05_lda_with_gensim

September 29, 2021

1 Topic Modeling: Latent Dirichlet Allocation with gensim

Gensim is a specialized NLP library with a fast LDA implementation and many additional features. We will also use it in the next chapter on word vectors (see the notebook lda_with_gensim for details.

1.1 Imports & Settings

[1]:
```
import warnings
warnings.filterwarnings('ignore')
```

[2]:
```
%matplotlib inline

from pathlib import Path
import pandas as pd

# Visualization
import seaborn as sns
import pyLDAvis

# sklearn for feature extraction & modeling
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.model_selection import train_test_split
import joblib

# gensim for alternative models
from gensim.models import LdaModel
from gensim.corpora import Dictionary
from gensim.matutils import Sparse2Corpus
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/scipy/sparse/sparsetools.py:21: DeprecationWarning:
`scipy.sparse.sparsetools` is deprecated!
scipy.sparse.sparsetools is a private module for scipy.sparse, and should not be
used.
  _deprecated()
```

[3]:
```
sns.set_style('white')
pyLDAvis.enable_notebook()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

1.2 Load BBC data

[4]:
```
# change to your data path if necessary
DATA_DIR = Path('../data')
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[5]:
```
path = DATA_DIR / 'bbc'
files = path.glob('**/*.txt')
doc_list = []
for i, file in enumerate(files):
    with open(str(file), encoding='latin1') as f:
        topic = file.parts[-2]
        lines = f.readlines()
        heading = lines[0].strip()
        body = ' '.join([l.strip() for l in lines[1:]])
        doc_list.append([topic.capitalize(), heading, body])
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

1.2.1 Convert to DataFrame

[6]:
```
docs = pd.DataFrame(doc_list, columns=['topic', 'heading', 'article'])
docs.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2225 entries, 0 to 2224
Data columns (total 3 columns):
```

```
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   topic    2225 non-null   object
 1   heading  2225 non-null   object
 2   article  2225 non-null   object
dtypes: object(3)
memory usage: 52.3+ KB
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

1.3 Create Train & Test Sets

[7]:
```
train_docs, test_docs = train_test_split(docs,
                                         stratify=docs.topic,
                                         test_size=50,
                                         random_state=42)
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[8]:
```
train_docs.shape, test_docs.shape
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[8]:
```
((2175, 3), (50, 3))
```

[9]:
```
pd.Series(test_docs.topic).value_counts()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[9]:
```
Sport            12
Business         11
Entertainment     9
Tech              9
Politics          9
Name: topic, dtype: int64
```

1.3.1 Vectorize train & test sets

[10]:
```
vectorizer = CountVectorizer(max_df=.2,
                             min_df=3,
                             stop_words='english',
                             max_features=2000)

train_dtm = vectorizer.fit_transform(train_docs.article)
words = vectorizer.get_feature_names()
train_dtm
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[10]:
```
<2175x2000 sparse matrix of type '<class 'numpy.int64'>'
        with 179068 stored elements in Compressed Sparse Row format>
```

[11]:
```
test_dtm = vectorizer.transform(test_docs.article)
test_dtm
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[11]:
```
<50x2000 sparse matrix of type '<class 'numpy.int64'>'
        with 4150 stored elements in Compressed Sparse Row format>
```

1.4 LDA with gensim

1.4.1 Using CountVectorizer Input

[12]:
```
max_df = .2
min_df = 3
max_features = 2000

# used by sklearn: https://github.com/scikit-learn/scikit-learn/blob/master/
 ↪sklearn/feature_extraction/stop_words.py
stop_words = pd.read_csv('http://ir.dcs.gla.ac.uk/resources/linguistic_utils/
 ↪stop_words',
                         header=None,
                         squeeze=True).tolist()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[13]:
```
vectorizer = CountVectorizer(max_df=max_df,
                             min_df=min_df,
                             stop_words='english',
                             max_features=max_features)

train_dtm = vectorizer.fit_transform(train_docs.article)
test_dtm = vectorizer.transform(test_docs.article)
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

1.4.2 Convert sklearn DTM to gensim data structures

It faciltiates the conversion of DTM produced by sklearn to gensim data structures as follows:

[14]:
```
train_corpus = Sparse2Corpus(train_dtm, documents_columns=False)
test_corpus = Sparse2Corpus(test_dtm, documents_columns=False)
id2word = pd.Series(vectorizer.get_feature_names()).to_dict()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
```

`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)

1.4.3 Train Model & Review Results

[15]:
```
LdaModel(corpus=train_corpus,
         num_topics=100,
         id2word=None,
         distributed=False,
         chunksize=2000,                    # Number of documents to be used in␣
↪each training chunk.
         passes=1,                          # Number of passes through the␣
↪corpus during training
         update_every=1,                    # Number of docs to be iterated␣
↪through for each update
         alpha='symmetric',
         eta=None,                          # a-priori belief on word probability
         decay=0.5,                         # percentage of previous lambda␣
↪forgotten when new document is examined
         offset=1.0,                        # controls slow down of the first␣
↪steps the first few iterations.
         eval_every=10,                     # estimate log perplexity
         iterations=50,                     # Maximum number of iterations␣
↪through the corpus
         gamma_threshold=0.001,             # Minimum change in the value of the␣
↪gamma parameters to continue iterating
         minimum_probability=0.01,          # Topics with a probability lower␣
↪than this threshold will be filtered out
         random_state=None,
         ns_conf=None,
         minimum_phi_value=0.01,            # if `per_word_topics` is True,␣
↪represents lower bound on term probabilities
         per_word_topics=False,             #  If True, compute a list of most␣
↪likely topics for each word with phi values multiplied by word count
         callbacks=None);
```

/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not call `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any exception that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)

[16]:
```
num_topics = 5
topic_labels = ['Topic {}'.format(i) for i in range(1, num_topics+1)]
```

/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-

```
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[17]:
```
lda_gensim = LdaModel(corpus=train_corpus,
                      num_topics=num_topics,
                      id2word=id2word)
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[18]:
```
topics = lda_gensim.print_topics()
topics[0]
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[18]:
```
(0,
 '0.007*"company" + 0.005*"party" + 0.005*"best" + 0.004*"says" + 0.004*"group"
+ 0.004*"film" + 0.004*"court" + 0.004*"games" + 0.004*"legal" + 0.003*"oil"')
```

1.4.4 Evaluate Topic Coherence

Topic Coherence measures whether the words in a topic tend to co-occur together.

- It adds up a score for each distinct pair of top ranked words.
- The score is the log of the probability that a document containing at least one instance of the higher-ranked word also contains at least one instance of the lower-ranked word.

Large negative values indicate words that don't co-occur often; values closer to zero indicate that words tend to co-occur more often.

[19]:
```
coherence = lda_gensim.top_topics(corpus=train_corpus, coherence='u_mass')
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Gensim permits topic coherence evaluation that produces the topic coherence and shows the most important words per topic:

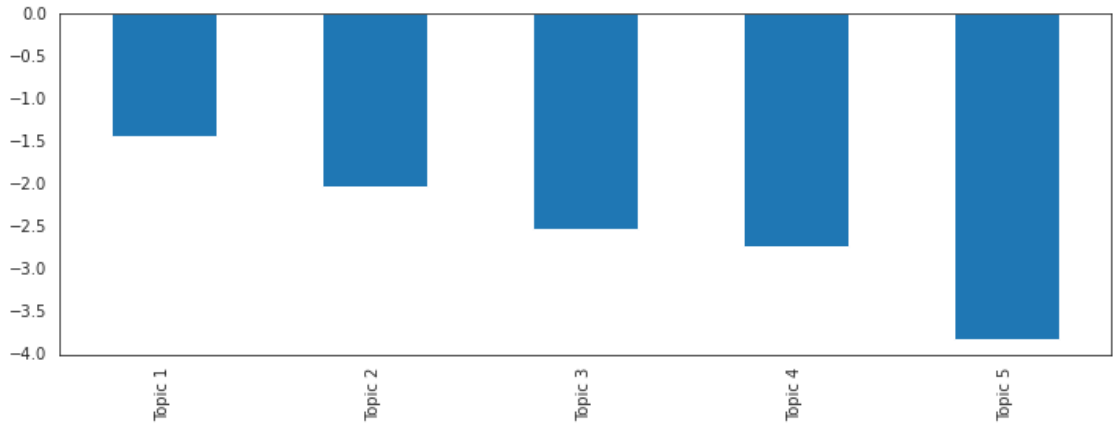
[20]:
```
topic_coherence = []
topic_words = pd.DataFrame()
for t in range(len(coherence)):
    label = topic_labels[t]
    topic_coherence.append(coherence[t][1])
    df = pd.DataFrame(coherence[t][0], columns=[(label, 'prob'), (label,␣
 ↪'term')])
    df[(label, 'prob')] = df[(label, 'prob')].apply(lambda x: '{:.2%}'.
 ↪format(x))
    topic_words = pd.concat([topic_words, df], axis=1)

topic_words.columns = pd.MultiIndex.from_tuples(topic_words.columns)
pd.set_option('expand_frame_repr', False)
topic_words.head().to_csv('topic_words.csv', index=False)
print(topic_words.head())

pd.Series(topic_coherence, index=topic_labels).plot.bar(figsize=(12,4));
```

```
  Topic 1           Topic 2         Topic 3          Topic 4        Topic 5
     prob      term    prob    term    prob     term    prob   term    prob
term
0    1.10%    labour   0.91%  mobile   0.70%  company   0.77%   game   0.62%
england
1    0.80%  election   0.64%   games   0.55%    party   0.69%  sales   0.56%
best
2    0.75%     blair   0.57%     web   0.46%     best   0.55%  games   0.52%
win
3    0.69%     brown   0.53%  search   0.42%     says   0.47%   deal   0.50%
won
4    0.60%    howard   0.52%     net   0.41%    group   0.45%   good   0.41%
team
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```



1.4.5 Using gensim Dictionary

[21]:
```
docs = [d.split() for d in train_docs.article.tolist()]
docs = [[t for t in doc if t not in stop_words] for doc in docs]
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[22]:
```
dictionary = Dictionary(docs)
dictionary.filter_extremes(no_below=min_df, no_above=max_df,␣
↪keep_n=max_features)
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[23]:
```
corpus = [dictionary.doc2bow(doc) for doc in docs]
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[24]:
```
print('Number of unique tokens: %d' % len(dictionary))
print('Number of documents: %d' % len(corpus))
```

```
Number of unique tokens: 2000
Number of documents: 2175
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[25]:
```
num_topics = 5
chunksize = 500
passes = 20
iterations = 400
eval_every = None # Don't evaluate model perplexity, takes too much time.

temp = dictionary[0]  # This is only to "load" the dictionary.
id2word = dictionary.id2token
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[26]:
```
model = LdaModel(corpus=corpus,
                 id2word=id2word,
                 chunksize=chunksize,
                 alpha='auto',
                 eta='auto',
                 iterations=iterations,
                 num_topics=num_topics,
                 passes=passes,
                 eval_every=eval_every)
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[27]:
```
model.show_topics()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[27]:
```
[(0,
  '0.012*"best" + 0.007*"film" + 0.007*"won" + 0.007*"win" + 0.006*"game" +
0.006*"England" + 0.005*"play" + 0.005*"good" + 0.005*"think" +
0.005*"second"'),
 (1,
  '0.021*"Labour" + 0.017*"Blair" + 0.015*"election" + 0.013*"Brown" +
0.012*"Lord" + 0.012*"party" + 0.011*"Howard" + 0.011*"Tory" + 0.010*"prime" +
0.008*"public"'),
 (2,
  '0.012*"government" + 0.005*"European" + 0.005*"legal" + 0.005*"says" +
0.005*"public" + 0.005*"Ms" + 0.005*"money" + 0.005*"EU" + 0.004*"work" +
0.004*"law"'),
 (3,
  '0.010*"mobile" + 0.009*"technology" + 0.008*"games" + 0.008*"music" +
0.007*"use" + 0.007*"users" + 0.007*"phone" + 0.006*"used" + 0.006*"net" +
0.006*"video"'),
 (4,
  '0.010*"company" + 0.009*"sales" + 0.009*"market" + 0.009*"growth" +
0.008*"economic" + 0.007*"rise" + 0.007*"oil" + 0.007*"economy" + 0.007*"firm" +
0.006*"chief"')]
```

1.4.6 Evaluating Topic Assignments on the Test Set

[28]:
```
docs_test = [d.split() for d in test_docs.article.tolist()]
docs_test = [[t for t in doc if t not in stop_words] for doc in docs_test]

test_dictionary = Dictionary(docs_test)
test_dictionary.filter_extremes(no_below=min_df, no_above=max_df,␣
 ↪keep_n=max_features)
test_corpus = [dictionary.doc2bow(doc) for doc in docs_test]
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[29]:
```
gamma, _ = model.inference(test_corpus)
topic_scores = pd.DataFrame(gamma)
```

```
topic_scores.head(10)
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[29]:

	0	1	2	3	4
0	19.146658	0.051314	0.139427	17.055145	0.093734
1	2.964511	3.631570	5.128225	157.635162	0.093728
2	2.437624	0.051314	38.566299	40.330196	0.093719
3	0.141710	0.051314	27.128258	9.319160	19.845629
4	86.310379	0.051314	2.145877	0.072351	2.894809
5	5.462916	0.051314	11.964343	0.072351	39.932270
6	16.709969	0.051314	26.629995	0.072351	87.001869
7	84.127693	0.051314	0.139049	0.072351	0.093723
8	0.141705	1.410880	0.139311	1.598531	134.170822
9	0.141487	0.051314	12.392625	2.545936	30.358202

[30]:
```
topic_probabilities = topic_scores.div(topic_scores.sum(axis=1), axis=0)
topic_probabilities.head()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[30]:

	0	1	2	3	4
0	0.524763	0.001406	0.003821	0.467440	0.002569
1	0.017495	0.021431	0.030263	0.930258	0.000553
2	0.029917	0.000630	0.473327	0.494976	0.001150
3	0.002509	0.000908	0.480265	0.164982	0.351337
4	0.943543	0.000561	0.023459	0.000791	0.031646

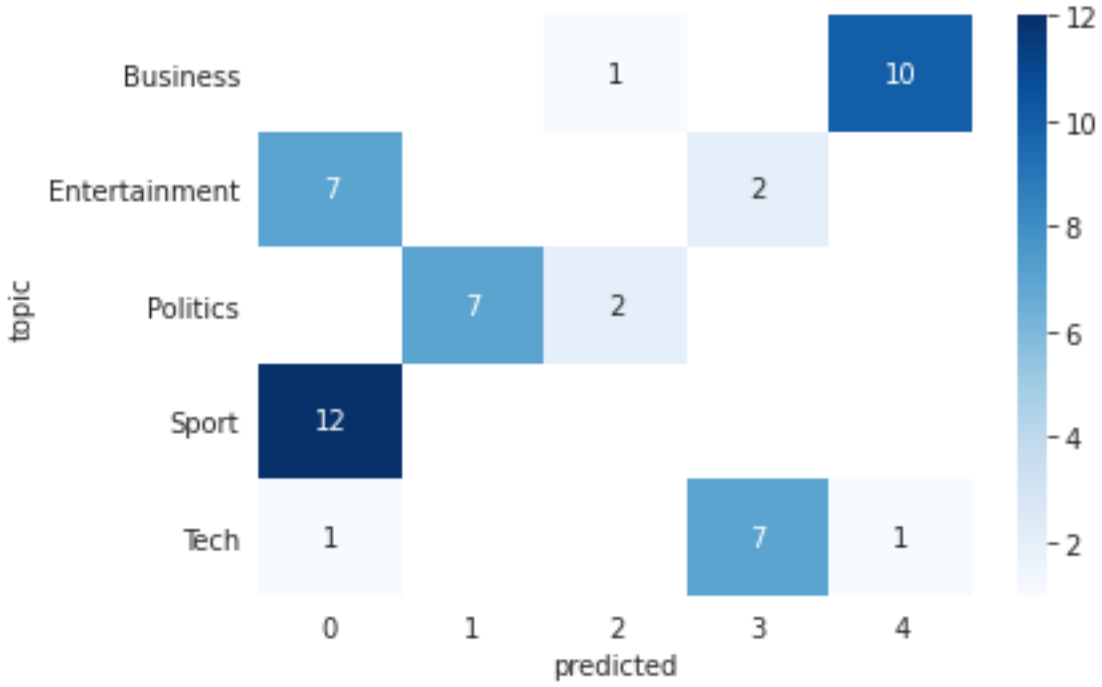
[31]:
```
topic_probabilities.idxmax(axis=1).head()
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

[31]:
```
0    0
1    3
2    3
3    2
4    0
dtype: int64
```

[32]:
```
predictions = test_docs.topic.to_frame('topic').
 ↪assign(predicted=topic_probabilities.idxmax(axis=1).values)
heatmap_data = predictions.groupby('topic').predicted.value_counts().unstack()
sns.heatmap(heatmap_data, annot=True, cmap='Blues');
```

```
/home/stefan/.pyenv/versions/miniconda3-latest/envs/ml4t/lib/python3.8/site-
packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```



1.5 Resources

- pyLDAvis:
  - Talk by the Author and Paper by (original) Author
  - Documentation
- LDA:

  - David Blei Homepage @ Columbia
  - Introductory Paper and more technical review paper
  - Blei Lab @ GitHub
- Topic Coherence:
  - Exploring Topic Coherence over many models and many topics
  - Paper on various Methods
  - Blog Post - Overview