FEE.org Content Recommendations & Visitor Analysis

David Veksler

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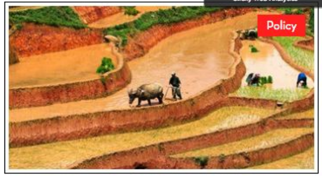
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The problem

Who are our visitors?

- What content engages users?
- What does a typical session look like?

Can we improve engagement?

- Can we push relevant content to visitors?

Solution

Build content recommendation algorithm

Analyze the content and suggest related content to users.

Process

Extract metadata	Extract features	Find related content
Build script which extracts all content from the CMS	**Convert all text fields in each article to a term frequency–inverse document frequency feature matrix**	**Given a URL, return 5 similar articles**

Part 2: Content & Visitor Analysis

https://github.com/DavidVeksler/DS3-Projects/blob/master/Final%20Project/Part%203%20-%20Exploratory%20Analysis.ipynb

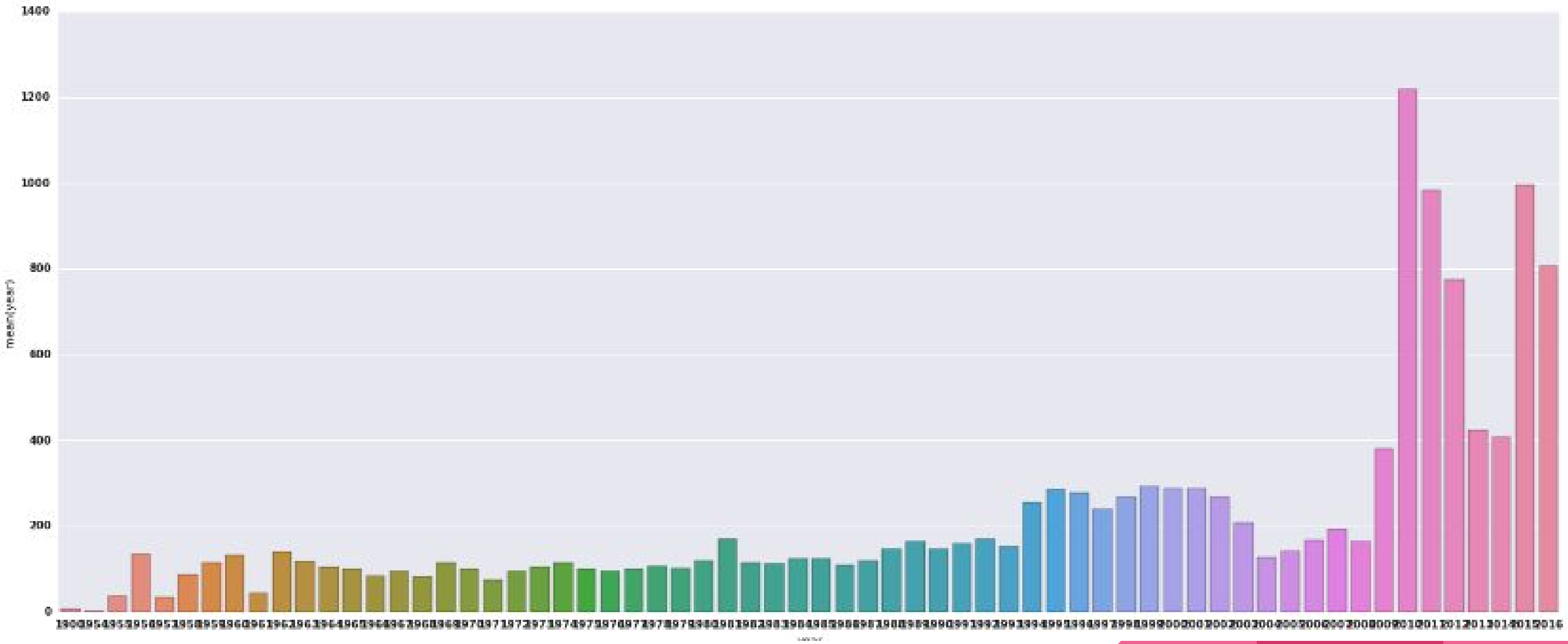
Content Analysis

- 13000 articles over 66 years
- Source: content management system

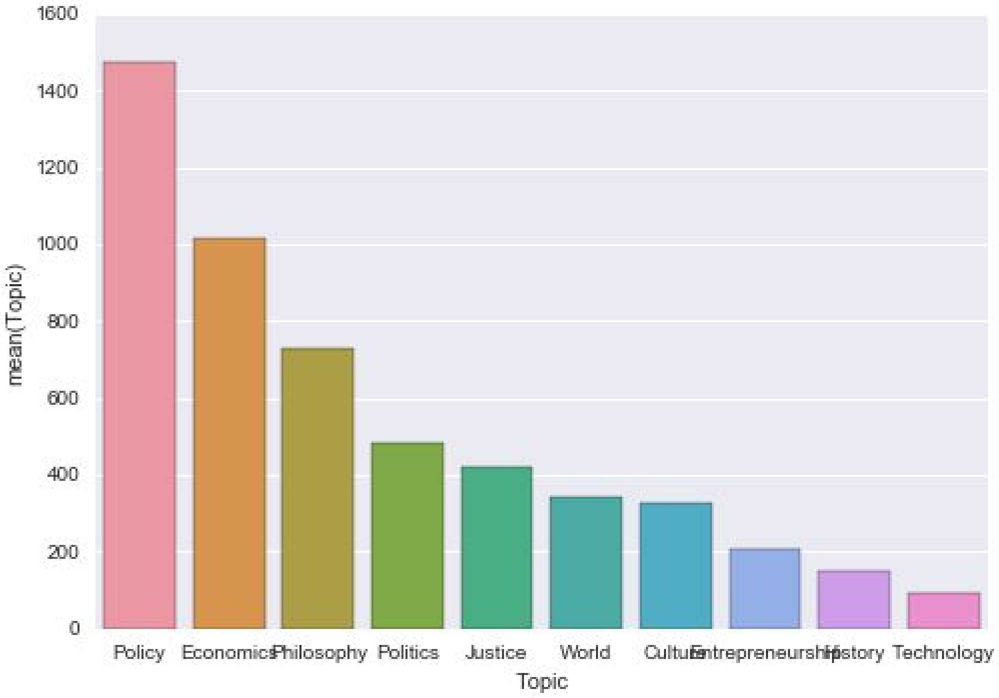
Visitor Analysis

- 50,000 actions (page views) over 11 hours
- Source: Clicky web traffic logs

Articles per year, 1952-2016



Top Categories



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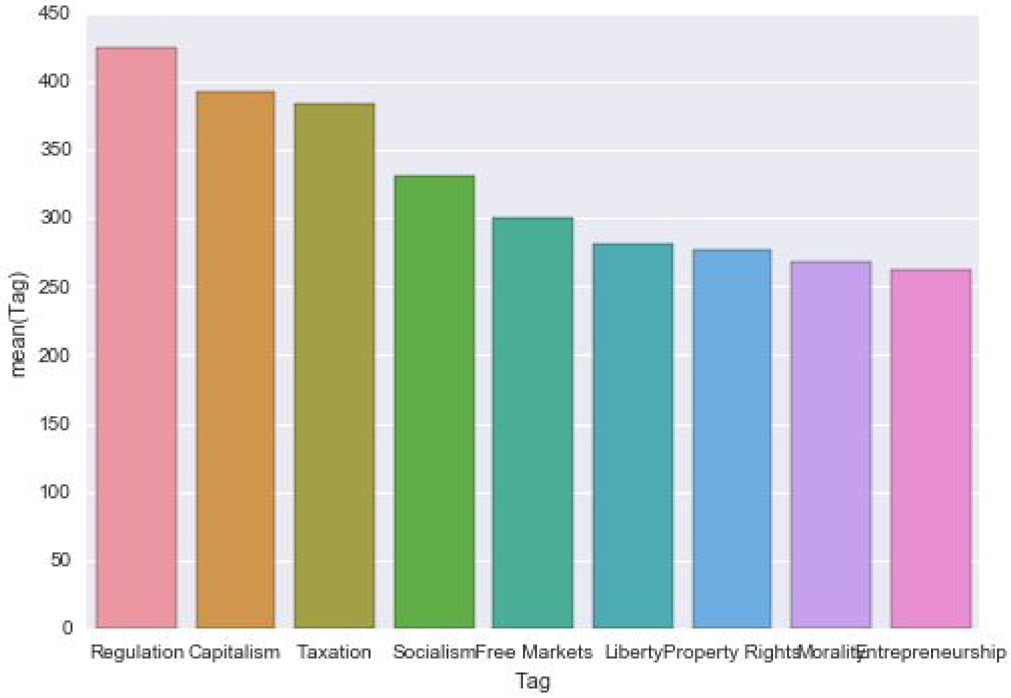
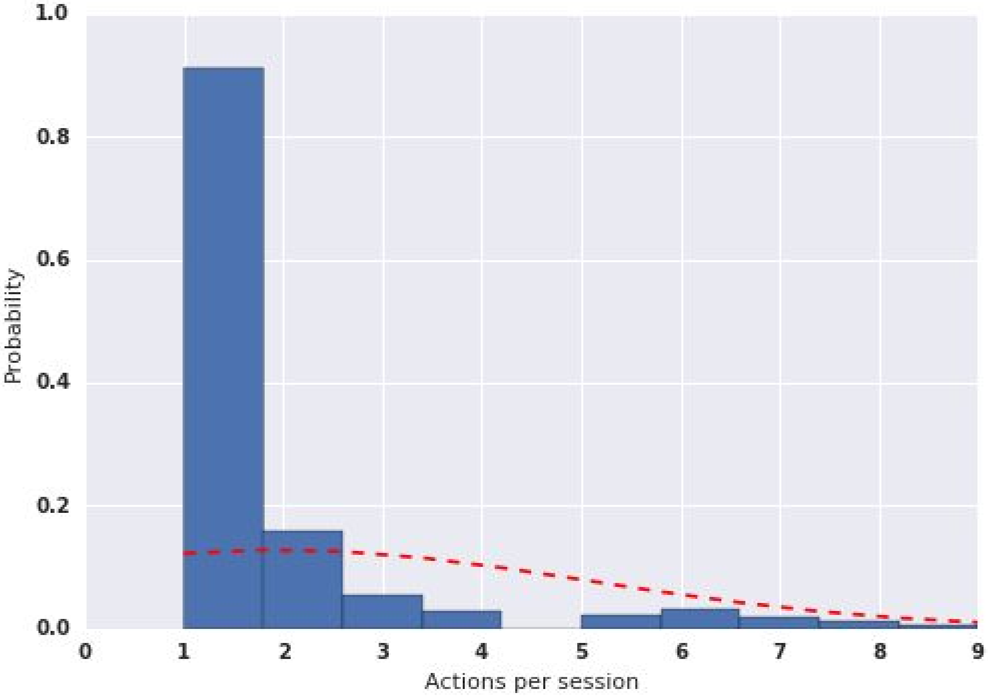
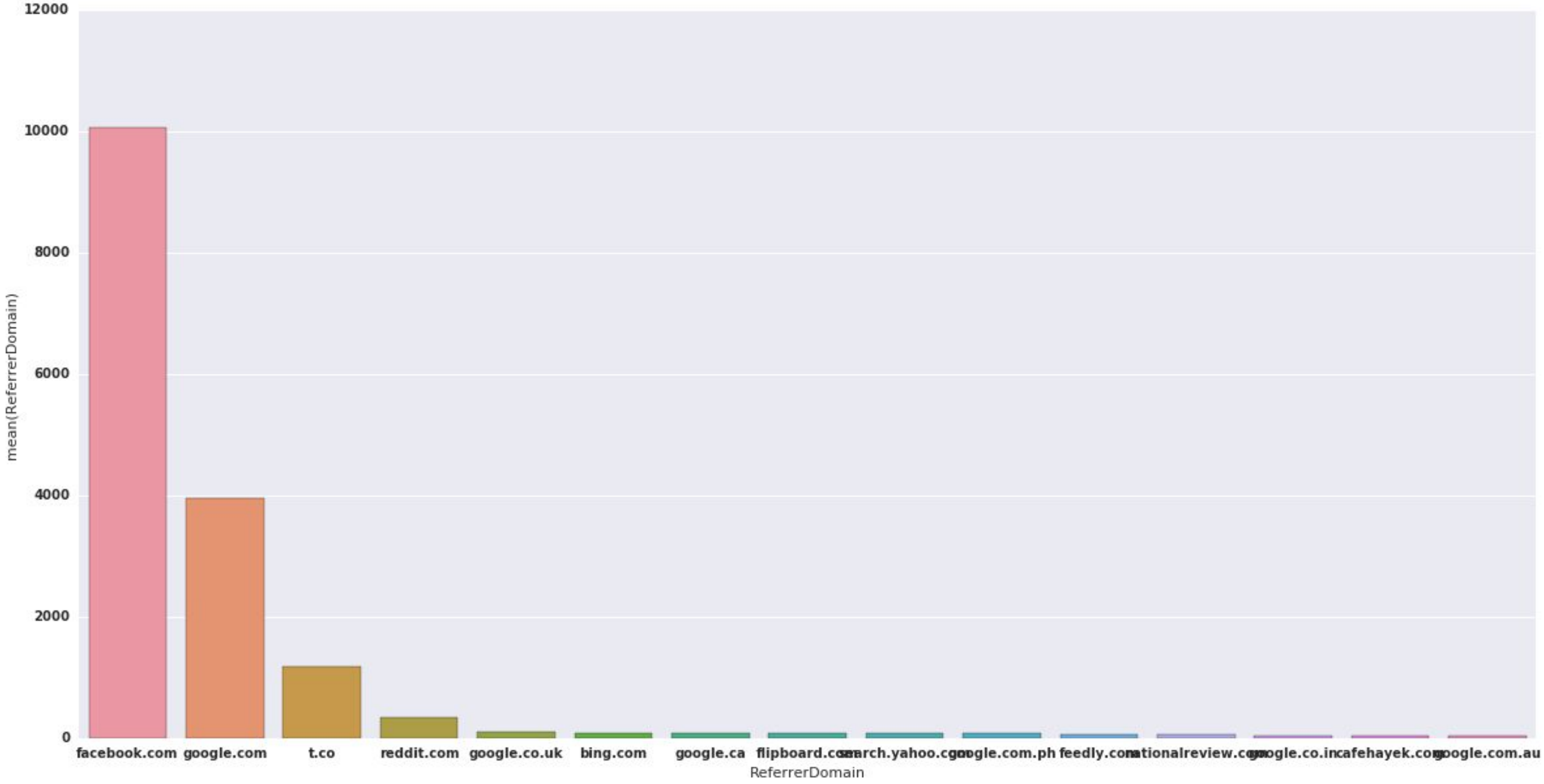


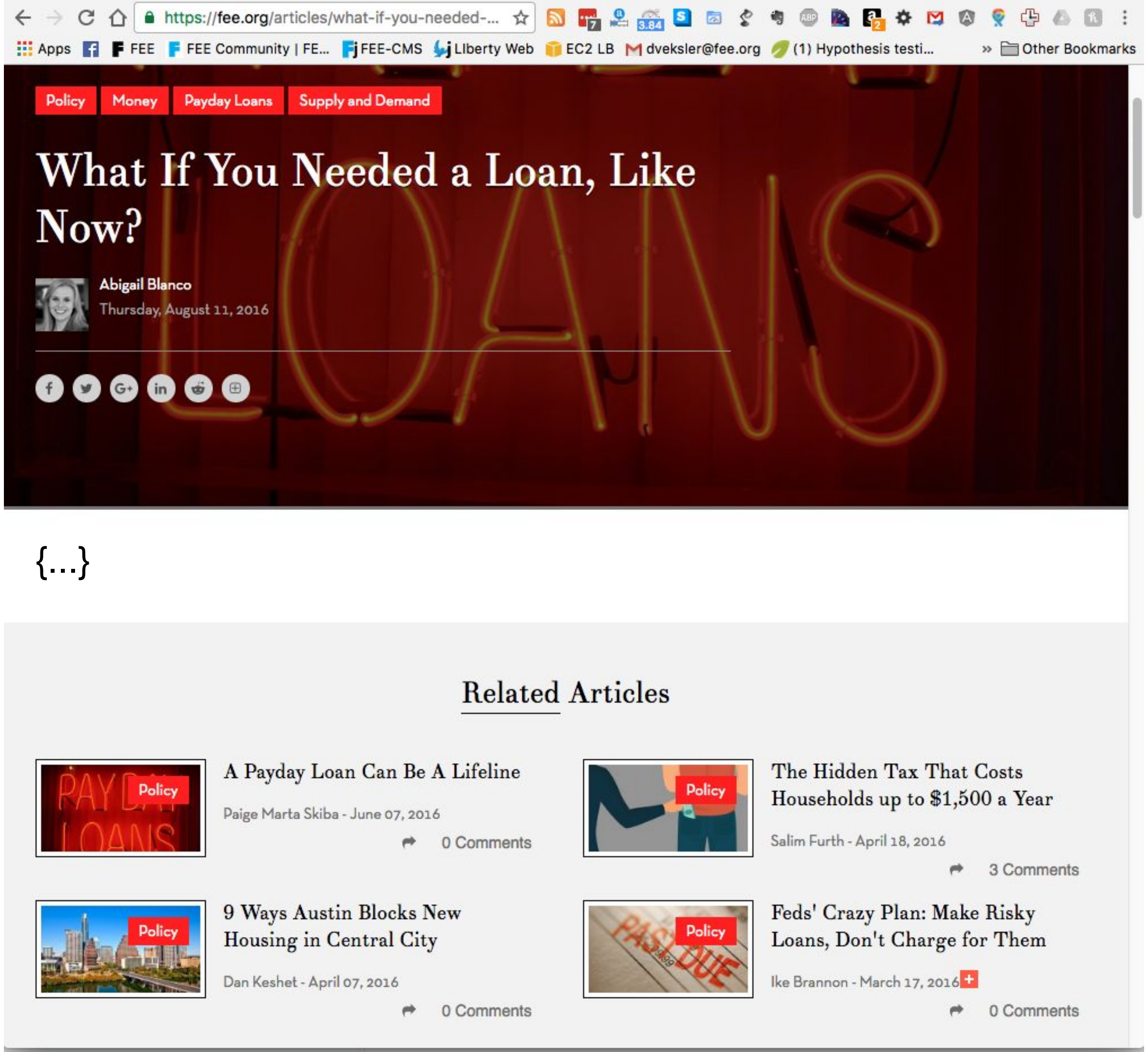
Actions per session



Top Referring domains



Part 2: Similar Article Recommendations



https://fee.org/articles/what-if-you-needed-...

Apps FEE FEE Community | FE... FEE-CMS Liberty Web EC2 LB dveksler@fee.org (1) Hypothesis testi... Other Bookmarks

Policy Money Payday Loans Supply and Demand

What If You Needed a Loan, Like Now?

Abigail Blanco
Thursday, August 11, 2016

{...}

Related Articles

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Paige Marta Skiba - June 07, 2016
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Ike Brannon - March 17, 2016
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Step 1: Extract all text fields & URLs

1. Build command-line interface to Umbraco Content Management System
2. Strip HTML.
3. Encode text to JSON.
4. Extract all values to a CSV file.

```
var articles = access.Services.ContentService.GetChildren((int)CmsTopLevelContentNodes.Articles);
var metas = new List<ArticleMetadata>();
        articles.ForEach(article =>
        {
            Console.WriteLine("{0}: {1}", article.Name, article.ToString());
                    metas.Add(GetArticleMetadata(article));
        });

        WriteMetaDataToFile(metas);
```

Pre-process CSV to Pandas Pickle

1. Convert CSV to Pandas DataFrame
2. Parse dates and convert tag to list.
3. Decode JSON strings
4. Strip HTML from content `from html.parser import HTMLParser`
5. Save DataFrame to Pandas pickle `data.to_pickle('assets\dataset\ArticleMetadata.pkl')`

```
import pandas as pd
import json

articles = pd.read_pickle('ArticleMetadata.pkl')
articles.DatePublished = pd.to_datetime(articles.DatePublished)
articles.Tags = articles.Tags.map(lambda x: str(x))
articles.TagArray = articles.Tags.map(lambda x: x.split(','))
articles.TagArray[0]
articles.head(1)
```

	Url	Title	Tags	Topic	DatePublished	Abstract	FullText
ArticleId							
12897	/articles/amc-s-halt-and-catch-fire-is-capital...	AMC's "Halt and Catch Fire" Is Capitalism's Fi...	Capitalism,Competition,Property Rights,Entrepr...	Economics	2015-09-02 10:56:24	"The show is a vibrant look at the early PC in...	"AMC's Halt and Catch Fire is a brilliant

Step 3: TfidfVectorizer

1. Extract words as features with TfidfVectorizer

```
from sklearn.feature_extraction.text import TfidfVectorizer

tfidf = TfidfVectorizer(stop_words='english',min_df=3).fit_transform(articles.RawText.dropna())
# no need to normalize, since Vectorizer will return normalized tf-idf
pairwise_similarity = tfidf * tfidf.T
```

Step 4: Compute Cosine Similarity

1. Compute the linear kernel between X and Y.

```
from sklearn.metrics.pairwise import linear_kernel

def FindSimiliarArticles(url, tfidf_matrix, articles):
    matches = articles.loc[articles['Url']  == url].index.tolist()
    originalArticleIndex = int(matches[0])
    print("original index: %s" % originalArticleIndex)
    cosine_similarities = linear_kernel(tfidf_matrix[originalArticleIndex], tfidf_matrix).flatten()
    print("cosine_similarities: %s" % cosine_similarities)
    related_docs_indices = cosine_similarities.argsort()[:-5:-1]
    print('related articles: ' % related_docs_indices)
    related_articles = []
    [related_articles.append(articles.iloc[index]) for index in related_docs_indices]
    return related_articles
```

Demo

```
related = FindSimiliarArticles('/articles/how-america-can-keep-the-entrepreneurs-we-train/',tfidf,articles)
print(related)
Original index: 13795
cosine_similarities: [ 0.05772269  0.04216487  0.04971372 ...,  0.00795316  0.03272186  0.024919  ]
related articles:
Url          /articles/how-america-can-keep-the-entrepreneu...
Title          How America Can Keep the Entrepreneurs We Train
Name: 13795, dtype: object, ArticleId                                          132805
Url          /articles/immigrants-are-twice-as-likely-to-st...
Title        Immigrants Are Twice as Likely to Start a Busi...
Name: 671, dtype: object, ArticleId                                          108006
Url          /articles/why-government-jobs-programs-destroy...
Title                Why Government Jobs Programs Destroy Jobs
Name: 1076, dtype: object, ArticleId                                          129584
Url          /articles/5-charts-that-show-trumps-immigratio...
Title        5 Charts that Show Trump's Immigration Paper I...
Name: 338, dtype: object]
```

Part 3: Other Classifier & Clustering Experiments

Other experiments:

- Keyword modeling with Word2Vec Neutral Network
  - Useful for tag recommendations.
- Document clustering - K means
  - Incomplete, too complex
- Topic modeling with latent Dirichlet allocation
  - Not very good results

```
In [18]: model.most_similar(positive=

Out[18]: [('entrepreneurship', 0.7297
          ('protectionism', 0.7233507
          ('global', 0.70528000593185
          ('capitalism', 0.6833494901
          ('instability', 0.667334139
          ('technological', 0.6574413
          ('liberalization', 0.652382
          ('overpopulation', 0.638936
          ('sustainable', 0.634416639
          ('specialization', 0.627989
```

```
In [12]: num_topics= 10
         num_words_per_topic= 10

         for ti, topic in enumerate(lda_model.show_topics(num_topics,num_words_per_topic)):
             print("Topic:      %d" %   (ti))
             print(topic)
             print()

         Topic:  0
         (0, '0.001*government + 0.000*tax + 0.000*people + 0.000*moore + 0.000*tubman + 0.000*soto + 0.
         *education + 0.000*trade + 0.000*new + 0.000*economic')

         Topic:  1
         (1, '0.001*government + 0.001*venezuela + 0.001*market + 0.001*free + 0.001*state + 0.001*madur
          0.001*erhard + 0.001*economic + 0.001*jury + 0.001*amazon')

         Topic:  2
         (2, '0.002*government + 0.002*people + 0.002*market + 0.001*economic + 0.001*world + 0.001*free
          0.001*state + 0.001*new + 0.001*money + 0.001*percent')
```

The End