openav_notebook_vec

October 28, 2022

This is the notebook for Word2Vec

[78]:
```
# Start gensim analysis with imports
import nltk
from nltk.corpus import stopwords
from gensim.models import Word2Vec,KeyedVectors
from gensim.test.utils import datapath
import re
import unicodedata
from tqdm import tqdm
import gensim
import multiprocessing
import random
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

[79]:
```
reports = pd.read_csv('open_ave_data.csv')
reports = reports.dropna()
reports.head(3)
```

[79]:
```
   Unnamed: 0                                         ReportText  \
0           0  EXAM: CHEST RADIOGRAPHY EXAM DATE: 06/01/2019 …
1           1  EXAM: CHEST RADIOGRAPHY EXAM DATE: 05/23/2020 …
2           2  EXAM: CHEST RADIOGRAPHY EXAM DATE: 12/13/2019 …

                                            findings  \
0  FINDINGS: Lungs/Pleura: No focal opacities evi…
1  FINDINGS: Lungs/Pleura: No focal opacities evi…
2  FINDINGS: Lungs/Pleura: No focal opacities evi…

                         clinicaldata  \
0       CLINICAL HISTORY: Cough. \n\n
1  CLINICAL HISTORY: CHEST PAIN. \n\n
2  CLINICAL HISTORY: CHEST PAIN. \n\n

                                            ExamName  \
0  EXAM: CHEST RADIOGRAPHY EXAM DATE: 06/01/2019 …
```

```
1  EXAM: CHEST RADIOGRAPHY EXAM DATE: 05/23/2020 …
2  EXAM: CHEST RADIOGRAPHY EXAM DATE: 12/13/2019 …

                                          impression
0      IMPRESSION: Normal 2-view chest radiography.
1  IMPRESSION: No acute cardiopulmonary abnormali…
2     IMPRESSION: No acute cardiopulmonary process.
```

```
[80]: report_findings = reports['findings'].str.split().tolist()
      report_clinicaldata = reports['clinicaldata'].str.split().tolist()
      report_examname = reports['ExamName'].str.split().tolist()
      report_impression = reports['impression'].str.split().tolist()
      corpus = report_findings + report_clinicaldata + report_examname +␣
       ↪report_impression
```

```
[81]: print(corpus[0])
```

```
['FINDINGS:', 'Lungs/Pleura:', 'No', 'focal', 'opacities', 'evident.', 'No',
'pleural', 'effusion.', 'No', 'pneumothorax.', 'Normal', 'volumes.',
'Mediastinum:', 'Heart', 'and', 'mediastinal', 'contours', 'are',
'unremarkable.', 'Other:', 'None.']
```

```
[82]: # Create empty gensim model
      cores= multiprocessing.cpu_count()
      model = Word2Vec(min_count=5,window=5,workers=cores-1,max_vocab_size=100000)
```

```
[83]: # Model using the dataset as the vocabulary
      model.build_vocab(corpus)
```

```
[84]: # Train the model
      model.train(corpus,total_examples=model.corpus_count,epochs=50)
```

```
[84]: (1462269, 2588300)
```

```
[85]: # Save the model
      model.save('gensim_w2v_model.model')
      # Load the model
      # trained_model = gensim.models.Word2Vec.load('gensim_w2v_model.model')
```

```
[86]: # Create the embeddings
      def embedding(sentence):
          vectors = []
          for word in sentence:
              try:
                  vector = model.wv.get_vector(word)
              except KeyError:
                  vector = [0] * 100
```

```
        except ValueError:
            continue
        vectors.append(vector)
    vector = np.sum(vectors, axis=0)
    return vector / len(sentence)


# X_embedded = [embedding(word) for word in corpus]
X_list = []
# for word
# print(embedding(corpus[0]))
# print(corpus[0])
# print(embedding(corpus))
for line in corpus:
    embed = embedding(line)
    X_list.append(embed.tolist())
    # print(embedding(line))
X_embedded = np.array(X_list)
X_embedded
```

[86]:

```
array([[ 0.2555311 , -0.82267183, -0.06381932, …,  0.40741882,
        -0.71673101, -0.27584931],
       [ 0.04379919, -0.63180339,  0.07207195, …,  0.57229287,
         0.35570148,  0.01460459],
       [ 0.2555311 , -0.82267183, -0.06381932, …,  0.40741882,
        -0.71673101, -0.27584931],
       …,
       [-0.63537091, -0.32506666, -0.25046062, …,  0.02259408,
        -0.77557534, -0.48565644],
       [-0.11736122, -0.45779172, -0.78641916, …, -0.19430898,
        -0.96106321, -0.93790964],
       [ 0.02690895,  0.25205789, -0.2018373 , …, -0.28713602,
         0.16249789, -0.72709557]])
```

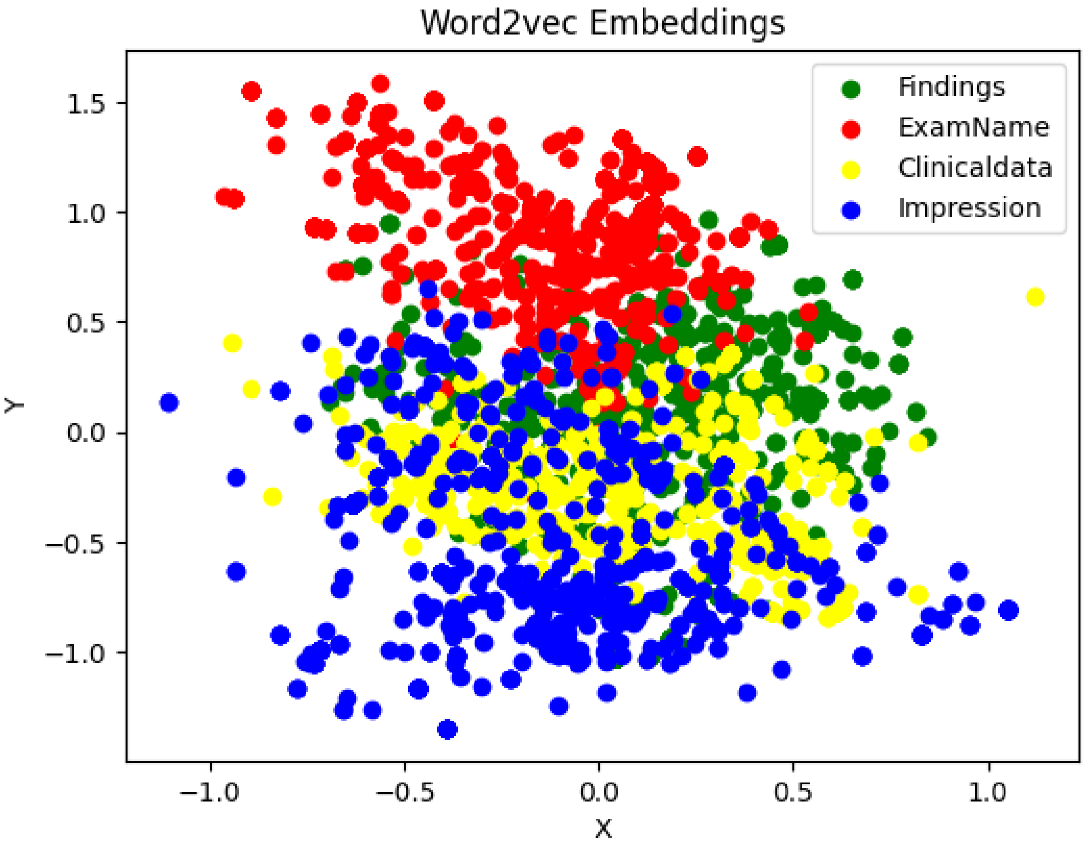
[87]:

```
plt.title("Word2vec Embeddings")
plt.xlabel("X")
plt.ylabel("Y")

# Notation :,# takes all the columns from the number
lF = len(report_findings)
lC = len(report_clinicaldata)
lE = len(report_examname)
lI = len(report_impression)


plt.scatter(X_embedded[0:lF,0], X_embedded[0:lF,1], c='green')
plt.scatter(X_embedded[lF:lF+lC,0], X_embedded[lF:lF+lC,1], c='red')
plt.scatter(X_embedded[lF+lC:lF+lC+lE,0], X_embedded[lF+lC:lF+lC+lE,1],␣
 ↪c='yellow')
plt.scatter(X_embedded[lF+lC+lE:,0], X_embedded[lF+lC+lE:,1], c='blue')
plt.legend(['Findings', 'ExamName','Clinicaldata','Impression'])
```

```
[87]: <matplotlib.legend.Legend at 0x1714e78bac0>
```



[88]:
```
# Imports for supervised machine learning
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
```

[89]:
```
# Examdata, clinical data, findings, impression combined for trainign
x = X_embedded
e = [0]*len(report_examname)
c = [1]*len(report_clinicaldata)
f= [2]*len(report_findings)
i=[3]*len(report_impression)
total = e+c+f+i
y = np.array(total)
```

[90]:
```
# Apply train test split
x_train, x_test, y_train, y_test = train_test_split(x, y,  test_size=0.20,␣
 ↪random_state=50, stratify=y)
```

[91]:
```
# Regression - fits the model and returns it with the intercept and slope
model = LogisticRegression(multi_class='ovr', solver='liblinear')
model.fit(x_train, y_train)
model.score(x_test,y_test)
```

[91]:
```
0.9973684210526316
```

[92]:
```
from sklearn.metrics import classification_report, confusion_matrix,␣
 ↪accuracy_score, plot_confusion_matrix
```

[93]:
```
lr=LogisticRegression(C=1, solver ='saga')
lr.fit(x_train, y_train)
lr_preds=lr.predict(x_test)

print(confusion_matrix(y_test, lr_preds))
print(classification_report(y_test, lr_preds))
print("Accuracy Score: %.3f" % accuracy_score(y_test, lr_preds))
```

```
[[190   0   0   0]
 [  0 190   0   0]
 [  0   0 190   0]
 [  2   0   0 188]]
              precision    recall  f1-score   support

           0       0.99      1.00      0.99       190
           1       1.00      1.00      1.00       190
           2       1.00      1.00      1.00       190
           3       1.00      0.99      0.99       190

    accuracy                           1.00       760
   macro avg       1.00      1.00      1.00       760
weighted avg       1.00      1.00      1.00       760

Accuracy Score: 0.997
```

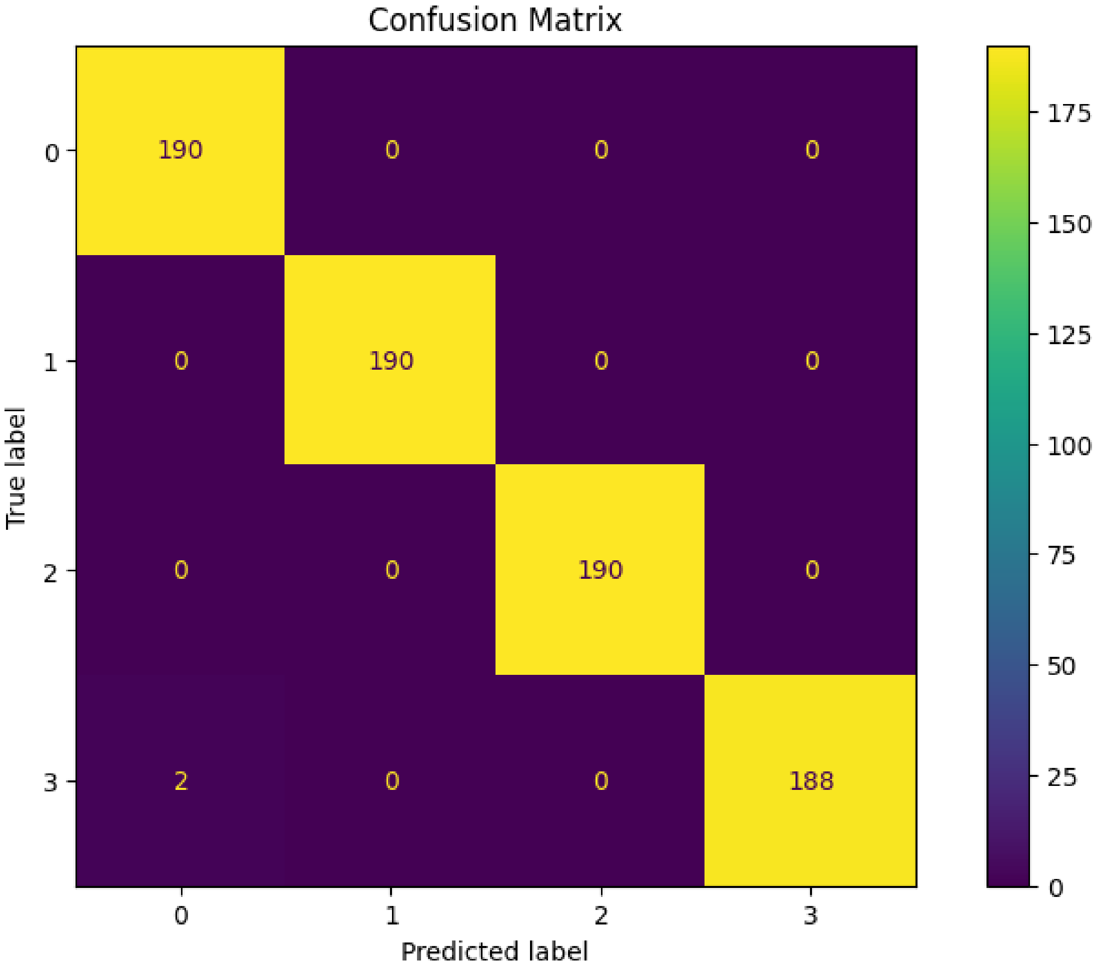
```
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\sklearn\linear_model\_sag.py:350: ConvergenceWarning:
The max_iter was reached which means the coef_ did not converge
  warnings.warn(
```

[94]:
```
# Graph confusion matrix
fig, ax = plt.subplots(figsize=(10, 6))
ax.set_title("Confusion Matrix")
display = plot_confusion_matrix(model, x_test, y_test, ax=ax)
```

```
display.confusion_matrix
```

```
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\sklearn\utils\deprecation.py:87: FutureWarning:
Function plot_confusion_matrix is deprecated; Function `plot_confusion_matrix`
is deprecated in 1.0 and will be removed in 1.2. Use one of the class methods:
ConfusionMatrixDisplay.from_predictions or
ConfusionMatrixDisplay.from_estimator.
  warnings.warn(msg, category=FutureWarning)
```

```
[94]: array([[190,   0,   0,   0],
             [  0, 190,   0,   0],
             [  0,   0, 190,   0],
             [  2,   0,   0, 188]], dtype=int64)
```


Confusion Matrix
True label
Predicted label