# Deep_Learning_Assignment

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## 1 Sentiment Analysis With Transformers

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[23]:
```
!!pip install -q rouge-score
!!pip install -q git+https://github.com/keras-team/keras-nlp.git --upgrade
```

[23]:
```
['  Installing build dependencies … \x1b[?25l\x1b[?25hdone',
 '  Getting requirements to build wheel … \x1b[?25l\x1b[?25hdone',
 '  Preparing metadata (pyproject.toml) … \x1b[?25l\x1b[?25hdone',
 '\x1b[?25l     \x1b[90m                                       \x1b[0m
\x1b[32m0.0/950.8 kB\x1b[0m \x1b[31m?\x1b[0m eta \x1b[36m-:--:--\x1b[0m',
 '\x1b[2K     \x1b[91m      \x1b[0m\x1b[91m \x1b[0m\x1b[90m
      \x1b[0m \x1b[32m307.2/950.8 kB\x1b[0m \x1b[31m9.1 MB/s\x1b[0m eta
\x1b[36m0:00:01\x1b[0m',
 '\x1b[2K     \x1b[90m                                       \x1b[0m
\x1b[32m950.8/950.8 kB\x1b[0m \x1b[31m17.2 MB/s\x1b[0m eta
\x1b[36m0:00:00\x1b[0m',
 '\x1b[?25h\x1b[?25l     \x1b[90m                                       \x1b[0m
\x1b[32m0.0/6.5 MB\x1b[0m \x1b[31m?\x1b[0m eta \x1b[36m-:--:--\x1b[0m',
 '\x1b[2K
\x1b[91m                      \x1b[0m\x1b[91m \x1b[0m
\x1b[32m6.5/6.5 MB\x1b[0m \x1b[31m207.9 MB/s\x1b[0m eta \x1b[36m0:00:01\x1b[0m',
 '\x1b[2K     \x1b[90m                                       \x1b[0m
\x1b[32m6.5/6.5 MB\x1b[0m \x1b[31m107.1 MB/s\x1b[0m eta \x1b[36m0:00:00\x1b[0m',
 '\x1b[?25h  Building wheel for keras-nlp (pyproject.toml) …
\x1b[?25l\x1b[?25hdone']
```

### 1.1 Import Required Libraries

[26]:
```
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
import keras_nlp
```

```
Using TensorFlow backend
```

### 1.2 Loading Data

[27]:
```
vocab_size = 20000
maxlen = 150

(x_train, y_train), (x_val, y_val) = keras.datasets.imdb.
 ↪load_data(num_words=vocab_size)

print(len(x_train), "Training sequences")
print(len(x_val), "Validation sequences")

x_train = keras.utils.pad_sequences(x_train, maxlen=maxlen)
x_val = keras.utils.pad_sequences(x_val, maxlen=maxlen)
```

```
25000 Training sequences
25000 Validation sequences
```

### 1.3 Building Architecture

[29]:
```
embed_dim = 256
num_heads = 8
ff_dim = 32
intermediate_dim =512
num_layers = 3
```

[31]:
```
input_ = keras.Input(shape=(None,), dtype="int32")

x = keras_nlp.layers.TokenAndPositionEmbedding(vocabulary_size=vocab_size,
                                               sequence_length=maxlen,
                                               embedding_dim = embed_dim,
                                               mask_zero=True,)(input_)


for _ in range(num_layers):
  encoder_layer = keras_nlp.layers.TransformerEncoder(num_heads= num_heads,
                                                      ␣
 ↪intermediate_dim=intermediate_dim,)
  x = encoder_layer(x)

x = layers.GlobalAveragePooling1D()(x)
x = layers.Dropout(rate=0.2) (x)
x = layers.Dense(30, activation="relu")(x)
x = layers.Dense(20, activation="relu")(x)

output_ = layers.Dense(2, activation="softmax")(x)

model = keras.Model(input_, output_)
```

[32]:
```
model.summary()
```

```
Model: "model_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_4 (InputLayer)        [(None, None)]            0

 token_and_position_embeddi  (None, None, 256)         5158400
 ng_2 (TokenAndPositionEmbe
 dding)

 transformer_encoder (Trans  (None, None, 256)         527104
 formerEncoder)

 transformer_encoder_1 (Tra  (None, None, 256)         527104
 nsformerEncoder)

 transformer_encoder_2 (Tra  (None, None, 256)         527104
 nsformerEncoder)

 global_average_pooling1d_2  (None, 256)               0
  (GlobalAveragePooling1D)

 dropout_14 (Dropout)        (None, 256)               0

 dense_18 (Dense)            (None, 30)                7710

 dense_19 (Dense)            (None, 20)                620

 dense_20 (Dense)            (None, 2)                 42

=================================================================
Total params: 6748084 (25.74 MB)
Trainable params: 6748084 (25.74 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

### 1.4 Training the model

[33]:
```
model.compile(optimizer="adam", loss="sparse_categorical_crossentropy",␣
 ↪metrics=["accuracy"])
history = model.fit(x_train, y_train, batch_size=32, epochs=5,␣
 ↪validation_data=(x_val, y_val))
```

```
Epoch 1/5
782/782 [==============================] - 88s 100ms/step - loss: 0.6960 -
```

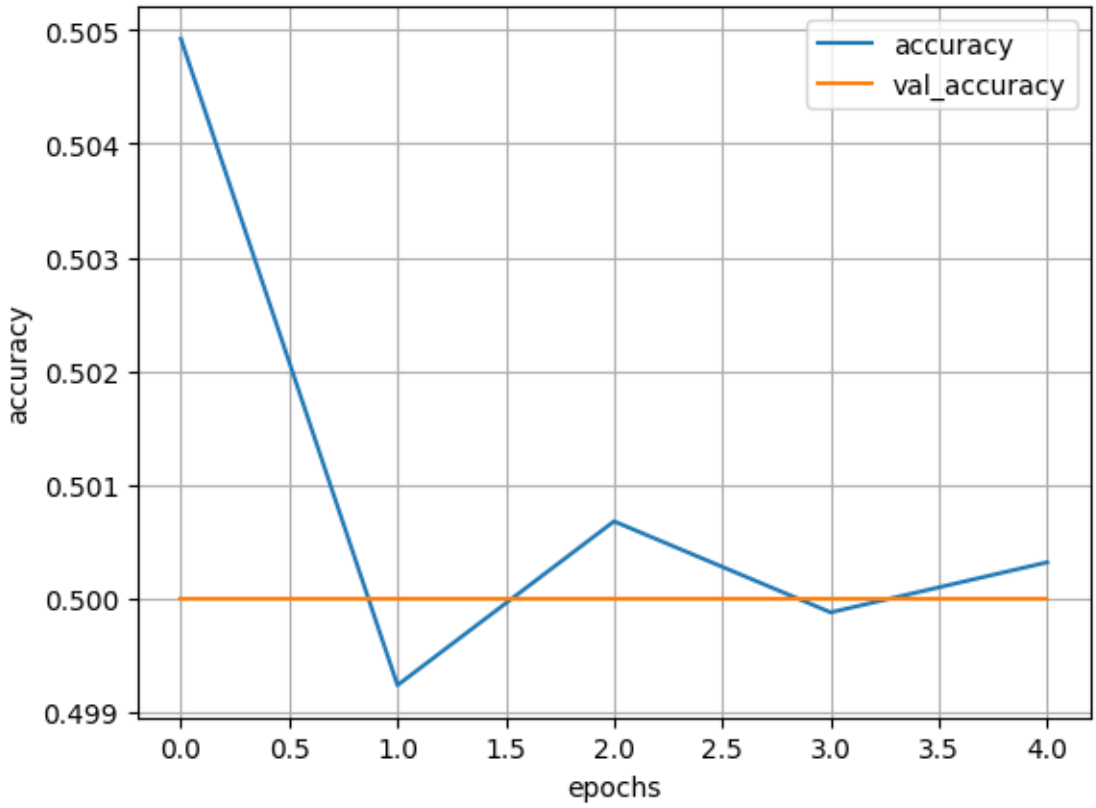
```
accuracy: 0.5049 - val_loss: 0.6934 - val_accuracy: 0.5000
Epoch 2/5
782/782 [==============================] - 57s 73ms/step - loss: 0.6934 -
accuracy: 0.4992 - val_loss: 0.6932 - val_accuracy: 0.5000
Epoch 3/5
782/782 [==============================] - 55s 71ms/step - loss: 0.6934 -
accuracy: 0.5007 - val_loss: 0.6932 - val_accuracy: 0.5000
Epoch 4/5
782/782 [==============================] - 46s 59ms/step - loss: 0.6932 -
accuracy: 0.4999 - val_loss: 0.6933 - val_accuracy: 0.5000
Epoch 5/5
782/782 [==============================] - 46s 59ms/step - loss: 0.6932 -
accuracy: 0.5003 - val_loss: 0.6932 - val_accuracy: 0.5000
```

[34]:
```
keys = ['accuracy', 'val_accuracy']
progress = {k:v for k,v in history.history.items() if k in keys}

import pandas as pd
pd.DataFrame(progress).plot()

plt.xlabel("epochs")
plt.ylabel("accuracy")

plt.grid(True)
plt.show()
```




### 1.5 Evaluating the model using "Precision", "Recall" and "F1-score"

[35]:
```
import numpy as np
from sklearn import metrics
from sklearn.metrics import confusion_matrix
from sklearn.metrics import ConfusionMatrixDisplay
import matplotlib.pyplot as plt
y_pred = np.argmax(model.predict(x_val), axis=1)


print("Classification report for classifier %s:\n%s\n"
% (model, metrics.classification_report(y_val, y_pred)))

confMatrix = confusion_matrix(y_true = y_val, y_pred = y_pred)
disp = ConfusionMatrixDisplay(confusion_matrix = confMatrix)
disp.plot()
plt.show()
```

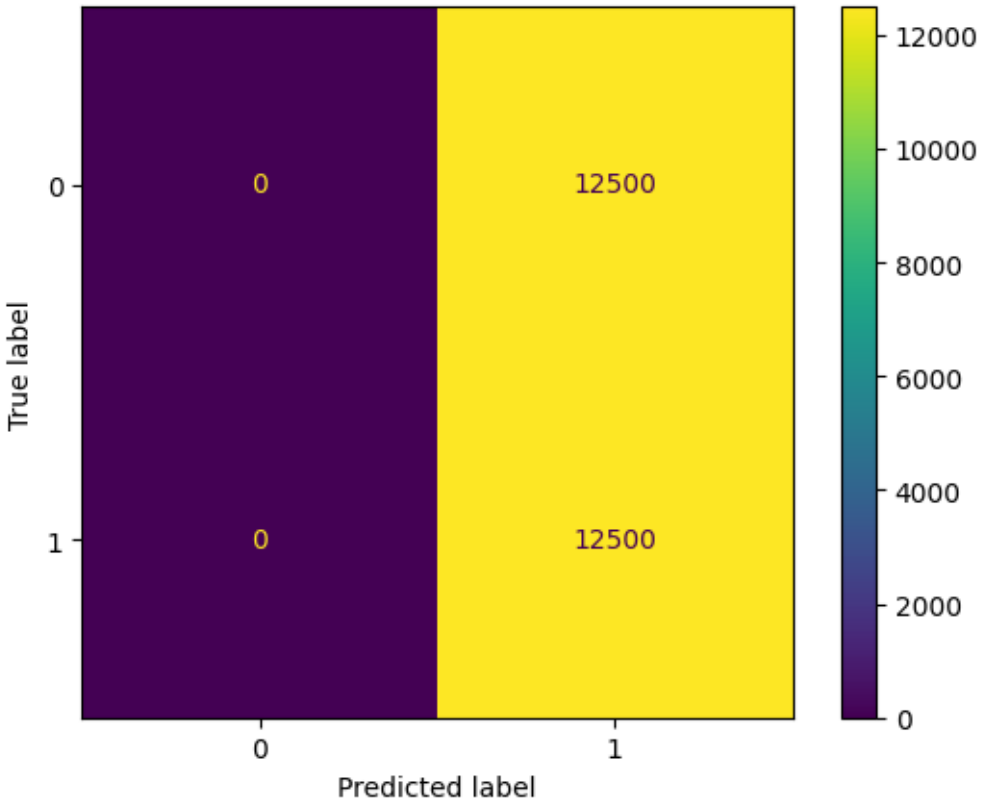
```
782/782 [==============================] - 16s 18ms/step
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344:
```

```
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))

Classification report for classifier <keras.src.engine.functional.Functional
object at 0x7d1afd441720>:
              precision    recall  f1-score   support

           0       0.00      0.00      0.00     12500
           1       0.50      1.00      0.67     12500

    accuracy                           0.50     25000
   macro avg       0.25      0.50      0.33     25000
weighted avg       0.25      0.50      0.33     25000
```


0
12500
0
12500
0
1
True label
Predicted label
12000
10000
8000
6000
4000
2000
0