problem4

November 29, 2023

[ ]:
```
# Import packages
# DL Packages
import tensorflow as tf
import keras

# Others
import matplotlib.pyplot as plt
import numpy as np
import scipy as sp
import sympy as sym
import seaborn as sns

from sklearn.metrics import confusion_matrix
```

```
2023-11-29 13:13:24.652038: I tensorflow/core/util/port.cc:111] oneDNN custom
operations are on. You may see slightly different numerical results due to
floating-point round-off errors from different computation orders. To turn them
off, set the environment variable `TF_ENABLE_ONEDNN_OPTS=0`.
2023-11-29 13:13:24.675509: E
tensorflow/compiler/xla/stream_executor/cuda/cuda_dnn.cc:9342] Unable to
register cuDNN factory: Attempting to register factory for plugin cuDNN when one
has already been registered
2023-11-29 13:13:24.675533: E
tensorflow/compiler/xla/stream_executor/cuda/cuda_fft.cc:609] Unable to register
cuFFT factory: Attempting to register factory for plugin cuFFT when one has
already been registered
2023-11-29 13:13:24.675547: E
tensorflow/compiler/xla/stream_executor/cuda/cuda_blas.cc:1518] Unable to
register cuBLAS factory: Attempting to register factory for plugin cuBLAS when
one has already been registered
2023-11-29 13:13:24.679782: I tensorflow/core/platform/cpu_feature_guard.cc:182]
This TensorFlow binary is optimized to use available CPU instructions in
performance-critical operations.
To enable the following instructions: AVX2 AVX512F AVX512_VNNI FMA, in other
operations, rebuild TensorFlow with the appropriate compiler flags.
```

1 Examine the Data:

I'll use the suggested IMDB movie review sentiment classification dataset. This dataset has 25,000 movie reviews that are rated as either positive or negative. The data is pre-processed so that words have been replaced with positive integers that correspond to the frequency of a word. For example the 19th most common word will be represented as 19 + an offset we specify.

[ ]:
```
# Reading instructions from https://keras.io/api/datasets/imdb/
# With extra parameters specified

# Start of a sequence is marked as this
start_char = 1

# Words that are skipped because they are too infrequent are replaced by this
oov_char = 2

# Actual words have this index or higher
index_from = 3

# Skip the top n most common words
skip_top = 0

# Only the num_words most frequent words are kept.
# Anything less frequent is treated as oov
num_words = 20000

# Maximum length of the review. Truncate past this point
maxlen = 500

# Random seed to make loading deterministic
seed = 17

# Retrieve the training sequences.
(x_train, y_train), (x_test, y_test) = keras.datasets.imdb.load_data(
    start_char=start_char, oov_char=oov_char, index_from=index_from, seed=seed,
    skip_top=skip_top, num_words=num_words, maxlen=maxlen
)
# Retrieve the word index file mapping words to indices
word_index = keras.datasets.imdb.get_word_index()

# Reverse the word index to obtain a dict mapping indices to words
# And add `index_from` to indices to sync with `x_train`
inverted_word_index = dict(
    (i + index_from, word) for (word, i) in word_index.items()
)

# Update `inverted_word_index` to include `start_char` and `oov_char`
inverted_word_index[start_char] = "[START]"
```

```
inverted_word_index[oov_char] = "[OOV]"

# Decode the first sequence in the dataset
decoded_sequence = " ".join(inverted_word_index[i] for i in x_train[0])

print("x[0]", decoded_sequence)
print("y[0]", y_train[0])
```

```
x[0] [START] rudy does it again with this hot off the streets follow up to
dolemite this entry is filled with the requisite rudy ray moore [OOV] humor and
martial arts rudy [OOV] a crazy red neck sheriff in this movie that also
features an infamous scene where rudy dives down a steep hill see it for laughs
and for a brain blasting hit of blaxploitation magic
y[0] 1
```

[ ]:
```
np.unique(y_train)
```

[ ]:
```
array([0, 1])
```

This code looks like it gets the review text, and from this example it seems that y=1 is positive sentiment and y=0 is negative sentiment. Now let's make a function to load the data. For feeding it to our network we want to keep it in the integer encoding, but to examine the data we want the actual text.

[ ]:
```
def load_review(x_data: np.array, y_data: np.array, i: int, load_txt: bool =␣
↪False, inverted_word_index:dict = inverted_word_index):
    """
    Loads the review at the specified index from the specified x, y data.

    Optionally converts to text.

    Args:
        x_data (np.array): dataset to load from (either x_train or x_test)
        y_data (np.array): labels to load from (either y_train or y_test)
        i (int): index of review to load
        load_txt (bool, optional): whether to convert integer encoding to text␣
↪or not. Defaults to False.
        inverted_word_index (dict, optional): mapping of indices to words.␣
↪Defaults to inverted_word_index.

    Returns:
        review_data, sentiment_label
    """

    review_data = x_data[i]

    if load_txt:
        review_data = " ".join(inverted_word_index[n] for n in x_train[i])
```

```
    return review_data, y_data[i]
```

Armed with this function, let's randomly select some positive and negative reviews to look at:

[ ]:
```
pos_idx = np.argwhere(y_train == 1).flatten()
neg_idx = np.argwhere(y_train == 0).flatten()
```

[ ]:
```
n_samples = 5

print("Positive Reviews...")
for n in range(n_samples):
    i = np.random.choice(pos_idx)
    print(load_review(x_train, y_train, i, load_txt=True))

print("\nNegative Reviews...")
for n in range(n_samples):
    i = np.random.choice(neg_idx)
    print(load_review(x_train, y_train, i, load_txt=True))
```

```
Positive Reviews…
("[START] barbra streisand is a tour de force in this hollywood story her
performances and the songs are one of a kind and are special in the halls of
great movies the scene where she is introduced to the [OOV] audience by [OOV]
against the [OOV] wishes and hers only to turn them around with her magnificent
performance of woman in the moon is one of the best examples on film of how well
a great performer can win over an audience it's real the scene where she records
evergreen ranks with the best in the business all live no lip sync very special
streisand is often criticized for being a diva but she delivers on this one she
is majestic singing with one more look at you she deserved the oscar she and
paul williams got for evergreen [OOV] had his moments too far above most of his
movie appearances this version of the born franchise ranks with the first one of
1937 janet [OOV] frederic march although i will always enjoy judy garland and
james mason musical remake of 1954 i haven't seen the dvd yet and don't know
about its quality", 1)
("[START] in the immediate aftermath following world war ii sound minds in
hollywood tried to distance themselves from the mindless flag waving that is a
natural ingredient in a war effort best years of our [OOV] and even [OOV] [OOV]
investigated the way americans looked at themselves in the wake of the war but
[OOV] [OOV] pride of the marines beat them to it br br the film is about
philadelphia smart alec john garfield who goes to war as a marine and after a
nightmarish evening in a [OOV] with japanese soldiers eerily crying out at him
and his buddies [OOV] tonight you die he is blinded by a hand grenade and dumps
his girlfriend back home rather than have to depend on her after coming home br
br [OOV] [OOV] is uncompromising in his depiction on these men who are brave as
it were almost by coincidence they are there in the [OOV] and when shot at they
react so much for heroism but they get the job done and then comes the self pity
the dark gloomy sense of humor garfield is in angry denial of his blindness and
```

the film makes no excuses there's no free candy for anyone in this world as his buddy tells him the same guy a jew played by dane clark reminds him in a war somebody gets it and you're it everybody's got problems when i get back some guys won't hire me because my name is diamond br br great movies are made with guts like these and if the first half hour of [OOV] of the [OOV] fails to rise to the occasion completely from then on it evolves into a true work of art you weep and you ponder you [OOV] and you hope against hope well simply art br br", 1)
("[START] i think this still is the best routine there are some others like rock's bring the pain and allen's men are pigs that are hilarious damon [OOV] last stand is also funny in a tearful way but this routine has no errors all the jokes are funny and the time limit of 70 minutes is perfect just long enough to last 20 years i just love how he allows the audience to be totally themselves and [OOV] i'm a fan of the classics and for a guy who watched a lot of of jim carrey growing up watching a more laid back comic is pretty cool not putting in a category with ellen and newhart but something you can watch if you're bloated thanks eddie god bless", 1)
("[START] before nicholas cage was a big action star he was a great actor this lesser known movie is where cage gives one of his best performances red rock west was a low budget almost un known film but is one of my favorite movies of all time i discovered it walking down the video store aisle and wanted to see cage and hopper who also is great in the movie appear together go get this one and i'm sure you won't be disappointed", 1)
("[START] a great movie rather challenging than really entertaining sadly no memorable quotes here but this one's my favorite alexandre if you're leaving someone that you have loved you have to say what i'm telling you now farewell i'm going but to disappear to hide like a criminal is [OOV] didn't watch it with english subtitles br br in my opinion this expresses it all there is so much tactics involved in the relationships between alexandre and the others and yet everyone longs for a little bit more truth however knowing the truth can hurt even more as alexandre experiences common interpretation is that the movie [OOV] the mere possibility of liberated love by depicting the unwanted implications on the people involved it does indeed show this in a convincing manner but i would appreciate it if the reasons had been treated a bit more in depth it's not that liberated love is in itself doomed to failure but people especially men i think should work on themselves and try to overcome the ruling morals before and not through practicing liberated love br br that said the movie's realistic though and really worthwhile watching", 1)

Negative Reviews…
("[START] lets start off by saying that [OOV] [OOV] is just a pathetic movie i agree with the last person who said i missed the [OOV] lol br br the jokes were just terrible performances were average something went terribly wrong with the film emraan totally deserved something better all [OOV] [OOV] did was expose [OOV] [OOV] was ok emraan [OOV] was ok too br br mann emraan [OOV] is a desperate guy who wants to become famous therefore he uses radha and pretends he loves her only because her father is a music director and could help him become famous since the father [OOV] everything his daughter says one day mann and his

friends go to [OOV] to have some fun there he meets roma [OOV] [OOV] and totally falls for her looks and tries to flirt with her bla bla bla br br then that night roma cannot open the door to her room and mann decides to help her seeing that he cannot as well roma goes to ask for help while she is gone mann is able to open the door and decides to come inside and sits on her bed bla bla bla roma comes in and they have a one night stand however in that one night stand roma falls in love with him that morning they spot the underworld don [OOV] who sees it all the don loves roma and couldn't stand what he saw he orders them to get married and being frightened mann [OOV] the order and [OOV] roma then their marriage news ends up in the newspaper mann is later finds out that he loves roma after they do a music video together he is now trapped between love and fame bla bla bla br br the movie is horrible the songs [OOV] ne [OOV] ne is fantastic the [OOV] version is even better dil [OOV] is also great the title track is also awesome guys avoid watching this movie", 0)
('[START] i found myself very caught up in this movie at least at the beginning and any credit i give to this movie is [OOV] [OOV] she was fantastic but thats where it ends i seem to be very good at figuring out who the killer is and i like it when a movie is able to completely [OOV] me but i felt out and out lied to they whole time they lead you in one direction and then suddenly they decided to go in a completely different direction at the end they gave no hit to it at all thats not misleading that very bad writing and planning someone did not think at all br br i felt the movie would have been much better if they had stuck to the plot that the lead you on they also seemed to not answer anything why did jane maria burn down the [OOV] house br br its a great pity as i felt it started out as a relatively good movie', 0)
("[START] well i just ordered this on my pay per view at home because i was bored and needed a laugh i have to admit i did chuckle a few times but i don't even remember what parts they were at i don't understand why this movie was made it claims to be a comedy but [OOV] i don't find a singing penis or a naked 70 year old woman very funny this movie was trying to fit itself into the [OOV] out' comedies of recent years such as american pie and road trip but it just failed miserably it was way to much gross out then it was comedy also why on earth did cameron diaz attach her name to this movie the only thing i liked about this movie was when dave and angela were in the pool i thought it was sexy and enjoyable and well done besides that avoid this movie 3 10", 0)
("[START] this movie is the biggest steaming pile of you know what being from and growing up in [OOV] kansas i know for a fact 90 of the movie was bogus aside from the names of some of the victims nothing else much was correct the movie looks like it was made with dad's handy cam it had footage that i believe came from another film along with stock footage from a slaughter house i usually enjoy watching bad films for the fun of it but due to the bad acting poorly prepared or non existent sets and a very dull and short ending it was a struggle to watch it through to the ending i recommend that you not waste your money on this film or you will be sorry [OOV]", 0)
("[START] i know that in this episode there's other stuff apart from what i am going to discuss and in fact i think it has some virtues for example the fact after we had been given a very negative opinion of [OOV] from seeing [OOV] flashbacks in house of the rising sun we get to see [OOV] side of things and get

```
a new more balanced understanding of his life br br but there is an element in
this story that made me so deeply uncomfortable that it greatly [OOV] my
enjoyment of the whole episode before now in the scene where [OOV] appeared with
blood on his hands and shirt it had been hinted that [OOV] father was someone
who was getting rich through shady illegal methods i thought maybe he was a mob
boss even [OOV] operate in korea just like in almost every other country in the
world so it was a reasonable possibility however in this episode we learn that
[OOV] father is in fact the boss or a top executive of a korean [OOV] company
and that what [OOV] had been doing was physically attacking a government
official who was actually going to be murdered on his behalf br br i may be
especially touchy about this because i happen to work in the [OOV] industry but
i would say it is spectacularly offensive and racist to even suggest that this
kind of thing goes on in korea that huge serious companies like [OOV] or [OOV]
which must be the model for this fictitious car company as they are the only
ones that actually exist in reality operate with these mafia like methods
instead of like any normal [OOV] company of the west it is just unbelievable to
me that the writers would have the gall to write something like that into the
story and that there hasn't been an uproar in korea over it it feels like
extraneous buy american propaganda portraying foreign car companies as criminal
[OOV] third world outfits", 0)
```

2 Pre-Process Data:

For the assignment, I want to try two different approaches: the default frequency-based embeddings of the dataset, and using a GLOVE embedding to see if we're able to pick out more information. For the first one, we just need to get every entry to be the same length, but we need to do some work for the second one.

2.1 Padding

Add Zeros up to max len and convert to numpy array

[ ]:
```
for i in range(len(x_train)):
    n_words = len(x_train[i])
    if n_words < maxlen:
        x_train[i] = x_train[i] + [0]*(maxlen-n_words)
    if isinstance(x_train[i], list):
        x_train[i] = np.array(x_train[i])
x_train = np.vstack(list(x_train))
y_train = y_train.reshape((-1, 1))

for i in range(len(x_test)):
    n_words = len(x_test[i])
    if n_words < maxlen:
        x_test[i] = x_test[i] + [0]*(maxlen-n_words)
    if isinstance(x_test[i], list):
        x_test[i] = np.array(x_test[i])
```

```
x_test = np.vstack(list(x_test))
y_test = y_test.reshape((-1, 1))
```

2.2 Create GLOVE embedding

Followed the instructions from: https://keras.io/examples/nlp/pretrained_word_embeddings/

[ ]:
```
import os
path_to_glove_file = "glove.6B.100d.txt"

embeddings_index = {}
with open(path_to_glove_file) as f:
    for line in f:
        word, coefs = line.split(maxsplit=1)
        coefs = np.fromstring(coefs, "f", sep=" ")
        embeddings_index[word] = coefs

print("Found %s word vectors." % len(embeddings_index))
```

```
Found 400000 word vectors.
```

[ ]:
```
num_tokens = num_words + 2
embedding_dim = 100
hits = 0
misses = 0

# Prepare embedding matrix
embedding_matrix = np.zeros((num_tokens, embedding_dim))
for word, i in word_index.items():
    embedding_vector = embeddings_index.get(word)
    if embedding_vector is not None and i < num_tokens:
        # Words not found in embedding index will be all-zeros.
        # This includes the representation for "padding" and "OOV"
        embedding_matrix[i] = embedding_vector
        hits += 1
    else:
        misses += 1
print("Converted %d words (%d misses)" % (hits, misses))
```

```
Converted 19132 words (69452 misses)
```

3 Make/Train a Network

3.1 RNN - Trained Embedding

[ ]:
```
# 20000 most common words, plus the out of dictionary
model = keras.Sequential([
    keras.layers.Embedding(input_dim=num_words+2, output_dim=100,␣
 ↪mask_zero=True),
    keras.layers.SimpleRNN(64, return_sequences=False),
    keras.layers.Dropout(0.1),
    keras.layers.Dense(64, activation="relu"),
    keras.layers.Dense(1, activation="sigmoid")
    ])
model.build()
model.compile(optimizer="adam", loss="binary_crossentropy",
              metrics=[keras.metrics.BinaryAccuracy()])
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, None, 100)         2000200

 simple_rnn (SimpleRNN)      (None, 64)                10560

 dropout (Dropout)           (None, 64)                0

 dense (Dense)               (None, 64)                4160

 dense_1 (Dense)             (None, 1)                 65

=================================================================
Total params: 2014985 (7.69 MB)
Trainable params: 2014985 (7.69 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
2023-11-29 13:13:31.490667: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.493584: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
```

```
pci#L344-L355
2023-11-29 13:13:31.493667: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.494604: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.494686: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.494748: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.545783: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.545980: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.546055: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:894]
successful NUMA node read from SysFS had negative value (-1), but there must be
at least one NUMA node, so returning NUMA node zero. See more at
https://github.com/torvalds/linux/blob/v6.0/Documentation/ABI/testing/sysfs-bus-
pci#L344-L355
2023-11-29 13:13:31.546112: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1886] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 18426 MB memory:  -> device:
0, name: NVIDIA RTX A4500, pci bus id: 0000:01:00.0, compute capability: 8.6
2023-11-29 13:13:31.656994: I tensorflow/tsl/platform/default/subprocess.cc:304]
```

```
Start cannot spawn child process: No such file or directory
```

[ ]:
```
history = model.fit(x_train, y_train, batch_size=12000, epochs=50,␣
↪validation_data=(x_test, y_test))
```

```
Epoch 1/50

2023-11-29 13:13:33.238038: I tensorflow/compiler/xla/service/service.cc:168]
XLA service 0x7f92245cb8a0 initialized for platform CUDA (this does not
guarantee that XLA will be used). Devices:
2023-11-29 13:13:33.238063: I tensorflow/compiler/xla/service/service.cc:176]
StreamExecutor device (0): NVIDIA RTX A4500, Compute Capability 8.6
2023-11-29 13:13:33.241249: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:269] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-11-29 13:13:33.249214: I
tensorflow/compiler/xla/stream_executor/cuda/cuda_dnn.cc:442] Loaded cuDNN
version 8700
2023-11-29 13:13:33.287083: I ./tensorflow/compiler/jit/device_compiler.h:186]
Compiled cluster using XLA!  This line is logged at most once for the lifetime
of the process.

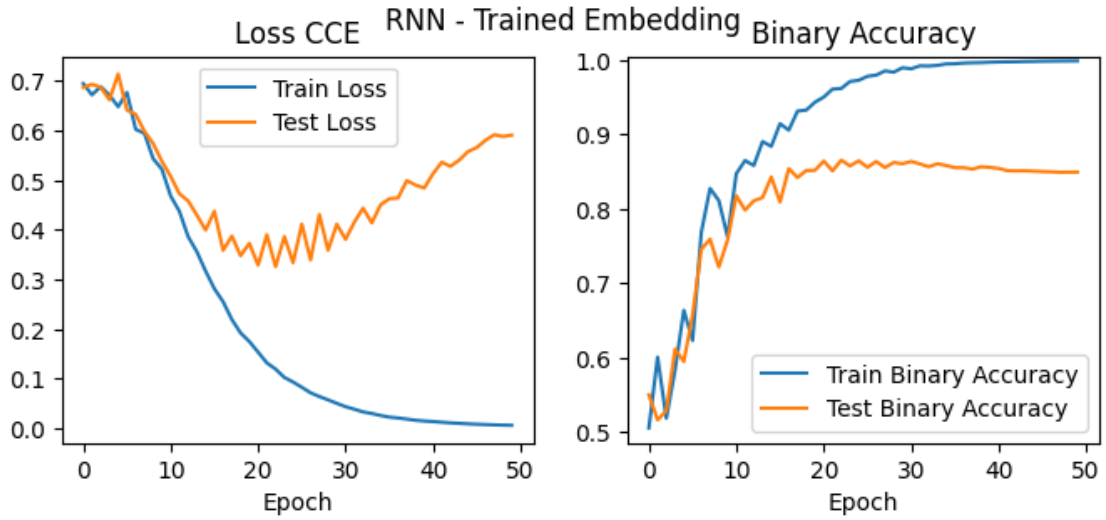
2/2 [==============================] - 3s 632ms/step - loss: 0.6950 -
binary_accuracy: 0.5053 - val_loss: 0.6871 - val_binary_accuracy: 0.5500
Epoch 2/50
2/2 [==============================] - 1s 469ms/step - loss: 0.6723 -
binary_accuracy: 0.6006 - val_loss: 0.6935 - val_binary_accuracy: 0.5163
Epoch 3/50
2/2 [==============================] - 1s 476ms/step - loss: 0.6889 -
binary_accuracy: 0.5185 - val_loss: 0.6876 - val_binary_accuracy: 0.5283
Epoch 4/50
2/2 [==============================] - 1s 467ms/step - loss: 0.6718 -
binary_accuracy: 0.5835 - val_loss: 0.6623 - val_binary_accuracy: 0.6115
Epoch 5/50
2/2 [==============================] - 1s 471ms/step - loss: 0.6483 -
binary_accuracy: 0.6636 - val_loss: 0.7143 - val_binary_accuracy: 0.5948
Epoch 6/50
2/2 [==============================] - 1s 468ms/step - loss: 0.6771 -
binary_accuracy: 0.6229 - val_loss: 0.6415 - val_binary_accuracy: 0.6572
Epoch 7/50
2/2 [==============================] - 1s 468ms/step - loss: 0.6027 -
binary_accuracy: 0.7687 - val_loss: 0.6329 - val_binary_accuracy: 0.7458
Epoch 8/50
2/2 [==============================] - 1s 453ms/step - loss: 0.5947 -
binary_accuracy: 0.8275 - val_loss: 0.5988 - val_binary_accuracy: 0.7592
Epoch 9/50
2/2 [==============================] - 1s 452ms/step - loss: 0.5437 -
binary_accuracy: 0.8112 - val_loss: 0.5742 - val_binary_accuracy: 0.7218
Epoch 10/50
```

```
2/2 [==============================] - 1s 468ms/step - loss: 0.5222 -
binary_accuracy: 0.7626 - val_loss: 0.5382 - val_binary_accuracy: 0.7581
Epoch 11/50
2/2 [==============================] - 1s 471ms/step - loss: 0.4685 -
binary_accuracy: 0.8474 - val_loss: 0.5080 - val_binary_accuracy: 0.8177
Epoch 12/50
2/2 [==============================] - 1s 469ms/step - loss: 0.4376 -
binary_accuracy: 0.8650 - val_loss: 0.4730 - val_binary_accuracy: 0.7984
Epoch 13/50
2/2 [==============================] - 1s 472ms/step - loss: 0.3866 -
binary_accuracy: 0.8584 - val_loss: 0.4585 - val_binary_accuracy: 0.8109
Epoch 14/50
2/2 [==============================] - 1s 455ms/step - loss: 0.3560 -
binary_accuracy: 0.8906 - val_loss: 0.4299 - val_binary_accuracy: 0.8152
Epoch 15/50
2/2 [==============================] - 1s 452ms/step - loss: 0.3170 -
binary_accuracy: 0.8841 - val_loss: 0.3998 - val_binary_accuracy: 0.8429
Epoch 16/50
2/2 [==============================] - 1s 470ms/step - loss: 0.2817 -
binary_accuracy: 0.9146 - val_loss: 0.4378 - val_binary_accuracy: 0.8092
Epoch 17/50
2/2 [==============================] - 1s 474ms/step - loss: 0.2553 -
binary_accuracy: 0.9059 - val_loss: 0.3589 - val_binary_accuracy: 0.8542
Epoch 18/50
2/2 [==============================] - 1s 472ms/step - loss: 0.2195 -
binary_accuracy: 0.9315 - val_loss: 0.3877 - val_binary_accuracy: 0.8422
Epoch 19/50
2/2 [==============================] - 1s 471ms/step - loss: 0.1924 -
binary_accuracy: 0.9329 - val_loss: 0.3481 - val_binary_accuracy: 0.8516
Epoch 20/50
2/2 [==============================] - 1s 471ms/step - loss: 0.1752 -
binary_accuracy: 0.9435 - val_loss: 0.3730 - val_binary_accuracy: 0.8520
Epoch 21/50
2/2 [==============================] - 1s 453ms/step - loss: 0.1538 -
binary_accuracy: 0.9504 - val_loss: 0.3293 - val_binary_accuracy: 0.8643
Epoch 22/50
2/2 [==============================] - 1s 471ms/step - loss: 0.1321 -
binary_accuracy: 0.9611 - val_loss: 0.3904 - val_binary_accuracy: 0.8511
Epoch 23/50
2/2 [==============================] - 1s 472ms/step - loss: 0.1196 -
binary_accuracy: 0.9619 - val_loss: 0.3261 - val_binary_accuracy: 0.8655
Epoch 24/50
2/2 [==============================] - 1s 471ms/step - loss: 0.1028 -
binary_accuracy: 0.9713 - val_loss: 0.3868 - val_binary_accuracy: 0.8578
Epoch 25/50
2/2 [==============================] - 1s 457ms/step - loss: 0.0936 -
binary_accuracy: 0.9729 - val_loss: 0.3340 - val_binary_accuracy: 0.8646
Epoch 26/50
```

```
2/2 [==============================] - 1s 455ms/step - loss: 0.0830 -
binary_accuracy: 0.9783 - val_loss: 0.4117 - val_binary_accuracy: 0.8560
Epoch 27/50
2/2 [==============================] - 1s 473ms/step - loss: 0.0719 -
binary_accuracy: 0.9799 - val_loss: 0.3396 - val_binary_accuracy: 0.8637
Epoch 28/50
2/2 [==============================] - 1s 454ms/step - loss: 0.0644 -
binary_accuracy: 0.9856 - val_loss: 0.4313 - val_binary_accuracy: 0.8556
Epoch 29/50
2/2 [==============================] - 1s 474ms/step - loss: 0.0577 -
binary_accuracy: 0.9838 - val_loss: 0.3590 - val_binary_accuracy: 0.8624
Epoch 30/50
2/2 [==============================] - 1s 455ms/step - loss: 0.0506 -
binary_accuracy: 0.9898 - val_loss: 0.4116 - val_binary_accuracy: 0.8607
Epoch 31/50
2/2 [==============================] - 1s 458ms/step - loss: 0.0439 -
binary_accuracy: 0.9884 - val_loss: 0.3811 - val_binary_accuracy: 0.8638
Epoch 32/50
2/2 [==============================] - 1s 457ms/step - loss: 0.0388 -
binary_accuracy: 0.9924 - val_loss: 0.4157 - val_binary_accuracy: 0.8604
Epoch 33/50
2/2 [==============================] - 1s 478ms/step - loss: 0.0334 -
binary_accuracy: 0.9921 - val_loss: 0.4440 - val_binary_accuracy: 0.8568
Epoch 34/50
2/2 [==============================] - 1s 457ms/step - loss: 0.0302 -
binary_accuracy: 0.9930 - val_loss: 0.4143 - val_binary_accuracy: 0.8606
Epoch 35/50
2/2 [==============================] - 1s 475ms/step - loss: 0.0262 -
binary_accuracy: 0.9950 - val_loss: 0.4506 - val_binary_accuracy: 0.8584
Epoch 36/50
2/2 [==============================] - 1s 457ms/step - loss: 0.0229 -
binary_accuracy: 0.9952 - val_loss: 0.4629 - val_binary_accuracy: 0.8554
Epoch 37/50
2/2 [==============================] - 1s 459ms/step - loss: 0.0211 -
binary_accuracy: 0.9961 - val_loss: 0.4643 - val_binary_accuracy: 0.8554
Epoch 38/50
2/2 [==============================] - 1s 477ms/step - loss: 0.0189 -
binary_accuracy: 0.9965 - val_loss: 0.4995 - val_binary_accuracy: 0.8535
Epoch 39/50
2/2 [==============================] - 1s 474ms/step - loss: 0.0166 -
binary_accuracy: 0.9967 - val_loss: 0.4906 - val_binary_accuracy: 0.8567
Epoch 40/50
2/2 [==============================] - 1s 458ms/step - loss: 0.0151 -
binary_accuracy: 0.9972 - val_loss: 0.4845 - val_binary_accuracy: 0.8558
Epoch 41/50
2/2 [==============================] - 1s 481ms/step - loss: 0.0140 -
binary_accuracy: 0.9976 - val_loss: 0.5135 - val_binary_accuracy: 0.8544
Epoch 42/50
```

```
2/2 [==============================] - 1s 479ms/step - loss: 0.0126 -
binary_accuracy: 0.9977 - val_loss: 0.5365 - val_binary_accuracy: 0.8514
Epoch 43/50
2/2 [==============================] - 1s 453ms/step - loss: 0.0113 -
binary_accuracy: 0.9978 - val_loss: 0.5283 - val_binary_accuracy: 0.8511
Epoch 44/50
2/2 [==============================] - 1s 478ms/step - loss: 0.0104 -
binary_accuracy: 0.9982 - val_loss: 0.5409 - val_binary_accuracy: 0.8512
Epoch 45/50
2/2 [==============================] - 1s 459ms/step - loss: 0.0094 -
binary_accuracy: 0.9983 - val_loss: 0.5579 - val_binary_accuracy: 0.8507
Epoch 46/50
2/2 [==============================] - 1s 474ms/step - loss: 0.0085 -
binary_accuracy: 0.9986 - val_loss: 0.5662 - val_binary_accuracy: 0.8502
Epoch 47/50
2/2 [==============================] - 1s 474ms/step - loss: 0.0080 -
binary_accuracy: 0.9987 - val_loss: 0.5807 - val_binary_accuracy: 0.8499
Epoch 48/50
2/2 [==============================] - 1s 457ms/step - loss: 0.0072 -
binary_accuracy: 0.9989 - val_loss: 0.5920 - val_binary_accuracy: 0.8493
Epoch 49/50
2/2 [==============================] - 1s 458ms/step - loss: 0.0068 -
binary_accuracy: 0.9990 - val_loss: 0.5884 - val_binary_accuracy: 0.8493
Epoch 50/50
2/2 [==============================] - 1s 462ms/step - loss: 0.0064 -
binary_accuracy: 0.9990 - val_loss: 0.5912 - val_binary_accuracy: 0.8494
```

[ ]:
```
history_rnn = history
f, ax = plt.subplots(ncols=2)
f.set_size_inches(8,3)
plt.suptitle("RNN - Trained Embedding")
ax[0].plot(history.history["loss"], label="Train Loss")
ax[0].set_title("Loss CCE")
ax[0].plot(history.history["val_loss"], label="Test Loss")
# ax[0].set_yscale("log")
ax[0].set_xlabel("Epoch")
ax[0].legend()
ax[1].plot(history.history["binary_accuracy"], label="Train Binary Accuracy")
ax[1].set_xlabel("Epoch")
ax[1].set_title("Binary Accuracy")
ax[1].plot(history.history["val_binary_accuracy"], label="Test Binary Accuracy")
ax[1].set_ylim(min(history.history["binary_accuracy"])-0.02, 1.005)
ax[1].legend();
```



Although we were able to train to very high accuracy in our training set, it seems we were quite overfit, as the loss in our test set grew after about epoch 15.

3.2 RNN - GLOVE Embedding

We're going to do the exact same network, only swapping the trained embeddings for a fixed GLOVE embedding.

[ ]:
```
# 20000 most common words, plus the out of dictionary
model = keras.Sequential([
    keras.layers.Embedding(input_dim=num_tokens, output_dim=embedding_dim,
                           mask_zero=True, embeddings_initializer=keras.
 ↪initializers.Constant(embedding_matrix),
                           trainable=False),
    keras.layers.SimpleRNN(64, return_sequences=False),
    keras.layers.Dropout(0.1),
    keras.layers.Dense(64, activation="relu"),
    keras.layers.Dense(1, activation="sigmoid")
    ])
model.build()
model.compile(optimizer="adam", loss="binary_crossentropy",
              metrics=[keras.metrics.BinaryAccuracy()])
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_1 (Embedding)     (None, None, 100)         2000200
```

```
 simple_rnn_1 (SimpleRNN)    (None, 64)                10560

 dropout_1 (Dropout)         (None, 64)                0

 dense_2 (Dense)             (None, 64)                4160

 dense_3 (Dense)             (None, 1)                 65

=================================================================
Total params: 2014985 (7.69 MB)
Trainable params: 14785 (57.75 KB)
Non-trainable params: 2000200 (7.63 MB)
_________________________________________________________________
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_1 (Embedding)     (None, None, 100)         2000200

 simple_rnn_1 (SimpleRNN)    (None, 64)                10560

 dropout_1 (Dropout)         (None, 64)                0

 dense_2 (Dense)             (None, 64)                4160

 dense_3 (Dense)             (None, 1)                 65

=================================================================
Total params: 2014985 (7.69 MB)
Trainable params: 14785 (57.75 KB)
Non-trainable params: 2000200 (7.63 MB)
_________________________________________________________________
```

[ ]:
```
history = model.fit(x_train, y_train, batch_size=12000, epochs=500,␣
↪validation_data=(x_test, y_test))
```

```
Epoch 1/500
2/2 [==============================] - 2s 525ms/step - loss: 0.7184 -
binary_accuracy: 0.5017 - val_loss: 0.7089 - val_binary_accuracy: 0.5055
Epoch 2/500
2/2 [==============================] - 1s 388ms/step - loss: 0.7082 -
binary_accuracy: 0.5121 - val_loss: 0.6994 - val_binary_accuracy: 0.5107
Epoch 3/500
2/2 [==============================] - 1s 388ms/step - loss: 0.7015 -
binary_accuracy: 0.5179 - val_loss: 0.6968 - val_binary_accuracy: 0.5234
Epoch 4/500
2/2 [==============================] - 1s 385ms/step - loss: 0.6978 -
binary_accuracy: 0.5255 - val_loss: 0.6933 - val_binary_accuracy: 0.5281
Epoch 5/500
```

```
2/2 [==============================] - 1s 383ms/step - loss: 0.6922 -
binary_accuracy: 0.5360 - val_loss: 0.6919 - val_binary_accuracy: 0.5281
Epoch 6/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6911 -
binary_accuracy: 0.5370 - val_loss: 0.6905 - val_binary_accuracy: 0.5315
Epoch 7/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6884 -
binary_accuracy: 0.5424 - val_loss: 0.6887 - val_binary_accuracy: 0.5357
Epoch 8/500
2/2 [==============================] - 1s 385ms/step - loss: 0.6861 -
binary_accuracy: 0.5468 - val_loss: 0.6877 - val_binary_accuracy: 0.5398
Epoch 9/500
2/2 [==============================] - 1s 384ms/step - loss: 0.6846 -
binary_accuracy: 0.5529 - val_loss: 0.6865 - val_binary_accuracy: 0.5411
Epoch 10/500
2/2 [==============================] - 1s 385ms/step - loss: 0.6824 -
binary_accuracy: 0.5545 - val_loss: 0.6854 - val_binary_accuracy: 0.5426
Epoch 11/500
2/2 [==============================] - 1s 385ms/step - loss: 0.6797 -
binary_accuracy: 0.5615 - val_loss: 0.6846 - val_binary_accuracy: 0.5420
Epoch 12/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6784 -
binary_accuracy: 0.5680 - val_loss: 0.6835 - val_binary_accuracy: 0.5446
Epoch 13/500
2/2 [==============================] - 1s 377ms/step - loss: 0.6770 -
binary_accuracy: 0.5647 - val_loss: 0.6824 - val_binary_accuracy: 0.5481
Epoch 14/500
2/2 [==============================] - 1s 385ms/step - loss: 0.6741 -
binary_accuracy: 0.5726 - val_loss: 0.6814 - val_binary_accuracy: 0.5516
Epoch 15/500
2/2 [==============================] - 1s 385ms/step - loss: 0.6731 -
binary_accuracy: 0.5739 - val_loss: 0.6804 - val_binary_accuracy: 0.5520
Epoch 16/500
2/2 [==============================] - 1s 384ms/step - loss: 0.6699 -
binary_accuracy: 0.5774 - val_loss: 0.6795 - val_binary_accuracy: 0.5518
Epoch 17/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6690 -
binary_accuracy: 0.5802 - val_loss: 0.6781 - val_binary_accuracy: 0.5575
Epoch 18/500
2/2 [==============================] - 1s 386ms/step - loss: 0.6668 -
binary_accuracy: 0.5842 - val_loss: 0.6767 - val_binary_accuracy: 0.5622
Epoch 19/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6653 -
binary_accuracy: 0.5893 - val_loss: 0.6752 - val_binary_accuracy: 0.5646
Epoch 20/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6619 -
binary_accuracy: 0.5946 - val_loss: 0.6733 - val_binary_accuracy: 0.5687
Epoch 21/500
```

```
2/2 [==============================] - 1s 387ms/step - loss: 0.6595 -
binary_accuracy: 0.5968 - val_loss: 0.6714 - val_binary_accuracy: 0.5736
Epoch 22/500
2/2 [==============================] - 1s 386ms/step - loss: 0.6571 -
binary_accuracy: 0.6042 - val_loss: 0.6727 - val_binary_accuracy: 0.5733
Epoch 23/500
2/2 [==============================] - 1s 384ms/step - loss: 0.6555 -
binary_accuracy: 0.6061 - val_loss: 0.6679 - val_binary_accuracy: 0.5823
Epoch 24/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6514 -
binary_accuracy: 0.6121 - val_loss: 0.6654 - val_binary_accuracy: 0.5880
Epoch 25/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6501 -
binary_accuracy: 0.6147 - val_loss: 0.6798 - val_binary_accuracy: 0.5681
Epoch 26/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6544 -
binary_accuracy: 0.6063 - val_loss: 0.6730 - val_binary_accuracy: 0.5791
Epoch 27/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6531 -
binary_accuracy: 0.6089 - val_loss: 0.6660 - val_binary_accuracy: 0.5862
Epoch 28/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6499 -
binary_accuracy: 0.6176 - val_loss: 0.6653 - val_binary_accuracy: 0.5853
Epoch 29/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6456 -
binary_accuracy: 0.6238 - val_loss: 0.6654 - val_binary_accuracy: 0.5850
Epoch 30/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6479 -
binary_accuracy: 0.6154 - val_loss: 0.6624 - val_binary_accuracy: 0.5915
Epoch 31/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6439 -
binary_accuracy: 0.6235 - val_loss: 0.6649 - val_binary_accuracy: 0.5856
Epoch 32/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6434 -
binary_accuracy: 0.6238 - val_loss: 0.6598 - val_binary_accuracy: 0.5967
Epoch 33/500
2/2 [==============================] - 1s 386ms/step - loss: 0.6411 -
binary_accuracy: 0.6276 - val_loss: 0.6586 - val_binary_accuracy: 0.5984
Epoch 34/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6379 -
binary_accuracy: 0.6321 - val_loss: 0.6600 - val_binary_accuracy: 0.5973
Epoch 35/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6380 -
binary_accuracy: 0.6270 - val_loss: 0.6560 - val_binary_accuracy: 0.6029
Epoch 36/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6346 -
binary_accuracy: 0.6334 - val_loss: 0.6546 - val_binary_accuracy: 0.6065
Epoch 37/500
```

```
2/2 [==============================] - 1s 389ms/step - loss: 0.6327 -
binary_accuracy: 0.6382 - val_loss: 0.6528 - val_binary_accuracy: 0.6096
Epoch 38/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6298 -
binary_accuracy: 0.6390 - val_loss: 0.6508 - val_binary_accuracy: 0.6115
Epoch 39/500
2/2 [==============================] - 1s 386ms/step - loss: 0.6276 -
binary_accuracy: 0.6429 - val_loss: 0.6505 - val_binary_accuracy: 0.6128
Epoch 40/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6255 -
binary_accuracy: 0.6452 - val_loss: 0.6485 - val_binary_accuracy: 0.6177
Epoch 41/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6271 -
binary_accuracy: 0.6450 - val_loss: 0.6489 - val_binary_accuracy: 0.6176
Epoch 42/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6234 -
binary_accuracy: 0.6487 - val_loss: 0.6454 - val_binary_accuracy: 0.6186
Epoch 43/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6194 -
binary_accuracy: 0.6546 - val_loss: 0.6443 - val_binary_accuracy: 0.6225
Epoch 44/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6235 -
binary_accuracy: 0.6497 - val_loss: 0.6539 - val_binary_accuracy: 0.6135
Epoch 45/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6278 -
binary_accuracy: 0.6434 - val_loss: 0.6477 - val_binary_accuracy: 0.6162
Epoch 46/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6234 -
binary_accuracy: 0.6500 - val_loss: 0.6474 - val_binary_accuracy: 0.6146
Epoch 47/500
2/2 [==============================] - 1s 386ms/step - loss: 0.6217 -
binary_accuracy: 0.6509 - val_loss: 0.6517 - val_binary_accuracy: 0.6099
Epoch 48/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6209 -
binary_accuracy: 0.6517 - val_loss: 0.6497 - val_binary_accuracy: 0.6108
Epoch 49/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6198 -
binary_accuracy: 0.6518 - val_loss: 0.6468 - val_binary_accuracy: 0.6171
Epoch 50/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6169 -
binary_accuracy: 0.6577 - val_loss: 0.6457 - val_binary_accuracy: 0.6225
Epoch 51/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6141 -
binary_accuracy: 0.6576 - val_loss: 0.6572 - val_binary_accuracy: 0.6121
Epoch 52/500
2/2 [==============================] - 1s 387ms/step - loss: 0.6190 -
binary_accuracy: 0.6543 - val_loss: 0.6450 - val_binary_accuracy: 0.6244
Epoch 53/500
```

```
2/2 [==============================] - 1s 389ms/step - loss: 0.6177 -
binary_accuracy: 0.6549 - val_loss: 0.6409 - val_binary_accuracy: 0.6240
Epoch 54/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6111 -
binary_accuracy: 0.6599 - val_loss: 0.6407 - val_binary_accuracy: 0.6244
Epoch 55/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6136 -
binary_accuracy: 0.6570 - val_loss: 0.6428 - val_binary_accuracy: 0.6220
Epoch 56/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6109 -
binary_accuracy: 0.6624 - val_loss: 0.6413 - val_binary_accuracy: 0.6261
Epoch 57/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6088 -
binary_accuracy: 0.6646 - val_loss: 0.6408 - val_binary_accuracy: 0.6254
Epoch 58/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6096 -
binary_accuracy: 0.6634 - val_loss: 0.6361 - val_binary_accuracy: 0.6325
Epoch 59/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6122 -
binary_accuracy: 0.6581 - val_loss: 0.6355 - val_binary_accuracy: 0.6334
Epoch 60/500
2/2 [==============================] - 1s 389ms/step - loss: 0.6057 -
binary_accuracy: 0.6667 - val_loss: 0.6400 - val_binary_accuracy: 0.6282
Epoch 61/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6062 -
binary_accuracy: 0.6652 - val_loss: 0.6380 - val_binary_accuracy: 0.6304
Epoch 62/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6022 -
binary_accuracy: 0.6725 - val_loss: 0.6366 - val_binary_accuracy: 0.6293
Epoch 63/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5999 -
binary_accuracy: 0.6748 - val_loss: 0.6363 - val_binary_accuracy: 0.6348
Epoch 64/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5990 -
binary_accuracy: 0.6729 - val_loss: 0.6348 - val_binary_accuracy: 0.6398
Epoch 65/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5988 -
binary_accuracy: 0.6759 - val_loss: 0.6378 - val_binary_accuracy: 0.6362
Epoch 66/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6010 -
binary_accuracy: 0.6724 - val_loss: 0.6367 - val_binary_accuracy: 0.6352
Epoch 67/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5971 -
binary_accuracy: 0.6723 - val_loss: 0.6318 - val_binary_accuracy: 0.6377
Epoch 68/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5955 -
binary_accuracy: 0.6773 - val_loss: 0.6327 - val_binary_accuracy: 0.6387
Epoch 69/500
```

```
2/2 [==============================] - 1s 388ms/step - loss: 0.5961 -
binary_accuracy: 0.6756 - val_loss: 0.6307 - val_binary_accuracy: 0.6390
Epoch 70/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5926 -
binary_accuracy: 0.6815 - val_loss: 0.6420 - val_binary_accuracy: 0.6293
Epoch 71/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5983 -
binary_accuracy: 0.6732 - val_loss: 0.6370 - val_binary_accuracy: 0.6369
Epoch 72/500
2/2 [==============================] - 1s 381ms/step - loss: 0.6046 -
binary_accuracy: 0.6686 - val_loss: 0.6329 - val_binary_accuracy: 0.6368
Epoch 73/500
2/2 [==============================] - 1s 391ms/step - loss: 0.6025 -
binary_accuracy: 0.6699 - val_loss: 0.6313 - val_binary_accuracy: 0.6357
Epoch 74/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5976 -
binary_accuracy: 0.6720 - val_loss: 0.6364 - val_binary_accuracy: 0.6289
Epoch 75/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5975 -
binary_accuracy: 0.6753 - val_loss: 0.6361 - val_binary_accuracy: 0.6339
Epoch 76/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5964 -
binary_accuracy: 0.6768 - val_loss: 0.6352 - val_binary_accuracy: 0.6334
Epoch 77/500
2/2 [==============================] - 1s 387ms/step - loss: 0.5945 -
binary_accuracy: 0.6791 - val_loss: 0.6290 - val_binary_accuracy: 0.6434
Epoch 78/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5927 -
binary_accuracy: 0.6808 - val_loss: 0.6272 - val_binary_accuracy: 0.6488
Epoch 79/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5896 -
binary_accuracy: 0.6822 - val_loss: 0.6518 - val_binary_accuracy: 0.6232
Epoch 80/500
2/2 [==============================] - 1s 387ms/step - loss: 0.5993 -
binary_accuracy: 0.6726 - val_loss: 0.6490 - val_binary_accuracy: 0.6248
Epoch 81/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6000 -
binary_accuracy: 0.6744 - val_loss: 0.6398 - val_binary_accuracy: 0.6253
Epoch 82/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5988 -
binary_accuracy: 0.6735 - val_loss: 0.6323 - val_binary_accuracy: 0.6341
Epoch 83/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5944 -
binary_accuracy: 0.6780 - val_loss: 0.6352 - val_binary_accuracy: 0.6312
Epoch 84/500
2/2 [==============================] - 1s 387ms/step - loss: 0.5906 -
binary_accuracy: 0.6820 - val_loss: 0.6359 - val_binary_accuracy: 0.6300
Epoch 85/500
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2/2 [==============================] - 1s 389ms/step - loss: 0.5882 -
binary_accuracy: 0.6855 - val_loss: 0.6324 - val_binary_accuracy: 0.6399
Epoch 86/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5849 -
binary_accuracy: 0.6860 - val_loss: 0.6327 - val_binary_accuracy: 0.6440
Epoch 87/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5856 -
binary_accuracy: 0.6832 - val_loss: 0.6306 - val_binary_accuracy: 0.6487
Epoch 88/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5813 -
binary_accuracy: 0.6933 - val_loss: 0.6247 - val_binary_accuracy: 0.6522
Epoch 89/500
2/2 [==============================] - 1s 387ms/step - loss: 0.5804 -
binary_accuracy: 0.6894 - val_loss: 0.6252 - val_binary_accuracy: 0.6476
Epoch 90/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5778 -
binary_accuracy: 0.6942 - val_loss: 0.6266 - val_binary_accuracy: 0.6440
Epoch 91/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5783 -
binary_accuracy: 0.6926 - val_loss: 0.6242 - val_binary_accuracy: 0.6487
Epoch 92/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5755 -
binary_accuracy: 0.6977 - val_loss: 0.6224 - val_binary_accuracy: 0.6537
Epoch 93/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5729 -
binary_accuracy: 0.6975 - val_loss: 0.6312 - val_binary_accuracy: 0.6459
Epoch 94/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6022 -
binary_accuracy: 0.6698 - val_loss: 0.6687 - val_binary_accuracy: 0.6080
Epoch 95/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6245 -
binary_accuracy: 0.6433 - val_loss: 0.6339 - val_binary_accuracy: 0.6307
Epoch 96/500
2/2 [==============================] - 1s 397ms/step - loss: 0.5945 -
binary_accuracy: 0.6790 - val_loss: 0.6562 - val_binary_accuracy: 0.6012
Epoch 97/500
2/2 [==============================] - 1s 390ms/step - loss: 0.6155 -
binary_accuracy: 0.6481 - val_loss: 0.6475 - val_binary_accuracy: 0.6091
Epoch 98/500
2/2 [==============================] - 1s 390ms/step - loss: 0.6045 -
binary_accuracy: 0.6714 - val_loss: 0.6455 - val_binary_accuracy: 0.6157
Epoch 99/500
2/2 [==============================] - 1s 390ms/step - loss: 0.6057 -
binary_accuracy: 0.6640 - val_loss: 0.6540 - val_binary_accuracy: 0.6046
Epoch 100/500
2/2 [==============================] - 1s 393ms/step - loss: 0.6109 -
binary_accuracy: 0.6542 - val_loss: 0.6476 - val_binary_accuracy: 0.6139
Epoch 101/500
```

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2/2 [==============================] - 1s 388ms/step - loss: 0.6017 -
binary_accuracy: 0.6679 - val_loss: 0.6424 - val_binary_accuracy: 0.6167
Epoch 102/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5999 -
binary_accuracy: 0.6767 - val_loss: 0.6451 - val_binary_accuracy: 0.6134
Epoch 103/500
2/2 [==============================] - 1s 388ms/step - loss: 0.6002 -
binary_accuracy: 0.6718 - val_loss: 0.6403 - val_binary_accuracy: 0.6200
Epoch 104/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5934 -
binary_accuracy: 0.6793 - val_loss: 0.6390 - val_binary_accuracy: 0.6254
Epoch 105/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5907 -
binary_accuracy: 0.6790 - val_loss: 0.6373 - val_binary_accuracy: 0.6264
Epoch 106/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5855 -
binary_accuracy: 0.6848 - val_loss: 0.6333 - val_binary_accuracy: 0.6363
Epoch 107/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5818 -
binary_accuracy: 0.6869 - val_loss: 0.6298 - val_binary_accuracy: 0.6412
Epoch 108/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5766 -
binary_accuracy: 0.6902 - val_loss: 0.6315 - val_binary_accuracy: 0.6487
Epoch 109/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5745 -
binary_accuracy: 0.6941 - val_loss: 0.6324 - val_binary_accuracy: 0.6509
Epoch 110/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5804 -
binary_accuracy: 0.6922 - val_loss: 0.6348 - val_binary_accuracy: 0.6448
Epoch 111/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5749 -
binary_accuracy: 0.6925 - val_loss: 0.6278 - val_binary_accuracy: 0.6465
Epoch 112/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5712 -
binary_accuracy: 0.7004 - val_loss: 0.6259 - val_binary_accuracy: 0.6436
Epoch 113/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5699 -
binary_accuracy: 0.7012 - val_loss: 0.6268 - val_binary_accuracy: 0.6454
Epoch 114/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5706 -
binary_accuracy: 0.7002 - val_loss: 0.6231 - val_binary_accuracy: 0.6493
Epoch 115/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5665 -
binary_accuracy: 0.7035 - val_loss: 0.6191 - val_binary_accuracy: 0.6601
Epoch 116/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5685 -
binary_accuracy: 0.7000 - val_loss: 0.6321 - val_binary_accuracy: 0.6512
Epoch 117/500
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2/2 [==============================] - 1s 392ms/step - loss: 0.5805 -
binary_accuracy: 0.6903 - val_loss: 0.6179 - val_binary_accuracy: 0.6571
Epoch 118/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5680 -
binary_accuracy: 0.6995 - val_loss: 0.6211 - val_binary_accuracy: 0.6505
Epoch 119/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5696 -
binary_accuracy: 0.7007 - val_loss: 0.6202 - val_binary_accuracy: 0.6481
Epoch 120/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5683 -
binary_accuracy: 0.7006 - val_loss: 0.6202 - val_binary_accuracy: 0.6509
Epoch 121/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5679 -
binary_accuracy: 0.7037 - val_loss: 0.6191 - val_binary_accuracy: 0.6532
Epoch 122/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5654 -
binary_accuracy: 0.7065 - val_loss: 0.6190 - val_binary_accuracy: 0.6570
Epoch 123/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5642 -
binary_accuracy: 0.7036 - val_loss: 0.6327 - val_binary_accuracy: 0.6483
Epoch 124/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5717 -
binary_accuracy: 0.6962 - val_loss: 0.6181 - val_binary_accuracy: 0.6591
Epoch 125/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5587 -
binary_accuracy: 0.7066 - val_loss: 0.6208 - val_binary_accuracy: 0.6553
Epoch 126/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5584 -
binary_accuracy: 0.7096 - val_loss: 0.6180 - val_binary_accuracy: 0.6588
Epoch 127/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5553 -
binary_accuracy: 0.7133 - val_loss: 0.6175 - val_binary_accuracy: 0.6595
Epoch 128/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5564 -
binary_accuracy: 0.7132 - val_loss: 0.6228 - val_binary_accuracy: 0.6556
Epoch 129/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5565 -
binary_accuracy: 0.7101 - val_loss: 0.6157 - val_binary_accuracy: 0.6657
Epoch 130/500
2/2 [==============================] - 1s 396ms/step - loss: 0.5521 -
binary_accuracy: 0.7165 - val_loss: 0.6171 - val_binary_accuracy: 0.6625
Epoch 131/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5550 -
binary_accuracy: 0.7134 - val_loss: 0.6200 - val_binary_accuracy: 0.6598
Epoch 132/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5560 -
binary_accuracy: 0.7132 - val_loss: 0.6157 - val_binary_accuracy: 0.6630
Epoch 133/500
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2/2 [==============================] - 1s 391ms/step - loss: 0.5488 -
binary_accuracy: 0.7192 - val_loss: 0.6170 - val_binary_accuracy: 0.6607
Epoch 134/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5503 -
binary_accuracy: 0.7187 - val_loss: 0.6134 - val_binary_accuracy: 0.6661
Epoch 135/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5494 -
binary_accuracy: 0.7151 - val_loss: 0.6337 - val_binary_accuracy: 0.6487
Epoch 136/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5716 -
binary_accuracy: 0.7008 - val_loss: 0.6213 - val_binary_accuracy: 0.6570
Epoch 137/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5531 -
binary_accuracy: 0.7119 - val_loss: 0.6243 - val_binary_accuracy: 0.6514
Epoch 138/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5559 -
binary_accuracy: 0.7123 - val_loss: 0.6201 - val_binary_accuracy: 0.6561
Epoch 139/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5526 -
binary_accuracy: 0.7180 - val_loss: 0.6136 - val_binary_accuracy: 0.6618
Epoch 140/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5480 -
binary_accuracy: 0.7201 - val_loss: 0.6163 - val_binary_accuracy: 0.6649
Epoch 141/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5510 -
binary_accuracy: 0.7144 - val_loss: 0.6244 - val_binary_accuracy: 0.6626
Epoch 142/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5746 -
binary_accuracy: 0.6955 - val_loss: 0.6143 - val_binary_accuracy: 0.6616
Epoch 143/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5484 -
binary_accuracy: 0.7214 - val_loss: 0.6177 - val_binary_accuracy: 0.6535
Epoch 144/500
2/2 [==============================] - 1s 384ms/step - loss: 0.5527 -
binary_accuracy: 0.7180 - val_loss: 0.6165 - val_binary_accuracy: 0.6543
Epoch 145/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5525 -
binary_accuracy: 0.7169 - val_loss: 0.6140 - val_binary_accuracy: 0.6601
Epoch 146/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5458 -
binary_accuracy: 0.7197 - val_loss: 0.6232 - val_binary_accuracy: 0.6597
Epoch 147/500
2/2 [==============================] - 1s 399ms/step - loss: 0.5661 -
binary_accuracy: 0.7026 - val_loss: 0.6307 - val_binary_accuracy: 0.6576
Epoch 148/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5553 -
binary_accuracy: 0.7134 - val_loss: 0.6137 - val_binary_accuracy: 0.6653
Epoch 149/500
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2/2 [==============================] - 1s 391ms/step - loss: 0.5472 -
binary_accuracy: 0.7180 - val_loss: 0.6136 - val_binary_accuracy: 0.6615
Epoch 150/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5459 -
binary_accuracy: 0.7219 - val_loss: 0.6133 - val_binary_accuracy: 0.6605
Epoch 151/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5424 -
binary_accuracy: 0.7239 - val_loss: 0.6142 - val_binary_accuracy: 0.6661
Epoch 152/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5400 -
binary_accuracy: 0.7254 - val_loss: 0.6103 - val_binary_accuracy: 0.6743
Epoch 153/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5404 -
binary_accuracy: 0.7213 - val_loss: 0.6212 - val_binary_accuracy: 0.6677
Epoch 154/500
2/2 [==============================] - 1s 395ms/step - loss: 0.5644 -
binary_accuracy: 0.7044 - val_loss: 0.6116 - val_binary_accuracy: 0.6648
Epoch 155/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5520 -
binary_accuracy: 0.7138 - val_loss: 0.6205 - val_binary_accuracy: 0.6518
Epoch 156/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5578 -
binary_accuracy: 0.7086 - val_loss: 0.6197 - val_binary_accuracy: 0.6476
Epoch 157/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5566 -
binary_accuracy: 0.7125 - val_loss: 0.6267 - val_binary_accuracy: 0.6444
Epoch 158/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5538 -
binary_accuracy: 0.7131 - val_loss: 0.6243 - val_binary_accuracy: 0.6476
Epoch 159/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5516 -
binary_accuracy: 0.7141 - val_loss: 0.6187 - val_binary_accuracy: 0.6567
Epoch 160/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5422 -
binary_accuracy: 0.7239 - val_loss: 0.6239 - val_binary_accuracy: 0.6621
Epoch 161/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5483 -
binary_accuracy: 0.7161 - val_loss: 0.6327 - val_binary_accuracy: 0.6581
Epoch 162/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5517 -
binary_accuracy: 0.7162 - val_loss: 0.6271 - val_binary_accuracy: 0.6576
Epoch 163/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5418 -
binary_accuracy: 0.7246 - val_loss: 0.6199 - val_binary_accuracy: 0.6571
Epoch 164/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5425 -
binary_accuracy: 0.7250 - val_loss: 0.6177 - val_binary_accuracy: 0.6578
Epoch 165/500
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2/2 [==============================] - 1s 391ms/step - loss: 0.5409 -
binary_accuracy: 0.7245 - val_loss: 0.6181 - val_binary_accuracy: 0.6595
Epoch 166/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5401 -
binary_accuracy: 0.7258 - val_loss: 0.6130 - val_binary_accuracy: 0.6671
Epoch 167/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5424 -
binary_accuracy: 0.7235 - val_loss: 0.6317 - val_binary_accuracy: 0.6560
Epoch 168/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5437 -
binary_accuracy: 0.7210 - val_loss: 0.6093 - val_binary_accuracy: 0.6739
Epoch 169/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5333 -
binary_accuracy: 0.7315 - val_loss: 0.6085 - val_binary_accuracy: 0.6721
Epoch 170/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5284 -
binary_accuracy: 0.7361 - val_loss: 0.6108 - val_binary_accuracy: 0.6684
Epoch 171/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5294 -
binary_accuracy: 0.7362 - val_loss: 0.6071 - val_binary_accuracy: 0.6741
Epoch 172/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5279 -
binary_accuracy: 0.7351 - val_loss: 0.6112 - val_binary_accuracy: 0.6737
Epoch 173/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5309 -
binary_accuracy: 0.7312 - val_loss: 0.6070 - val_binary_accuracy: 0.6766
Epoch 174/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5257 -
binary_accuracy: 0.7381 - val_loss: 0.6113 - val_binary_accuracy: 0.6719
Epoch 175/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5257 -
binary_accuracy: 0.7361 - val_loss: 0.6064 - val_binary_accuracy: 0.6759
Epoch 176/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5221 -
binary_accuracy: 0.7401 - val_loss: 0.6093 - val_binary_accuracy: 0.6753
Epoch 177/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5322 -
binary_accuracy: 0.7311 - val_loss: 0.6244 - val_binary_accuracy: 0.6640
Epoch 178/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5487 -
binary_accuracy: 0.7179 - val_loss: 0.6079 - val_binary_accuracy: 0.6676
Epoch 179/500
2/2 [==============================] - 1s 387ms/step - loss: 0.5400 -
binary_accuracy: 0.7264 - val_loss: 0.6144 - val_binary_accuracy: 0.6628
Epoch 180/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5390 -
binary_accuracy: 0.7262 - val_loss: 0.6114 - val_binary_accuracy: 0.6631
Epoch 181/500
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2/2 [==============================] - 1s 392ms/step - loss: 0.5341 -
binary_accuracy: 0.7322 - val_loss: 0.6126 - val_binary_accuracy: 0.6664
Epoch 182/500
2/2 [==============================] - 1s 397ms/step - loss: 0.5279 -
binary_accuracy: 0.7367 - val_loss: 0.6203 - val_binary_accuracy: 0.6678
Epoch 183/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5454 -
binary_accuracy: 0.7196 - val_loss: 0.6246 - val_binary_accuracy: 0.6659
Epoch 184/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5515 -
binary_accuracy: 0.7135 - val_loss: 0.6064 - val_binary_accuracy: 0.6702
Epoch 185/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5321 -
binary_accuracy: 0.7335 - val_loss: 0.6122 - val_binary_accuracy: 0.6626
Epoch 186/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5342 -
binary_accuracy: 0.7312 - val_loss: 0.6093 - val_binary_accuracy: 0.6632
Epoch 187/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5299 -
binary_accuracy: 0.7363 - val_loss: 0.6082 - val_binary_accuracy: 0.6675
Epoch 188/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5228 -
binary_accuracy: 0.7381 - val_loss: 0.6229 - val_binary_accuracy: 0.6677
Epoch 189/500
2/2 [==============================] - 1s 384ms/step - loss: 0.5603 -
binary_accuracy: 0.7064 - val_loss: 0.6054 - val_binary_accuracy: 0.6763
Epoch 190/500
2/2 [==============================] - 1s 395ms/step - loss: 0.5336 -
binary_accuracy: 0.7316 - val_loss: 0.6337 - val_binary_accuracy: 0.6499
Epoch 191/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5512 -
binary_accuracy: 0.7110 - val_loss: 0.6168 - val_binary_accuracy: 0.6568
Epoch 192/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5456 -
binary_accuracy: 0.7184 - val_loss: 0.6167 - val_binary_accuracy: 0.6547
Epoch 193/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5381 -
binary_accuracy: 0.7272 - val_loss: 0.6258 - val_binary_accuracy: 0.6465
Epoch 194/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5413 -
binary_accuracy: 0.7259 - val_loss: 0.6191 - val_binary_accuracy: 0.6562
Epoch 195/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5318 -
binary_accuracy: 0.7321 - val_loss: 0.6147 - val_binary_accuracy: 0.6680
Epoch 196/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5200 -
binary_accuracy: 0.7398 - val_loss: 0.6253 - val_binary_accuracy: 0.6700
Epoch 197/500
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2/2 [==============================] - 1s 389ms/step - loss: 0.5664 -
binary_accuracy: 0.7038 - val_loss: 0.6056 - val_binary_accuracy: 0.6775
Epoch 198/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5457 -
binary_accuracy: 0.7190 - val_loss: 0.6188 - val_binary_accuracy: 0.6592
Epoch 199/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5463 -
binary_accuracy: 0.7153 - val_loss: 0.6219 - val_binary_accuracy: 0.6482
Epoch 200/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5419 -
binary_accuracy: 0.7243 - val_loss: 0.6346 - val_binary_accuracy: 0.6384
Epoch 201/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5568 -
binary_accuracy: 0.7065 - val_loss: 0.6229 - val_binary_accuracy: 0.6430
Epoch 202/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5477 -
binary_accuracy: 0.7189 - val_loss: 0.6312 - val_binary_accuracy: 0.6393
Epoch 203/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5472 -
binary_accuracy: 0.7200 - val_loss: 0.6171 - val_binary_accuracy: 0.6554
Epoch 204/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5351 -
binary_accuracy: 0.7295 - val_loss: 0.6163 - val_binary_accuracy: 0.6609
Epoch 205/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5267 -
binary_accuracy: 0.7372 - val_loss: 0.6181 - val_binary_accuracy: 0.6685
Epoch 206/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5295 -
binary_accuracy: 0.7324 - val_loss: 0.6254 - val_binary_accuracy: 0.6704
Epoch 207/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5237 -
binary_accuracy: 0.7370 - val_loss: 0.6117 - val_binary_accuracy: 0.6805
Epoch 208/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5279 -
binary_accuracy: 0.7355 - val_loss: 0.6172 - val_binary_accuracy: 0.6712
Epoch 209/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5198 -
binary_accuracy: 0.7417 - val_loss: 0.6183 - val_binary_accuracy: 0.6631
Epoch 210/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5236 -
binary_accuracy: 0.7404 - val_loss: 0.6166 - val_binary_accuracy: 0.6641
Epoch 211/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5209 -
binary_accuracy: 0.7397 - val_loss: 0.6135 - val_binary_accuracy: 0.6662
Epoch 212/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5155 -
binary_accuracy: 0.7446 - val_loss: 0.6105 - val_binary_accuracy: 0.6760
Epoch 213/500
```

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2/2 [==============================] - 1s 390ms/step - loss: 0.5181 -
binary_accuracy: 0.7434 - val_loss: 0.6050 - val_binary_accuracy: 0.6833
Epoch 214/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5114 -
binary_accuracy: 0.7487 - val_loss: 0.6268 - val_binary_accuracy: 0.6672
Epoch 215/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5450 -
binary_accuracy: 0.7216 - val_loss: 0.6321 - val_binary_accuracy: 0.6572
Epoch 216/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5354 -
binary_accuracy: 0.7261 - val_loss: 0.6221 - val_binary_accuracy: 0.6568
Epoch 217/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5372 -
binary_accuracy: 0.7263 - val_loss: 0.6140 - val_binary_accuracy: 0.6576
Epoch 218/500
2/2 [==============================] - 1s 396ms/step - loss: 0.5317 -
binary_accuracy: 0.7342 - val_loss: 0.6236 - val_binary_accuracy: 0.6486
Epoch 219/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5316 -
binary_accuracy: 0.7320 - val_loss: 0.6205 - val_binary_accuracy: 0.6547
Epoch 220/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5300 -
binary_accuracy: 0.7328 - val_loss: 0.6122 - val_binary_accuracy: 0.6651
Epoch 221/500
2/2 [==============================] - 1s 388ms/step - loss: 0.5233 -
binary_accuracy: 0.7369 - val_loss: 0.6099 - val_binary_accuracy: 0.6757
Epoch 222/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5106 -
binary_accuracy: 0.7472 - val_loss: 0.6154 - val_binary_accuracy: 0.6785
Epoch 223/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5182 -
binary_accuracy: 0.7426 - val_loss: 0.6605 - val_binary_accuracy: 0.6482
Epoch 224/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5457 -
binary_accuracy: 0.7189 - val_loss: 0.6110 - val_binary_accuracy: 0.6712
Epoch 225/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5171 -
binary_accuracy: 0.7423 - val_loss: 0.6138 - val_binary_accuracy: 0.6622
Epoch 226/500
2/2 [==============================] - 1s 397ms/step - loss: 0.5223 -
binary_accuracy: 0.7379 - val_loss: 0.6164 - val_binary_accuracy: 0.6627
Epoch 227/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5194 -
binary_accuracy: 0.7413 - val_loss: 0.6149 - val_binary_accuracy: 0.6632
Epoch 228/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5133 -
binary_accuracy: 0.7467 - val_loss: 0.6159 - val_binary_accuracy: 0.6732
Epoch 229/500
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2/2 [==============================] - 1s 388ms/step - loss: 0.5127 -
binary_accuracy: 0.7460 - val_loss: 0.6081 - val_binary_accuracy: 0.6810
Epoch 230/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5130 -
binary_accuracy: 0.7466 - val_loss: 0.6479 - val_binary_accuracy: 0.6549
Epoch 231/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5315 -
binary_accuracy: 0.7301 - val_loss: 0.6134 - val_binary_accuracy: 0.6730
Epoch 232/500
2/2 [==============================] - 1s 397ms/step - loss: 0.5207 -
binary_accuracy: 0.7384 - val_loss: 0.6141 - val_binary_accuracy: 0.6634
Epoch 233/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5179 -
binary_accuracy: 0.7425 - val_loss: 0.6189 - val_binary_accuracy: 0.6614
Epoch 234/500
2/2 [==============================] - 1s 378ms/step - loss: 0.5181 -
binary_accuracy: 0.7422 - val_loss: 0.6184 - val_binary_accuracy: 0.6610
Epoch 235/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5163 -
binary_accuracy: 0.7437 - val_loss: 0.6163 - val_binary_accuracy: 0.6686
Epoch 236/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5071 -
binary_accuracy: 0.7505 - val_loss: 0.6154 - val_binary_accuracy: 0.6732
Epoch 237/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5247 -
binary_accuracy: 0.7369 - val_loss: 0.6590 - val_binary_accuracy: 0.6467
Epoch 238/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5357 -
binary_accuracy: 0.7270 - val_loss: 0.6397 - val_binary_accuracy: 0.6553
Epoch 239/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5304 -
binary_accuracy: 0.7314 - val_loss: 0.6294 - val_binary_accuracy: 0.6512
Epoch 240/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5267 -
binary_accuracy: 0.7367 - val_loss: 0.6200 - val_binary_accuracy: 0.6572
Epoch 241/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5301 -
binary_accuracy: 0.7337 - val_loss: 0.6120 - val_binary_accuracy: 0.6605
Epoch 242/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5222 -
binary_accuracy: 0.7387 - val_loss: 0.6173 - val_binary_accuracy: 0.6594
Epoch 243/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5153 -
binary_accuracy: 0.7464 - val_loss: 0.6161 - val_binary_accuracy: 0.6680
Epoch 244/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5099 -
binary_accuracy: 0.7477 - val_loss: 0.6118 - val_binary_accuracy: 0.6765
Epoch 245/500
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2/2 [==============================] - 1s 390ms/step - loss: 0.5232 -
binary_accuracy: 0.7396 - val_loss: 0.6433 - val_binary_accuracy: 0.6614
Epoch 246/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5178 -
binary_accuracy: 0.7401 - val_loss: 0.6458 - val_binary_accuracy: 0.6584
Epoch 247/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5362 -
binary_accuracy: 0.7256 - val_loss: 0.6272 - val_binary_accuracy: 0.6561
Epoch 248/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5203 -
binary_accuracy: 0.7435 - val_loss: 0.6270 - val_binary_accuracy: 0.6557
Epoch 249/500
2/2 [==============================] - 1s 395ms/step - loss: 0.5228 -
binary_accuracy: 0.7360 - val_loss: 0.6168 - val_binary_accuracy: 0.6582
Epoch 250/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5229 -
binary_accuracy: 0.7373 - val_loss: 0.6094 - val_binary_accuracy: 0.6660
Epoch 251/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5115 -
binary_accuracy: 0.7480 - val_loss: 0.6084 - val_binary_accuracy: 0.6728
Epoch 252/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5049 -
binary_accuracy: 0.7525 - val_loss: 0.6076 - val_binary_accuracy: 0.6778
Epoch 253/500
2/2 [==============================] - 1s 396ms/step - loss: 0.5055 -
binary_accuracy: 0.7497 - val_loss: 0.6212 - val_binary_accuracy: 0.6769
Epoch 254/500
2/2 [==============================] - 1s 402ms/step - loss: 0.5016 -
binary_accuracy: 0.7543 - val_loss: 0.6082 - val_binary_accuracy: 0.6856
Epoch 255/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5134 -
binary_accuracy: 0.7467 - val_loss: 0.6094 - val_binary_accuracy: 0.6799
Epoch 256/500
2/2 [==============================] - 1s 395ms/step - loss: 0.5011 -
binary_accuracy: 0.7550 - val_loss: 0.6154 - val_binary_accuracy: 0.6670
Epoch 257/500
2/2 [==============================] - 1s 399ms/step - loss: 0.5081 -
binary_accuracy: 0.7502 - val_loss: 0.6121 - val_binary_accuracy: 0.6698
Epoch 258/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5053 -
binary_accuracy: 0.7526 - val_loss: 0.6081 - val_binary_accuracy: 0.6735
Epoch 259/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4986 -
binary_accuracy: 0.7569 - val_loss: 0.6094 - val_binary_accuracy: 0.6803
Epoch 260/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4932 -
binary_accuracy: 0.7594 - val_loss: 0.6127 - val_binary_accuracy: 0.6806
Epoch 261/500
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2/2 [==============================] - 1s 391ms/step - loss: 0.5065 -
binary_accuracy: 0.7511 - val_loss: 0.6301 - val_binary_accuracy: 0.6705
Epoch 262/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5112 -
binary_accuracy: 0.7458 - val_loss: 0.6018 - val_binary_accuracy: 0.6816
Epoch 263/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4974 -
binary_accuracy: 0.7581 - val_loss: 0.6036 - val_binary_accuracy: 0.6769
Epoch 264/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4992 -
binary_accuracy: 0.7586 - val_loss: 0.6040 - val_binary_accuracy: 0.6761
Epoch 265/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4960 -
binary_accuracy: 0.7606 - val_loss: 0.6030 - val_binary_accuracy: 0.6817
Epoch 266/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4889 -
binary_accuracy: 0.7663 - val_loss: 0.6082 - val_binary_accuracy: 0.6834
Epoch 267/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4993 -
binary_accuracy: 0.7556 - val_loss: 0.6396 - val_binary_accuracy: 0.6664
Epoch 268/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5279 -
binary_accuracy: 0.7306 - val_loss: 0.6133 - val_binary_accuracy: 0.6739
Epoch 269/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4987 -
binary_accuracy: 0.7561 - val_loss: 0.6142 - val_binary_accuracy: 0.6688
Epoch 270/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5018 -
binary_accuracy: 0.7547 - val_loss: 0.6123 - val_binary_accuracy: 0.6675
Epoch 271/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5026 -
binary_accuracy: 0.7565 - val_loss: 0.6075 - val_binary_accuracy: 0.6757
Epoch 272/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4963 -
binary_accuracy: 0.7614 - val_loss: 0.6170 - val_binary_accuracy: 0.6732
Epoch 273/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4969 -
binary_accuracy: 0.7559 - val_loss: 0.6030 - val_binary_accuracy: 0.6906
Epoch 274/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5000 -
binary_accuracy: 0.7565 - val_loss: 0.6267 - val_binary_accuracy: 0.6773
Epoch 275/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5077 -
binary_accuracy: 0.7519 - val_loss: 0.6003 - val_binary_accuracy: 0.6846
Epoch 276/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4936 -
binary_accuracy: 0.7618 - val_loss: 0.6081 - val_binary_accuracy: 0.6747
Epoch 277/500
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2/2 [==============================] - 1s 392ms/step - loss: 0.4946 -
binary_accuracy: 0.7597 - val_loss: 0.6083 - val_binary_accuracy: 0.6763
Epoch 278/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4932 -
binary_accuracy: 0.7633 - val_loss: 0.6144 - val_binary_accuracy: 0.6740
Epoch 279/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4927 -
binary_accuracy: 0.7588 - val_loss: 0.6071 - val_binary_accuracy: 0.6873
Epoch 280/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5025 -
binary_accuracy: 0.7559 - val_loss: 0.6148 - val_binary_accuracy: 0.6829
Epoch 281/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4919 -
binary_accuracy: 0.7620 - val_loss: 0.6009 - val_binary_accuracy: 0.6842
Epoch 282/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4844 -
binary_accuracy: 0.7691 - val_loss: 0.6028 - val_binary_accuracy: 0.6814
Epoch 283/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4836 -
binary_accuracy: 0.7678 - val_loss: 0.6172 - val_binary_accuracy: 0.6775
Epoch 284/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4988 -
binary_accuracy: 0.7554 - val_loss: 0.5988 - val_binary_accuracy: 0.6887
Epoch 285/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4865 -
binary_accuracy: 0.7660 - val_loss: 0.6233 - val_binary_accuracy: 0.6711
Epoch 286/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4964 -
binary_accuracy: 0.7590 - val_loss: 0.6057 - val_binary_accuracy: 0.6841
Epoch 287/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4958 -
binary_accuracy: 0.7557 - val_loss: 0.6000 - val_binary_accuracy: 0.6854
Epoch 288/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4875 -
binary_accuracy: 0.7678 - val_loss: 0.6293 - val_binary_accuracy: 0.6672
Epoch 289/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4981 -
binary_accuracy: 0.7571 - val_loss: 0.6249 - val_binary_accuracy: 0.6731
Epoch 290/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5096 -
binary_accuracy: 0.7480 - val_loss: 0.6100 - val_binary_accuracy: 0.6750
Epoch 291/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5032 -
binary_accuracy: 0.7509 - val_loss: 0.6020 - val_binary_accuracy: 0.6794
Epoch 292/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4948 -
binary_accuracy: 0.7612 - val_loss: 0.6016 - val_binary_accuracy: 0.6811
Epoch 293/500
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2/2 [==============================] - 1s 397ms/step - loss: 0.4965 -
binary_accuracy: 0.7578 - val_loss: 0.6061 - val_binary_accuracy: 0.6794
Epoch 294/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4870 -
binary_accuracy: 0.7623 - val_loss: 0.6245 - val_binary_accuracy: 0.6763
Epoch 295/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5080 -
binary_accuracy: 0.7493 - val_loss: 0.5989 - val_binary_accuracy: 0.6900
Epoch 296/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4899 -
binary_accuracy: 0.7618 - val_loss: 0.6291 - val_binary_accuracy: 0.6670
Epoch 297/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5003 -
binary_accuracy: 0.7548 - val_loss: 0.6329 - val_binary_accuracy: 0.6651
Epoch 298/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5046 -
binary_accuracy: 0.7504 - val_loss: 0.6222 - val_binary_accuracy: 0.6651
Epoch 299/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4936 -
binary_accuracy: 0.7608 - val_loss: 0.6229 - val_binary_accuracy: 0.6696
Epoch 300/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4985 -
binary_accuracy: 0.7549 - val_loss: 0.6116 - val_binary_accuracy: 0.6754
Epoch 301/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4888 -
binary_accuracy: 0.7634 - val_loss: 0.5996 - val_binary_accuracy: 0.6905
Epoch 302/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4867 -
binary_accuracy: 0.7637 - val_loss: 0.6339 - val_binary_accuracy: 0.6744
Epoch 303/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5201 -
binary_accuracy: 0.7416 - val_loss: 0.5996 - val_binary_accuracy: 0.6867
Epoch 304/500
2/2 [==============================] - 1s 399ms/step - loss: 0.4951 -
binary_accuracy: 0.7565 - val_loss: 0.6059 - val_binary_accuracy: 0.6755
Epoch 305/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4954 -
binary_accuracy: 0.7588 - val_loss: 0.6049 - val_binary_accuracy: 0.6756
Epoch 306/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4951 -
binary_accuracy: 0.7583 - val_loss: 0.6043 - val_binary_accuracy: 0.6763
Epoch 307/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4895 -
binary_accuracy: 0.7628 - val_loss: 0.6015 - val_binary_accuracy: 0.6847
Epoch 308/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4887 -
binary_accuracy: 0.7644 - val_loss: 0.6283 - val_binary_accuracy: 0.6732
Epoch 309/500
```

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2/2 [==============================] - 1s 391ms/step - loss: 0.4897 -
binary_accuracy: 0.7641 - val_loss: 0.6142 - val_binary_accuracy: 0.6851
Epoch 310/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5118 -
binary_accuracy: 0.7432 - val_loss: 0.5999 - val_binary_accuracy: 0.6868
Epoch 311/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4919 -
binary_accuracy: 0.7593 - val_loss: 0.6036 - val_binary_accuracy: 0.6782
Epoch 312/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4905 -
binary_accuracy: 0.7609 - val_loss: 0.6042 - val_binary_accuracy: 0.6762
Epoch 313/500
2/2 [==============================] - 1s 396ms/step - loss: 0.4906 -
binary_accuracy: 0.7641 - val_loss: 0.6027 - val_binary_accuracy: 0.6787
Epoch 314/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4846 -
binary_accuracy: 0.7680 - val_loss: 0.6001 - val_binary_accuracy: 0.6881
Epoch 315/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4797 -
binary_accuracy: 0.7703 - val_loss: 0.6209 - val_binary_accuracy: 0.6792
Epoch 316/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4811 -
binary_accuracy: 0.7694 - val_loss: 0.6244 - val_binary_accuracy: 0.6827
Epoch 317/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5220 -
binary_accuracy: 0.7404 - val_loss: 0.6017 - val_binary_accuracy: 0.6854
Epoch 318/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5036 -
binary_accuracy: 0.7498 - val_loss: 0.6051 - val_binary_accuracy: 0.6751
Epoch 319/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4992 -
binary_accuracy: 0.7568 - val_loss: 0.6269 - val_binary_accuracy: 0.6563
Epoch 320/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5053 -
binary_accuracy: 0.7523 - val_loss: 0.6251 - val_binary_accuracy: 0.6584
Epoch 321/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5104 -
binary_accuracy: 0.7432 - val_loss: 0.6097 - val_binary_accuracy: 0.6666
Epoch 322/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4965 -
binary_accuracy: 0.7582 - val_loss: 0.6105 - val_binary_accuracy: 0.6729
Epoch 323/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4844 -
binary_accuracy: 0.7685 - val_loss: 0.6058 - val_binary_accuracy: 0.6863
Epoch 324/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4952 -
binary_accuracy: 0.7595 - val_loss: 0.6129 - val_binary_accuracy: 0.6918
Epoch 325/500
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2/2 [==============================] - 1s 395ms/step - loss: 0.4757 -
binary_accuracy: 0.7718 - val_loss: 0.6158 - val_binary_accuracy: 0.6848
Epoch 326/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4839 -
binary_accuracy: 0.7670 - val_loss: 0.6031 - val_binary_accuracy: 0.6877
Epoch 327/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4710 -
binary_accuracy: 0.7755 - val_loss: 0.6034 - val_binary_accuracy: 0.6841
Epoch 328/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4729 -
binary_accuracy: 0.7775 - val_loss: 0.6024 - val_binary_accuracy: 0.6845
Epoch 329/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4666 -
binary_accuracy: 0.7811 - val_loss: 0.6030 - val_binary_accuracy: 0.6923
Epoch 330/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4685 -
binary_accuracy: 0.7772 - val_loss: 0.6010 - val_binary_accuracy: 0.6969
Epoch 331/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4683 -
binary_accuracy: 0.7786 - val_loss: 0.6288 - val_binary_accuracy: 0.6776
Epoch 332/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4958 -
binary_accuracy: 0.7574 - val_loss: 0.6104 - val_binary_accuracy: 0.6796
Epoch 333/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4727 -
binary_accuracy: 0.7731 - val_loss: 0.6117 - val_binary_accuracy: 0.6778
Epoch 334/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4776 -
binary_accuracy: 0.7730 - val_loss: 0.6117 - val_binary_accuracy: 0.6750
Epoch 335/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4746 -
binary_accuracy: 0.7762 - val_loss: 0.6110 - val_binary_accuracy: 0.6829
Epoch 336/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4774 -
binary_accuracy: 0.7706 - val_loss: 0.5988 - val_binary_accuracy: 0.6948
Epoch 337/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4790 -
binary_accuracy: 0.7679 - val_loss: 0.7030 - val_binary_accuracy: 0.6406
Epoch 338/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5285 -
binary_accuracy: 0.7336 - val_loss: 0.6765 - val_binary_accuracy: 0.6445
Epoch 339/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5221 -
binary_accuracy: 0.7376 - val_loss: 0.6374 - val_binary_accuracy: 0.6512
Epoch 340/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5204 -
binary_accuracy: 0.7365 - val_loss: 0.6196 - val_binary_accuracy: 0.6558
Epoch 341/500
```

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2/2 [==============================] - 1s 395ms/step - loss: 0.5074 -
binary_accuracy: 0.7499 - val_loss: 0.6358 - val_binary_accuracy: 0.6487
Epoch 342/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5201 -
binary_accuracy: 0.7378 - val_loss: 0.6192 - val_binary_accuracy: 0.6572
Epoch 343/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5037 -
binary_accuracy: 0.7529 - val_loss: 0.6277 - val_binary_accuracy: 0.6547
Epoch 344/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5005 -
binary_accuracy: 0.7521 - val_loss: 0.6121 - val_binary_accuracy: 0.6721
Epoch 345/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4856 -
binary_accuracy: 0.7681 - val_loss: 0.6045 - val_binary_accuracy: 0.6859
Epoch 346/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4687 -
binary_accuracy: 0.7755 - val_loss: 0.6297 - val_binary_accuracy: 0.6869
Epoch 347/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5023 -
binary_accuracy: 0.7546 - val_loss: 0.6299 - val_binary_accuracy: 0.6875
Epoch 348/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4866 -
binary_accuracy: 0.7664 - val_loss: 0.6008 - val_binary_accuracy: 0.6892
Epoch 349/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4682 -
binary_accuracy: 0.7797 - val_loss: 0.6035 - val_binary_accuracy: 0.6814
Epoch 350/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4711 -
binary_accuracy: 0.7784 - val_loss: 0.6027 - val_binary_accuracy: 0.6825
Epoch 351/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4711 -
binary_accuracy: 0.7796 - val_loss: 0.6013 - val_binary_accuracy: 0.6873
Epoch 352/500
2/2 [==============================] - 1s 395ms/step - loss: 0.4618 -
binary_accuracy: 0.7859 - val_loss: 0.6093 - val_binary_accuracy: 0.6937
Epoch 353/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4791 -
binary_accuracy: 0.7699 - val_loss: 0.6245 - val_binary_accuracy: 0.6870
Epoch 354/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4916 -
binary_accuracy: 0.7619 - val_loss: 0.6031 - val_binary_accuracy: 0.6914
Epoch 355/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4678 -
binary_accuracy: 0.7775 - val_loss: 0.6171 - val_binary_accuracy: 0.6752
Epoch 356/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4780 -
binary_accuracy: 0.7706 - val_loss: 0.6135 - val_binary_accuracy: 0.6760
Epoch 357/500
```

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2/2 [==============================] - 1s 389ms/step - loss: 0.4749 -
binary_accuracy: 0.7730 - val_loss: 0.6115 - val_binary_accuracy: 0.6774
Epoch 358/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4713 -
binary_accuracy: 0.7759 - val_loss: 0.6207 - val_binary_accuracy: 0.6826
Epoch 359/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4718 -
binary_accuracy: 0.7740 - val_loss: 0.6062 - val_binary_accuracy: 0.6913
Epoch 360/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4848 -
binary_accuracy: 0.7672 - val_loss: 0.6789 - val_binary_accuracy: 0.6506
Epoch 361/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5064 -
binary_accuracy: 0.7457 - val_loss: 0.6752 - val_binary_accuracy: 0.6472
Epoch 362/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5142 -
binary_accuracy: 0.7444 - val_loss: 0.6361 - val_binary_accuracy: 0.6551
Epoch 363/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5152 -
binary_accuracy: 0.7400 - val_loss: 0.6176 - val_binary_accuracy: 0.6609
Epoch 364/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5001 -
binary_accuracy: 0.7560 - val_loss: 0.6363 - val_binary_accuracy: 0.6490
Epoch 365/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5117 -
binary_accuracy: 0.7455 - val_loss: 0.6164 - val_binary_accuracy: 0.6604
Epoch 366/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4968 -
binary_accuracy: 0.7620 - val_loss: 0.6251 - val_binary_accuracy: 0.6588
Epoch 367/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4898 -
binary_accuracy: 0.7628 - val_loss: 0.6167 - val_binary_accuracy: 0.6711
Epoch 368/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4793 -
binary_accuracy: 0.7703 - val_loss: 0.6167 - val_binary_accuracy: 0.6794
Epoch 369/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4668 -
binary_accuracy: 0.7793 - val_loss: 0.6237 - val_binary_accuracy: 0.6916
Epoch 370/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5044 -
binary_accuracy: 0.7547 - val_loss: 0.6247 - val_binary_accuracy: 0.6894
Epoch 371/500
2/2 [==============================] - 1s 396ms/step - loss: 0.4706 -
binary_accuracy: 0.7779 - val_loss: 0.6099 - val_binary_accuracy: 0.6835
Epoch 372/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4640 -
binary_accuracy: 0.7814 - val_loss: 0.6084 - val_binary_accuracy: 0.6816
Epoch 373/500
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2/2 [==============================] - 1s 392ms/step - loss: 0.4668 -
binary_accuracy: 0.7814 - val_loss: 0.6075 - val_binary_accuracy: 0.6797
Epoch 374/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4636 -
binary_accuracy: 0.7809 - val_loss: 0.6037 - val_binary_accuracy: 0.6881
Epoch 375/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4624 -
binary_accuracy: 0.7812 - val_loss: 0.6022 - val_binary_accuracy: 0.6971
Epoch 376/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4547 -
binary_accuracy: 0.7890 - val_loss: 0.6211 - val_binary_accuracy: 0.6875
Epoch 377/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4756 -
binary_accuracy: 0.7703 - val_loss: 0.6305 - val_binary_accuracy: 0.6770
Epoch 378/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4725 -
binary_accuracy: 0.7755 - val_loss: 0.6202 - val_binary_accuracy: 0.6809
Epoch 379/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4757 -
binary_accuracy: 0.7724 - val_loss: 0.6161 - val_binary_accuracy: 0.6752
Epoch 380/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4715 -
binary_accuracy: 0.7792 - val_loss: 0.6174 - val_binary_accuracy: 0.6767
Epoch 381/500
2/2 [==============================] - 1s 395ms/step - loss: 0.4727 -
binary_accuracy: 0.7749 - val_loss: 0.6126 - val_binary_accuracy: 0.6799
Epoch 382/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4738 -
binary_accuracy: 0.7721 - val_loss: 0.5989 - val_binary_accuracy: 0.6949
Epoch 383/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4565 -
binary_accuracy: 0.7845 - val_loss: 0.6313 - val_binary_accuracy: 0.6852
Epoch 384/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5021 -
binary_accuracy: 0.7514 - val_loss: 0.5985 - val_binary_accuracy: 0.6937
Epoch 385/500
2/2 [==============================] - 1s 395ms/step - loss: 0.4708 -
binary_accuracy: 0.7743 - val_loss: 0.6179 - val_binary_accuracy: 0.6755
Epoch 386/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4816 -
binary_accuracy: 0.7660 - val_loss: 0.6065 - val_binary_accuracy: 0.6790
Epoch 387/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4773 -
binary_accuracy: 0.7724 - val_loss: 0.6042 - val_binary_accuracy: 0.6783
Epoch 388/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4718 -
binary_accuracy: 0.7770 - val_loss: 0.6060 - val_binary_accuracy: 0.6811
Epoch 389/500
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2/2 [==============================] - 1s 392ms/step - loss: 0.4679 -
binary_accuracy: 0.7767 - val_loss: 0.6008 - val_binary_accuracy: 0.6925
Epoch 390/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4651 -
binary_accuracy: 0.7786 - val_loss: 0.6067 - val_binary_accuracy: 0.6974
Epoch 391/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4523 -
binary_accuracy: 0.7892 - val_loss: 0.6256 - val_binary_accuracy: 0.6842
Epoch 392/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4687 -
binary_accuracy: 0.7782 - val_loss: 0.6007 - val_binary_accuracy: 0.6943
Epoch 393/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4505 -
binary_accuracy: 0.7888 - val_loss: 0.6046 - val_binary_accuracy: 0.6915
Epoch 394/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4487 -
binary_accuracy: 0.7937 - val_loss: 0.6078 - val_binary_accuracy: 0.6861
Epoch 395/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4550 -
binary_accuracy: 0.7870 - val_loss: 0.6013 - val_binary_accuracy: 0.6958
Epoch 396/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4554 -
binary_accuracy: 0.7859 - val_loss: 0.6107 - val_binary_accuracy: 0.6956
Epoch 397/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4578 -
binary_accuracy: 0.7831 - val_loss: 0.6036 - val_binary_accuracy: 0.6981
Epoch 398/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4463 -
binary_accuracy: 0.7931 - val_loss: 0.5982 - val_binary_accuracy: 0.6981
Epoch 399/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4425 -
binary_accuracy: 0.7981 - val_loss: 0.5987 - val_binary_accuracy: 0.6985
Epoch 400/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4422 -
binary_accuracy: 0.7961 - val_loss: 0.5988 - val_binary_accuracy: 0.7008
Epoch 401/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4382 -
binary_accuracy: 0.7985 - val_loss: 0.6060 - val_binary_accuracy: 0.6956
Epoch 402/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4572 -
binary_accuracy: 0.7843 - val_loss: 0.6363 - val_binary_accuracy: 0.6783
Epoch 403/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4733 -
binary_accuracy: 0.7695 - val_loss: 0.5987 - val_binary_accuracy: 0.6927
Epoch 404/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4488 -
binary_accuracy: 0.7920 - val_loss: 0.6008 - val_binary_accuracy: 0.6916
Epoch 405/500
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2/2 [==============================] - 1s 393ms/step - loss: 0.4466 -
binary_accuracy: 0.7952 - val_loss: 0.6080 - val_binary_accuracy: 0.6891
Epoch 406/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4505 -
binary_accuracy: 0.7911 - val_loss: 0.6019 - val_binary_accuracy: 0.6993
Epoch 407/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4416 -
binary_accuracy: 0.7937 - val_loss: 0.6058 - val_binary_accuracy: 0.7015
Epoch 408/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4527 -
binary_accuracy: 0.7892 - val_loss: 0.6785 - val_binary_accuracy: 0.6572
Epoch 409/500
2/2 [==============================] - 1s 373ms/step - loss: 0.4982 -
binary_accuracy: 0.7503 - val_loss: 0.6166 - val_binary_accuracy: 0.6803
Epoch 410/500
2/2 [==============================] - 1s 382ms/step - loss: 0.4659 -
binary_accuracy: 0.7790 - val_loss: 0.6194 - val_binary_accuracy: 0.6702
Epoch 411/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4685 -
binary_accuracy: 0.7807 - val_loss: 0.6194 - val_binary_accuracy: 0.6730
Epoch 412/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4660 -
binary_accuracy: 0.7812 - val_loss: 0.6128 - val_binary_accuracy: 0.6811
Epoch 413/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4525 -
binary_accuracy: 0.7898 - val_loss: 0.6256 - val_binary_accuracy: 0.6898
Epoch 414/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5100 -
binary_accuracy: 0.7510 - val_loss: 0.6042 - val_binary_accuracy: 0.7009
Epoch 415/500
2/2 [==============================] - 1s 398ms/step - loss: 0.4627 -
binary_accuracy: 0.7817 - val_loss: 0.6735 - val_binary_accuracy: 0.6497
Epoch 416/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5157 -
binary_accuracy: 0.7421 - val_loss: 0.6267 - val_binary_accuracy: 0.6664
Epoch 417/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5050 -
binary_accuracy: 0.7455 - val_loss: 0.6223 - val_binary_accuracy: 0.6636
Epoch 418/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4882 -
binary_accuracy: 0.7641 - val_loss: 0.6422 - val_binary_accuracy: 0.6450
Epoch 419/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5118 -
binary_accuracy: 0.7445 - val_loss: 0.6236 - val_binary_accuracy: 0.6556
Epoch 420/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4909 -
binary_accuracy: 0.7586 - val_loss: 0.6341 - val_binary_accuracy: 0.6535
Epoch 421/500
```

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2/2 [==============================] - 1s 389ms/step - loss: 0.4989 -
binary_accuracy: 0.7559 - val_loss: 0.6140 - val_binary_accuracy: 0.6666
Epoch 422/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4768 -
binary_accuracy: 0.7732 - val_loss: 0.6170 - val_binary_accuracy: 0.6745
Epoch 423/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4621 -
binary_accuracy: 0.7852 - val_loss: 0.6144 - val_binary_accuracy: 0.6913
Epoch 424/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4654 -
binary_accuracy: 0.7774 - val_loss: 0.6120 - val_binary_accuracy: 0.7000
Epoch 425/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4461 -
binary_accuracy: 0.7938 - val_loss: 0.6385 - val_binary_accuracy: 0.6832
Epoch 426/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4766 -
binary_accuracy: 0.7714 - val_loss: 0.6069 - val_binary_accuracy: 0.6892
Epoch 427/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4463 -
binary_accuracy: 0.7904 - val_loss: 0.6081 - val_binary_accuracy: 0.6838
Epoch 428/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4519 -
binary_accuracy: 0.7912 - val_loss: 0.6069 - val_binary_accuracy: 0.6836
Epoch 429/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4502 -
binary_accuracy: 0.7928 - val_loss: 0.6080 - val_binary_accuracy: 0.6914
Epoch 430/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4424 -
binary_accuracy: 0.7960 - val_loss: 0.6028 - val_binary_accuracy: 0.6999
Epoch 431/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4383 -
binary_accuracy: 0.7983 - val_loss: 0.6330 - val_binary_accuracy: 0.6892
Epoch 432/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4954 -
binary_accuracy: 0.7603 - val_loss: 0.7167 - val_binary_accuracy: 0.6362
Epoch 433/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5411 -
binary_accuracy: 0.7266 - val_loss: 0.6335 - val_binary_accuracy: 0.6610
Epoch 434/500
2/2 [==============================] - 1s 389ms/step - loss: 0.5140 -
binary_accuracy: 0.7409 - val_loss: 0.6452 - val_binary_accuracy: 0.6469
Epoch 435/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5064 -
binary_accuracy: 0.7460 - val_loss: 0.6372 - val_binary_accuracy: 0.6379
Epoch 436/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5203 -
binary_accuracy: 0.7346 - val_loss: 0.6546 - val_binary_accuracy: 0.6278
Epoch 437/500
```

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2/2 [==============================] - 1s 392ms/step - loss: 0.5286 -
binary_accuracy: 0.7291 - val_loss: 0.6417 - val_binary_accuracy: 0.6331
Epoch 438/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5170 -
binary_accuracy: 0.7447 - val_loss: 0.6394 - val_binary_accuracy: 0.6388
Epoch 439/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5191 -
binary_accuracy: 0.7369 - val_loss: 0.6449 - val_binary_accuracy: 0.6393
Epoch 440/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5188 -
binary_accuracy: 0.7362 - val_loss: 0.6361 - val_binary_accuracy: 0.6433
Epoch 441/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5058 -
binary_accuracy: 0.7491 - val_loss: 0.6327 - val_binary_accuracy: 0.6435
Epoch 442/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5008 -
binary_accuracy: 0.7564 - val_loss: 0.6303 - val_binary_accuracy: 0.6510
Epoch 443/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4846 -
binary_accuracy: 0.7650 - val_loss: 0.6206 - val_binary_accuracy: 0.6666
Epoch 444/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4735 -
binary_accuracy: 0.7731 - val_loss: 0.6109 - val_binary_accuracy: 0.6825
Epoch 445/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4522 -
binary_accuracy: 0.7874 - val_loss: 0.6139 - val_binary_accuracy: 0.6992
Epoch 446/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4457 -
binary_accuracy: 0.7939 - val_loss: 0.6437 - val_binary_accuracy: 0.6972
Epoch 447/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5091 -
binary_accuracy: 0.7554 - val_loss: 0.7759 - val_binary_accuracy: 0.6230
Epoch 448/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5781 -
binary_accuracy: 0.7065 - val_loss: 0.6464 - val_binary_accuracy: 0.6588
Epoch 449/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5322 -
binary_accuracy: 0.7251 - val_loss: 0.6670 - val_binary_accuracy: 0.6326
Epoch 450/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5250 -
binary_accuracy: 0.7321 - val_loss: 0.6412 - val_binary_accuracy: 0.6358
Epoch 451/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5238 -
binary_accuracy: 0.7342 - val_loss: 0.6653 - val_binary_accuracy: 0.6214
Epoch 452/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5443 -
binary_accuracy: 0.7156 - val_loss: 0.6614 - val_binary_accuracy: 0.6189
Epoch 453/500
```

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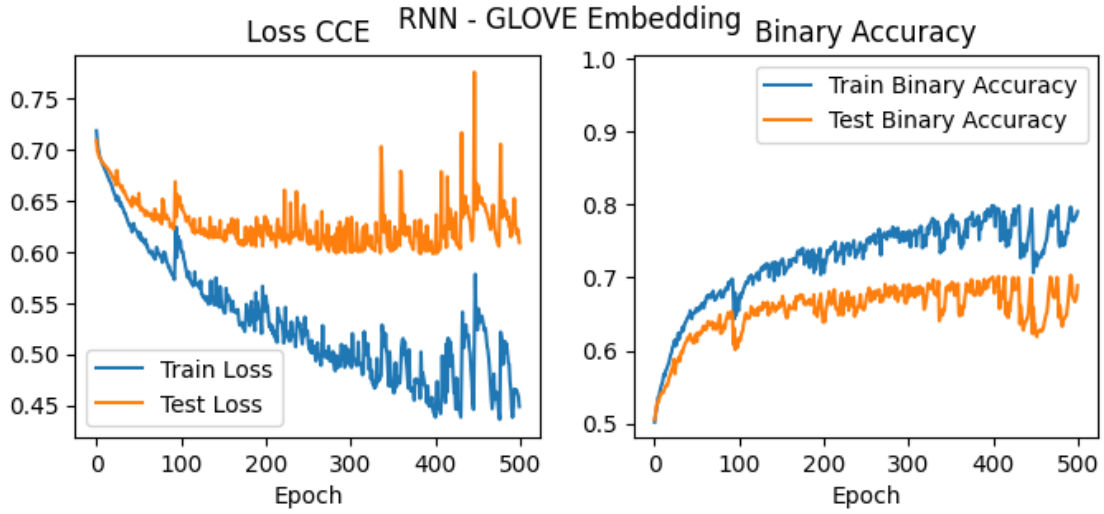
2/2 [==============================] - 1s 389ms/step - loss: 0.5377 -
binary_accuracy: 0.7215 - val_loss: 0.6486 - val_binary_accuracy: 0.6243
Epoch 454/500
2/2 [==============================] - 1s 374ms/step - loss: 0.5311 -
binary_accuracy: 0.7295 - val_loss: 0.6493 - val_binary_accuracy: 0.6258
Epoch 455/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5358 -
binary_accuracy: 0.7271 - val_loss: 0.6536 - val_binary_accuracy: 0.6271
Epoch 456/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5371 -
binary_accuracy: 0.7275 - val_loss: 0.6509 - val_binary_accuracy: 0.6271
Epoch 457/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5324 -
binary_accuracy: 0.7273 - val_loss: 0.6461 - val_binary_accuracy: 0.6289
Epoch 458/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5271 -
binary_accuracy: 0.7337 - val_loss: 0.6457 - val_binary_accuracy: 0.6267
Epoch 459/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5227 -
binary_accuracy: 0.7361 - val_loss: 0.6466 - val_binary_accuracy: 0.6285
Epoch 460/500
2/2 [==============================] - 1s 397ms/step - loss: 0.5252 -
binary_accuracy: 0.7324 - val_loss: 0.6430 - val_binary_accuracy: 0.6323
Epoch 461/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5162 -
binary_accuracy: 0.7409 - val_loss: 0.6388 - val_binary_accuracy: 0.6391
Epoch 462/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5080 -
binary_accuracy: 0.7464 - val_loss: 0.6381 - val_binary_accuracy: 0.6442
Epoch 463/500
2/2 [==============================] - 1s 393ms/step - loss: 0.5037 -
binary_accuracy: 0.7493 - val_loss: 0.6342 - val_binary_accuracy: 0.6495
Epoch 464/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4956 -
binary_accuracy: 0.7551 - val_loss: 0.6303 - val_binary_accuracy: 0.6522
Epoch 465/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4845 -
binary_accuracy: 0.7644 - val_loss: 0.6263 - val_binary_accuracy: 0.6629
Epoch 466/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4700 -
binary_accuracy: 0.7755 - val_loss: 0.6217 - val_binary_accuracy: 0.6776
Epoch 467/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4569 -
binary_accuracy: 0.7865 - val_loss: 0.6249 - val_binary_accuracy: 0.6888
Epoch 468/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4465 -
binary_accuracy: 0.7915 - val_loss: 0.6354 - val_binary_accuracy: 0.7008
Epoch 469/500
```

```
2/2 [==============================] - 1s 389ms/step - loss: 0.4530 -
binary_accuracy: 0.7900 - val_loss: 0.6459 - val_binary_accuracy: 0.6984
Epoch 470/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4806 -
binary_accuracy: 0.7704 - val_loss: 0.6384 - val_binary_accuracy: 0.6861
Epoch 471/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4559 -
binary_accuracy: 0.7847 - val_loss: 0.6222 - val_binary_accuracy: 0.6763
Epoch 472/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4581 -
binary_accuracy: 0.7822 - val_loss: 0.6181 - val_binary_accuracy: 0.6728
Epoch 473/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4630 -
binary_accuracy: 0.7812 - val_loss: 0.6130 - val_binary_accuracy: 0.6720
Epoch 474/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4595 -
binary_accuracy: 0.7835 - val_loss: 0.6105 - val_binary_accuracy: 0.6771
Epoch 475/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4491 -
binary_accuracy: 0.7922 - val_loss: 0.6068 - val_binary_accuracy: 0.6877
Epoch 476/500
2/2 [==============================] - 1s 392ms/step - loss: 0.4401 -
binary_accuracy: 0.7958 - val_loss: 0.6056 - val_binary_accuracy: 0.7002
Epoch 477/500
2/2 [==============================] - 1s 396ms/step - loss: 0.4360 -
binary_accuracy: 0.7986 - val_loss: 0.6493 - val_binary_accuracy: 0.6876
Epoch 478/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5215 -
binary_accuracy: 0.7490 - val_loss: 0.7053 - val_binary_accuracy: 0.6455
Epoch 479/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5159 -
binary_accuracy: 0.7423 - val_loss: 0.6394 - val_binary_accuracy: 0.6618
Epoch 480/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5043 -
binary_accuracy: 0.7446 - val_loss: 0.6334 - val_binary_accuracy: 0.6555
Epoch 481/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4899 -
binary_accuracy: 0.7622 - val_loss: 0.6425 - val_binary_accuracy: 0.6394
Epoch 482/500
2/2 [==============================] - 1s 392ms/step - loss: 0.5082 -
binary_accuracy: 0.7454 - val_loss: 0.6500 - val_binary_accuracy: 0.6330
Epoch 483/500
2/2 [==============================] - 1s 391ms/step - loss: 0.5126 -
binary_accuracy: 0.7436 - val_loss: 0.6363 - val_binary_accuracy: 0.6404
Epoch 484/500
2/2 [==============================] - 1s 394ms/step - loss: 0.5013 -
binary_accuracy: 0.7543 - val_loss: 0.6412 - val_binary_accuracy: 0.6429
Epoch 485/500
```

```
2/2 [==============================] - 1s 390ms/step - loss: 0.5103 -
binary_accuracy: 0.7451 - val_loss: 0.6404 - val_binary_accuracy: 0.6444
Epoch 486/500
2/2 [==============================] - 1s 390ms/step - loss: 0.5017 -
binary_accuracy: 0.7533 - val_loss: 0.6313 - val_binary_accuracy: 0.6474
Epoch 487/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4916 -
binary_accuracy: 0.7629 - val_loss: 0.6348 - val_binary_accuracy: 0.6481
Epoch 488/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4901 -
binary_accuracy: 0.7593 - val_loss: 0.6245 - val_binary_accuracy: 0.6574
Epoch 489/500
2/2 [==============================] - 1s 391ms/step - loss: 0.4736 -
binary_accuracy: 0.7730 - val_loss: 0.6241 - val_binary_accuracy: 0.6676
Epoch 490/500
2/2 [==============================] - 1s 394ms/step - loss: 0.4653 -
binary_accuracy: 0.7776 - val_loss: 0.6146 - val_binary_accuracy: 0.6816
Epoch 491/500
2/2 [==============================] - 1s 393ms/step - loss: 0.4463 -
binary_accuracy: 0.7925 - val_loss: 0.6175 - val_binary_accuracy: 0.6947
Epoch 492/500
2/2 [==============================] - 1s 388ms/step - loss: 0.4380 -
binary_accuracy: 0.7967 - val_loss: 0.6323 - val_binary_accuracy: 0.7031
Epoch 493/500
2/2 [==============================] - 1s 390ms/step - loss: 0.4478 -
binary_accuracy: 0.7909 - val_loss: 0.6369 - val_binary_accuracy: 0.6984
Epoch 494/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4657 -
binary_accuracy: 0.7795 - val_loss: 0.6522 - val_binary_accuracy: 0.6751
Epoch 495/500
2/2 [==============================] - 1s 388ms/step - loss: 0.4634 -
binary_accuracy: 0.7769 - val_loss: 0.6354 - val_binary_accuracy: 0.6722
Epoch 496/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4653 -
binary_accuracy: 0.7780 - val_loss: 0.6194 - val_binary_accuracy: 0.6695
Epoch 497/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4641 -
binary_accuracy: 0.7796 - val_loss: 0.6175 - val_binary_accuracy: 0.6667
Epoch 498/500
2/2 [==============================] - 1s 376ms/step - loss: 0.4609 -
binary_accuracy: 0.7838 - val_loss: 0.6222 - val_binary_accuracy: 0.6695
Epoch 499/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4583 -
binary_accuracy: 0.7847 - val_loss: 0.6150 - val_binary_accuracy: 0.6757
Epoch 500/500
2/2 [==============================] - 1s 389ms/step - loss: 0.4486 -
binary_accuracy: 0.7903 - val_loss: 0.6091 - val_binary_accuracy: 0.6889
```

```
[ ]: history_rnn_g = history
f, ax = plt.subplots(ncols=2)
f.set_size_inches(8,3)
plt.suptitle("RNN - GLOVE Embedding")
ax[0].plot(history.history["loss"], label="Train Loss")
ax[0].set_title("Loss CCE")
ax[0].plot(history.history["val_loss"], label="Test Loss")
# ax[0].set_yscale("log")
ax[0].set_xlabel("Epoch")
ax[0].legend()
ax[1].plot(history.history["binary_accuracy"], label="Train Binary Accuracy")
ax[1].set_xlabel("Epoch")
ax[1].set_title("Binary Accuracy")
ax[1].plot(history.history["val_binary_accuracy"], label="Test Binary Accuracy")
ax[1].set_ylim(min(history.history["binary_accuracy"])-0.02, 1.005)
ax[1].legend();
```



Interestingly the GLOVE embedding seems to lead to slower training and worse performance, it's possible I'm not setting up the embedding right, or some other structure would be more appropriate here.

3.3 LSTM – Trained Embedding

```
[ ]: # 20000 most common words, plus the out of dictionary
model = keras.Sequential([
    keras.layers.Embedding(input_dim=num_words+2, output_dim=100,␣
 ↪mask_zero=True),
    keras.layers.LSTM(64, return_sequences=False),
    keras.layers.Dropout(0.1),
```

```
    keras.layers.Dense(64, activation="relu"),
    keras.layers.Dense(1, activation="sigmoid")
    ])
model.build()
model.compile(optimizer="adam", loss="binary_crossentropy",
              metrics=[keras.metrics.BinaryAccuracy()])
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_2 (Embedding)     (None, None, 100)         2000200

 lstm (LSTM)                 (None, 64)                42240

 dropout_2 (Dropout)         (None, 64)                0

 dense_4 (Dense)             (None, 64)                4160

 dense_5 (Dense)             (None, 1)                 65

=================================================================
Total params: 2046665 (7.81 MB)
Trainable params: 2046665 (7.81 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_2 (Embedding)     (None, None, 100)         2000200

 lstm (LSTM)                 (None, 64)                42240

 dropout_2 (Dropout)         (None, 64)                0

 dense_4 (Dense)             (None, 64)                4160

 dense_5 (Dense)             (None, 1)                 65

=================================================================
Total params: 2046665 (7.81 MB)
Trainable params: 2046665 (7.81 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
[ ]: history = model.fit(x_train, y_train, batch_size=5000, epochs=50,␣
      ↪validation_data=(x_test, y_test))
```

```
Epoch 1/50
2023-11-29 13:19:19.434833: W
tensorflow/core/common_runtime/type_inference.cc:339] Type inference failed.
This indicates an invalid graph that escaped type checking. Error message:
INVALID_ARGUMENT: expected compatible input types, but input 1:
type_id: TFT_OPTIONAL
args {
  type_id: TFT_PRODUCT
  args {
    type_id: TFT_TENSOR
    args {
      type_id: TFT_INT32
    }
  }
}
 is neither a subtype nor a supertype of the combined inputs preceding it:
type_id: TFT_OPTIONAL
args {
  type_id: TFT_PRODUCT
  args {
    type_id: TFT_TENSOR
    args {
      type_id: TFT_FLOAT
    }
  }
}

        for Tuple type infernce function 0
        while inferring type of node 'cond_40/output/_23'
5/5 [==============================] - 4s 350ms/step - loss: 0.6923 -
binary_accuracy: 0.5489 - val_loss: 0.6902 - val_binary_accuracy: 0.5974
Epoch 2/50
5/5 [==============================] - 1s 201ms/step - loss: 0.6869 -
binary_accuracy: 0.6256 - val_loss: 0.6819 - val_binary_accuracy: 0.6596
Epoch 3/50
5/5 [==============================] - 1s 222ms/step - loss: 0.6723 -
binary_accuracy: 0.7032 - val_loss: 0.6591 - val_binary_accuracy: 0.7052
Epoch 4/50
5/5 [==============================] - 1s 222ms/step - loss: 0.6295 -
binary_accuracy: 0.7554 - val_loss: 0.5635 - val_binary_accuracy: 0.7756
Epoch 5/50
5/5 [==============================] - 1s 214ms/step - loss: 0.5008 -
binary_accuracy: 0.7810 - val_loss: 0.4627 - val_binary_accuracy: 0.8001
Epoch 6/50
```

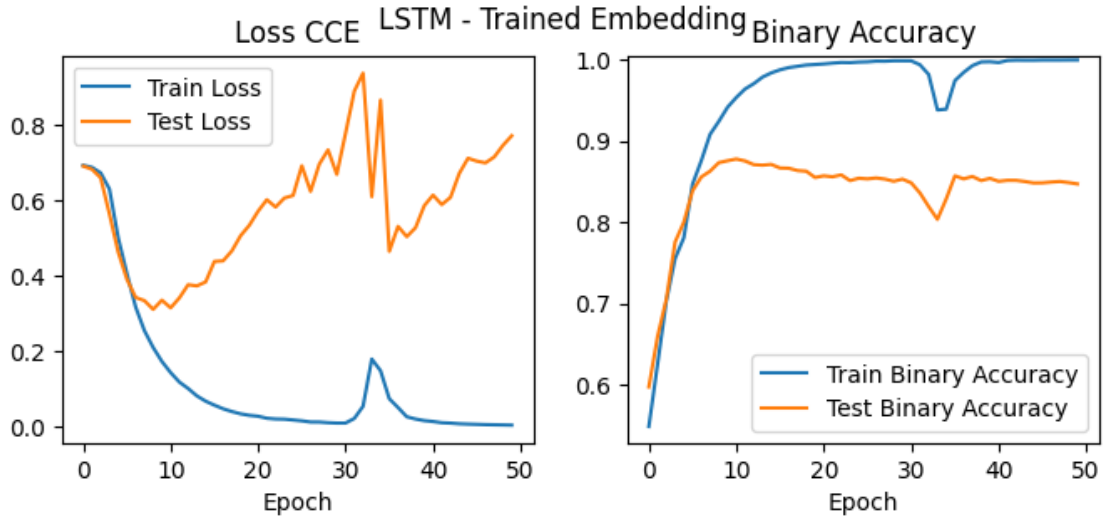
```
5/5 [==============================] - 1s 222ms/step - loss: 0.4056 -
binary_accuracy: 0.8470 - val_loss: 0.3905 - val_binary_accuracy: 0.8387
Epoch 7/50
5/5 [==============================] - 1s 223ms/step - loss: 0.3168 -
binary_accuracy: 0.8758 - val_loss: 0.3423 - val_binary_accuracy: 0.8558
Epoch 8/50
5/5 [==============================] - 1s 213ms/step - loss: 0.2544 -
binary_accuracy: 0.9081 - val_loss: 0.3339 - val_binary_accuracy: 0.8628
Epoch 9/50
5/5 [==============================] - 1s 193ms/step - loss: 0.2098 -
binary_accuracy: 0.9241 - val_loss: 0.3108 - val_binary_accuracy: 0.8733
Epoch 10/50
5/5 [==============================] - 1s 223ms/step - loss: 0.1727 -
binary_accuracy: 0.9414 - val_loss: 0.3351 - val_binary_accuracy: 0.8757
Epoch 11/50
5/5 [==============================] - 1s 223ms/step - loss: 0.1432 -
binary_accuracy: 0.9535 - val_loss: 0.3149 - val_binary_accuracy: 0.8778
Epoch 12/50
5/5 [==============================] - 1s 213ms/step - loss: 0.1181 -
binary_accuracy: 0.9639 - val_loss: 0.3412 - val_binary_accuracy: 0.8754
Epoch 13/50
5/5 [==============================] - 1s 203ms/step - loss: 0.1012 -
binary_accuracy: 0.9705 - val_loss: 0.3761 - val_binary_accuracy: 0.8708
Epoch 14/50
5/5 [==============================] - 1s 211ms/step - loss: 0.0816 -
binary_accuracy: 0.9785 - val_loss: 0.3730 - val_binary_accuracy: 0.8702
Epoch 15/50
5/5 [==============================] - 1s 225ms/step - loss: 0.0676 -
binary_accuracy: 0.9837 - val_loss: 0.3833 - val_binary_accuracy: 0.8711
Epoch 16/50
5/5 [==============================] - 1s 203ms/step - loss: 0.0571 -
binary_accuracy: 0.9875 - val_loss: 0.4377 - val_binary_accuracy: 0.8667
Epoch 17/50
5/5 [==============================] - 1s 214ms/step - loss: 0.0475 -
binary_accuracy: 0.9902 - val_loss: 0.4393 - val_binary_accuracy: 0.8664
Epoch 18/50
5/5 [==============================] - 1s 226ms/step - loss: 0.0401 -
binary_accuracy: 0.9918 - val_loss: 0.4657 - val_binary_accuracy: 0.8636
Epoch 19/50
5/5 [==============================] - 1s 212ms/step - loss: 0.0341 -
binary_accuracy: 0.9934 - val_loss: 0.5059 - val_binary_accuracy: 0.8628
Epoch 20/50
5/5 [==============================] - 1s 177ms/step - loss: 0.0301 -
binary_accuracy: 0.9940 - val_loss: 0.5336 - val_binary_accuracy: 0.8551
Epoch 21/50
5/5 [==============================] - 1s 214ms/step - loss: 0.0277 -
binary_accuracy: 0.9947 - val_loss: 0.5708 - val_binary_accuracy: 0.8571
Epoch 22/50
```

```
5/5 [==============================] - 1s 213ms/step - loss: 0.0224 -
binary_accuracy: 0.9957 - val_loss: 0.6013 - val_binary_accuracy: 0.8559
Epoch 23/50
5/5 [==============================] - 1s 215ms/step - loss: 0.0205 -
binary_accuracy: 0.9965 - val_loss: 0.5818 - val_binary_accuracy: 0.8583
Epoch 24/50
5/5 [==============================] - 1s 205ms/step - loss: 0.0200 -
binary_accuracy: 0.9963 - val_loss: 0.6057 - val_binary_accuracy: 0.8512
Epoch 25/50
5/5 [==============================] - 1s 213ms/step - loss: 0.0178 -
binary_accuracy: 0.9970 - val_loss: 0.6125 - val_binary_accuracy: 0.8541
Epoch 26/50
5/5 [==============================] - 1s 212ms/step - loss: 0.0155 -
binary_accuracy: 0.9973 - val_loss: 0.6911 - val_binary_accuracy: 0.8534
Epoch 27/50
5/5 [==============================] - 1s 203ms/step - loss: 0.0124 -
binary_accuracy: 0.9981 - val_loss: 0.6232 - val_binary_accuracy: 0.8545
Epoch 28/50
5/5 [==============================] - 1s 204ms/step - loss: 0.0123 -
binary_accuracy: 0.9980 - val_loss: 0.6955 - val_binary_accuracy: 0.8531
Epoch 29/50
5/5 [==============================] - 1s 213ms/step - loss: 0.0106 -
binary_accuracy: 0.9986 - val_loss: 0.7331 - val_binary_accuracy: 0.8504
Epoch 30/50
5/5 [==============================] - 1s 215ms/step - loss: 0.0097 -
binary_accuracy: 0.9986 - val_loss: 0.6684 - val_binary_accuracy: 0.8530
Epoch 31/50
5/5 [==============================] - 1s 201ms/step - loss: 0.0097 -
binary_accuracy: 0.9985 - val_loss: 0.7771 - val_binary_accuracy: 0.8485
Epoch 32/50
5/5 [==============================] - 1s 205ms/step - loss: 0.0218 -
binary_accuracy: 0.9937 - val_loss: 0.8889 - val_binary_accuracy: 0.8360
Epoch 33/50
5/5 [==============================] - 1s 187ms/step - loss: 0.0541 -
binary_accuracy: 0.9817 - val_loss: 0.9364 - val_binary_accuracy: 0.8192
Epoch 34/50
5/5 [==============================] - 1s 177ms/step - loss: 0.1792 -
binary_accuracy: 0.9382 - val_loss: 0.6094 - val_binary_accuracy: 0.8036
Epoch 35/50
5/5 [==============================] - 1s 204ms/step - loss: 0.1482 -
binary_accuracy: 0.9391 - val_loss: 0.8651 - val_binary_accuracy: 0.8287
Epoch 36/50
5/5 [==============================] - 1s 194ms/step - loss: 0.0741 -
binary_accuracy: 0.9743 - val_loss: 0.4644 - val_binary_accuracy: 0.8571
Epoch 37/50
5/5 [==============================] - 1s 213ms/step - loss: 0.0507 -
binary_accuracy: 0.9843 - val_loss: 0.5305 - val_binary_accuracy: 0.8534
Epoch 38/50
```

```
5/5 [==============================] - 1s 204ms/step - loss: 0.0263 -
binary_accuracy: 0.9926 - val_loss: 0.5033 - val_binary_accuracy: 0.8563
Epoch 39/50
5/5 [==============================] - 1s 204ms/step - loss: 0.0204 -
binary_accuracy: 0.9972 - val_loss: 0.5271 - val_binary_accuracy: 0.8512
Epoch 40/50
5/5 [==============================] - 1s 194ms/step - loss: 0.0161 -
binary_accuracy: 0.9974 - val_loss: 0.5854 - val_binary_accuracy: 0.8539
Epoch 41/50
5/5 [==============================] - 1s 203ms/step - loss: 0.0138 -
binary_accuracy: 0.9965 - val_loss: 0.6134 - val_binary_accuracy: 0.8504
Epoch 42/50
5/5 [==============================] - 1s 203ms/step - loss: 0.0105 -
binary_accuracy: 0.9989 - val_loss: 0.5884 - val_binary_accuracy: 0.8515
Epoch 43/50
5/5 [==============================] - 1s 213ms/step - loss: 0.0095 -
binary_accuracy: 0.9993 - val_loss: 0.6075 - val_binary_accuracy: 0.8515
Epoch 44/50
5/5 [==============================] - 1s 193ms/step - loss: 0.0078 -
binary_accuracy: 0.9992 - val_loss: 0.6708 - val_binary_accuracy: 0.8501
Epoch 45/50
5/5 [==============================] - 1s 205ms/step - loss: 0.0070 -
binary_accuracy: 0.9992 - val_loss: 0.7110 - val_binary_accuracy: 0.8483
Epoch 46/50
5/5 [==============================] - 1s 194ms/step - loss: 0.0063 -
binary_accuracy: 0.9994 - val_loss: 0.7035 - val_binary_accuracy: 0.8485
Epoch 47/50
5/5 [==============================] - 1s 194ms/step - loss: 0.0055 -
binary_accuracy: 0.9994 - val_loss: 0.6989 - val_binary_accuracy: 0.8494
Epoch 48/50
5/5 [==============================] - 1s 187ms/step - loss: 0.0051 -
binary_accuracy: 0.9994 - val_loss: 0.7145 - val_binary_accuracy: 0.8501
Epoch 49/50
5/5 [==============================] - 1s 177ms/step - loss: 0.0047 -
binary_accuracy: 0.9995 - val_loss: 0.7453 - val_binary_accuracy: 0.8488
Epoch 50/50
5/5 [==============================] - 1s 213ms/step - loss: 0.0042 -
binary_accuracy: 0.9996 - val_loss: 0.7706 - val_binary_accuracy: 0.8471
```

[ ]:
```
history_lstm = history
f, ax = plt.subplots(ncols=2)
f.set_size_inches(8,3)
plt.suptitle("LSTM - Trained Embedding")
ax[0].plot(history.history["loss"], label="Train Loss")
ax[0].set_title("Loss CCE")
ax[0].plot(history.history["val_loss"], label="Test Loss")
# ax[0].set_yscale("log")
```

```
ax[0].set_xlabel("Epoch")
ax[0].legend()
ax[1].plot(history.history["binary_accuracy"], label="Train Binary Accuracy")
ax[1].set_xlabel("Epoch")
ax[1].set_title("Binary Accuracy")
ax[1].plot(history.history["val_binary_accuracy"], label="Test Binary Accuracy")
ax[1].set_ylim(min(history.history["binary_accuracy"])-0.02, 1.005)
ax[1].legend();
```



It's a similar story to the RNN where we're clearly overfit. It does seem like minus the one weird spike, the training is smoother with the LSTM.

3.4 LSTM – GLOVE Embedding

[ ]:
```
# 20000 most common words, plus the out of dictionary
model = keras.Sequential([
    keras.layers.Embedding(input_dim=num_tokens, output_dim=embedding_dim,
                           mask_zero=True, embeddings_initializer=keras.
 ↪initializers.Constant(embedding_matrix),
                           trainable=False),
    keras.layers.LSTM(64, return_sequences=False),
    keras.layers.Dropout(0.1),
    keras.layers.Dense(64, activation="relu"),
    keras.layers.Dense(1, activation="sigmoid")
    ])
model.build()
model.compile(optimizer="adam", loss="binary_crossentropy",
              metrics=[keras.metrics.BinaryAccuracy()])
model.summary()
```

```
Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_3 (Embedding)     (None, None, 100)         2000200

 lstm_1 (LSTM)               (None, 64)                42240

 dropout_3 (Dropout)         (None, 64)                0

 dense_6 (Dense)             (None, 64)                4160

 dense_7 (Dense)             (None, 1)                 65

=================================================================
Total params: 2046665 (7.81 MB)
Trainable params: 46465 (181.50 KB)
Non-trainable params: 2000200 (7.63 MB)
_________________________________________________________________
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_3 (Embedding)     (None, None, 100)         2000200

 lstm_1 (LSTM)               (None, 64)                42240

 dropout_3 (Dropout)         (None, 64)                0

 dense_6 (Dense)             (None, 64)                4160

 dense_7 (Dense)             (None, 1)                 65

=================================================================
Total params: 2046665 (7.81 MB)
Trainable params: 46465 (181.50 KB)
Non-trainable params: 2000200 (7.63 MB)
_________________________________________________________________
```

[ ]:
```
history = model.fit(x_train, y_train, batch_size=5000, epochs=500,␣
  ↪validation_data=(x_test, y_test))
```

```
Epoch 1/500
5/5 [==============================] - 3s 307ms/step - loss: 0.6944 -
binary_accuracy: 0.5092 - val_loss: 0.6914 - val_binary_accuracy: 0.5253
Epoch 2/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6912 -
binary_accuracy: 0.5256 - val_loss: 0.6890 - val_binary_accuracy: 0.5462
Epoch 3/500
```

```
5/5 [==============================] - 1s 166ms/step - loss: 0.6886 -
binary_accuracy: 0.5409 - val_loss: 0.6866 - val_binary_accuracy: 0.5551
Epoch 4/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6852 -
binary_accuracy: 0.5564 - val_loss: 0.6836 - val_binary_accuracy: 0.5593
Epoch 5/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6806 -
binary_accuracy: 0.5659 - val_loss: 0.6791 - val_binary_accuracy: 0.5641
Epoch 6/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6747 -
binary_accuracy: 0.5778 - val_loss: 0.6729 - val_binary_accuracy: 0.5800
Epoch 7/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6717 -
binary_accuracy: 0.5836 - val_loss: 0.6894 - val_binary_accuracy: 0.5560
Epoch 8/500
5/5 [==============================] - 1s 167ms/step - loss: 0.6710 -
binary_accuracy: 0.5844 - val_loss: 0.6658 - val_binary_accuracy: 0.5932
Epoch 9/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6654 -
binary_accuracy: 0.5971 - val_loss: 0.6670 - val_binary_accuracy: 0.5939
Epoch 10/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6619 -
binary_accuracy: 0.6026 - val_loss: 0.6629 - val_binary_accuracy: 0.5952
Epoch 11/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6547 -
binary_accuracy: 0.6161 - val_loss: 0.6572 - val_binary_accuracy: 0.6091
Epoch 12/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6495 -
binary_accuracy: 0.6204 - val_loss: 0.6472 - val_binary_accuracy: 0.6236
Epoch 13/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6456 -
binary_accuracy: 0.6246 - val_loss: 0.6440 - val_binary_accuracy: 0.6254
Epoch 14/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6374 -
binary_accuracy: 0.6365 - val_loss: 0.6383 - val_binary_accuracy: 0.6349
Epoch 15/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6286 -
binary_accuracy: 0.6476 - val_loss: 0.6381 - val_binary_accuracy: 0.6351
Epoch 16/500
5/5 [==============================] - 1s 167ms/step - loss: 0.6282 -
binary_accuracy: 0.6475 - val_loss: 0.6353 - val_binary_accuracy: 0.6417
Epoch 17/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6249 -
binary_accuracy: 0.6519 - val_loss: 0.6300 - val_binary_accuracy: 0.6433
Epoch 18/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6177 -
binary_accuracy: 0.6594 - val_loss: 0.6217 - val_binary_accuracy: 0.6546
Epoch 19/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.6138 -
binary_accuracy: 0.6631 - val_loss: 0.6255 - val_binary_accuracy: 0.6515
Epoch 20/500
5/5 [==============================] - 1s 167ms/step - loss: 0.6079 -
binary_accuracy: 0.6679 - val_loss: 0.6135 - val_binary_accuracy: 0.6634
Epoch 21/500
5/5 [==============================] - 1s 167ms/step - loss: 0.6047 -
binary_accuracy: 0.6728 - val_loss: 0.6163 - val_binary_accuracy: 0.6578
Epoch 22/500
5/5 [==============================] - 1s 166ms/step - loss: 0.6051 -
binary_accuracy: 0.6713 - val_loss: 0.6181 - val_binary_accuracy: 0.6580
Epoch 23/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6030 -
binary_accuracy: 0.6718 - val_loss: 0.6015 - val_binary_accuracy: 0.6728
Epoch 24/500
5/5 [==============================] - 1s 167ms/step - loss: 0.6043 -
binary_accuracy: 0.6701 - val_loss: 0.6127 - val_binary_accuracy: 0.6607
Epoch 25/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5941 -
binary_accuracy: 0.6825 - val_loss: 0.6204 - val_binary_accuracy: 0.6617
Epoch 26/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5922 -
binary_accuracy: 0.6862 - val_loss: 0.5969 - val_binary_accuracy: 0.6790
Epoch 27/500
5/5 [==============================] - 1s 165ms/step - loss: 0.5839 -
binary_accuracy: 0.6925 - val_loss: 0.5931 - val_binary_accuracy: 0.6822
Epoch 28/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5981 -
binary_accuracy: 0.6780 - val_loss: 0.6373 - val_binary_accuracy: 0.6346
Epoch 29/500
5/5 [==============================] - 1s 168ms/step - loss: 0.6077 -
binary_accuracy: 0.6686 - val_loss: 0.6091 - val_binary_accuracy: 0.6647
Epoch 30/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5930 -
binary_accuracy: 0.6818 - val_loss: 0.6110 - val_binary_accuracy: 0.6679
Epoch 31/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5793 -
binary_accuracy: 0.6955 - val_loss: 0.5859 - val_binary_accuracy: 0.6870
Epoch 32/500
5/5 [==============================] - 1s 165ms/step - loss: 0.5775 -
binary_accuracy: 0.6964 - val_loss: 0.5962 - val_binary_accuracy: 0.6782
Epoch 33/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5695 -
binary_accuracy: 0.7043 - val_loss: 0.5839 - val_binary_accuracy: 0.6916
Epoch 34/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5624 -
binary_accuracy: 0.7123 - val_loss: 0.5772 - val_binary_accuracy: 0.6965
Epoch 35/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.5569 -
binary_accuracy: 0.7152 - val_loss: 0.5849 - val_binary_accuracy: 0.6940
Epoch 36/500
5/5 [==============================] - 1s 167ms/step - loss: 0.6017 -
binary_accuracy: 0.6754 - val_loss: 0.6260 - val_binary_accuracy: 0.6390
Epoch 37/500
5/5 [==============================] - 1s 165ms/step - loss: 0.6031 -
binary_accuracy: 0.6720 - val_loss: 0.6092 - val_binary_accuracy: 0.6674
Epoch 38/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5925 -
binary_accuracy: 0.6826 - val_loss: 0.5915 - val_binary_accuracy: 0.6823
Epoch 39/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5683 -
binary_accuracy: 0.7038 - val_loss: 0.6459 - val_binary_accuracy: 0.6594
Epoch 40/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5853 -
binary_accuracy: 0.6935 - val_loss: 0.5883 - val_binary_accuracy: 0.6862
Epoch 41/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5729 -
binary_accuracy: 0.7046 - val_loss: 0.5860 - val_binary_accuracy: 0.6877
Epoch 42/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5569 -
binary_accuracy: 0.7135 - val_loss: 0.6073 - val_binary_accuracy: 0.6816
Epoch 43/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5673 -
binary_accuracy: 0.7021 - val_loss: 0.6044 - val_binary_accuracy: 0.6705
Epoch 44/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5630 -
binary_accuracy: 0.7061 - val_loss: 0.5805 - val_binary_accuracy: 0.6910
Epoch 45/500
5/5 [==============================] - 1s 168ms/step - loss: 0.5493 -
binary_accuracy: 0.7231 - val_loss: 0.5819 - val_binary_accuracy: 0.6986
Epoch 46/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5477 -
binary_accuracy: 0.7221 - val_loss: 0.5820 - val_binary_accuracy: 0.6908
Epoch 47/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5495 -
binary_accuracy: 0.7187 - val_loss: 0.5607 - val_binary_accuracy: 0.7101
Epoch 48/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5445 -
binary_accuracy: 0.7229 - val_loss: 0.5539 - val_binary_accuracy: 0.7148
Epoch 49/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5368 -
binary_accuracy: 0.7271 - val_loss: 0.5689 - val_binary_accuracy: 0.7038
Epoch 50/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5324 -
binary_accuracy: 0.7336 - val_loss: 0.5606 - val_binary_accuracy: 0.7116
Epoch 51/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.5311 -
binary_accuracy: 0.7312 - val_loss: 0.5767 - val_binary_accuracy: 0.7002
Epoch 52/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5283 -
binary_accuracy: 0.7372 - val_loss: 0.5649 - val_binary_accuracy: 0.7081
Epoch 53/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5300 -
binary_accuracy: 0.7353 - val_loss: 0.5657 - val_binary_accuracy: 0.7074
Epoch 54/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5312 -
binary_accuracy: 0.7336 - val_loss: 0.5506 - val_binary_accuracy: 0.7187
Epoch 55/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5255 -
binary_accuracy: 0.7339 - val_loss: 0.6283 - val_binary_accuracy: 0.6680
Epoch 56/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5517 -
binary_accuracy: 0.7153 - val_loss: 0.5515 - val_binary_accuracy: 0.7165
Epoch 57/500
5/5 [==============================] - 1s 168ms/step - loss: 0.5323 -
binary_accuracy: 0.7338 - val_loss: 0.5607 - val_binary_accuracy: 0.7120
Epoch 58/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5165 -
binary_accuracy: 0.7424 - val_loss: 0.5362 - val_binary_accuracy: 0.7289
Epoch 59/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5025 -
binary_accuracy: 0.7547 - val_loss: 0.5513 - val_binary_accuracy: 0.7207
Epoch 60/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5087 -
binary_accuracy: 0.7498 - val_loss: 0.5360 - val_binary_accuracy: 0.7305
Epoch 61/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5094 -
binary_accuracy: 0.7491 - val_loss: 0.5392 - val_binary_accuracy: 0.7270
Epoch 62/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5109 -
binary_accuracy: 0.7455 - val_loss: 0.5262 - val_binary_accuracy: 0.7356
Epoch 63/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4946 -
binary_accuracy: 0.7584 - val_loss: 0.5296 - val_binary_accuracy: 0.7375
Epoch 64/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5142 -
binary_accuracy: 0.7427 - val_loss: 0.5478 - val_binary_accuracy: 0.7190
Epoch 65/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5071 -
binary_accuracy: 0.7512 - val_loss: 0.5362 - val_binary_accuracy: 0.7321
Epoch 66/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4840 -
binary_accuracy: 0.7657 - val_loss: 0.5219 - val_binary_accuracy: 0.7406
Epoch 67/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.4802 -
binary_accuracy: 0.7676 - val_loss: 0.5503 - val_binary_accuracy: 0.7237
Epoch 68/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4924 -
binary_accuracy: 0.7604 - val_loss: 0.5215 - val_binary_accuracy: 0.7392
Epoch 69/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4763 -
binary_accuracy: 0.7716 - val_loss: 0.6013 - val_binary_accuracy: 0.6993
Epoch 70/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5851 -
binary_accuracy: 0.6910 - val_loss: 0.6149 - val_binary_accuracy: 0.6466
Epoch 71/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5835 -
binary_accuracy: 0.6851 - val_loss: 0.6168 - val_binary_accuracy: 0.6433
Epoch 72/500
5/5 [==============================] - 1s 168ms/step - loss: 0.5798 -
binary_accuracy: 0.6944 - val_loss: 0.5997 - val_binary_accuracy: 0.6684
Epoch 73/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5697 -
binary_accuracy: 0.7048 - val_loss: 0.5771 - val_binary_accuracy: 0.6922
Epoch 74/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5404 -
binary_accuracy: 0.7271 - val_loss: 0.5545 - val_binary_accuracy: 0.7158
Epoch 75/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5089 -
binary_accuracy: 0.7507 - val_loss: 0.6789 - val_binary_accuracy: 0.6622
Epoch 76/500
5/5 [==============================] - 1s 166ms/step - loss: 0.5540 -
binary_accuracy: 0.7221 - val_loss: 0.5944 - val_binary_accuracy: 0.6698
Epoch 77/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5486 -
binary_accuracy: 0.7180 - val_loss: 0.5818 - val_binary_accuracy: 0.6842
Epoch 78/500
5/5 [==============================] - 1s 167ms/step - loss: 0.5415 -
binary_accuracy: 0.7225 - val_loss: 0.5505 - val_binary_accuracy: 0.7142
Epoch 79/500
5/5 [==============================] - 1s 168ms/step - loss: 0.5067 -
binary_accuracy: 0.7479 - val_loss: 0.5269 - val_binary_accuracy: 0.7376
Epoch 80/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4891 -
binary_accuracy: 0.7625 - val_loss: 0.5706 - val_binary_accuracy: 0.7141
Epoch 81/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4940 -
binary_accuracy: 0.7618 - val_loss: 0.5177 - val_binary_accuracy: 0.7404
Epoch 82/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4754 -
binary_accuracy: 0.7706 - val_loss: 0.5276 - val_binary_accuracy: 0.7453
Epoch 83/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.4834 -
binary_accuracy: 0.7643 - val_loss: 0.5045 - val_binary_accuracy: 0.7511
Epoch 84/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4725 -
binary_accuracy: 0.7738 - val_loss: 0.5108 - val_binary_accuracy: 0.7508
Epoch 85/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4813 -
binary_accuracy: 0.7658 - val_loss: 0.4985 - val_binary_accuracy: 0.7576
Epoch 86/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4953 -
binary_accuracy: 0.7561 - val_loss: 0.5344 - val_binary_accuracy: 0.7282
Epoch 87/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4930 -
binary_accuracy: 0.7594 - val_loss: 0.5144 - val_binary_accuracy: 0.7470
Epoch 88/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4680 -
binary_accuracy: 0.7752 - val_loss: 0.5693 - val_binary_accuracy: 0.7178
Epoch 89/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4826 -
binary_accuracy: 0.7665 - val_loss: 0.5239 - val_binary_accuracy: 0.7390
Epoch 90/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4706 -
binary_accuracy: 0.7748 - val_loss: 0.5368 - val_binary_accuracy: 0.7374
Epoch 91/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4784 -
binary_accuracy: 0.7704 - val_loss: 0.5025 - val_binary_accuracy: 0.7529
Epoch 92/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4694 -
binary_accuracy: 0.7745 - val_loss: 0.5285 - val_binary_accuracy: 0.7369
Epoch 93/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4625 -
binary_accuracy: 0.7805 - val_loss: 0.5097 - val_binary_accuracy: 0.7530
Epoch 94/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4529 -
binary_accuracy: 0.7863 - val_loss: 0.5177 - val_binary_accuracy: 0.7476
Epoch 95/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4504 -
binary_accuracy: 0.7893 - val_loss: 0.5151 - val_binary_accuracy: 0.7481
Epoch 96/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4560 -
binary_accuracy: 0.7837 - val_loss: 0.4910 - val_binary_accuracy: 0.7639
Epoch 97/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4467 -
binary_accuracy: 0.7909 - val_loss: 0.4947 - val_binary_accuracy: 0.7591
Epoch 98/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4451 -
binary_accuracy: 0.7906 - val_loss: 0.5172 - val_binary_accuracy: 0.7482
Epoch 99/500
```

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5/5 [==============================] - 1s 168ms/step - loss: 0.4453 -
binary_accuracy: 0.7905 - val_loss: 0.5014 - val_binary_accuracy: 0.7576
Epoch 100/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4333 -
binary_accuracy: 0.8006 - val_loss: 0.4918 - val_binary_accuracy: 0.7677
Epoch 101/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4214 -
binary_accuracy: 0.8058 - val_loss: 0.4815 - val_binary_accuracy: 0.7699
Epoch 102/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4169 -
binary_accuracy: 0.8065 - val_loss: 0.4839 - val_binary_accuracy: 0.7728
Epoch 103/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4485 -
binary_accuracy: 0.7887 - val_loss: 0.5150 - val_binary_accuracy: 0.7393
Epoch 104/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4421 -
binary_accuracy: 0.7937 - val_loss: 0.5083 - val_binary_accuracy: 0.7620
Epoch 105/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4679 -
binary_accuracy: 0.7794 - val_loss: 0.5578 - val_binary_accuracy: 0.7150
Epoch 106/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4826 -
binary_accuracy: 0.7644 - val_loss: 0.5429 - val_binary_accuracy: 0.7207
Epoch 107/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4691 -
binary_accuracy: 0.7721 - val_loss: 0.5278 - val_binary_accuracy: 0.7475
Epoch 108/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4490 -
binary_accuracy: 0.7876 - val_loss: 0.4781 - val_binary_accuracy: 0.7727
Epoch 109/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4399 -
binary_accuracy: 0.7942 - val_loss: 0.5078 - val_binary_accuracy: 0.7531
Epoch 110/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4282 -
binary_accuracy: 0.8023 - val_loss: 0.5176 - val_binary_accuracy: 0.7577
Epoch 111/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4420 -
binary_accuracy: 0.7950 - val_loss: 0.4887 - val_binary_accuracy: 0.7638
Epoch 112/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4292 -
binary_accuracy: 0.8009 - val_loss: 0.4984 - val_binary_accuracy: 0.7621
Epoch 113/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4253 -
binary_accuracy: 0.8026 - val_loss: 0.5326 - val_binary_accuracy: 0.7424
Epoch 114/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4449 -
binary_accuracy: 0.7913 - val_loss: 0.5050 - val_binary_accuracy: 0.7470
Epoch 115/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.4277 -
binary_accuracy: 0.8029 - val_loss: 0.5704 - val_binary_accuracy: 0.7371
Epoch 116/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4818 -
binary_accuracy: 0.7677 - val_loss: 0.5292 - val_binary_accuracy: 0.7285
Epoch 117/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4698 -
binary_accuracy: 0.7730 - val_loss: 0.4920 - val_binary_accuracy: 0.7605
Epoch 118/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4324 -
binary_accuracy: 0.8007 - val_loss: 0.5253 - val_binary_accuracy: 0.7575
Epoch 119/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4198 -
binary_accuracy: 0.8076 - val_loss: 0.4727 - val_binary_accuracy: 0.7757
Epoch 120/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4054 -
binary_accuracy: 0.8185 - val_loss: 0.4743 - val_binary_accuracy: 0.7764
Epoch 121/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4130 -
binary_accuracy: 0.8100 - val_loss: 0.4699 - val_binary_accuracy: 0.7763
Epoch 122/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4099 -
binary_accuracy: 0.8109 - val_loss: 0.4675 - val_binary_accuracy: 0.7788
Epoch 123/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4122 -
binary_accuracy: 0.8120 - val_loss: 0.4724 - val_binary_accuracy: 0.7766
Epoch 124/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4062 -
binary_accuracy: 0.8130 - val_loss: 0.4653 - val_binary_accuracy: 0.7812
Epoch 125/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4022 -
binary_accuracy: 0.8185 - val_loss: 0.4659 - val_binary_accuracy: 0.7829
Epoch 126/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3993 -
binary_accuracy: 0.8186 - val_loss: 0.4866 - val_binary_accuracy: 0.7695
Epoch 127/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4170 -
binary_accuracy: 0.8074 - val_loss: 0.4856 - val_binary_accuracy: 0.7675
Epoch 128/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4156 -
binary_accuracy: 0.8079 - val_loss: 0.4955 - val_binary_accuracy: 0.7625
Epoch 129/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4083 -
binary_accuracy: 0.8111 - val_loss: 0.4651 - val_binary_accuracy: 0.7827
Epoch 130/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3950 -
binary_accuracy: 0.8210 - val_loss: 0.4788 - val_binary_accuracy: 0.7734
Epoch 131/500
```

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5/5 [==============================] - 1s 168ms/step - loss: 0.3911 -
binary_accuracy: 0.8206 - val_loss: 0.4753 - val_binary_accuracy: 0.7799
Epoch 132/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3869 -
binary_accuracy: 0.8267 - val_loss: 0.4648 - val_binary_accuracy: 0.7816
Epoch 133/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3838 -
binary_accuracy: 0.8266 - val_loss: 0.4672 - val_binary_accuracy: 0.7843
Epoch 134/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3769 -
binary_accuracy: 0.8308 - val_loss: 0.4658 - val_binary_accuracy: 0.7823
Epoch 135/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3893 -
binary_accuracy: 0.8223 - val_loss: 0.4648 - val_binary_accuracy: 0.7821
Epoch 136/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3825 -
binary_accuracy: 0.8267 - val_loss: 0.5074 - val_binary_accuracy: 0.7638
Epoch 137/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3943 -
binary_accuracy: 0.8218 - val_loss: 0.4681 - val_binary_accuracy: 0.7795
Epoch 138/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3855 -
binary_accuracy: 0.8251 - val_loss: 0.4649 - val_binary_accuracy: 0.7853
Epoch 139/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3691 -
binary_accuracy: 0.8359 - val_loss: 0.4585 - val_binary_accuracy: 0.7883
Epoch 140/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4061 -
binary_accuracy: 0.8154 - val_loss: 0.4655 - val_binary_accuracy: 0.7767
Epoch 141/500
5/5 [==============================] - 1s 166ms/step - loss: 0.4314 -
binary_accuracy: 0.7967 - val_loss: 0.4791 - val_binary_accuracy: 0.7663
Epoch 142/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4115 -
binary_accuracy: 0.8121 - val_loss: 0.5225 - val_binary_accuracy: 0.7670
Epoch 143/500
5/5 [==============================] - 1s 169ms/step - loss: 0.4625 -
binary_accuracy: 0.7819 - val_loss: 0.5403 - val_binary_accuracy: 0.7232
Epoch 144/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4574 -
binary_accuracy: 0.7821 - val_loss: 0.4906 - val_binary_accuracy: 0.7585
Epoch 145/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4087 -
binary_accuracy: 0.8167 - val_loss: 0.4907 - val_binary_accuracy: 0.7778
Epoch 146/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3936 -
binary_accuracy: 0.8229 - val_loss: 0.4614 - val_binary_accuracy: 0.7806
Epoch 147/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.3843 -
binary_accuracy: 0.8275 - val_loss: 0.4647 - val_binary_accuracy: 0.7812
Epoch 148/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3706 -
binary_accuracy: 0.8357 - val_loss: 0.4640 - val_binary_accuracy: 0.7916
Epoch 149/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3685 -
binary_accuracy: 0.8349 - val_loss: 0.4677 - val_binary_accuracy: 0.7786
Epoch 150/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3700 -
binary_accuracy: 0.8356 - val_loss: 0.4807 - val_binary_accuracy: 0.7811
Epoch 151/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3711 -
binary_accuracy: 0.8317 - val_loss: 0.4537 - val_binary_accuracy: 0.7900
Epoch 152/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3593 -
binary_accuracy: 0.8407 - val_loss: 0.4886 - val_binary_accuracy: 0.7791
Epoch 153/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4067 -
binary_accuracy: 0.8115 - val_loss: 0.4654 - val_binary_accuracy: 0.7763
Epoch 154/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3902 -
binary_accuracy: 0.8259 - val_loss: 0.4832 - val_binary_accuracy: 0.7781
Epoch 155/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4077 -
binary_accuracy: 0.8143 - val_loss: 0.4673 - val_binary_accuracy: 0.7774
Epoch 156/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3913 -
binary_accuracy: 0.8242 - val_loss: 0.4875 - val_binary_accuracy: 0.7701
Epoch 157/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3933 -
binary_accuracy: 0.8209 - val_loss: 0.4504 - val_binary_accuracy: 0.7919
Epoch 158/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3702 -
binary_accuracy: 0.8346 - val_loss: 0.4587 - val_binary_accuracy: 0.7853
Epoch 159/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3702 -
binary_accuracy: 0.8373 - val_loss: 0.4752 - val_binary_accuracy: 0.7835
Epoch 160/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3605 -
binary_accuracy: 0.8413 - val_loss: 0.4758 - val_binary_accuracy: 0.7786
Epoch 161/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3656 -
binary_accuracy: 0.8383 - val_loss: 0.4517 - val_binary_accuracy: 0.7934
Epoch 162/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3771 -
binary_accuracy: 0.8307 - val_loss: 0.4650 - val_binary_accuracy: 0.7813
Epoch 163/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.3686 -
binary_accuracy: 0.8359 - val_loss: 0.4597 - val_binary_accuracy: 0.7902
Epoch 164/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3666 -
binary_accuracy: 0.8378 - val_loss: 0.4499 - val_binary_accuracy: 0.7919
Epoch 165/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3641 -
binary_accuracy: 0.8381 - val_loss: 0.4548 - val_binary_accuracy: 0.7907
Epoch 166/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3662 -
binary_accuracy: 0.8377 - val_loss: 0.4542 - val_binary_accuracy: 0.7909
Epoch 167/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3490 -
binary_accuracy: 0.8459 - val_loss: 0.4538 - val_binary_accuracy: 0.7945
Epoch 168/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3405 -
binary_accuracy: 0.8519 - val_loss: 0.4639 - val_binary_accuracy: 0.7885
Epoch 169/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3507 -
binary_accuracy: 0.8463 - val_loss: 0.4546 - val_binary_accuracy: 0.7914
Epoch 170/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3566 -
binary_accuracy: 0.8439 - val_loss: 0.4521 - val_binary_accuracy: 0.7932
Epoch 171/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3757 -
binary_accuracy: 0.8314 - val_loss: 0.4532 - val_binary_accuracy: 0.7873
Epoch 172/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3768 -
binary_accuracy: 0.8310 - val_loss: 0.4530 - val_binary_accuracy: 0.7921
Epoch 173/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4003 -
binary_accuracy: 0.8148 - val_loss: 0.4992 - val_binary_accuracy: 0.7552
Epoch 174/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3792 -
binary_accuracy: 0.8310 - val_loss: 0.4535 - val_binary_accuracy: 0.7950
Epoch 175/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3692 -
binary_accuracy: 0.8341 - val_loss: 0.5046 - val_binary_accuracy: 0.7598
Epoch 176/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3786 -
binary_accuracy: 0.8312 - val_loss: 0.4574 - val_binary_accuracy: 0.7837
Epoch 177/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3657 -
binary_accuracy: 0.8414 - val_loss: 0.4880 - val_binary_accuracy: 0.7781
Epoch 178/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3500 -
binary_accuracy: 0.8477 - val_loss: 0.4519 - val_binary_accuracy: 0.7879
Epoch 179/500
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5/5 [==============================] - 1s 168ms/step - loss: 0.3400 -
binary_accuracy: 0.8525 - val_loss: 0.5198 - val_binary_accuracy: 0.7741
Epoch 180/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3867 -
binary_accuracy: 0.8254 - val_loss: 0.4854 - val_binary_accuracy: 0.7668
Epoch 181/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3672 -
binary_accuracy: 0.8375 - val_loss: 0.4568 - val_binary_accuracy: 0.7971
Epoch 182/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4301 -
binary_accuracy: 0.8066 - val_loss: 0.4982 - val_binary_accuracy: 0.7540
Epoch 183/500
5/5 [==============================] - 1s 168ms/step - loss: 0.4266 -
binary_accuracy: 0.7996 - val_loss: 0.5109 - val_binary_accuracy: 0.7449
Epoch 184/500
5/5 [==============================] - 1s 167ms/step - loss: 0.4137 -
binary_accuracy: 0.8127 - val_loss: 0.4637 - val_binary_accuracy: 0.7814
Epoch 185/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3691 -
binary_accuracy: 0.8369 - val_loss: 0.4631 - val_binary_accuracy: 0.7951
Epoch 186/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3440 -
binary_accuracy: 0.8476 - val_loss: 0.4527 - val_binary_accuracy: 0.7889
Epoch 187/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3374 -
binary_accuracy: 0.8548 - val_loss: 0.4657 - val_binary_accuracy: 0.7956
Epoch 188/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3366 -
binary_accuracy: 0.8532 - val_loss: 0.4693 - val_binary_accuracy: 0.7886
Epoch 189/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3394 -
binary_accuracy: 0.8509 - val_loss: 0.4794 - val_binary_accuracy: 0.7845
Epoch 190/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3407 -
binary_accuracy: 0.8511 - val_loss: 0.4494 - val_binary_accuracy: 0.7994
Epoch 191/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3454 -
binary_accuracy: 0.8482 - val_loss: 0.4680 - val_binary_accuracy: 0.7860
Epoch 192/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3388 -
binary_accuracy: 0.8522 - val_loss: 0.4579 - val_binary_accuracy: 0.7952
Epoch 193/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3238 -
binary_accuracy: 0.8590 - val_loss: 0.4504 - val_binary_accuracy: 0.7992
Epoch 194/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3207 -
binary_accuracy: 0.8626 - val_loss: 0.4493 - val_binary_accuracy: 0.7991
Epoch 195/500
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5/5 [==============================] - 1s 168ms/step - loss: 0.3159 -
binary_accuracy: 0.8655 - val_loss: 0.4642 - val_binary_accuracy: 0.7959
Epoch 196/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3179 -
binary_accuracy: 0.8620 - val_loss: 0.4522 - val_binary_accuracy: 0.8003
Epoch 197/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3401 -
binary_accuracy: 0.8514 - val_loss: 0.4739 - val_binary_accuracy: 0.7839
Epoch 198/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3572 -
binary_accuracy: 0.8398 - val_loss: 0.4909 - val_binary_accuracy: 0.7763
Epoch 199/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3501 -
binary_accuracy: 0.8477 - val_loss: 0.5433 - val_binary_accuracy: 0.7635
Epoch 200/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3814 -
binary_accuracy: 0.8252 - val_loss: 0.4805 - val_binary_accuracy: 0.7734
Epoch 201/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3611 -
binary_accuracy: 0.8391 - val_loss: 0.4665 - val_binary_accuracy: 0.7907
Epoch 202/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3439 -
binary_accuracy: 0.8494 - val_loss: 0.4794 - val_binary_accuracy: 0.7854
Epoch 203/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3378 -
binary_accuracy: 0.8531 - val_loss: 0.4455 - val_binary_accuracy: 0.7969
Epoch 204/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3304 -
binary_accuracy: 0.8569 - val_loss: 0.4811 - val_binary_accuracy: 0.7900
Epoch 205/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3285 -
binary_accuracy: 0.8575 - val_loss: 0.4613 - val_binary_accuracy: 0.7911
Epoch 206/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3174 -
binary_accuracy: 0.8640 - val_loss: 0.4543 - val_binary_accuracy: 0.8011
Epoch 207/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3111 -
binary_accuracy: 0.8664 - val_loss: 0.4694 - val_binary_accuracy: 0.7940
Epoch 208/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3135 -
binary_accuracy: 0.8647 - val_loss: 0.4524 - val_binary_accuracy: 0.8000
Epoch 209/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3068 -
binary_accuracy: 0.8704 - val_loss: 0.4534 - val_binary_accuracy: 0.8007
Epoch 210/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3042 -
binary_accuracy: 0.8707 - val_loss: 0.4611 - val_binary_accuracy: 0.7971
Epoch 211/500
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5/5 [==============================] - 1s 168ms/step - loss: 0.3165 -
binary_accuracy: 0.8644 - val_loss: 0.4494 - val_binary_accuracy: 0.7981
Epoch 212/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3068 -
binary_accuracy: 0.8676 - val_loss: 0.4819 - val_binary_accuracy: 0.7943
Epoch 213/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3161 -
binary_accuracy: 0.8629 - val_loss: 0.4681 - val_binary_accuracy: 0.7943
Epoch 214/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3239 -
binary_accuracy: 0.8568 - val_loss: 0.4719 - val_binary_accuracy: 0.7915
Epoch 215/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3120 -
binary_accuracy: 0.8671 - val_loss: 0.4708 - val_binary_accuracy: 0.7929
Epoch 216/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3078 -
binary_accuracy: 0.8687 - val_loss: 0.4627 - val_binary_accuracy: 0.7968
Epoch 217/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2978 -
binary_accuracy: 0.8746 - val_loss: 0.4558 - val_binary_accuracy: 0.8007
Epoch 218/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2918 -
binary_accuracy: 0.8796 - val_loss: 0.4673 - val_binary_accuracy: 0.7998
Epoch 219/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3106 -
binary_accuracy: 0.8656 - val_loss: 0.4514 - val_binary_accuracy: 0.7979
Epoch 220/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3133 -
binary_accuracy: 0.8649 - val_loss: 0.5841 - val_binary_accuracy: 0.7521
Epoch 221/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3590 -
binary_accuracy: 0.8373 - val_loss: 0.4539 - val_binary_accuracy: 0.7890
Epoch 222/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3363 -
binary_accuracy: 0.8535 - val_loss: 0.4531 - val_binary_accuracy: 0.8014
Epoch 223/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3014 -
binary_accuracy: 0.8711 - val_loss: 0.4521 - val_binary_accuracy: 0.7984
Epoch 224/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2937 -
binary_accuracy: 0.8774 - val_loss: 0.4868 - val_binary_accuracy: 0.7919
Epoch 225/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3216 -
binary_accuracy: 0.8613 - val_loss: 0.4677 - val_binary_accuracy: 0.7898
Epoch 226/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3055 -
binary_accuracy: 0.8710 - val_loss: 0.4823 - val_binary_accuracy: 0.7962
Epoch 227/500
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5/5 [==============================] - 1s 168ms/step - loss: 0.3241 -
binary_accuracy: 0.8571 - val_loss: 0.4558 - val_binary_accuracy: 0.7915
Epoch 228/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3071 -
binary_accuracy: 0.8692 - val_loss: 0.5094 - val_binary_accuracy: 0.7853
Epoch 229/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3240 -
binary_accuracy: 0.8605 - val_loss: 0.4530 - val_binary_accuracy: 0.7946
Epoch 230/500
5/5 [==============================] - 1s 170ms/step - loss: 0.3097 -
binary_accuracy: 0.8687 - val_loss: 0.4644 - val_binary_accuracy: 0.8026
Epoch 231/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3124 -
binary_accuracy: 0.8656 - val_loss: 0.5116 - val_binary_accuracy: 0.7721
Epoch 232/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3384 -
binary_accuracy: 0.8477 - val_loss: 0.4878 - val_binary_accuracy: 0.7826
Epoch 233/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3390 -
binary_accuracy: 0.8517 - val_loss: 0.5277 - val_binary_accuracy: 0.7657
Epoch 234/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3374 -
binary_accuracy: 0.8513 - val_loss: 0.4525 - val_binary_accuracy: 0.7929
Epoch 235/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3095 -
binary_accuracy: 0.8678 - val_loss: 0.4584 - val_binary_accuracy: 0.8045
Epoch 236/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3081 -
binary_accuracy: 0.8658 - val_loss: 0.4561 - val_binary_accuracy: 0.7931
Epoch 237/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3031 -
binary_accuracy: 0.8711 - val_loss: 0.4741 - val_binary_accuracy: 0.7995
Epoch 238/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2873 -
binary_accuracy: 0.8792 - val_loss: 0.4708 - val_binary_accuracy: 0.7954
Epoch 239/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2971 -
binary_accuracy: 0.8735 - val_loss: 0.4701 - val_binary_accuracy: 0.7963
Epoch 240/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2933 -
binary_accuracy: 0.8776 - val_loss: 0.4581 - val_binary_accuracy: 0.8021
Epoch 241/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2886 -
binary_accuracy: 0.8775 - val_loss: 0.4717 - val_binary_accuracy: 0.7973
Epoch 242/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2811 -
binary_accuracy: 0.8839 - val_loss: 0.4641 - val_binary_accuracy: 0.8042
Epoch 243/500
```

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5/5 [==============================] - 1s 167ms/step - loss: 0.2732 -
binary_accuracy: 0.8868 - val_loss: 0.4603 - val_binary_accuracy: 0.8023
Epoch 244/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2742 -
binary_accuracy: 0.8861 - val_loss: 0.4810 - val_binary_accuracy: 0.7976
Epoch 245/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2787 -
binary_accuracy: 0.8839 - val_loss: 0.4980 - val_binary_accuracy: 0.7901
Epoch 246/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2858 -
binary_accuracy: 0.8792 - val_loss: 0.4665 - val_binary_accuracy: 0.8000
Epoch 247/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2671 -
binary_accuracy: 0.8905 - val_loss: 0.4705 - val_binary_accuracy: 0.8046
Epoch 248/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2695 -
binary_accuracy: 0.8890 - val_loss: 0.4898 - val_binary_accuracy: 0.7947
Epoch 249/500
5/5 [==============================] - 1s 166ms/step - loss: 0.2746 -
binary_accuracy: 0.8862 - val_loss: 0.4884 - val_binary_accuracy: 0.7993
Epoch 250/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3050 -
binary_accuracy: 0.8680 - val_loss: 0.4964 - val_binary_accuracy: 0.7787
Epoch 251/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3020 -
binary_accuracy: 0.8715 - val_loss: 0.5501 - val_binary_accuracy: 0.7758
Epoch 252/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3110 -
binary_accuracy: 0.8651 - val_loss: 0.4609 - val_binary_accuracy: 0.7958
Epoch 253/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2798 -
binary_accuracy: 0.8820 - val_loss: 0.5142 - val_binary_accuracy: 0.7920
Epoch 254/500
5/5 [==============================] - 1s 170ms/step - loss: 0.2933 -
binary_accuracy: 0.8750 - val_loss: 0.4593 - val_binary_accuracy: 0.7968
Epoch 255/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2739 -
binary_accuracy: 0.8868 - val_loss: 0.5462 - val_binary_accuracy: 0.7794
Epoch 256/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3256 -
binary_accuracy: 0.8595 - val_loss: 0.5091 - val_binary_accuracy: 0.7711
Epoch 257/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3056 -
binary_accuracy: 0.8672 - val_loss: 0.5616 - val_binary_accuracy: 0.7773
Epoch 258/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3203 -
binary_accuracy: 0.8614 - val_loss: 0.4919 - val_binary_accuracy: 0.7790
Epoch 259/500
```

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5/5 [==============================] - 1s 168ms/step - loss: 0.2904 -
binary_accuracy: 0.8764 - val_loss: 0.5697 - val_binary_accuracy: 0.7761
Epoch 260/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3175 -
binary_accuracy: 0.8636 - val_loss: 0.4938 - val_binary_accuracy: 0.7801
Epoch 261/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2923 -
binary_accuracy: 0.8763 - val_loss: 0.5242 - val_binary_accuracy: 0.7866
Epoch 262/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3066 -
binary_accuracy: 0.8680 - val_loss: 0.4615 - val_binary_accuracy: 0.7961
Epoch 263/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2780 -
binary_accuracy: 0.8852 - val_loss: 0.4788 - val_binary_accuracy: 0.8026
Epoch 264/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2794 -
binary_accuracy: 0.8818 - val_loss: 0.4835 - val_binary_accuracy: 0.7902
Epoch 265/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2719 -
binary_accuracy: 0.8873 - val_loss: 0.4848 - val_binary_accuracy: 0.8021
Epoch 266/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2735 -
binary_accuracy: 0.8857 - val_loss: 0.4690 - val_binary_accuracy: 0.7982
Epoch 267/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2595 -
binary_accuracy: 0.8942 - val_loss: 0.4832 - val_binary_accuracy: 0.8055
Epoch 268/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2540 -
binary_accuracy: 0.8962 - val_loss: 0.4746 - val_binary_accuracy: 0.8001
Epoch 269/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2500 -
binary_accuracy: 0.9010 - val_loss: 0.4913 - val_binary_accuracy: 0.8050
Epoch 270/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2717 -
binary_accuracy: 0.8858 - val_loss: 0.4803 - val_binary_accuracy: 0.7935
Epoch 271/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2626 -
binary_accuracy: 0.8914 - val_loss: 0.4970 - val_binary_accuracy: 0.8029
Epoch 272/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2507 -
binary_accuracy: 0.8981 - val_loss: 0.4790 - val_binary_accuracy: 0.8011
Epoch 273/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2516 -
binary_accuracy: 0.8970 - val_loss: 0.4888 - val_binary_accuracy: 0.8031
Epoch 274/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2520 -
binary_accuracy: 0.8960 - val_loss: 0.4800 - val_binary_accuracy: 0.8048
Epoch 275/500
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5/5 [==============================] - 1s 169ms/step - loss: 0.2636 -
binary_accuracy: 0.8902 - val_loss: 0.4805 - val_binary_accuracy: 0.7970
Epoch 276/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2529 -
binary_accuracy: 0.8970 - val_loss: 0.4977 - val_binary_accuracy: 0.8024
Epoch 277/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3199 -
binary_accuracy: 0.8600 - val_loss: 0.5345 - val_binary_accuracy: 0.7566
Epoch 278/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3291 -
binary_accuracy: 0.8531 - val_loss: 0.5229 - val_binary_accuracy: 0.7693
Epoch 279/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3069 -
binary_accuracy: 0.8687 - val_loss: 0.4674 - val_binary_accuracy: 0.8036
Epoch 280/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2730 -
binary_accuracy: 0.8851 - val_loss: 0.4706 - val_binary_accuracy: 0.7977
Epoch 281/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2548 -
binary_accuracy: 0.8962 - val_loss: 0.4910 - val_binary_accuracy: 0.8062
Epoch 282/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2440 -
binary_accuracy: 0.9005 - val_loss: 0.4850 - val_binary_accuracy: 0.8035
Epoch 283/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2485 -
binary_accuracy: 0.8986 - val_loss: 0.4787 - val_binary_accuracy: 0.8042
Epoch 284/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2611 -
binary_accuracy: 0.8912 - val_loss: 0.5651 - val_binary_accuracy: 0.7744
Epoch 285/500
5/5 [==============================] - 1s 168ms/step - loss: 0.3015 -
binary_accuracy: 0.8686 - val_loss: 0.5375 - val_binary_accuracy: 0.7707
Epoch 286/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2887 -
binary_accuracy: 0.8746 - val_loss: 0.5116 - val_binary_accuracy: 0.7897
Epoch 287/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2829 -
binary_accuracy: 0.8789 - val_loss: 0.4985 - val_binary_accuracy: 0.7869
Epoch 288/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2564 -
binary_accuracy: 0.8929 - val_loss: 0.5433 - val_binary_accuracy: 0.7905
Epoch 289/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2623 -
binary_accuracy: 0.8919 - val_loss: 0.4812 - val_binary_accuracy: 0.7989
Epoch 290/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2468 -
binary_accuracy: 0.8973 - val_loss: 0.5183 - val_binary_accuracy: 0.7919
Epoch 291/500
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5/5 [==============================] - 1s 168ms/step - loss: 0.2634 -
binary_accuracy: 0.8903 - val_loss: 0.5109 - val_binary_accuracy: 0.7893
Epoch 292/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2620 -
binary_accuracy: 0.8917 - val_loss: 0.4890 - val_binary_accuracy: 0.8025
Epoch 293/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2457 -
binary_accuracy: 0.8982 - val_loss: 0.5077 - val_binary_accuracy: 0.7973
Epoch 294/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2435 -
binary_accuracy: 0.9004 - val_loss: 0.5102 - val_binary_accuracy: 0.7961
Epoch 295/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2403 -
binary_accuracy: 0.9011 - val_loss: 0.5390 - val_binary_accuracy: 0.7913
Epoch 296/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2540 -
binary_accuracy: 0.8946 - val_loss: 0.4837 - val_binary_accuracy: 0.8001
Epoch 297/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2337 -
binary_accuracy: 0.9084 - val_loss: 0.5060 - val_binary_accuracy: 0.8010
Epoch 298/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2274 -
binary_accuracy: 0.9081 - val_loss: 0.5123 - val_binary_accuracy: 0.8008
Epoch 299/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2282 -
binary_accuracy: 0.9087 - val_loss: 0.5174 - val_binary_accuracy: 0.8003
Epoch 300/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2416 -
binary_accuracy: 0.9008 - val_loss: 0.4966 - val_binary_accuracy: 0.7976
Epoch 301/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2387 -
binary_accuracy: 0.9021 - val_loss: 0.5245 - val_binary_accuracy: 0.7960
Epoch 302/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2384 -
binary_accuracy: 0.9032 - val_loss: 0.5273 - val_binary_accuracy: 0.7920
Epoch 303/500
5/5 [==============================] - 1s 170ms/step - loss: 0.2428 -
binary_accuracy: 0.9022 - val_loss: 0.5430 - val_binary_accuracy: 0.7890
Epoch 304/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2661 -
binary_accuracy: 0.8874 - val_loss: 0.4942 - val_binary_accuracy: 0.7973
Epoch 305/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2384 -
binary_accuracy: 0.9011 - val_loss: 0.5375 - val_binary_accuracy: 0.7944
Epoch 306/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2411 -
binary_accuracy: 0.9015 - val_loss: 0.4970 - val_binary_accuracy: 0.8033
Epoch 307/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.2304 -
binary_accuracy: 0.9073 - val_loss: 0.5275 - val_binary_accuracy: 0.7936
Epoch 308/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2303 -
binary_accuracy: 0.9062 - val_loss: 0.5401 - val_binary_accuracy: 0.7960
Epoch 309/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2671 -
binary_accuracy: 0.8861 - val_loss: 0.5089 - val_binary_accuracy: 0.7888
Epoch 310/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2311 -
binary_accuracy: 0.9078 - val_loss: 0.5901 - val_binary_accuracy: 0.7915
Epoch 311/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3633 -
binary_accuracy: 0.8387 - val_loss: 0.6188 - val_binary_accuracy: 0.7114
Epoch 312/500
5/5 [==============================] - 1s 166ms/step - loss: 0.3939 -
binary_accuracy: 0.8134 - val_loss: 0.5146 - val_binary_accuracy: 0.7550
Epoch 313/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3045 -
binary_accuracy: 0.8709 - val_loss: 0.5505 - val_binary_accuracy: 0.7883
Epoch 314/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3841 -
binary_accuracy: 0.8391 - val_loss: 0.4813 - val_binary_accuracy: 0.7772
Epoch 315/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3207 -
binary_accuracy: 0.8632 - val_loss: 0.4804 - val_binary_accuracy: 0.7811
Epoch 316/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2886 -
binary_accuracy: 0.8765 - val_loss: 0.4907 - val_binary_accuracy: 0.8075
Epoch 317/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2533 -
binary_accuracy: 0.8962 - val_loss: 0.4771 - val_binary_accuracy: 0.8024
Epoch 318/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2399 -
binary_accuracy: 0.9036 - val_loss: 0.5110 - val_binary_accuracy: 0.7974
Epoch 319/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2479 -
binary_accuracy: 0.8976 - val_loss: 0.4897 - val_binary_accuracy: 0.8045
Epoch 320/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2306 -
binary_accuracy: 0.9070 - val_loss: 0.4938 - val_binary_accuracy: 0.8023
Epoch 321/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2154 -
binary_accuracy: 0.9153 - val_loss: 0.5110 - val_binary_accuracy: 0.8073
Epoch 322/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2197 -
binary_accuracy: 0.9120 - val_loss: 0.5118 - val_binary_accuracy: 0.8004
Epoch 323/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.2187 -
binary_accuracy: 0.9129 - val_loss: 0.5582 - val_binary_accuracy: 0.7931
Epoch 324/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2299 -
binary_accuracy: 0.9061 - val_loss: 0.5034 - val_binary_accuracy: 0.8012
Epoch 325/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2130 -
binary_accuracy: 0.9158 - val_loss: 0.5521 - val_binary_accuracy: 0.7962
Epoch 326/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2483 -
binary_accuracy: 0.8975 - val_loss: 0.5061 - val_binary_accuracy: 0.7930
Epoch 327/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2219 -
binary_accuracy: 0.9124 - val_loss: 0.5982 - val_binary_accuracy: 0.7867
Epoch 328/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2449 -
binary_accuracy: 0.8979 - val_loss: 0.5039 - val_binary_accuracy: 0.7966
Epoch 329/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2198 -
binary_accuracy: 0.9133 - val_loss: 0.5801 - val_binary_accuracy: 0.7886
Epoch 330/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2296 -
binary_accuracy: 0.9054 - val_loss: 0.5118 - val_binary_accuracy: 0.7960
Epoch 331/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2106 -
binary_accuracy: 0.9171 - val_loss: 0.5941 - val_binary_accuracy: 0.7883
Epoch 332/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2453 -
binary_accuracy: 0.8975 - val_loss: 0.5175 - val_binary_accuracy: 0.7909
Epoch 333/500
5/5 [==============================] - 1s 169ms/step - loss: 0.2266 -
binary_accuracy: 0.9090 - val_loss: 0.6007 - val_binary_accuracy: 0.7818
Epoch 334/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2356 -
binary_accuracy: 0.9018 - val_loss: 0.5446 - val_binary_accuracy: 0.7840
Epoch 335/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2233 -
binary_accuracy: 0.9080 - val_loss: 0.5320 - val_binary_accuracy: 0.8055
Epoch 336/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2142 -
binary_accuracy: 0.9150 - val_loss: 0.5247 - val_binary_accuracy: 0.7949
Epoch 337/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2099 -
binary_accuracy: 0.9170 - val_loss: 0.5376 - val_binary_accuracy: 0.8029
Epoch 338/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1983 -
binary_accuracy: 0.9217 - val_loss: 0.5372 - val_binary_accuracy: 0.8023
Epoch 339/500
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5/5 [==============================] - 1s 168ms/step - loss: 0.2017 -
binary_accuracy: 0.9206 - val_loss: 0.5410 - val_binary_accuracy: 0.8013
Epoch 340/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1968 -
binary_accuracy: 0.9236 - val_loss: 0.5507 - val_binary_accuracy: 0.8027
Epoch 341/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1981 -
binary_accuracy: 0.9237 - val_loss: 0.5448 - val_binary_accuracy: 0.8003
Epoch 342/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2008 -
binary_accuracy: 0.9205 - val_loss: 0.5659 - val_binary_accuracy: 0.7935
Epoch 343/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2169 -
binary_accuracy: 0.9122 - val_loss: 0.5344 - val_binary_accuracy: 0.8008
Epoch 344/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2107 -
binary_accuracy: 0.9153 - val_loss: 0.5504 - val_binary_accuracy: 0.7995
Epoch 345/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1939 -
binary_accuracy: 0.9242 - val_loss: 0.5584 - val_binary_accuracy: 0.8005
Epoch 346/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1892 -
binary_accuracy: 0.9269 - val_loss: 0.5821 - val_binary_accuracy: 0.7950
Epoch 347/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2157 -
binary_accuracy: 0.9125 - val_loss: 0.5737 - val_binary_accuracy: 0.7880
Epoch 348/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2087 -
binary_accuracy: 0.9186 - val_loss: 0.5669 - val_binary_accuracy: 0.7958
Epoch 349/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1916 -
binary_accuracy: 0.9271 - val_loss: 0.5690 - val_binary_accuracy: 0.7962
Epoch 350/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2159 -
binary_accuracy: 0.9133 - val_loss: 0.5944 - val_binary_accuracy: 0.7852
Epoch 351/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2239 -
binary_accuracy: 0.9080 - val_loss: 0.5463 - val_binary_accuracy: 0.7962
Epoch 352/500
5/5 [==============================] - 1s 166ms/step - loss: 0.2139 -
binary_accuracy: 0.9124 - val_loss: 0.5614 - val_binary_accuracy: 0.7943
Epoch 353/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1957 -
binary_accuracy: 0.9224 - val_loss: 0.5931 - val_binary_accuracy: 0.7928
Epoch 354/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1965 -
binary_accuracy: 0.9195 - val_loss: 0.5766 - val_binary_accuracy: 0.7946
Epoch 355/500
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5/5 [==============================] - 1s 170ms/step - loss: 0.1853 -
binary_accuracy: 0.9282 - val_loss: 0.5853 - val_binary_accuracy: 0.7996
Epoch 356/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1889 -
binary_accuracy: 0.9260 - val_loss: 0.5671 - val_binary_accuracy: 0.7974
Epoch 357/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1871 -
binary_accuracy: 0.9268 - val_loss: 0.6758 - val_binary_accuracy: 0.7732
Epoch 358/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2408 -
binary_accuracy: 0.8985 - val_loss: 0.5977 - val_binary_accuracy: 0.7759
Epoch 359/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2450 -
binary_accuracy: 0.8952 - val_loss: 0.5939 - val_binary_accuracy: 0.7809
Epoch 360/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2288 -
binary_accuracy: 0.9038 - val_loss: 0.5252 - val_binary_accuracy: 0.7923
Epoch 361/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2327 -
binary_accuracy: 0.9049 - val_loss: 0.9380 - val_binary_accuracy: 0.7008
Epoch 362/500
5/5 [==============================] - 1s 167ms/step - loss: 0.3996 -
binary_accuracy: 0.8287 - val_loss: 0.6010 - val_binary_accuracy: 0.7262
Epoch 363/500
5/5 [==============================] - 1s 169ms/step - loss: 0.3559 -
binary_accuracy: 0.8401 - val_loss: 0.5285 - val_binary_accuracy: 0.7598
Epoch 364/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2894 -
binary_accuracy: 0.8757 - val_loss: 0.5342 - val_binary_accuracy: 0.7948
Epoch 365/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2463 -
binary_accuracy: 0.8983 - val_loss: 0.5012 - val_binary_accuracy: 0.7988
Epoch 366/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2246 -
binary_accuracy: 0.9088 - val_loss: 0.5059 - val_binary_accuracy: 0.8037
Epoch 367/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2164 -
binary_accuracy: 0.9115 - val_loss: 0.5215 - val_binary_accuracy: 0.8015
Epoch 368/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1979 -
binary_accuracy: 0.9218 - val_loss: 0.5428 - val_binary_accuracy: 0.8107
Epoch 369/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1975 -
binary_accuracy: 0.9228 - val_loss: 0.5466 - val_binary_accuracy: 0.8035
Epoch 370/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1879 -
binary_accuracy: 0.9268 - val_loss: 0.5458 - val_binary_accuracy: 0.8072
Epoch 371/500
```

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5/5 [==============================] - 1s 167ms/step - loss: 0.1829 -
binary_accuracy: 0.9287 - val_loss: 0.5583 - val_binary_accuracy: 0.8037
Epoch 372/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1926 -
binary_accuracy: 0.9241 - val_loss: 0.5664 - val_binary_accuracy: 0.7977
Epoch 373/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1786 -
binary_accuracy: 0.9321 - val_loss: 0.5644 - val_binary_accuracy: 0.8024
Epoch 374/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1771 -
binary_accuracy: 0.9313 - val_loss: 0.6021 - val_binary_accuracy: 0.7981
Epoch 375/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1907 -
binary_accuracy: 0.9252 - val_loss: 0.5759 - val_binary_accuracy: 0.7946
Epoch 376/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1884 -
binary_accuracy: 0.9264 - val_loss: 0.5767 - val_binary_accuracy: 0.7977
Epoch 377/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1987 -
binary_accuracy: 0.9188 - val_loss: 0.6239 - val_binary_accuracy: 0.7803
Epoch 378/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2086 -
binary_accuracy: 0.9139 - val_loss: 0.5883 - val_binary_accuracy: 0.7929
Epoch 379/500
5/5 [==============================] - 1s 166ms/step - loss: 0.2124 -
binary_accuracy: 0.9135 - val_loss: 0.5488 - val_binary_accuracy: 0.7982
Epoch 380/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1930 -
binary_accuracy: 0.9247 - val_loss: 0.6308 - val_binary_accuracy: 0.7813
Epoch 381/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1996 -
binary_accuracy: 0.9195 - val_loss: 0.5931 - val_binary_accuracy: 0.7938
Epoch 382/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1915 -
binary_accuracy: 0.9237 - val_loss: 0.5814 - val_binary_accuracy: 0.7975
Epoch 383/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1817 -
binary_accuracy: 0.9292 - val_loss: 0.5912 - val_binary_accuracy: 0.7940
Epoch 384/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1686 -
binary_accuracy: 0.9358 - val_loss: 0.5932 - val_binary_accuracy: 0.8039
Epoch 385/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1712 -
binary_accuracy: 0.9357 - val_loss: 0.5988 - val_binary_accuracy: 0.7969
Epoch 386/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1647 -
binary_accuracy: 0.9388 - val_loss: 0.6020 - val_binary_accuracy: 0.8025
Epoch 387/500
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5/5 [==============================] - 1s 167ms/step - loss: 0.1580 -
binary_accuracy: 0.9405 - val_loss: 0.6159 - val_binary_accuracy: 0.7979
Epoch 388/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1665 -
binary_accuracy: 0.9356 - val_loss: 0.6003 - val_binary_accuracy: 0.7994
Epoch 389/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1791 -
binary_accuracy: 0.9299 - val_loss: 0.5923 - val_binary_accuracy: 0.8005
Epoch 390/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1606 -
binary_accuracy: 0.9408 - val_loss: 0.6529 - val_binary_accuracy: 0.7927
Epoch 391/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1775 -
binary_accuracy: 0.9310 - val_loss: 0.6099 - val_binary_accuracy: 0.7995
Epoch 392/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1629 -
binary_accuracy: 0.9378 - val_loss: 0.6244 - val_binary_accuracy: 0.7971
Epoch 393/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1695 -
binary_accuracy: 0.9340 - val_loss: 0.6014 - val_binary_accuracy: 0.7959
Epoch 394/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1631 -
binary_accuracy: 0.9378 - val_loss: 0.6289 - val_binary_accuracy: 0.8012
Epoch 395/500
5/5 [==============================] - 1s 166ms/step - loss: 0.2010 -
binary_accuracy: 0.9186 - val_loss: 0.5915 - val_binary_accuracy: 0.7862
Epoch 396/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2100 -
binary_accuracy: 0.9122 - val_loss: 0.5683 - val_binary_accuracy: 0.7991
Epoch 397/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1724 -
binary_accuracy: 0.9319 - val_loss: 0.7035 - val_binary_accuracy: 0.7773
Epoch 398/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2775 -
binary_accuracy: 0.8821 - val_loss: 0.6506 - val_binary_accuracy: 0.7508
Epoch 399/500
5/5 [==============================] - 1s 166ms/step - loss: 0.2474 -
binary_accuracy: 0.8950 - val_loss: 0.5573 - val_binary_accuracy: 0.7984
Epoch 400/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1953 -
binary_accuracy: 0.9210 - val_loss: 0.6004 - val_binary_accuracy: 0.7968
Epoch 401/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1579 -
binary_accuracy: 0.9418 - val_loss: 0.5890 - val_binary_accuracy: 0.7986
Epoch 402/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1528 -
binary_accuracy: 0.9433 - val_loss: 0.6354 - val_binary_accuracy: 0.8041
Epoch 403/500
```

```
5/5 [==============================] - 1s 168ms/step - loss: 0.1503 -
binary_accuracy: 0.9443 - val_loss: 0.6079 - val_binary_accuracy: 0.8021
Epoch 404/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1558 -
binary_accuracy: 0.9410 - val_loss: 0.6091 - val_binary_accuracy: 0.7994
Epoch 405/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1540 -
binary_accuracy: 0.9431 - val_loss: 0.6531 - val_binary_accuracy: 0.8016
Epoch 406/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1544 -
binary_accuracy: 0.9396 - val_loss: 0.6268 - val_binary_accuracy: 0.7982
Epoch 407/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1417 -
binary_accuracy: 0.9477 - val_loss: 0.6455 - val_binary_accuracy: 0.8010
Epoch 408/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1386 -
binary_accuracy: 0.9513 - val_loss: 0.6435 - val_binary_accuracy: 0.8013
Epoch 409/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1383 -
binary_accuracy: 0.9498 - val_loss: 0.6462 - val_binary_accuracy: 0.8011
Epoch 410/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1513 -
binary_accuracy: 0.9425 - val_loss: 0.6895 - val_binary_accuracy: 0.7861
Epoch 411/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1616 -
binary_accuracy: 0.9366 - val_loss: 0.6419 - val_binary_accuracy: 0.8007
Epoch 412/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1461 -
binary_accuracy: 0.9452 - val_loss: 0.7111 - val_binary_accuracy: 0.7843
Epoch 413/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1712 -
binary_accuracy: 0.9316 - val_loss: 0.6282 - val_binary_accuracy: 0.7955
Epoch 414/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1623 -
binary_accuracy: 0.9356 - val_loss: 0.6485 - val_binary_accuracy: 0.8015
Epoch 415/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1544 -
binary_accuracy: 0.9403 - val_loss: 0.7158 - val_binary_accuracy: 0.7779
Epoch 416/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1987 -
binary_accuracy: 0.9164 - val_loss: 0.6303 - val_binary_accuracy: 0.7940
Epoch 417/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2092 -
binary_accuracy: 0.9119 - val_loss: 0.6691 - val_binary_accuracy: 0.7784
Epoch 418/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1712 -
binary_accuracy: 0.9326 - val_loss: 0.6838 - val_binary_accuracy: 0.7885
Epoch 419/500
```

```
5/5 [==============================] - 1s 166ms/step - loss: 0.2244 -
binary_accuracy: 0.9065 - val_loss: 0.6069 - val_binary_accuracy: 0.7836
Epoch 420/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1837 -
binary_accuracy: 0.9253 - val_loss: 0.7227 - val_binary_accuracy: 0.7822
Epoch 421/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1936 -
binary_accuracy: 0.9212 - val_loss: 0.5966 - val_binary_accuracy: 0.7962
Epoch 422/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1654 -
binary_accuracy: 0.9366 - val_loss: 0.6290 - val_binary_accuracy: 0.7948
Epoch 423/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1878 -
binary_accuracy: 0.9230 - val_loss: 0.6549 - val_binary_accuracy: 0.7855
Epoch 424/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1562 -
binary_accuracy: 0.9411 - val_loss: 0.6280 - val_binary_accuracy: 0.7990
Epoch 425/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1421 -
binary_accuracy: 0.9463 - val_loss: 0.6552 - val_binary_accuracy: 0.8025
Epoch 426/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1330 -
binary_accuracy: 0.9520 - val_loss: 0.6672 - val_binary_accuracy: 0.7925
Epoch 427/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1349 -
binary_accuracy: 0.9493 - val_loss: 0.6657 - val_binary_accuracy: 0.8014
Epoch 428/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1300 -
binary_accuracy: 0.9528 - val_loss: 0.6784 - val_binary_accuracy: 0.7984
Epoch 429/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1276 -
binary_accuracy: 0.9544 - val_loss: 0.6926 - val_binary_accuracy: 0.7984
Epoch 430/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1293 -
binary_accuracy: 0.9535 - val_loss: 0.6949 - val_binary_accuracy: 0.7945
Epoch 431/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1340 -
binary_accuracy: 0.9506 - val_loss: 0.6903 - val_binary_accuracy: 0.7994
Epoch 432/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1251 -
binary_accuracy: 0.9553 - val_loss: 0.6993 - val_binary_accuracy: 0.7967
Epoch 433/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1326 -
binary_accuracy: 0.9506 - val_loss: 0.6900 - val_binary_accuracy: 0.7964
Epoch 434/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1217 -
binary_accuracy: 0.9564 - val_loss: 0.7104 - val_binary_accuracy: 0.7990
Epoch 435/500
```

```
5/5 [==============================] - 1s 166ms/step - loss: 0.1186 -
binary_accuracy: 0.9574 - val_loss: 0.7191 - val_binary_accuracy: 0.7987
Epoch 436/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1185 -
binary_accuracy: 0.9588 - val_loss: 0.7382 - val_binary_accuracy: 0.7924
Epoch 437/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1232 -
binary_accuracy: 0.9559 - val_loss: 0.7119 - val_binary_accuracy: 0.7994
Epoch 438/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1156 -
binary_accuracy: 0.9601 - val_loss: 0.7395 - val_binary_accuracy: 0.7989
Epoch 439/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1441 -
binary_accuracy: 0.9429 - val_loss: 0.8280 - val_binary_accuracy: 0.7664
Epoch 440/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1968 -
binary_accuracy: 0.9167 - val_loss: 0.6538 - val_binary_accuracy: 0.7957
Epoch 441/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1579 -
binary_accuracy: 0.9353 - val_loss: 0.6904 - val_binary_accuracy: 0.7938
Epoch 442/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1419 -
binary_accuracy: 0.9455 - val_loss: 0.7509 - val_binary_accuracy: 0.7827
Epoch 443/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1548 -
binary_accuracy: 0.9380 - val_loss: 0.7006 - val_binary_accuracy: 0.7870
Epoch 444/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1489 -
binary_accuracy: 0.9409 - val_loss: 0.7006 - val_binary_accuracy: 0.7951
Epoch 445/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1349 -
binary_accuracy: 0.9493 - val_loss: 0.7481 - val_binary_accuracy: 0.7912
Epoch 446/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1372 -
binary_accuracy: 0.9473 - val_loss: 0.7704 - val_binary_accuracy: 0.7818
Epoch 447/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1621 -
binary_accuracy: 0.9324 - val_loss: 0.7180 - val_binary_accuracy: 0.7864
Epoch 448/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1579 -
binary_accuracy: 0.9372 - val_loss: 0.7090 - val_binary_accuracy: 0.7877
Epoch 449/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1319 -
binary_accuracy: 0.9497 - val_loss: 0.7168 - val_binary_accuracy: 0.7977
Epoch 450/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1202 -
binary_accuracy: 0.9570 - val_loss: 0.7284 - val_binary_accuracy: 0.7954
Epoch 451/500
```

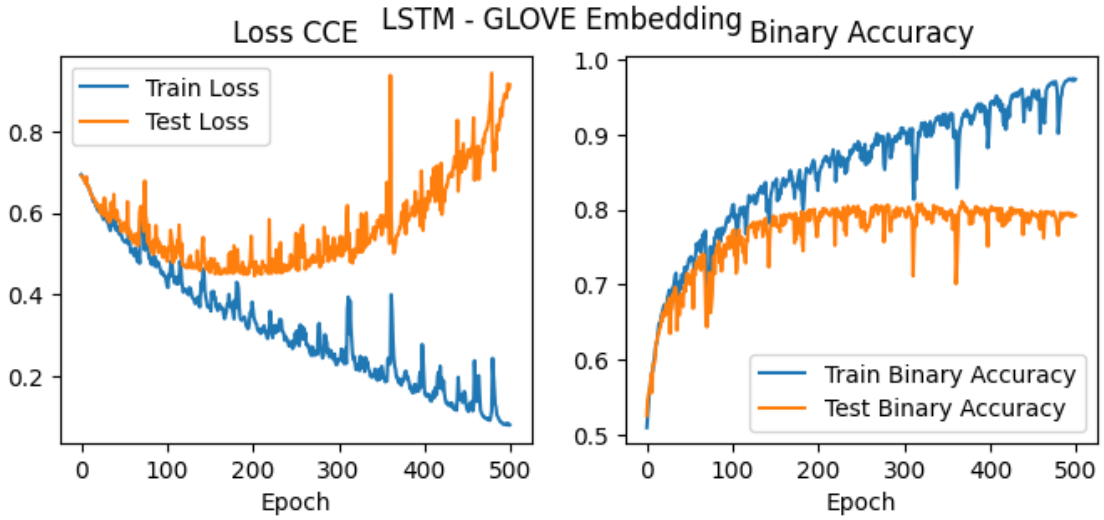
```
5/5 [==============================] - 1s 168ms/step - loss: 0.1153 -
binary_accuracy: 0.9589 - val_loss: 0.7479 - val_binary_accuracy: 0.7945
Epoch 452/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1126 -
binary_accuracy: 0.9588 - val_loss: 0.7560 - val_binary_accuracy: 0.7920
Epoch 453/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1302 -
binary_accuracy: 0.9502 - val_loss: 0.7459 - val_binary_accuracy: 0.7924
Epoch 454/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1274 -
binary_accuracy: 0.9523 - val_loss: 0.7360 - val_binary_accuracy: 0.7940
Epoch 455/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1364 -
binary_accuracy: 0.9469 - val_loss: 0.7586 - val_binary_accuracy: 0.7892
Epoch 456/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1235 -
binary_accuracy: 0.9528 - val_loss: 0.7583 - val_binary_accuracy: 0.7899
Epoch 457/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1140 -
binary_accuracy: 0.9587 - val_loss: 0.7740 - val_binary_accuracy: 0.7917
Epoch 458/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1287 -
binary_accuracy: 0.9507 - val_loss: 0.8339 - val_binary_accuracy: 0.7775
Epoch 459/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2376 -
binary_accuracy: 0.9016 - val_loss: 0.6804 - val_binary_accuracy: 0.7737
Epoch 460/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1740 -
binary_accuracy: 0.9290 - val_loss: 0.7310 - val_binary_accuracy: 0.7977
Epoch 461/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1406 -
binary_accuracy: 0.9446 - val_loss: 0.7215 - val_binary_accuracy: 0.7863
Epoch 462/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1372 -
binary_accuracy: 0.9472 - val_loss: 0.7397 - val_binary_accuracy: 0.7929
Epoch 463/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1944 -
binary_accuracy: 0.9196 - val_loss: 0.7645 - val_binary_accuracy: 0.7617
Epoch 464/500
5/5 [==============================] - 1s 168ms/step - loss: 0.2009 -
binary_accuracy: 0.9150 - val_loss: 0.6825 - val_binary_accuracy: 0.7836
Epoch 465/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1508 -
binary_accuracy: 0.9387 - val_loss: 0.7211 - val_binary_accuracy: 0.7970
Epoch 466/500
5/5 [==============================] - 1s 166ms/step - loss: 0.1158 -
binary_accuracy: 0.9584 - val_loss: 0.7355 - val_binary_accuracy: 0.7932
Epoch 467/500
```

```
5/5 [==============================] - 1s 167ms/step - loss: 0.1096 -
binary_accuracy: 0.9617 - val_loss: 0.7530 - val_binary_accuracy: 0.7971
Epoch 468/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1052 -
binary_accuracy: 0.9645 - val_loss: 0.7459 - val_binary_accuracy: 0.7967
Epoch 469/500
5/5 [==============================] - 1s 169ms/step - loss: 0.1010 -
binary_accuracy: 0.9656 - val_loss: 0.7812 - val_binary_accuracy: 0.7967
Epoch 470/500
5/5 [==============================] - 1s 168ms/step - loss: 0.1008 -
binary_accuracy: 0.9650 - val_loss: 0.7717 - val_binary_accuracy: 0.7960
Epoch 471/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0963 -
binary_accuracy: 0.9678 - val_loss: 0.7929 - val_binary_accuracy: 0.7943
Epoch 472/500
5/5 [==============================] - 1s 167ms/step - loss: 0.0964 -
binary_accuracy: 0.9685 - val_loss: 0.8003 - val_binary_accuracy: 0.7936
Epoch 473/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0948 -
binary_accuracy: 0.9691 - val_loss: 0.8037 - val_binary_accuracy: 0.7916
Epoch 474/500
5/5 [==============================] - 1s 167ms/step - loss: 0.0935 -
binary_accuracy: 0.9698 - val_loss: 0.8109 - val_binary_accuracy: 0.7972
Epoch 475/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0967 -
binary_accuracy: 0.9662 - val_loss: 0.8211 - val_binary_accuracy: 0.7964
Epoch 476/500
5/5 [==============================] - 1s 167ms/step - loss: 0.0921 -
binary_accuracy: 0.9696 - val_loss: 0.8318 - val_binary_accuracy: 0.7924
Epoch 477/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0909 -
binary_accuracy: 0.9704 - val_loss: 0.8664 - val_binary_accuracy: 0.7897
Epoch 478/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1003 -
binary_accuracy: 0.9646 - val_loss: 0.8798 - val_binary_accuracy: 0.7827
Epoch 479/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1146 -
binary_accuracy: 0.9556 - val_loss: 0.9435 - val_binary_accuracy: 0.7723
Epoch 480/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2431 -
binary_accuracy: 0.9012 - val_loss: 0.7493 - val_binary_accuracy: 0.7653
Epoch 481/500
5/5 [==============================] - 1s 167ms/step - loss: 0.2048 -
binary_accuracy: 0.9167 - val_loss: 0.7503 - val_binary_accuracy: 0.7831
Epoch 482/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1628 -
binary_accuracy: 0.9335 - val_loss: 0.7042 - val_binary_accuracy: 0.7859
Epoch 483/500
```

```
5/5 [==============================] - 1s 169ms/step - loss: 0.1318 -
binary_accuracy: 0.9498 - val_loss: 0.7770 - val_binary_accuracy: 0.7956
Epoch 484/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1231 -
binary_accuracy: 0.9521 - val_loss: 0.7537 - val_binary_accuracy: 0.7944
Epoch 485/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1047 -
binary_accuracy: 0.9625 - val_loss: 0.7991 - val_binary_accuracy: 0.7882
Epoch 486/500
5/5 [==============================] - 1s 167ms/step - loss: 0.1005 -
binary_accuracy: 0.9650 - val_loss: 0.8168 - val_binary_accuracy: 0.7940
Epoch 487/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0968 -
binary_accuracy: 0.9670 - val_loss: 0.8036 - val_binary_accuracy: 0.7950
Epoch 488/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0913 -
binary_accuracy: 0.9698 - val_loss: 0.8189 - val_binary_accuracy: 0.7929
Epoch 489/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0875 -
binary_accuracy: 0.9712 - val_loss: 0.8375 - val_binary_accuracy: 0.7952
Epoch 490/500
5/5 [==============================] - 1s 167ms/step - loss: 0.0872 -
binary_accuracy: 0.9710 - val_loss: 0.8577 - val_binary_accuracy: 0.7933
Epoch 491/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0851 -
binary_accuracy: 0.9724 - val_loss: 0.8384 - val_binary_accuracy: 0.7938
Epoch 492/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0818 -
binary_accuracy: 0.9730 - val_loss: 0.8731 - val_binary_accuracy: 0.7958
Epoch 493/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0809 -
binary_accuracy: 0.9740 - val_loss: 0.8764 - val_binary_accuracy: 0.7930
Epoch 494/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0812 -
binary_accuracy: 0.9735 - val_loss: 0.8922 - val_binary_accuracy: 0.7912
Epoch 495/500
5/5 [==============================] - 1s 167ms/step - loss: 0.0831 -
binary_accuracy: 0.9720 - val_loss: 0.8895 - val_binary_accuracy: 0.7906
Epoch 496/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0824 -
binary_accuracy: 0.9729 - val_loss: 0.8824 - val_binary_accuracy: 0.7949
Epoch 497/500
5/5 [==============================] - 1s 168ms/step - loss: 0.0793 -
binary_accuracy: 0.9745 - val_loss: 0.8982 - val_binary_accuracy: 0.7926
Epoch 498/500
5/5 [==============================] - 1s 166ms/step - loss: 0.0837 -
binary_accuracy: 0.9715 - val_loss: 0.9172 - val_binary_accuracy: 0.7905
Epoch 499/500
```

```
5/5 [==============================] - 1s 166ms/step - loss: 0.0823 -
binary_accuracy: 0.9719 - val_loss: 0.9041 - val_binary_accuracy: 0.7912
Epoch 500/500
5/5 [==============================] - 1s 167ms/step - loss: 0.0800 -
binary_accuracy: 0.9735 - val_loss: 0.9148 - val_binary_accuracy: 0.7921
```

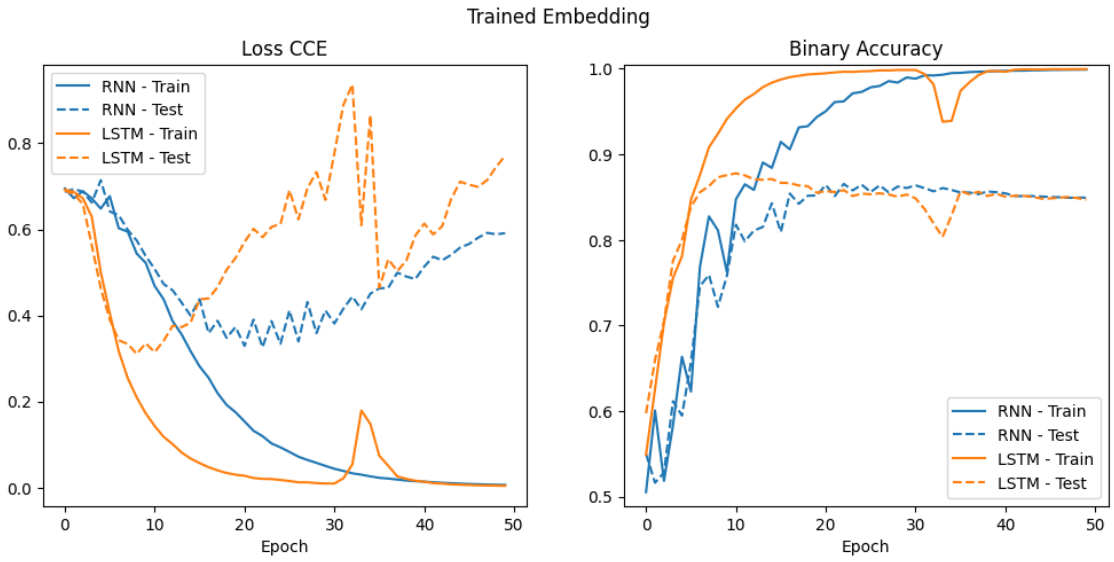
[ ]:
```
history_lstm_g = history
f, ax = plt.subplots(ncols=2)
f.set_size_inches(8,3)
plt.suptitle("LSTM - GLOVE Embedding")
ax[0].plot(history.history["loss"], label="Train Loss")
ax[0].set_title("Loss CCE")
ax[0].plot(history.history["val_loss"], label="Test Loss")
# ax[0].set_yscale("log")
ax[0].set_xlabel("Epoch")
ax[0].legend()
ax[1].plot(history.history["binary_accuracy"], label="Train Binary Accuracy")
ax[1].set_xlabel("Epoch")
ax[1].set_title("Binary Accuracy")
ax[1].plot(history.history["val_binary_accuracy"], label="Test Binary Accuracy")
ax[1].set_ylim(min(history.history["binary_accuracy"])-0.02, 1.005)
ax[1].legend();
```



The LSTM seems to do a better job with the GLOVE embeddings, but it still doesn't seem to do too well. Maybe a different architecture would be good for this?

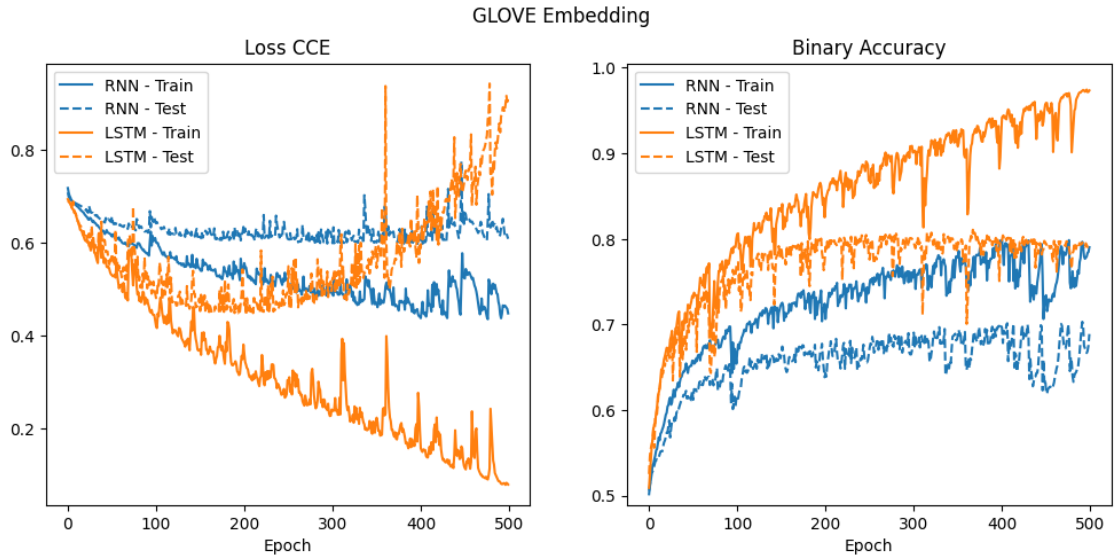
3.5 Summary Results

[ ]:
```
f, ax = plt.subplots(ncols=2)
f.set_size_inches(12,5)
plt.suptitle("Trained Embedding")
ax[0].plot(history_rnn.history["loss"], label="RNN - Train", color="tab:blue")
ax[0].plot(history_rnn.history["val_loss"], label="RNN - Test", ls="dashed",␣
 ↪color="tab:blue")
ax[0].plot(history_lstm.history["loss"], label="LSTM - Train", color="tab:
 ↪orange")
ax[0].plot(history_lstm.history["val_loss"], label="LSTM - Test", ls="dashed",␣
 ↪color="tab:orange")
ax[0].set_title("Loss CCE")
ax[0].set_xlabel("Epoch")
ax[0].legend()
ax[1].plot(history_rnn.history["binary_accuracy"], label="RNN - Train",␣
 ↪color="tab:blue")
ax[1].plot(history_rnn.history["val_binary_accuracy"], label="RNN - Test",␣
 ↪ls="dashed", color="tab:blue")
ax[1].plot(history_lstm.history["binary_accuracy"], label="LSTM - Train",␣
 ↪color="tab:orange")
ax[1].plot(history_lstm.history["val_binary_accuracy"], label="LSTM - Test",␣
 ↪ls="dashed", color="tab:orange")
ax[1].set_xlabel("Epoch")
ax[1].set_title("Binary Accuracy")
ax[1].set_ylim(min(history.history["binary_accuracy"])-0.02, 1.005)
ax[1].legend();
```



The LSTM appears to train significantly faster than the RNN, and it reaches a lower overall loss and higher accuracy on the test data than the RNN.

[ ]:
```
f, ax = plt.subplots(ncols=2)
f.set_size_inches(12,5)
plt.suptitle("GLOVE Embedding")
ax[0].plot(history_rnn_g.history["loss"], label="RNN - Train", color="tab:blue")
ax[0].plot(history_rnn_g.history["val_loss"], label="RNN - Test", ls="dashed",␣
 ↪color="tab:blue")
ax[0].plot(history_lstm_g.history["loss"], label="LSTM - Train", color="tab:
 ↪orange")
ax[0].plot(history_lstm_g.history["val_loss"], label="LSTM - Test",␣
 ↪ls="dashed", color="tab:orange")
ax[0].set_title("Loss CCE")
ax[0].set_xlabel("Epoch")
ax[0].legend()
ax[1].plot(history_rnn_g.history["binary_accuracy"], label="RNN - Train",␣
 ↪color="tab:blue")
ax[1].plot(history_rnn_g.history["val_binary_accuracy"], label="RNN - Test",␣
 ↪ls="dashed", color="tab:blue")
ax[1].plot(history_lstm_g.history["binary_accuracy"], label="LSTM - Train",␣
 ↪color="tab:orange")
ax[1].plot(history_lstm_g.history["val_binary_accuracy"], label="LSTM - Test",␣
 ↪ls="dashed", color="tab:orange")
ax[1].set_xlabel("Epoch")
ax[1].set_title("Binary Accuracy")
ax[1].set_ylim(min(history.history["binary_accuracy"])-0.02, 1.005)
ax[1].legend();
```



The LSTM definitely appears to be doing more with the GLOVE embedding than the RNN is, but both seem to be doing a pretty poor job overall. Either I'm doing something wrong with the embedding, or a different network structure would be more appropriate here.