1 requires tensorflow<2.16,>=2.15, but you have tensorflow 2.8.0
which is incompatible.

Successfully installed google-auth-oauthlib-0.4.6 keras-2.8.0 keras-
preprocessing-1.1.2 tensorboard-2.8.0 tensorboard-data-server-0.6.1 tensorboard-
plugin-wit-1.8.1 tensorflow-2.8.0 tf-estimator-nightly-2.8.0.dev2021122109

Requirement already satisfied: tensorflow-hub==0.12.0 in
/usr/local/lib/python3.10/dist-packages (0.12.0)
Requirement already satisfied: numpy>=1.12.0 in /usr/local/lib/python3.10/dist-
packages (from tensorflow-hub==0.12.0) (1.25.2)
Requirement already satisfied: protobuf>=3.8.0 in
/usr/local/lib/python3.10/dist-packages (from tensorflow-hub==0.12.0) (3.20.3)
Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/pkg_resources/__init__.py", line 3108, in _dep_map
    return self.__dep_map
  File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/pkg_resources/__init__.py", line 2901, in __getattr__
    raise AttributeError(attr)
AttributeError: _DistInfoDistribution__dep_map

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File "/usr/local/lib/python3.10/dist-

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packages/pip/_internal/cli/base_command.py", line 169, in exc_logging_wrapper
    status = run_func(*args)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/cli/req_command.py", line 242, in wrapper
    return func(self, options, args)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/commands/install.py", line 441, in run
    conflicts = self._determine_conflicts(to_install)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/commands/install.py", line 572, in _determine_conflicts
    return check_install_conflicts(to_install)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/operations/check.py", line 101, in
check_install_conflicts
    package_set, _ = create_package_set_from_installed()
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/operations/check.py", line 42, in
create_package_set_from_installed
    dependencies = list(dist.iter_dependencies())
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/metadata/pkg_resources.py", line 216, in
iter_dependencies
    return self._dist.requires(extras)
File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/pkg_resources/__init__.py", line 2821, in requires
    dm = self._dep_map
File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/pkg_resources/__init__.py", line 3110, in _dep_map
    self._dep_map = self._compute_dependencies()
File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/pkg_resources/__init__.py", line 3120, in
_compute_dependencies
    reqs.extend(parse_requirements(req))
File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/pkg_resources/__init__.py", line 3173, in __init__
    super(Requirement, self).__init__(requirement_string)
File "/usr/local/lib/python3.10/dist-
packages/pip/_vendor/packaging/requirements.py", line 102, in __init__
    req = REQUIREMENT.parseString(requirement_string)
File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py",
line 1131, in parse_string
    loc, tokens = self._parse(instring, 0)
File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py",
line 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py",
line 3886, in parseImpl
    loc, exprtokens = e._parse(instring, loc, doActions)

```

```

File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py",
line 817, in _parseNoCache
    loc, tokens = self.parseImpl(instring, pre_loc, doActions)
File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py",
line 4375, in parseImpl
    return self.expr._parse(instring, loc, doActions, callPreParse=False)
File "/usr/local/lib/python3.10/dist-packages/pip/_vendor/pyparsing/core.py",
line 776, in _parseNoCache
    def _parseNoCache(
KeyboardInterrupt

```

During handling of the above exception, another exception occurred:

Traceback (most recent call last):

```

File "/usr/local/bin/pip3", line 8, in <module>
    sys.exit(main())
File "/usr/local/lib/python3.10/dist-packages/pip/_internal/cli/main.py", line
79, in main
    return command.main(cmd_args)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/cli/base_command.py", line 101, in main
    return self._main(args)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/cli/base_command.py", line 223, in _main
    return run(options, args)
File "/usr/local/lib/python3.10/dist-
packages/pip/_internal/cli/base_command.py", line 206, in exc_logging_wrapper
    logger.critical("Operation cancelled by user")
File "/usr/lib/python3.10/logging/__init__.py", line 1524, in critical
    self._log(CRITICAL, msg, args, **kwargs)
File "/usr/lib/python3.10/logging/__init__.py", line 1600, in _log
    def _log(self, level, msg, args, exc_info=None, extra=None,
stack_info=False,
KeyboardInterrupt
^C

```

```

Requirement already satisfied: tensorflow-datasets==4.8.0 in
/usr/local/lib/python3.10/dist-packages (4.8.0)
Requirement already satisfied: absl-py in /usr/local/lib/python3.10/dist-
packages (from tensorflow-datasets==4.8.0) (1.4.0)
Requirement already satisfied: click in /usr/local/lib/python3.10/dist-packages
(from tensorflow-datasets==4.8.0) (8.1.7)
Requirement already satisfied: dill in /usr/local/lib/python3.10/dist-packages
(from tensorflow-datasets==4.8.0) (0.3.8)
Requirement already satisfied: dm-tree in /usr/local/lib/python3.10/dist-
packages (from tensorflow-datasets==4.8.0) (0.1.8)
Requirement already satisfied: etils[epath] in /usr/local/lib/python3.10/dist-
packages (from tensorflow-datasets==4.8.0) (1.7.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages

```

(from tensorflow-datasets==4.8.0) (1.25.2)
Requirement already satisfied: promise in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (2.3)
Requirement already satisfied: protobuf>=3.12.2 in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (3.20.3)
Requirement already satisfied: psutil in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (5.9.5)
Requirement already satisfied: requests>=2.19.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (2.31.0)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (1.16.0)
Requirement already satisfied: tensorflow-metadata in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (1.14.0)
Requirement already satisfied: termcolor in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (2.4.0)
Requirement already satisfied: toml in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (0.10.2)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (from tensorflow-datasets==4.8.0) (4.66.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests>=2.19.0->tensorflow-datasets==4.8.0) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests>=2.19.0->tensorflow-datasets==4.8.0) (3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests>=2.19.0->tensorflow-datasets==4.8.0) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests>=2.19.0->tensorflow-datasets==4.8.0) (2024.2.2)
Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-packages (from etils[epath]->tensorflow-datasets==4.8.0) (2023.6.0)
Requirement already satisfied: importlib_resources in /usr/local/lib/python3.10/dist-packages (from etils[epath]->tensorflow-datasets==4.8.0) (6.3.0)
Requirement already satisfied: typing_extensions in /usr/local/lib/python3.10/dist-packages (from etils[epath]->tensorflow-datasets==4.8.0) (4.10.0)
Requirement already satisfied: zipp in /usr/local/lib/python3.10/dist-packages (from etils[epath]->tensorflow-datasets==4.8.0) (3.18.1)
Requirement already satisfied: googleapis-common-protos<2,>=1.52.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow-metadata->tensorflow-datasets==4.8.0) (1.63.0)

```
[ ]: import numpy as np
import tensorflow_hub as hub
import tensorflow_datasets as tfds
import tensorflow as tf
```

```
[ ]: train_data, val_data, test_data = tfds.load(name="imdb_reviews",
↳split=('train', 'test[:40%]', 'test[40%:]'), as_supervised=True)
```

Downloading and preparing dataset 80.23 MiB (download: 80.23 MiB, generated: Unknown size, total: 80.23 MiB) to
/root/tensorflow_datasets/imdb_reviews/plain_text/1.0.0...

Dl Completed...: 0 url [00:00, ? url/s]

Dl Size...: 0 MiB [00:00, ? MiB/s]

Generating splits...: 0%| | 0/3 [00:00<?, ? splits/s]

Generating train examples...: 0%| | 0/25000 [00:00<?, ? examples/s]

Shuffling /root/tensorflow_datasets/imdb_reviews/plain_text/1.0.0.
↳incompleteAZ59XB/imdb_reviews-train.tfrecord...

Generating test examples...: 0%| | 0/25000 [00:00<?, ? examples/s]

Shuffling /root/tensorflow_datasets/imdb_reviews/plain_text/1.0.0.
↳incompleteAZ59XB/imdb_reviews-test.tfrecord*...

Generating unsupervised examples...: 0%| | 0/50000 [00:00<?, ? examples/s]
↳s]

Shuffling /root/tensorflow_datasets/imdb_reviews/plain_text/1.0.0.
↳incompleteAZ59XB/imdb_reviews-unsupervised.t...

Dataset imdb_reviews downloaded and prepared to
/root/tensorflow_datasets/imdb_reviews/plain_text/1.0.0. Subsequent calls will
reuse this data.

```
[ ]: train_example_batch, train_labels_batch = next(iter(train_data.batch(5)))
```

```
[ ]: train_example_batch
```

```
[ ]: <tf.Tensor: shape=(5,), dtype=string, numpy=
array([b"This was an absolutely terrible movie. Don't be lured in by Christopher
Walken or Michael Ironside. Both are great actors, but this must simply be their
worst role in history. Even their great acting could not redeem this movie's
ridiculous storyline. This movie is an early nineties US propaganda piece. The
most pathetic scenes were those when the Columbian rebels were making their
cases for revolutions. Maria Conchita Alonso appeared phony, and her pseudo-love
affair with Walken was nothing but a pathetic emotional plug in a movie that was
devoid of any real meaning. I am disappointed that there are movies like this,
ruining actor's like Christopher Walken's good name. I could barely sit through
```


it.",

b'I have been known to fall asleep during films, but this is usually due to a combination of things including, really tired, being warm and comfortable on the sette and having just eaten a lot. However on this occasion I fell asleep because the film was rubbish. The plot development was constant. Constantly slow and boring. Things seemed to happen, but with no explanation of what was causing them or why. I admit, I may have missed part of the film, but i watched the majority of it and everything just seemed to happen of its own accord without any real concern for anything else. I cant recommend this film at all.',

b'Mann photographs the Alberta Rocky Mountains in a superb fashion, and Jimmy Stewart and Walter Brennan give enjoyable performances as they always seem to do.

But come on Hollywood - a Mountie telling the people of Dawson City, Yukon to elect themselves a marshal (yes a marshal!) and to enforce the law themselves, then gunfighters battling it out on the streets for control of the town?

Nothing even remotely resembling that happened on the Canadian side of the border during the Klondike gold rush. Mr. Mann and company appear to have mistaken Dawson City for Deadwood, the Canadian North for the American Wild West.

Canadian viewers be prepared for a Reefer Madness type of enjoyable howl with this ludicrous plot, or, to shake your head in disgust.',

b'This is the kind of film for a snowy Sunday afternoon when the rest of the world can go ahead with its own business as you descend into a big arm-chair and mellow for a couple of hours. Wonderful performances from Cher and Nicolas Cage (as always) gently row the plot along. There are no rapids to cross, no dangerous waters, just a warm and witty paddle through New York life at its best. A family film in every sense and one that deserves the praise it received.',

b'As others have mentioned, all the women that go nude in this film are mostly absolutely gorgeous. The plot very ably shows the hypocrisy of the female libido. When men are around they want to be pursued, but when no "men" are around, they become the pursuers of a 14 year old boy. And the boy becomes a man really fast (we should all be so lucky at this age!). He then gets up the courage to pursue his true love.',

dtype=object)>

```
[ ]: train_labels_batch
```

```
[ ]: <tf.Tensor: shape=(5,), dtype=int64, numpy=array([0, 0, 0, 1, 1])>
```

```
[ ]: hub_layer = hub.KerasLayer("https://kaggle.com/models/google/gnews-swivel/  
↳frameworks/TensorFlow2/variations/tf2-preview-20dim/versions/1",  
↳output_shape=[20],input_shape=[], dtype=tf.string)
```

```
[ ]: model = tf.keras.Sequential()  
model.add(hub_layer)  
model.add(tf.keras.layers.Dense(16, activation='relu'))  
model.add(tf.keras.layers.Dense(1, activation='sigmoid'))
```

```
model.summary()
```

Model: "sequential_1"

Layer (type)	Output Shape	Param #
keras_layer (KerasLayer)	(None, 20)	400020
dense (Dense)	(None, 16)	336
dense_1 (Dense)	(None, 1)	17

=====
Total params: 400,373
Trainable params: 353
Non-trainable params: 400,020
=====

```
[ ]: model.compile(optimizer='adam',loss=tf.keras.losses.  
      ↪BinaryCrossentropy(from_logits=True), metrics=['accuracy'])
```

```
[ ]: history=model.fit(train_data.shuffle(10000).batch(100),  
      ↪epochs=20,validation_data=val_data.batch(100), verbose=1)
```

Epoch 1/20

```
/usr/local/lib/python3.10/dist-packages/tensorflow/python/util/dispatch.py:1082:  
UserWarning: "`binary_crossentropy` received `from_logits=True`, but the  
`output` argument was produced by a sigmoid or softmax activation and thus does  
not represent logits. Was this intended?"  
    return dispatch_target(*args, **kwargs)
```

```
250/250 [=====] - 7s 19ms/step - loss: 0.6909 -  
accuracy: 0.6272 - val_loss: 0.6082 - val_accuracy: 0.6729
```

Epoch 2/20

```
250/250 [=====] - 4s 15ms/step - loss: 0.5903 -  
accuracy: 0.6890 - val_loss: 0.5853 - val_accuracy: 0.6898
```

Epoch 3/20

```
250/250 [=====] - 4s 16ms/step - loss: 0.5752 -  
accuracy: 0.7041 - val_loss: 0.5752 - val_accuracy: 0.6996
```

Epoch 4/20

```
250/250 [=====] - 4s 14ms/step - loss: 0.5666 -  
accuracy: 0.7085 - val_loss: 0.5717 - val_accuracy: 0.7023
```

Epoch 5/20

```
250/250 [=====] - 4s 15ms/step - loss: 0.5620 -  
accuracy: 0.7142 - val_loss: 0.5641 - val_accuracy: 0.7091
```

Epoch 6/20

```

250/250 [=====] - 5s 17ms/step - loss: 0.5583 -
accuracy: 0.7165 - val_loss: 0.5611 - val_accuracy: 0.7114
Epoch 7/20
250/250 [=====] - 4s 14ms/step - loss: 0.5553 -
accuracy: 0.7186 - val_loss: 0.5618 - val_accuracy: 0.7111
Epoch 8/20
250/250 [=====] - 4s 13ms/step - loss: 0.5533 -
accuracy: 0.7195 - val_loss: 0.5578 - val_accuracy: 0.7141
Epoch 9/20
250/250 [=====] - 4s 16ms/step - loss: 0.5513 -
accuracy: 0.7218 - val_loss: 0.5687 - val_accuracy: 0.7086
Epoch 10/20
250/250 [=====] - 4s 14ms/step - loss: 0.5516 -
accuracy: 0.7229 - val_loss: 0.5545 - val_accuracy: 0.7204
Epoch 11/20
250/250 [=====] - 5s 20ms/step - loss: 0.5491 -
accuracy: 0.7230 - val_loss: 0.5538 - val_accuracy: 0.7188
Epoch 12/20
250/250 [=====] - 4s 16ms/step - loss: 0.5483 -
accuracy: 0.7204 - val_loss: 0.5534 - val_accuracy: 0.7225
Epoch 13/20
250/250 [=====] - 4s 16ms/step - loss: 0.5477 -
accuracy: 0.7221 - val_loss: 0.5552 - val_accuracy: 0.7171
Epoch 14/20
250/250 [=====] - 4s 16ms/step - loss: 0.5461 -
accuracy: 0.7232 - val_loss: 0.5566 - val_accuracy: 0.7193
Epoch 15/20
250/250 [=====] - 4s 16ms/step - loss: 0.5463 -
accuracy: 0.7235 - val_loss: 0.5529 - val_accuracy: 0.7184
Epoch 16/20
250/250 [=====] - 4s 13ms/step - loss: 0.5463 -
accuracy: 0.7244 - val_loss: 0.5553 - val_accuracy: 0.7185
Epoch 17/20
250/250 [=====] - 4s 13ms/step - loss: 0.5448 -
accuracy: 0.7247 - val_loss: 0.5512 - val_accuracy: 0.7204
Epoch 18/20
250/250 [=====] - 5s 17ms/step - loss: 0.5441 -
accuracy: 0.7249 - val_loss: 0.5518 - val_accuracy: 0.7200
Epoch 19/20
250/250 [=====] - 3s 13ms/step - loss: 0.5447 -
accuracy: 0.7245 - val_loss: 0.5507 - val_accuracy: 0.7217
Epoch 20/20
250/250 [=====] - 4s 15ms/step - loss: 0.5441 -
accuracy: 0.7255 - val_loss: 0.5505 - val_accuracy: 0.7210

```

```

[ ]: history=model.fit(train_data.shuffle(10000).batch(100),
↪epochs=40,validation_data=val_data.batch(100), verbose=1)

```

Epoch 1/40
250/250 [=====] - 4s 13ms/step - loss: 0.5385 - accuracy: 0.7280 - val_loss: 0.5494 - val_accuracy: 0.7199
Epoch 2/40
250/250 [=====] - 4s 13ms/step - loss: 0.5391 - accuracy: 0.7284 - val_loss: 0.5497 - val_accuracy: 0.7190
Epoch 3/40
250/250 [=====] - 4s 15ms/step - loss: 0.5393 - accuracy: 0.7269 - val_loss: 0.5488 - val_accuracy: 0.7201
Epoch 4/40
250/250 [=====] - 3s 13ms/step - loss: 0.5391 - accuracy: 0.7283 - val_loss: 0.5556 - val_accuracy: 0.7142
Epoch 5/40
250/250 [=====] - 4s 16ms/step - loss: 0.5386 - accuracy: 0.7277 - val_loss: 0.5490 - val_accuracy: 0.7203
Epoch 6/40
250/250 [=====] - 4s 13ms/step - loss: 0.5378 - accuracy: 0.7279 - val_loss: 0.5510 - val_accuracy: 0.7172
Epoch 7/40
250/250 [=====] - 4s 14ms/step - loss: 0.5381 - accuracy: 0.7279 - val_loss: 0.5489 - val_accuracy: 0.7204
Epoch 8/40
250/250 [=====] - 4s 17ms/step - loss: 0.5380 - accuracy: 0.7291 - val_loss: 0.5559 - val_accuracy: 0.7172
Epoch 9/40
250/250 [=====] - 4s 14ms/step - loss: 0.5386 - accuracy: 0.7267 - val_loss: 0.5544 - val_accuracy: 0.7161
Epoch 10/40
250/250 [=====] - 4s 13ms/step - loss: 0.5384 - accuracy: 0.7298 - val_loss: 0.5509 - val_accuracy: 0.7186
Epoch 11/40
250/250 [=====] - 5s 17ms/step - loss: 0.5386 - accuracy: 0.7282 - val_loss: 0.5513 - val_accuracy: 0.7169
Epoch 12/40
250/250 [=====] - 4s 13ms/step - loss: 0.5383 - accuracy: 0.7269 - val_loss: 0.5489 - val_accuracy: 0.7185
Epoch 13/40
250/250 [=====] - 3s 13ms/step - loss: 0.5387 - accuracy: 0.7275 - val_loss: 0.5501 - val_accuracy: 0.7167
Epoch 14/40
250/250 [=====] - 5s 19ms/step - loss: 0.5374 - accuracy: 0.7295 - val_loss: 0.5484 - val_accuracy: 0.7211
Epoch 15/40
250/250 [=====] - 4s 14ms/step - loss: 0.5376 - accuracy: 0.7292 - val_loss: 0.5486 - val_accuracy: 0.7184
Epoch 16/40
250/250 [=====] - 4s 16ms/step - loss: 0.5374 - accuracy: 0.7287 - val_loss: 0.5490 - val_accuracy: 0.7200

Epoch 17/40
250/250 [=====] - 4s 15ms/step - loss: 0.5382 - accuracy: 0.7272 - val_loss: 0.5558 - val_accuracy: 0.7143

Epoch 18/40
250/250 [=====] - 4s 13ms/step - loss: 0.5381 - accuracy: 0.7302 - val_loss: 0.5495 - val_accuracy: 0.7195

Epoch 19/40
250/250 [=====] - 5s 17ms/step - loss: 0.5367 - accuracy: 0.7295 - val_loss: 0.5494 - val_accuracy: 0.7194

Epoch 20/40
250/250 [=====] - 4s 13ms/step - loss: 0.5372 - accuracy: 0.7290 - val_loss: 0.5489 - val_accuracy: 0.7186

Epoch 21/40
250/250 [=====] - 4s 17ms/step - loss: 0.5373 - accuracy: 0.7282 - val_loss: 0.5483 - val_accuracy: 0.7204

Epoch 22/40
250/250 [=====] - 6s 23ms/step - loss: 0.5375 - accuracy: 0.7299 - val_loss: 0.5488 - val_accuracy: 0.7197

Epoch 23/40
250/250 [=====] - 3s 13ms/step - loss: 0.5369 - accuracy: 0.7285 - val_loss: 0.5508 - val_accuracy: 0.7193

Epoch 24/40
250/250 [=====] - 4s 16ms/step - loss: 0.5371 - accuracy: 0.7288 - val_loss: 0.5485 - val_accuracy: 0.7196

Epoch 25/40
250/250 [=====] - 4s 13ms/step - loss: 0.5369 - accuracy: 0.7275 - val_loss: 0.5481 - val_accuracy: 0.7196

Epoch 26/40
250/250 [=====] - 4s 15ms/step - loss: 0.5372 - accuracy: 0.7303 - val_loss: 0.5507 - val_accuracy: 0.7181

Epoch 27/40
250/250 [=====] - 4s 14ms/step - loss: 0.5376 - accuracy: 0.7291 - val_loss: 0.5487 - val_accuracy: 0.7191

Epoch 28/40
250/250 [=====] - 4s 13ms/step - loss: 0.5371 - accuracy: 0.7300 - val_loss: 0.5474 - val_accuracy: 0.7213

Epoch 29/40
250/250 [=====] - 4s 14ms/step - loss: 0.5364 - accuracy: 0.7286 - val_loss: 0.5487 - val_accuracy: 0.7199

Epoch 30/40
250/250 [=====] - 4s 13ms/step - loss: 0.5366 - accuracy: 0.7299 - val_loss: 0.5499 - val_accuracy: 0.7180

Epoch 31/40
250/250 [=====] - 4s 13ms/step - loss: 0.5374 - accuracy: 0.7290 - val_loss: 0.5500 - val_accuracy: 0.7186

Epoch 32/40
250/250 [=====] - 5s 17ms/step - loss: 0.5374 - accuracy: 0.7309 - val_loss: 0.5483 - val_accuracy: 0.7207

```

Epoch 33/40
250/250 [=====] - 4s 14ms/step - loss: 0.5366 -
accuracy: 0.7295 - val_loss: 0.5492 - val_accuracy: 0.7192
Epoch 34/40
250/250 [=====] - 3s 13ms/step - loss: 0.5364 -
accuracy: 0.7296 - val_loss: 0.5476 - val_accuracy: 0.7204
Epoch 35/40
250/250 [=====] - 5s 19ms/step - loss: 0.5369 -
accuracy: 0.7284 - val_loss: 0.5486 - val_accuracy: 0.7207
Epoch 36/40
250/250 [=====] - 4s 14ms/step - loss: 0.5362 -
accuracy: 0.7308 - val_loss: 0.5500 - val_accuracy: 0.7183
Epoch 37/40
250/250 [=====] - 4s 15ms/step - loss: 0.5358 -
accuracy: 0.7308 - val_loss: 0.5479 - val_accuracy: 0.7196
Epoch 38/40
250/250 [=====] - 4s 13ms/step - loss: 0.5352 -
accuracy: 0.7304 - val_loss: 0.5480 - val_accuracy: 0.7208
Epoch 39/40
250/250 [=====] - 4s 13ms/step - loss: 0.5356 -
accuracy: 0.7298 - val_loss: 0.5491 - val_accuracy: 0.7201
Epoch 40/40
250/250 [=====] - 4s 15ms/step - loss: 0.5358 -
accuracy: 0.7281 - val_loss: 0.5482 - val_accuracy: 0.7201

```

```

[ ]: results=model.evaluate(test_data.batch(100),verbose=2)
results

```

```

150/150 - 2s - loss: 0.5472 - accuracy: 0.7215 - 2s/epoch - 15ms/step

```

```

[ ]: [0.5471668243408203, 0.7214666604995728]

```