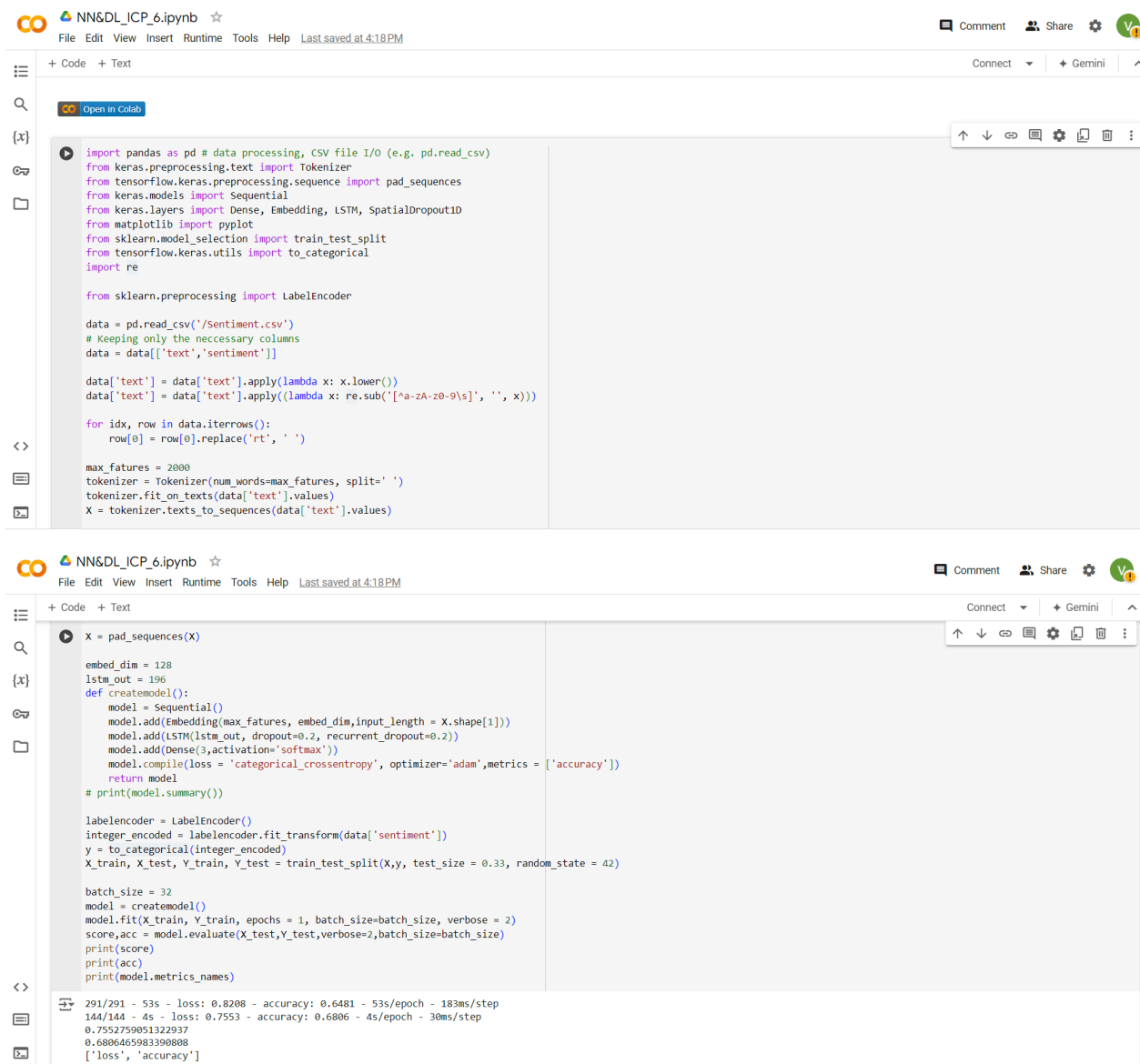


# NNDL ASSIGNMENT 6

## VYSHNAVI NAGALLA - 700759215

Video Link:

<https://drive.google.com/file/d/1K7o3xjSNs0chsCvAqhsR4GpBkzsErnr/view?usp=sharing>



The image displays two screenshots of a Jupyter Notebook titled "NN&DL\_ICP\_6.ipynb". The first screenshot shows the initial data loading and preprocessing steps. The second screenshot shows the model creation, training, and evaluation steps.

```
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
from keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Dense, Embedding, LSTM, SpatialDropout1D
from matplotlib import pyplot
from sklearn.model_selection import train_test_split
from tensorflow.keras.utils import to_categorical
import re

from sklearn.preprocessing import LabelEncoder

data = pd.read_csv('/Sentiment.csv')
# Keeping only the necessary columns
data = data[['text', 'sentiment']]

data['text'] = data['text'].apply(lambda x: x.lower())
data['text'] = data['text'].apply(lambda x: re.sub('[^a-zA-z0-9\s]', '', x))

for idx, row in data.iterrows():
    row[0] = row[0].replace('rt', ' ')

max_fatures = 2000
tokenizer = Tokenizer(num_words=max_fatures, split=' ')
tokenizer.fit_on_texts(data['text'].values)
X = tokenizer.texts_to_sequences(data['text'].values)

X = pad_sequences(X)

embed_dim = 128
lstm_out = 196
def createmodel():
    model = Sequential()
    model.add(Embedding(max_fatures, embed_dim, input_length = X.shape[1]))
    model.add(LSTM(lstm_out, dropout=0.2, recurrent_dropout=0.2))
    model.add(Dense(3, activation='softmax'))
    model.compile(loss = 'categorical_crossentropy', optimizer='adam', metrics = ['accuracy'])
    return model
# print(model.summary())

labelencoder = LabelEncoder()
integer_encoded = labelencoder.fit_transform(data['sentiment'])
y = to_categorical(integer_encoded)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.33, random_state = 42)

batch_size = 32
model = createmodel()
model.fit(X_train, y_train, epochs = 1, batch_size=batch_size, verbose = 2)
score, acc = model.evaluate(X_test, y_test, verbose=2, batch_size=batch_size)
print(score)
print(acc)
print(model.metrics_names)
```

291/291 - 53s - loss: 0.8208 - accuracy: 0.6481 - 53s/epoch - 183ms/step  
144/144 - 4s - loss: 0.7553 - accuracy: 0.6806 - 4s/epoch - 30ms/step  
0.7552759051322937  
0.6806465983390808  
['loss', 'accuracy']

👤 NN&DL\_ICP\_6.ipynb ☆

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pip install scikeras

Collecting scikeras  
Downloading scikeras-0.12.0-py3-none-any.whl (27 kB)  
Requirement already satisfied: packaging>0.21 in /usr/local/lib/python3.10/dist-packages (from scikeras) (23.2)  
Requirement already satisfied: scikit-learn>1.0.0 in /usr/local/lib/python3.10/dist-packages (from scikeras) (1.2.2)  
Requirement already satisfied: numpy>1.17.3 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>1.0.0->scikeras) (1.23.5)  
Requirement already satisfied: scipy>1.3.2 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>1.0.0->scikeras) (1.11.3)  
Requirement already satisfied: joblib>1.1.1 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>1.0.0->scikeras) (1.3.2)  
Requirement already satisfied: threadpoolctl>2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>1.0.0->scikeras) (3.2.0)  
Installing collected packages: scikeras  
Successfully installed scikeras-0.12.0

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```
[ ] from scikeras.wrappers import KerasClassifier
#from keras.wrappers.scikit_learn import KerasClassifier
from sklearn.model_selection import GridSearchCV
from keras.optimizers import Adam

def create_model(units=196, dropout=0.2, learning_rate=0.001):
    model = Sequential()
    model.add(Embedding(max_features, embed_dim, input_length = X.shape[1]))
    model.add(LSTM(units, dropout=dropout, recurrent_dropout=dropout))
    model.add(Dense(3, activation='softmax'))
    optimizer = Adam(lr=learning_rate)
    model.compile(loss='categorical_crossentropy', optimizer=optimizer, metrics=['accuracy'])
    return model

model = KerasClassifier(build_fn=create_model, verbose=2) #initializing model to test performance by applying multiple hyper parameters
batch_size = [10, 20, 40] #hyper parameter batch_size
epochs = [1, 2] #hyper parameter no. of epochs
param_grid = {'batch_size':batch_size, 'epochs':epochs} #creating dictionary for batch size, no. of epochs
```

```
model = kerasClassifier(build_fn=create_model, verbose=2) #initiating model to test performance by applying multiple hyper parameters
batch_size = [10, 20, 40] #hyper parameter batch_size
epochs = [1, 2] #hyper parameter no. of epochs
param_grid = {'batch_size':batch_size, 'epochs':epochs} #creating dictionary for batch size, no. of epochs
grid = GridSearchCV(estimator=model, param_grid=param_grid) #Applying dictionary with hyper parameters
grid_result = grid.fit(X_train, Y_train) #fitting the model
# summarize results
print("Best: %f using %s" % (grid_result.best_score_, grid_result.best_params_)) #best score, best hyper parameters

/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
744/744 - 110s - loss: 0.8295 - accuracy: 0.6450 - 110s/epoch - 148ms/step
186/186 - 3s - 3s/epoch - 15ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
744/744 - 104s - loss: 0.8206 - accuracy: 0.6499 - 104s/epoch - 140ms/step
186/186 - 4s - 4s/epoch - 19ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
744/744 - 108s - loss: 0.8198 - accuracy: 0.6484 - 108s/epoch - 145ms/step
186/186 - 3s - 3s/epoch - 15ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
744/744 - 107s - loss: 0.8243 - accuracy: 0.6457 - 107s/epoch - 143ms/step
186/186 - 3s - 3s/epoch - 18ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
744/744 - 113s - loss: 0.8277 - accuracy: 0.6498 - 113s/epoch - 151ms/step
186/186 - 3s - 3s/epoch - 16ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
744/744 - 119s - loss: 0.8224 - accuracy: 0.6433 - 119s/epoch - 161ms/step
```



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```
Epoch 1/2
744/744 - 119s - loss: 0.8224 - accuracy: 0.6433 - 119s/epoch - 161ms/step
Epoch 2/2
744/744 - 112s - loss: 0.6780 - accuracy: 0.7133 - 112s/epoch - 151ms/step
186/186 - 3s - 3s/epoch - 16ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
744/744 - 111s - loss: 0.8220 - accuracy: 0.6543 - 111s/epoch - 149ms/step
Epoch 2/2
744/744 - 106s - loss: 0.6763 - accuracy: 0.7132 - 106s/epoch - 143ms/step
186/186 - 3s - 3s/epoch - 15ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
744/744 - 115s - loss: 0.8274 - accuracy: 0.6482 - 115s/epoch - 155ms/step
Epoch 2/2
744/744 - 110s - loss: 0.6739 - accuracy: 0.7140 - 110s/epoch - 148ms/step
186/186 - 5s - 5s/epoch - 25ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
744/744 - 115s - loss: 0.8291 - accuracy: 0.6465 - 115s/epoch - 155ms/step
Epoch 2/2
744/744 - 113s - loss: 0.6801 - accuracy: 0.7116 - 113s/epoch - 152ms/step
186/186 - 5s - 5s/epoch - 25ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
744/744 - 115s - loss: 0.8198 - accuracy: 0.6484 - 115s/epoch - 155ms/step
Epoch 2/2
744/744 - 110s - loss: 0.6672 - accuracy: 0.7188 - 110s/epoch - 148ms/step
186/186 - 3s - 3s/epoch - 17ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
```



```
372/372 - 66s - loss: 0.8372 - accuracy: 0.6425 - 66s/epoch - 178ms/step
93/93 - 3s - 3s/epoch - 30ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
372/372 - 64s - loss: 0.8320 - accuracy: 0.6425 - 64s/epoch - 173ms/step
93/93 - 2s - 2s/epoch - 21ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
372/372 - 62s - loss: 0.8316 - accuracy: 0.6442 - 62s/epoch - 167ms/step
93/93 - 2s - 2s/epoch - 22ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
372/372 - 64s - loss: 0.8407 - accuracy: 0.6379 - 64s/epoch - 173ms/step
93/93 - 2s - 2s/epoch - 21ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
372/372 - 65s - loss: 0.8326 - accuracy: 0.6426 - 65s/epoch - 175ms/step
93/93 - 2s - 2s/epoch - 22ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
372/372 - 64s - loss: 0.8366 - accuracy: 0.6425 - 64s/epoch - 173ms/step
Epoch 2/2
372/372 - 60s - loss: 0.6878 - accuracy: 0.7111 - 60s/epoch - 162ms/step
93/93 - 3s - 3s/epoch - 17ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
372/372 - 67s - loss: 0.8249 - accuracy: 0.6439 - 67s/epoch - 179ms/step
Epoch 2/2
372/372 - 57s - loss: 0.6829 - accuracy: 0.7119 - 57s/epoch - 155ms/step
93/93 - 2s - 2s/epoch - 22ms/step
```



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93/93 - 2s - 2s/epoch - 22ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
372/372 - 65s - loss: 0.8333 - accuracy: 0.6446 - 65s/epoch - 174ms/step
Epoch 2/2
372/372 - 58s - loss: 0.6770 - accuracy: 0.7100 - 58s/epoch - 156ms/step
93/93 - 2s - 2s/epoch - 20ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
372/372 - 68s - loss: 0.8482 - accuracy: 0.6403 - 68s/epoch - 182ms/step
Epoch 2/2
372/372 - 60s - loss: 0.6813 - accuracy: 0.7081 - 60s/epoch - 162ms/step
93/93 - 2s - 2s/epoch - 21ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
372/372 - 63s - loss: 0.8240 - accuracy: 0.6448 - 63s/epoch - 170ms/step
Epoch 2/2
372/372 - 56s - loss: 0.6727 - accuracy: 0.7173 - 56s/epoch - 151ms/step
93/93 - 2s - 2s/epoch - 20ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
186/186 - 40s - loss: 0.8436 - accuracy: 0.6400 - 40s/epoch - 216ms/step
47/47 - 1s - 1s/epoch - 28ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
186/186 - 40s - loss: 0.8516 - accuracy: 0.6337 - 40s/epoch - 215ms/step
47/47 - 1s - 1s/epoch - 28ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
186/186 - 39s - loss: 0.6289 - accuracy: 0.6289 - 39s/epoch - 208ms/step
47/47 - 1s - 1s/epoch - 20ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
```

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186/186 - 39s - loss: 0.8439 - accuracy: 0.6289 - 39s/epoch - 208ms/step
47/47 - 1s - 1s/epoch - 29ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
186/186 - 39s - loss: 0.8452 - accuracy: 0.6343 - 39s/epoch - 209ms/step
47/47 - 1s - 1s/epoch - 28ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
186/186 - 41s - loss: 0.8426 - accuracy: 0.6316 - 41s/epoch - 219ms/step
47/47 - 1s - 1s/epoch - 28ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
186/186 - 40s - loss: 0.8518 - accuracy: 0.6357 - 40s/epoch - 213ms/step
Epoch 2/2
186/186 - 36s - loss: 0.6967 - accuracy: 0.6994 - 36s/epoch - 195ms/step
47/47 - 1s - 1s/epoch - 28ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
186/186 - 40s - loss: 0.8511 - accuracy: 0.6353 - 40s/epoch - 217ms/step
Epoch 2/2
186/186 - 36s - loss: 0.6888 - accuracy: 0.7045 - 36s/epoch - 195ms/step
47/47 - 1s - 1s/epoch - 29ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
186/186 - 40s - loss: 0.8436 - accuracy: 0.6345 - 40s/epoch - 214ms/step
Epoch 2/2
186/186 - 36s - loss: 0.6946 - accuracy: 0.7037 - 36s/epoch - 194ms/step
47/47 - 2s - 2s/epoch - 37ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
```

```
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186/186 - 40s - loss: 0.8436 - accuracy: 0.6345 - 40s/epoch - 214ms/step
Epoch 2/2
186/186 - 36s - loss: 0.6946 - accuracy: 0.7037 - 36s/epoch - 194ms/step
47/47 - 2s - 2s/epoch - 37ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
186/186 - 41s - loss: 0.8444 - accuracy: 0.6331 - 41s/epoch - 218ms/step
Epoch 2/2
186/186 - 37s - loss: 0.6924 - accuracy: 0.7046 - 37s/epoch - 196ms/step
47/47 - 1s - 1s/epoch - 30ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
186/186 - 42s - loss: 0.8449 - accuracy: 0.6340 - 42s/epoch - 228ms/step
Epoch 2/2
186/186 - 38s - loss: 0.6750 - accuracy: 0.7107 - 38s/epoch - 203ms/step
47/47 - 1s - 1s/epoch - 30ms/step
/usr/local/lib/python3.10/dist-packages/scikeras/wrappers.py:915: UserWarning: ``build_fn`` will be renamed to ``model`` in a future release, at which point use of ``build_fn`` will
X, y = self._initialize(X, y)
Epoch 1/2
233/233 - 51s - loss: 0.8219 - accuracy: 0.6469 - 51s/epoch - 218ms/step
Epoch 2/2
233/233 - 44s - loss: 0.6776 - accuracy: 0.7114 - 44s/epoch - 190ms/step
Best: 0.680941 using {'batch_size': 40, 'epochs': 2}
```