

ml_imdb_error_analysis

March 11, 2021

```
[1]: from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

```
[2]: import sys
sys.path.insert(0, '/content/drive/My Drive/')
```

```
[3]: import pandas as pd

cased_predictions_bert = pd.read_csv('/content/drive/My Drive/imdb_data/
→cased_predictions_bert.csv')
cased_predictions_bert = cased_predictions_bert[['y_pred', 'y_truth']]
```

```
[4]: import pandas as pd

predictions_bert = pd.read_csv('/content/drive/My Drive/imdb_data/
→predictions_bert.csv')
predictions_bert = predictions_bert[['y_pred', 'y_truth']]
predictions_bert.head()
```

```
[4]:   y_pred  y_truth
0        0         0
1        1         1
2        1         1
3        1         1
4        0         0
```

```
[6]: predictions_rf = pd.read_csv('/content/drive/My Drive/imdb_data/predictions_rf.
→csv')
predictions_rf = predictions_rf[['y_pred', 'y_truth']]
predictions_rf.head()
```

```
[6]:   y_pred  y_truth
0        0         0
1        1         1
2        1         1
3        1         0
4        1         1
```

```
[7]: predictions_cnn = pd.read_csv('/content/drive/My Drive/imdb_data/
    ↳predictions_CNN.csv')
predictions_cnn = predictions_cnn[['y_prediction', 'y_truth']]
predictions_cnn.head()
```

```
[7]:   y_prediction  y_truth
0           0         0
1           0         0
2           0         0
3           1         0
4           0         0
```

```
[8]: predictions_lstm = pd.read_csv('/content/drive/My Drive/imdb_data/
    ↳predictions_RNN.csv')
predictions_lstm = predictions_lstm[['y_prediction', 'y_truth']]
predictions_lstm.head()
```

```
[8]:   y_prediction  y_truth
0           0         0
1           0         0
2           1         0
3           1         0
4           0         0
```

```
[14]: from sklearn.metrics import confusion_matrix

cm_bert = confusion_matrix(list(predictions_bert.y_truth),
    ↳list(predictions_bert.y_pred))
cm_bert

cm_cased_bert = confusion_matrix(list(cased_predictions_bert.y_truth),
    ↳list(cased_predictions_bert.y_pred))
cm_cased_bert

cm_rf = confusion_matrix(list(predictions_rf.y_truth), list(predictions_rf.
    ↳y_pred))
cm_rf

cm_cnn = confusion_matrix(list(predictions_cnn.y_truth), list(predictions_cnn.
    ↳y_prediction))
cm_cnn

cm_lstm = confusion_matrix(list(predictions_lstm.y_truth),
    ↳list(predictions_lstm.y_prediction))
cm_lstm
```

```
[14]: array([[10976, 1524],
    [ 2856, 9644]])
```

```

[15]: import seaborn as sns
from sklearn.metrics import roc_auc_score
import matplotlib.pyplot as plt
import numpy as np

def plot_confusion_matrix(predictions, confusion_matrix):

    tn = confusion_matrix[0, 0]
    fp = confusion_matrix[0, 1]
    fn = confusion_matrix[1, 0]
    tp = confusion_matrix[1, 1]
    total = predictions.shape[0]
    percent = (confusion_matrix/confusion_matrix.sum())*100

    accuracy = ((tp+tn)/total)*100
    Precision = (tp/(tp+fp))*100
    Recall = (tp/(tp+fn))*100
    F1_score = 2 * (Precision * Recall) / (Precision + Recall)
    AUROC_score = roc_auc_score(list(predictions.y_truth), list(predictions.
→y_pred))

    df_cm = pd.DataFrame(confusion_matrix, ['Positive', 'Negative'],
→['Positive', 'Negative'])
    text = np.asarray(['True Negatives', 'False Positives'], ['False
→Negatives', 'True Positives'])
    label = (np.asarray(["{0}\n{n{1}}\n{n{2}: .2f}%".
→format(text,confusion_matrix,percent) for text, confusion_matrix, percent in
→zip(text.flatten(), confusion_matrix.flatten(), percent.flatten())])).
→reshape(2,2)

    plt.figure(figsize=(10,10))
    sns.set(font_scale=2)
    sns.heatmap(df_cm, annot=label, annot_kws={"size": 20}, cbar_kws={'label':
→"Reviews"}, fmt='', cmap='Greens')

    plt.title('Confusion Matrix', fontsize=20)
    plt.text(0.1, 2.5, 'Precision: '+str(round(Precision,2)) + '          Recall:
→'+str(round(Recall,2))+ '          F1 Score: '+str(round(F1_score,2))+
          '\n\nAccuracy: '+ str(round(accuracy,2))+ '          AUROC: '+
→str(round(AUROC_score,2)), fontsize=20)
    plt.show()

def plot_confusion_matrix2(predictions, confusion_matrix):

    tn = confusion_matrix[0, 0]
    fp = confusion_matrix[0, 1]

```

```

fn = confusion_matrix[1, 0]
tp = confusion_matrix[1, 1]
total = predictions.shape[0]
percent = (confusion_matrix/confusion_matrix.sum())*100

accuracy = ((tp+tn)/total)*100
Precision = (tp/(tp+fp))*100
Recall = (tp/(tp+fn))*100
F1_score = 2 * (Precision * Recall) / (Precision + Recall)
AUROC_score = roc_auc_score(list(predictions.y_truth), list(predictions.
→y_prediction))

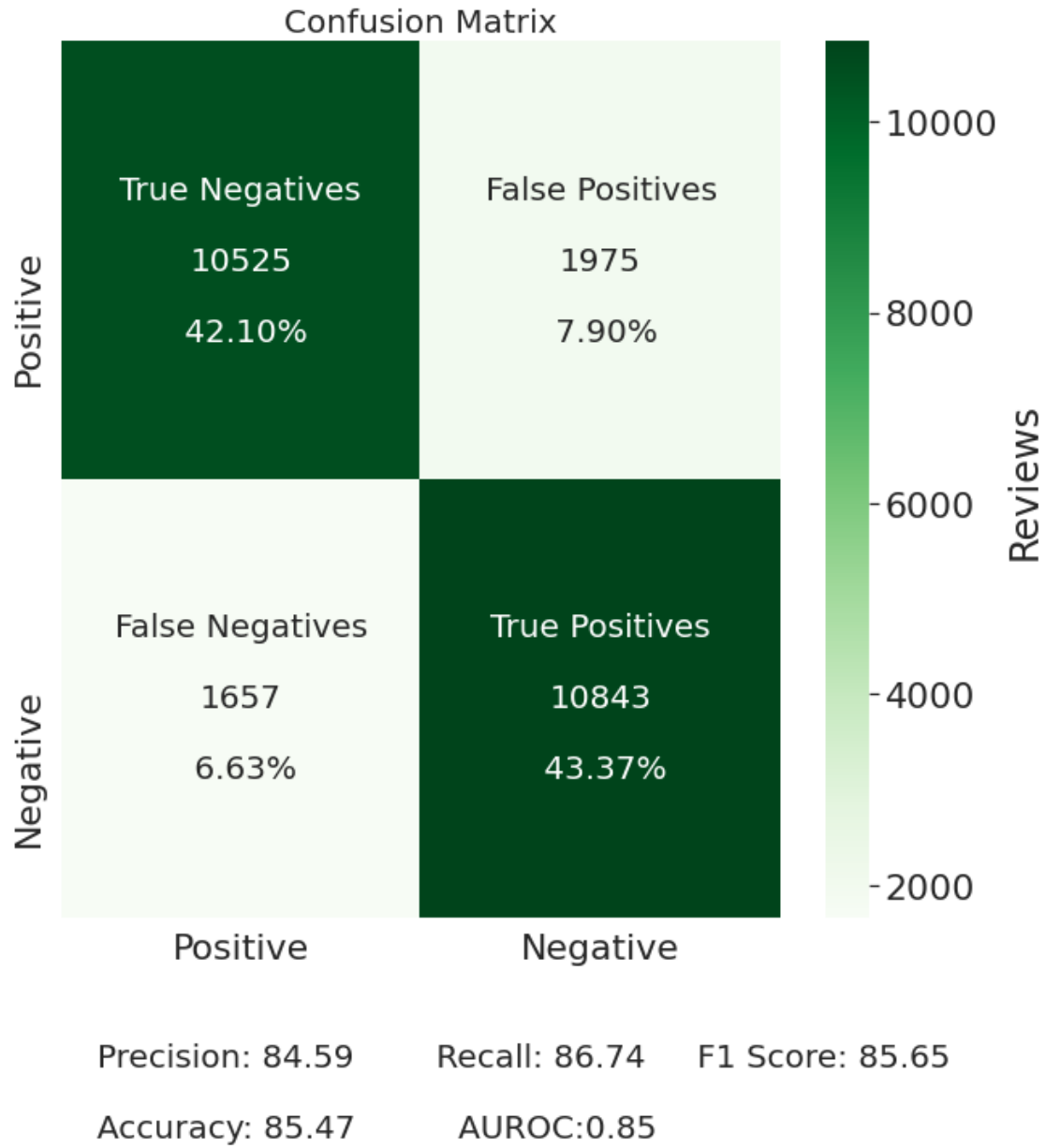
df_cm = pd.DataFrame(confusion_matrix, ['Positive','Negative'],
→['Positive','Negative'])
text = np.asarray(['True Negatives', 'False Positives'], ['False_
→Negatives', 'True Positives'])
label = (np.asarray(["{0}\n\n{1}\n\n{2: .2f}%".
→format(text,confusion_matrix,percent) for text, confusion_matrix, percent in
→zip(text.flatten(), confusion_matrix.flatten(), percent.flatten())])).
→reshape(2,2)

plt.figure(figsize=(10,10))
sns.set(font_scale=2)
sns.heatmap(df_cm, annot=label, annot_kws={"size": 20}, cbar_kws={'label':
→"Reviews"}, fmt='', cmap='Blues')

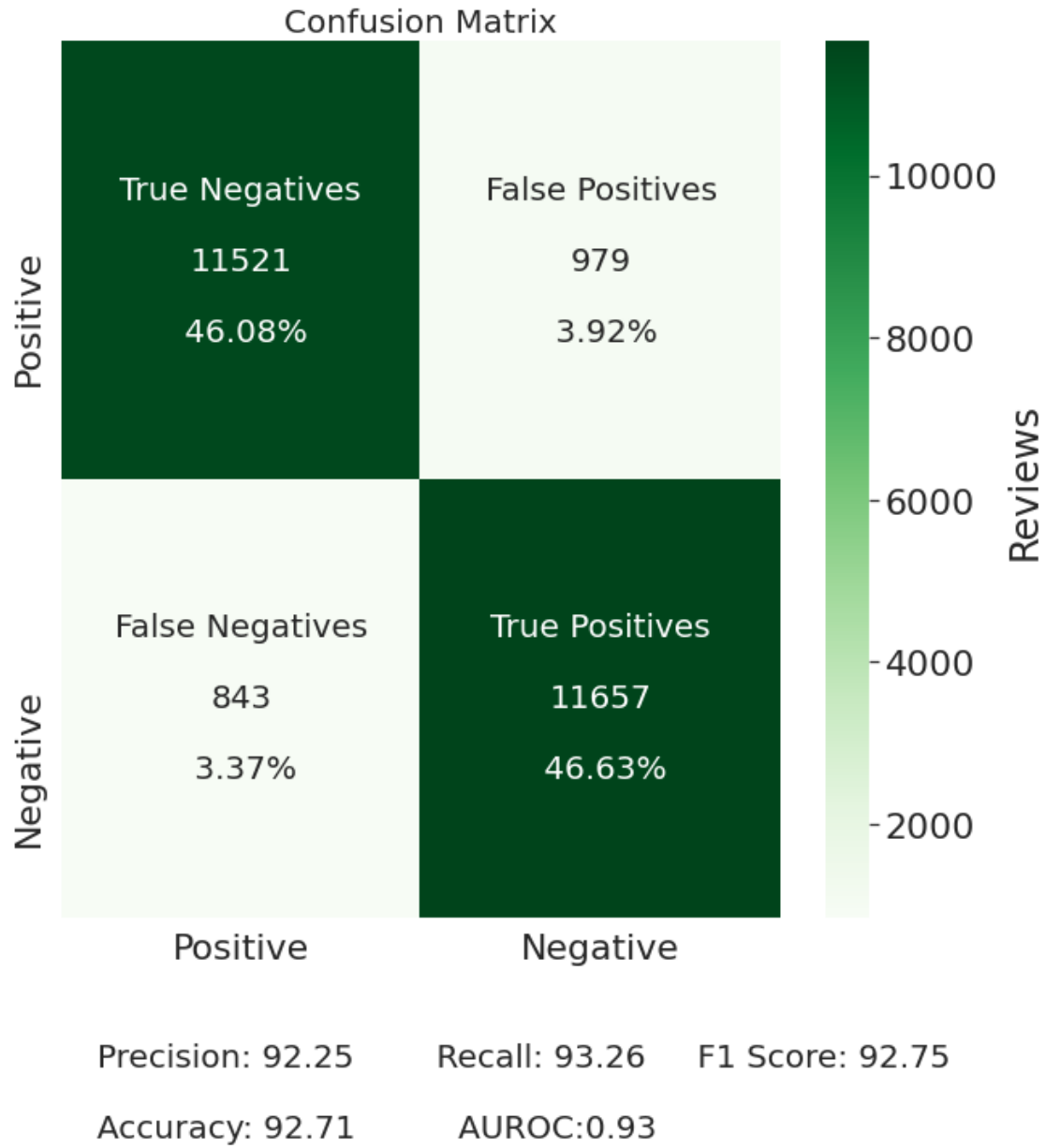
plt.title('Confusion Matrix', fontsize=20)
plt.text(0.1, 2.5, 'Precision: '+str(round(Precision,2)) + '          Recall:
→'+str(round(Recall,2))+ '          F1 Score: '+str(round(F1_score,2))+
          '\n\nAccuracy: '+ str(round(accuracy,2))+ '          AUROC: '+
→str(round(AUROC_score,2)), fontsize=20)
plt.show()

```

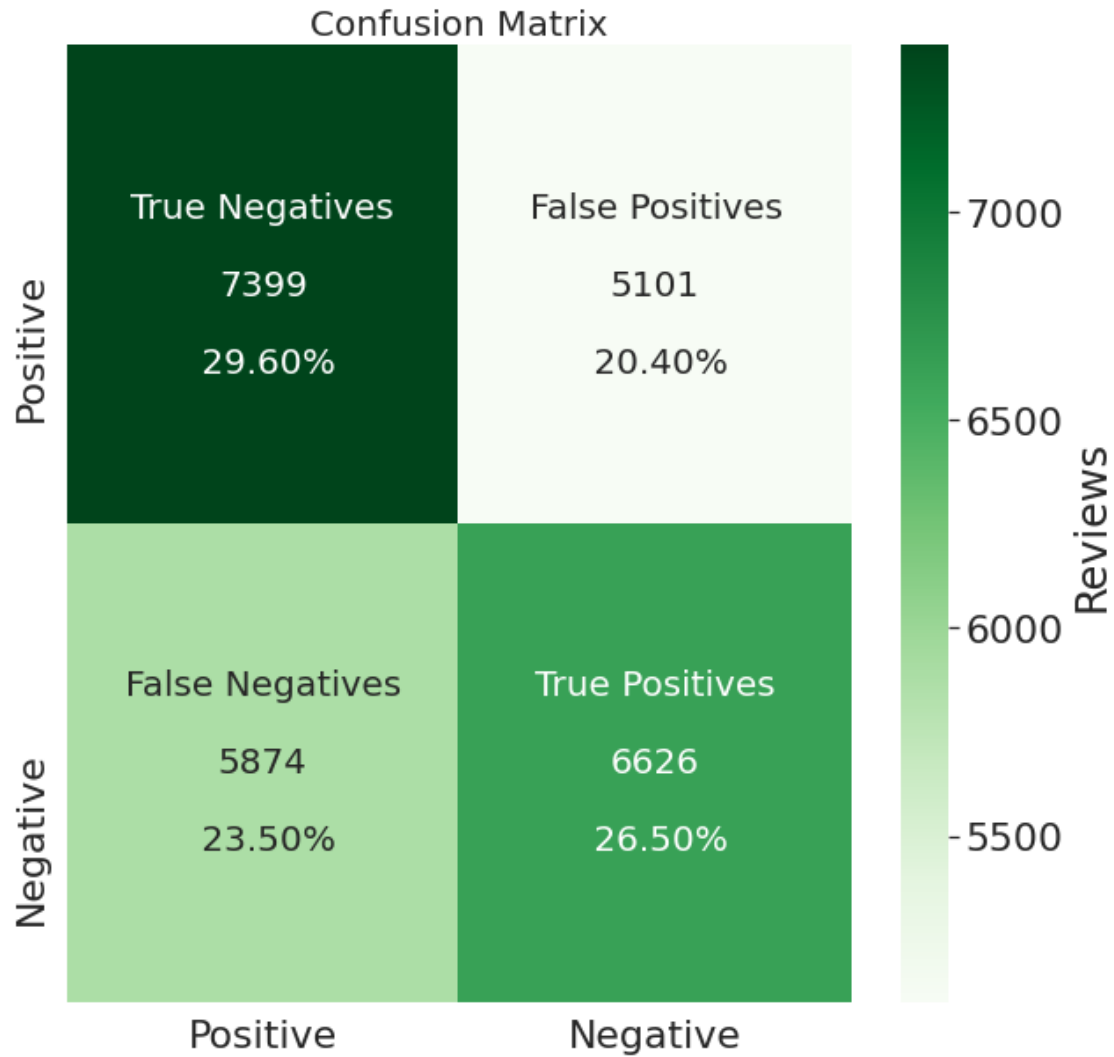
[16]: `plot_confusion_matrix(cased_predictions_bert, cm_cased_bert)`



```
[17]: plot_confusion_matrix(predictions_bert, cm_bert)
```

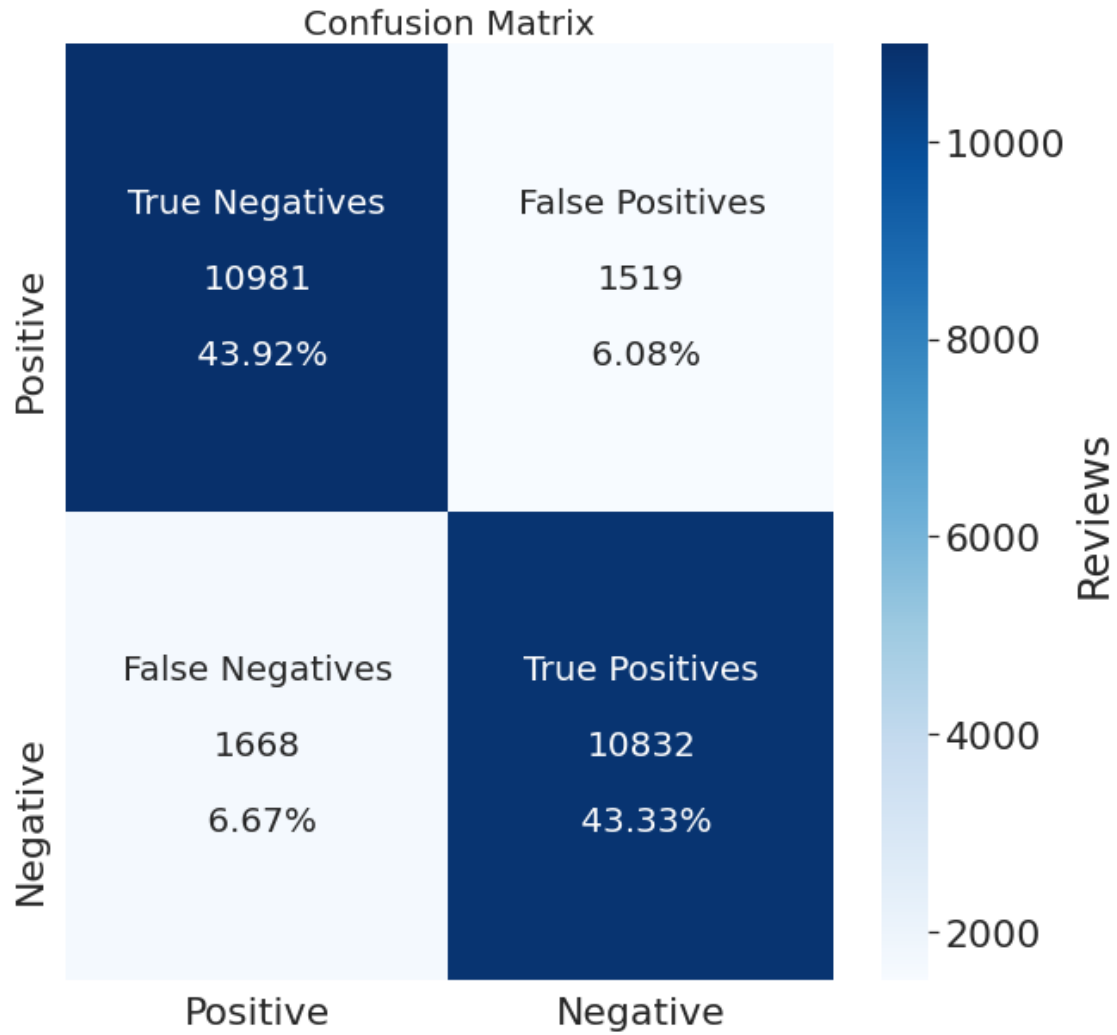


```
[18]: plot_confusion_matrix(predictions_rf, cm_rf)
```



Precision: 56.5 Recall: 53.01 F1 Score: 54.7
Accuracy: 56.1 AUROC:0.56

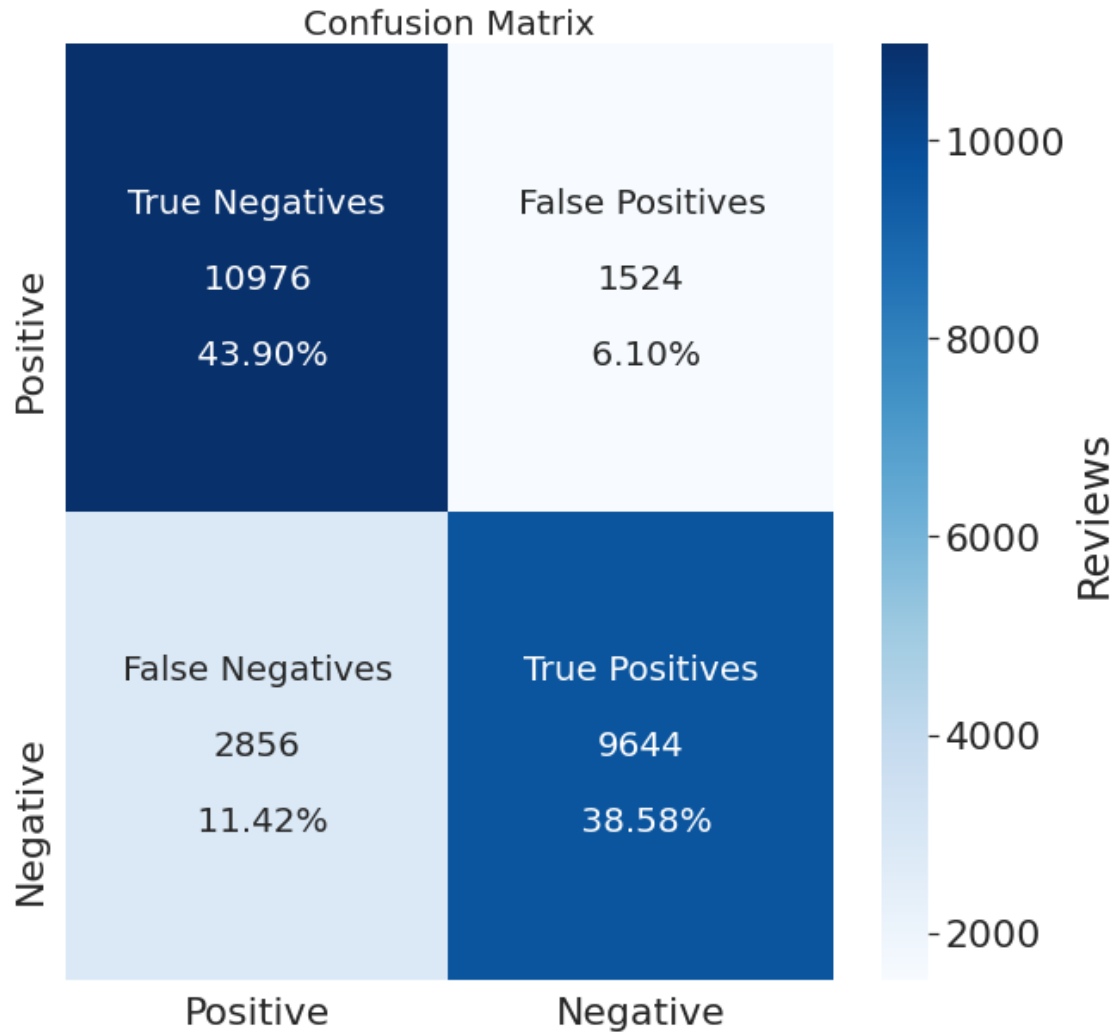
```
[19]: plot_confusion_matrix2(predictions_cnn, cm_cnn)
```



Precision: 87.7 Recall: 86.66 F1 Score: 87.18

Accuracy: 87.25 AUROC:0.87

[20]: `plot_confusion_matrix2(predictions_lstm, cm_lstm)`



Precision: 86.35 Recall: 77.15 F1 Score: 81.49
 Accuracy: 82.48 AUROC:0.82

```
[21]: !apt-get install texlive texlive-xetex texlive-latex-extra pandoc
      !pip install py pandoc
```

```

Reading package lists... Done
Building dependency tree
Reading state information... Done
pandoc is already the newest version (1.19.2.4~dfsg-1build4).
pandoc set to manually installed.
The following additional packages will be installed:
  fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-texgyre

```

javascript-common libcupsfilters1 libcupsimage2 libgs9 libgs9-common
libijs-0.35 libjbig2dec0 libjs-jquery libkpathsea6 libpotrace0 libptexenc1
libruby2.5 libsynchronet1 libtexlua52 libtexluajit2 libzip-0-13 lmodern
poppler-data preview-latex-style rake ruby ruby-did-you-mean ruby-minitest
ruby-net-telnet ruby-power-assert ruby-test-unit ruby2.5
rubygems-integration tlutils tex-common tex-gyre texlive-base
texlive-binaries texlive-fonts-recommended texlive-latex-base
texlive-latex-recommended texlive-pictures texlive-plain-generic tipa

Suggested packages:

fonts-noto apache2 | lighttpd | httpd poppler-utils ghostscript
fonts-japanese-mincho | fonts-ipafont-mincho fonts-japanese-gothic
| fonts-ipafont-gothic fonts-arphic-ukai fonts-arphic-uming fonts-nanum ri
ruby-dev bundler debhelper gv | postscript-viewer perl-tk xpdf-reader
| pdf-viewer texlive-fonts-recommended-doc texlive-latex-base-doc
python-pygments icc-profiles libfile-which-perl
libspreadsheet-parseexcel-perl texlive-latex-extra-doc
texlive-latex-recommended-doc texlive-pstricks dot2tex prerex ruby-tcltk
| libtcltk-ruby texlive-pictures-doc vprerex

The following NEW packages will be installed:

fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-texgyre
javascript-common libcupsfilters1 libcupsimage2 libgs9 libgs9-common
libijs-0.35 libjbig2dec0 libjs-jquery libkpathsea6 libpotrace0 libptexenc1
libruby2.5 libsynchronet1 libtexlua52 libtexluajit2 libzip-0-13 lmodern
poppler-data preview-latex-style rake ruby ruby-did-you-mean ruby-minitest
ruby-net-telnet ruby-power-assert ruby-test-unit ruby2.5
rubygems-integration tlutils tex-common tex-gyre texlive texlive-base
texlive-binaries texlive-fonts-recommended texlive-latex-base
texlive-latex-extra texlive-latex-recommended texlive-pictures
texlive-plain-generic texlive-xetex tipa

0 upgraded, 47 newly installed, 0 to remove and 29 not upgraded.

Need to get 146 MB of archives.

After this operation, 460 MB of additional disk space will be used.

Get:1 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 fonts-droid-fallback
all 1:6.0.1r16-1.1 [1,805 kB]

Get:2 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 fonts-lato all 2.0-2
[2,698 kB]

Get:3 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 poppler-data all
0.4.8-2 [1,479 kB]

Get:4 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 tex-common all 6.09
[33.0 kB]

Get:5 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 fonts-lmodern all
2.004.5-3 [4,551 kB]

Get:6 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 fonts-noto-mono all
20171026-2 [75.5 kB]

Get:7 <http://archive.ubuntu.com/ubuntu> bionic/universe amd64 fonts-texgyre all
20160520-1 [8,761 kB]

Get:8 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 javascript-common all
11 [6,066 B]

Get:9 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libcupsfilters1
amd64 1.20.2-0ubuntu3.1 [108 kB]

Get:10 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libcupsimage2
amd64 2.2.7-1ubuntu2.8 [18.6 kB]

Get:11 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 libijs-0.35 amd64
0.35-13 [15.5 kB]

Get:12 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 libjbig2dec0 amd64
0.13-6 [55.9 kB]

Get:13 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libgs9-common
all 9.26~dfsg+0-0ubuntu0.18.04.14 [5,092 kB]

Get:14 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libgs9 amd64
9.26~dfsg+0-0ubuntu0.18.04.14 [2,265 kB]

Get:15 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 libjs-jquery all
3.2.1-1 [152 kB]

Get:16 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libkpathsea6
amd64 2017.20170613.44572-8ubuntu0.1 [54.9 kB]

Get:17 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 libpotrace0 amd64
1.14-2 [17.4 kB]

Get:18 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libptexenc1
amd64 2017.20170613.44572-8ubuntu0.1 [34.5 kB]

Get:19 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 rubygems-integration
all 1.11 [4,994 B]

Get:20 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 ruby2.5 amd64
2.5.1-1ubuntu1.7 [48.6 kB]

Get:21 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 ruby amd64 1:2.5.1
[5,712 B]

Get:22 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 rake all
12.3.1-1ubuntu0.1 [44.9 kB]

Get:23 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 ruby-did-you-mean all
1.2.0-2 [9,700 B]

Get:24 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 ruby-minitest all
5.10.3-1 [38.6 kB]

Get:25 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 ruby-net-telnet all
0.1.1-2 [12.6 kB]

Get:26 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 ruby-power-assert all
0.3.0-1 [7,952 B]

Get:27 <http://archive.ubuntu.com/ubuntu> bionic/main amd64 ruby-test-unit all
3.2.5-1 [61.1 kB]

Get:28 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libruby2.5
amd64 2.5.1-1ubuntu1.7 [3,068 kB]

Get:29 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libsyntax
amd64 2017.20170613.44572-8ubuntu0.1 [41.4 kB]

Get:30 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libtexlua52
amd64 2017.20170613.44572-8ubuntu0.1 [91.2 kB]

Get:31 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libtexluajit2
amd64 2017.20170613.44572-8ubuntu0.1 [230 kB]

Get:32 <http://archive.ubuntu.com/ubuntu> bionic-updates/main amd64 libzip-0-13
amd64 0.13.62-3.1ubuntu0.18.04.1 [26.0 kB]

Get:33 http://archive.ubuntu.com/ubuntu bionic/main amd64 lmodern all 2.004.5-3
 [9,631 kB]
 Get:34 http://archive.ubuntu.com/ubuntu bionic/main amd64 preview-latex-style
 all 11.91-1ubuntu1 [185 kB]
 Get:35 http://archive.ubuntu.com/ubuntu bionic/main amd64 tiutils amd64 1.41-2
 [56.0 kB]
 Get:36 http://archive.ubuntu.com/ubuntu bionic/universe amd64 tex-gyre all
 20160520-1 [4,998 kB]
 Get:37 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 texlive-
 binaries amd64 2017.20170613.44572-8ubuntu0.1 [8,179 kB]
 Get:38 http://archive.ubuntu.com/ubuntu bionic/main amd64 texlive-base all
 2017.20180305-1 [18.7 MB]
 Get:39 http://archive.ubuntu.com/ubuntu bionic/universe amd64 texlive-fonts-
 recommended all 2017.20180305-1 [5,262 kB]
 Get:40 http://archive.ubuntu.com/ubuntu bionic/main amd64 texlive-latex-base all
 2017.20180305-1 [951 kB]
 Get:41 http://archive.ubuntu.com/ubuntu bionic/main amd64 texlive-latex-
 recommended all 2017.20180305-1 [14.9 MB]
 Get:42 http://archive.ubuntu.com/ubuntu bionic/universe amd64 texlive all
 2017.20180305-1 [14.4 kB]
 Get:43 http://archive.ubuntu.com/ubuntu bionic/universe amd64 texlive-pictures
 all 2017.20180305-1 [4,026 kB]
 Get:44 http://archive.ubuntu.com/ubuntu bionic/universe amd64 texlive-latex-
 extra all 2017.20180305-2 [10.6 MB]
 Get:45 http://archive.ubuntu.com/ubuntu bionic/universe amd64 texlive-plain-
 generic all 2017.20180305-2 [23.6 MB]
 Get:46 http://archive.ubuntu.com/ubuntu bionic/universe amd64 tipa all 2:1.3-20
 [2,978 kB]
 Get:47 http://archive.ubuntu.com/ubuntu bionic/universe amd64 texlive-xetex all
 2017.20180305-1 [10.7 MB]
 Fetched 146 MB in 5s (27.5 MB/s)
 Extracting templates from packages: 100%
 Preconfiguring packages ...
 Selecting previously unselected package fonts-droid-fallback.
 (Reading database ... 160975 files and directories currently installed.)
 Preparing to unpack .../00-fonts-droid-fallback_1%3a6.0.1r16-1.1_all.deb ...
 Unpacking fonts-droid-fallback (1:6.0.1r16-1.1) ...
 Selecting previously unselected package fonts-lato.
 Preparing to unpack .../01-fonts-lato_2.0-2_all.deb ...
 Unpacking fonts-lato (2.0-2) ...
 Selecting previously unselected package poppler-data.
 Preparing to unpack .../02-poppler-data_0.4.8-2_all.deb ...
 Unpacking poppler-data (0.4.8-2) ...
 Selecting previously unselected package tex-common.
 Preparing to unpack .../03-tex-common_6.09_all.deb ...
 Unpacking tex-common (6.09) ...
 Selecting previously unselected package fonts-lmodern.
 Preparing to unpack .../04-fonts-lmodern_2.004.5-3_all.deb ...

```

Unpacking fonts-lmodern (2.004.5-3) ...
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack .../05-fonts-noto-mono_20171026-2_all.deb ...
Unpacking fonts-noto-mono (20171026-2) ...
Selecting previously unselected package fonts-texgyre.
Preparing to unpack .../06-fonts-texgyre_20160520-1_all.deb ...
Unpacking fonts-texgyre (20160520-1) ...
Selecting previously unselected package javascript-common.
Preparing to unpack .../07-javascript-common_11_all.deb ...
Unpacking javascript-common (11) ...
Selecting previously unselected package libcupsfilters1:amd64.
Preparing to unpack .../08-libcupsfilters1_1.20.2-0ubuntu3.1_amd64.deb ...
Unpacking libcupsfilters1:amd64 (1.20.2-0ubuntu3.1) ...
Selecting previously unselected package libcupsimage2:amd64.
Preparing to unpack .../09-libcupsimage2_2.2.7-1ubuntu2.8_amd64.deb ...
Unpacking libcupsimage2:amd64 (2.2.7-1ubuntu2.8) ...
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack .../10-libijs-0.35_0.35-13_amd64.deb ...
Unpacking libijs-0.35:amd64 (0.35-13) ...
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack .../11-libjbig2dec0_0.13-6_amd64.deb ...
Unpacking libjbig2dec0:amd64 (0.13-6) ...
Selecting previously unselected package libgs9-common.
Preparing to unpack .../12-libgs9-common_9.26~dfsg+0-0ubuntu0.18.04.14_all.deb
...
Unpacking libgs9-common (9.26~dfsg+0-0ubuntu0.18.04.14) ...
Selecting previously unselected package libgs9:amd64.
Preparing to unpack .../13-libgs9_9.26~dfsg+0-0ubuntu0.18.04.14_amd64.deb ...
Unpacking libgs9:amd64 (9.26~dfsg+0-0ubuntu0.18.04.14) ...
Selecting previously unselected package libjs-jquery.
Preparing to unpack .../14-libjs-jquery_3.2.1-1_all.deb ...
Unpacking libjs-jquery (3.2.1-1) ...
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack .../15-libkpathsea6_2017.20170613.44572-8ubuntu0.1_amd64.deb
...
Unpacking libkpathsea6:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Selecting previously unselected package libpotrace0.
Preparing to unpack .../16-libpotrace0_1.14-2_amd64.deb ...
Unpacking libpotrace0 (1.14-2) ...
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack .../17-libptexenc1_2017.20170613.44572-8ubuntu0.1_amd64.deb
...
Unpacking libptexenc1:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Selecting previously unselected package rubygems-integration.
Preparing to unpack .../18-rubygems-integration_1.11_all.deb ...
Unpacking rubygems-integration (1.11) ...
Selecting previously unselected package ruby2.5.
Preparing to unpack .../19-ruby2.5_2.5.1-1ubuntu1.7_amd64.deb ...

```

```

Unpacking ruby2.5 (2.5.1-1ubuntu1.7) ...
Selecting previously unselected package ruby.
Preparing to unpack .../20-ruby_1%3a2.5.1_amd64.deb ...
Unpacking ruby (1:2.5.1) ...
Selecting previously unselected package rake.
Preparing to unpack .../21-rake_12.3.1-1ubuntu0.1_all.deb ...
Unpacking rake (12.3.1-1ubuntu0.1) ...
Selecting previously unselected package ruby-did-you-mean.
Preparing to unpack .../22-ruby-did-you-mean_1.2.0-2_all.deb ...
Unpacking ruby-did-you-mean (1.2.0-2) ...
Selecting previously unselected package ruby-minitest.
Preparing to unpack .../23-ruby-minitest_5.10.3-1_all.deb ...
Unpacking ruby-minitest (5.10.3-1) ...
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack .../24-ruby-net-telnet_0.1.1-2_all.deb ...
Unpacking ruby-net-telnet (0.1.1-2) ...
Selecting previously unselected package ruby-power-assert.
Preparing to unpack .../25-ruby-power-assert_0.3.0-1_all.deb ...
Unpacking ruby-power-assert (0.3.0-1) ...
Selecting previously unselected package ruby-test-unit.
Preparing to unpack .../26-ruby-test-unit_3.2.5-1_all.deb ...
Unpacking ruby-test-unit (3.2.5-1) ...
Selecting previously unselected package libruby2.5:amd64.
Preparing to unpack .../27-libruby2.5_2.5.1-1ubuntu1.7_amd64.deb ...
Unpacking libruby2.5:amd64 (2.5.1-1ubuntu1.7) ...
Selecting previously unselected package libsyntax1:amd64.
Preparing to unpack .../28-libsyntax1_2017.20170613.44572-8ubuntu0.1_amd64.deb
...
Unpacking libsyntax1:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Selecting previously unselected package libtexlua52:amd64.
Preparing to unpack .../29-libtexlua52_2017.20170613.44572-8ubuntu0.1_amd64.deb
...
Unpacking libtexlua52:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack
.../30-libtexluajit2_2017.20170613.44572-8ubuntu0.1_amd64.deb ...
Unpacking libtexluajit2:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Selecting previously unselected package libzip-0-13:amd64.
Preparing to unpack .../31-libzip-0-13_0.13.62-3.1ubuntu0.18.04.1_amd64.deb ...
Unpacking libzip-0-13:amd64 (0.13.62-3.1ubuntu0.18.04.1) ...
Selecting previously unselected package lmodern.
Preparing to unpack .../32-lmodern_2.004.5-3_all.deb ...
Unpacking lmodern (2.004.5-3) ...
Selecting previously unselected package preview-latex-style.
Preparing to unpack .../33-preview-latex-style_11.91-1ubuntu1_all.deb ...
Unpacking preview-latex-style (11.91-1ubuntu1) ...
Selecting previously unselected package t1utils.
Preparing to unpack .../34-t1utils_1.41-2_amd64.deb ...

```

```

Unpacking t1utils (1.41-2) ...
Selecting previously unselected package tex-gyre.
Preparing to unpack .../35-tex-gyre_20160520-1_all.deb ...
Unpacking tex-gyre (20160520-1) ...
Selecting previously unselected package texlive-binaries.
Preparing to unpack .../36-texlive-
binaries_2017.20170613.44572-8ubuntu0.1_amd64.deb ...
Unpacking texlive-binaries (2017.20170613.44572-8ubuntu0.1) ...
Selecting previously unselected package texlive-base.
Preparing to unpack .../37-texlive-base_2017.20180305-1_all.deb ...
Unpacking texlive-base (2017.20180305-1) ...
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack .../38-texlive-fonts-recommended_2017.20180305-1_all.deb ...
Unpacking texlive-fonts-recommended (2017.20180305-1) ...
Selecting previously unselected package texlive-latex-base.
Preparing to unpack .../39-texlive-latex-base_2017.20180305-1_all.deb ...
Unpacking texlive-latex-base (2017.20180305-1) ...
Selecting previously unselected package texlive-latex-recommended.
Preparing to unpack .../40-texlive-latex-recommended_2017.20180305-1_all.deb ...
Unpacking texlive-latex-recommended (2017.20180305-1) ...
Selecting previously unselected package texlive.
Preparing to unpack .../41-texlive_2017.20180305-1_all.deb ...
Unpacking texlive (2017.20180305-1) ...
Selecting previously unselected package texlive-pictures.
Preparing to unpack .../42-texlive-pictures_2017.20180305-1_all.deb ...
Unpacking texlive-pictures (2017.20180305-1) ...
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack .../43-texlive-latex-extra_2017.20180305-2_all.deb ...
Unpacking texlive-latex-extra (2017.20180305-2) ...
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack .../44-texlive-plain-generic_2017.20180305-2_all.deb ...
Unpacking texlive-plain-generic (2017.20180305-2) ...
Selecting previously unselected package tipa.
Preparing to unpack .../45-tipa_2%3a1.3-20_all.deb ...
Unpacking tipa (2:1.3-20) ...
Selecting previously unselected package texlive-xetex.
Preparing to unpack .../46-texlive-xetex_2017.20180305-1_all.deb ...
Unpacking texlive-xetex (2017.20180305-1) ...
Setting up libgs9-common (9.26~dfsg+0-0ubuntu0.18.04.14) ...
Setting up libkpathsea6:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Setting up libjs-jquery (3.2.1-1) ...
Setting up libtexlua52:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Setting up fonts-droid-fallback (1:6.0.1r16-1.1) ...
Setting up libsynctex1:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Setting up libptexenc1:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Setting up tex-common (6.09) ...
update-language: texlive-base not installed and configured, doing nothing!
Setting up poppler-data (0.4.8-2) ...

```

```

Setting up tex-gyre (20160520-1) ...
Setting up preview-latex-style (11.91-1ubuntu1) ...
Setting up fonts-texgyre (20160520-1) ...
Setting up fonts-noto-mono (20171026-2) ...
Setting up fonts-lato (2.0-2) ...
Setting up libcupsfilters1:amd64 (1.20.2-0ubuntu3.1) ...
Setting up libcupsimage2:amd64 (2.2.7-1ubuntu2.8) ...
Setting up libjbig2dec0:amd64 (0.13-6) ...
Setting up ruby-did-you-mean (1.2.0-2) ...
Setting up t1utils (1.41-2) ...
Setting up ruby-net-telnet (0.1.1-2) ...
Setting up libijs-0.35:amd64 (0.35-13) ...
Setting up rubygems-integration (1.11) ...
Setting up libpotrace0 (1.14-2) ...
Setting up javascript-common (11) ...
Setting up ruby-minitest (5.10.3-1) ...
Setting up libzzip-0-13:amd64 (0.13.62-3.1ubuntu0.18.04.1) ...
Setting up libgs9:amd64 (9.26~dfsg+0-0ubuntu0.18.04.14) ...
Setting up libtexluaajit2:amd64 (2017.20170613.44572-8ubuntu0.1) ...
Setting up fonts-lmodern (2.004.5-3) ...
Setting up ruby-power-assert (0.3.0-1) ...
Setting up texlive-binaries (2017.20170613.44572-8ubuntu0.1) ...
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up texlive-base (2017.20180305-1) ...
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST...
mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN...
mktexlsr: Updating /var/lib/texmf/ls-R...
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4: /var/lib/texmf/dvips/config
/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4: /var/lib/texmf/dvipdfmx
/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4:
/var/lib/texmf/tex/generic/config/pdftexconfig.tex
Setting up texlive-fonts-recommended (2017.20180305-1) ...
Setting up texlive-plain-generic (2017.20180305-2) ...
Setting up texlive-latex-base (2017.20180305-1) ...
Setting up lmodern (2.004.5-3) ...
Setting up texlive-latex-recommended (2017.20180305-1) ...
Setting up texlive-pictures (2017.20180305-1) ...
Setting up tipa (2:1.3-20) ...
Regenerating '/var/lib/texmf/fmtutil.cnf-DEBIAN'... done.
Regenerating '/var/lib/texmf/fmtutil.cnf-TEXLIVEDIST'... done.
update-fmtutil has updated the following file(s):

```



```

/var/lib/texmf/fmtutil.cnf-DEBIAN
/var/lib/texmf/fmtutil.cnf-TEXLIVEDIST
If you want to activate the changes in the above file(s),
you should run fmtutil-sys or fmtutil.
Setting up texlive (2017.20180305-1) ...
Setting up texlive-latex-extra (2017.20180305-2) ...
Setting up texlive-xetex (2017.20180305-1) ...
Setting up ruby2.5 (2.5.1-1ubuntu1.7) ...
Setting up ruby (1:2.5.1) ...
Setting up ruby-test-unit (3.2.5-1) ...
Setting up rake (12.3.1-1ubuntu0.1) ...
Setting up libruby2.5:amd64 (2.5.1-1ubuntu1.7) ...
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.2) ...
/sbin/ldconfig.real: /usr/local/lib/python3.7/dist-
packages/ideep4py/lib/libmkldnn.so.0 is not a symbolic link

```

```

Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for fontconfig (2.12.6-0ubuntu2) ...
Processing triggers for tex-common (6.09) ...
Running updmap-sys. This may take some time... done.
Running mktexlsr /var/lib/texmf ... done.
Building format(s) --all.

```

This may take some time... done.

Collecting py pandoc

Downloading <https://files.pythonhosted.org/packages/d6/b7/5050dc1769c8a93d3ec7c4bd55be161991c94b8b235f88bf7c764449e708/py pandoc-1.5.tar.gz>

Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-packages (from py pandoc) (54.0.0)

Requirement already satisfied: pip>=8.1.0 in /usr/local/lib/python3.7/dist-packages (from py pandoc) (19.3.1)

Requirement already satisfied: wheel>=0.25.0 in /usr/local/lib/python3.7/dist-packages (from py pandoc) (0.36.2)

Building wheels for collected packages: py pandoc

Building wheel for py pandoc (setup.py) ... done

Created wheel for py pandoc: filename=py pandoc-1.5-cp37-none-any.whl size=17036 sha256=15e15ce934af0e5f8fba6d117ccf3c198081fb38c7aeb62f8b763a71226c88b4

Stored in directory: /root/.cache/pip/wheels/bb/7d/d6/2f9af55e800d37e42e546106bcbd36a86e24e725e303d17e04

Successfully built py pandoc

Installing collected packages: py pandoc

Successfully installed py pandoc-1.5

```

[!]: !cp "/content/drive/MyDrive/Colab Notebooks/ml_imdb_error_analysis.ipynb" ./
!jupyter nbconvert --to PDF "ml_imdb_error_analysis.ipynb"

```

[NbConvertApp] Converting notebook ml_imdb_error_analysis.ipynb to PDF

[NbConvertApp] Support files will be in ml_imdb_error_analysis_files/

```
[NbConvertApp] Making directory ./ml_imdb_error_analysis_files
[NbConvertApp] Making directory ./ml_imdb_error_analysis_files
[NbConvertApp] Making directory ./ml_imdb_error_analysis_files
[NbConvertApp] Making directory ./ml_imdb_error_analysis_files
[NbConvertApp] Making directory ./ml_imdb_error_analysis_files
[NbConvertApp] Writing 61435 bytes to ./notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: [u'xelatex', u'./notebook.tex',
'-quiet']
```

```
[ ]: files.download('/content/ml_imdb_error_analysis.ipynb')
files.download('/content/ml_imdb_error_analysis.pdf')
```