Project 2 - Deduplication of Spanish Articles

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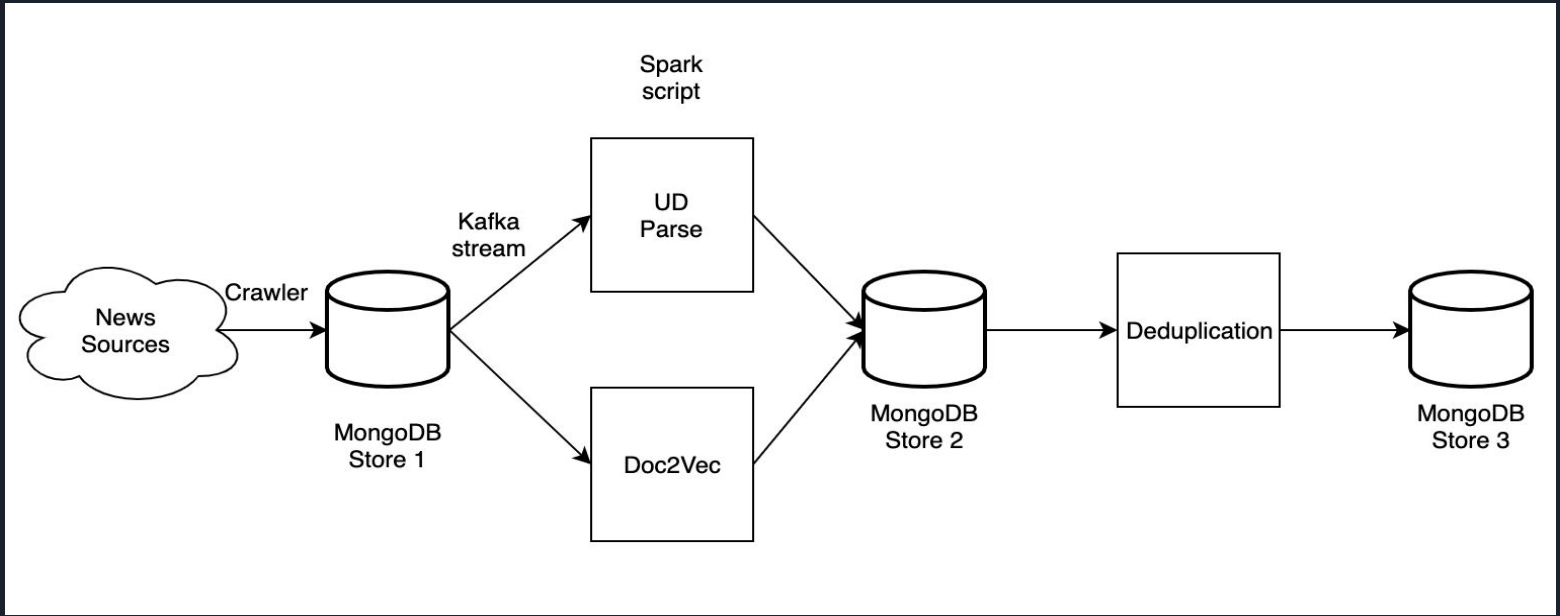
Motivation

Our project is to be a part of a pipeline for political event coding.

Our particular piece of the pipeline

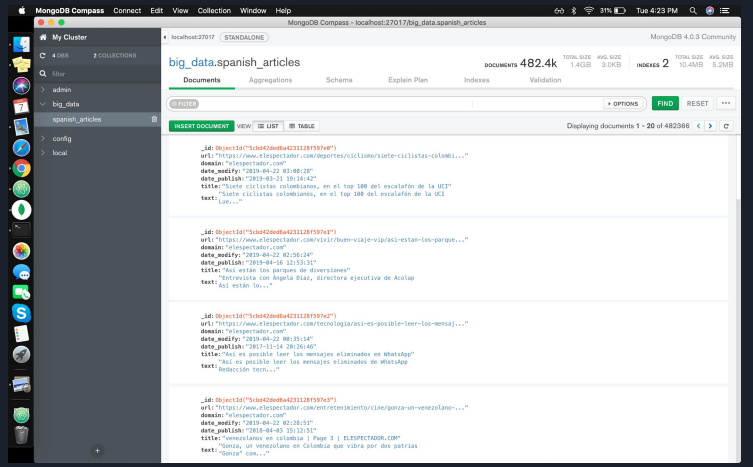
- collects Spanish news articles with a web crawler
- parses the articles into Universal Dependencies (UD)
- performs content-level deduplication
- stores the results in MongoDB

Approach - Architecture

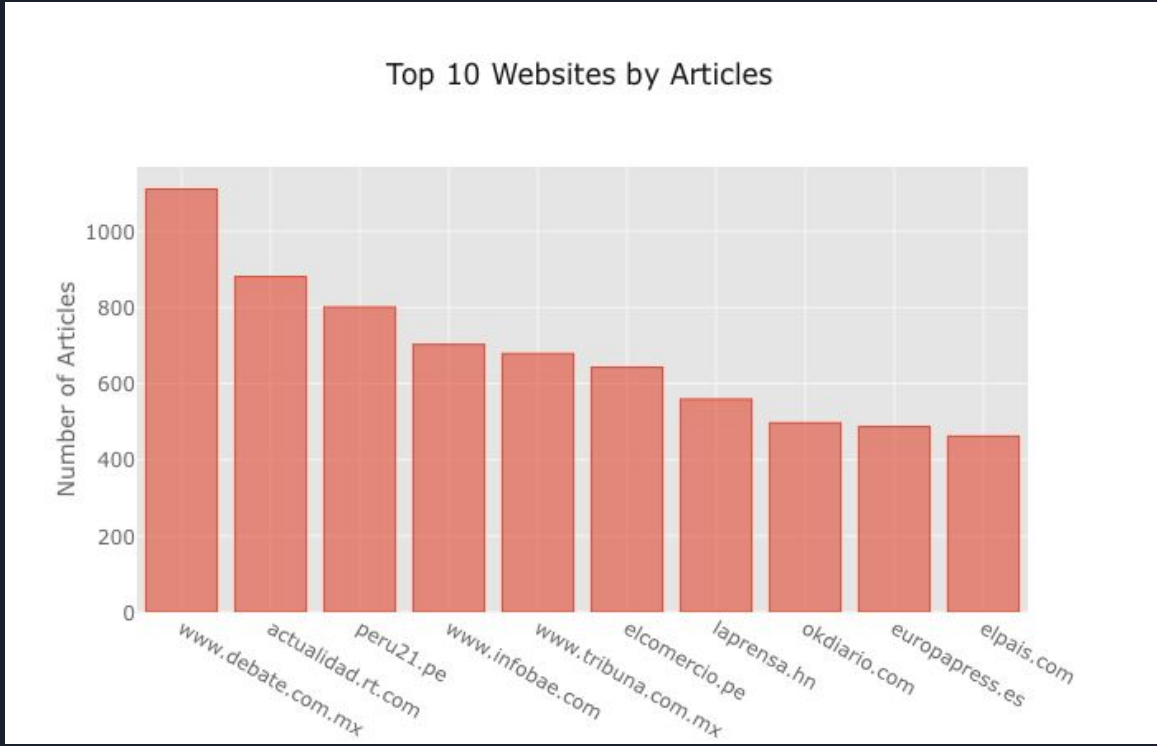


Crawler Design

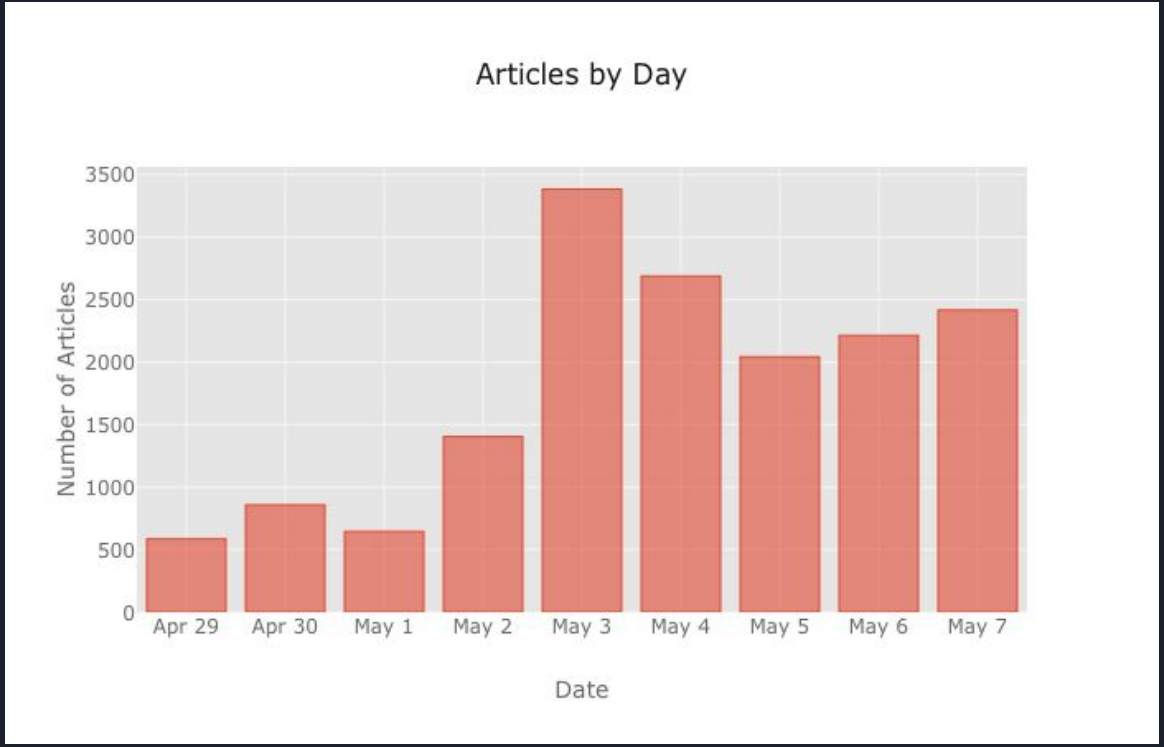
- Inconsistent data sources existed
- Crawler Options: News Please, Scrapy, RSS
- News Please: 500-600 articles per day
- Scrapy: Manual work needed per website, not scalable
- RSS: Latest articles, standard format, limited to 10-20 articles



Data Overview

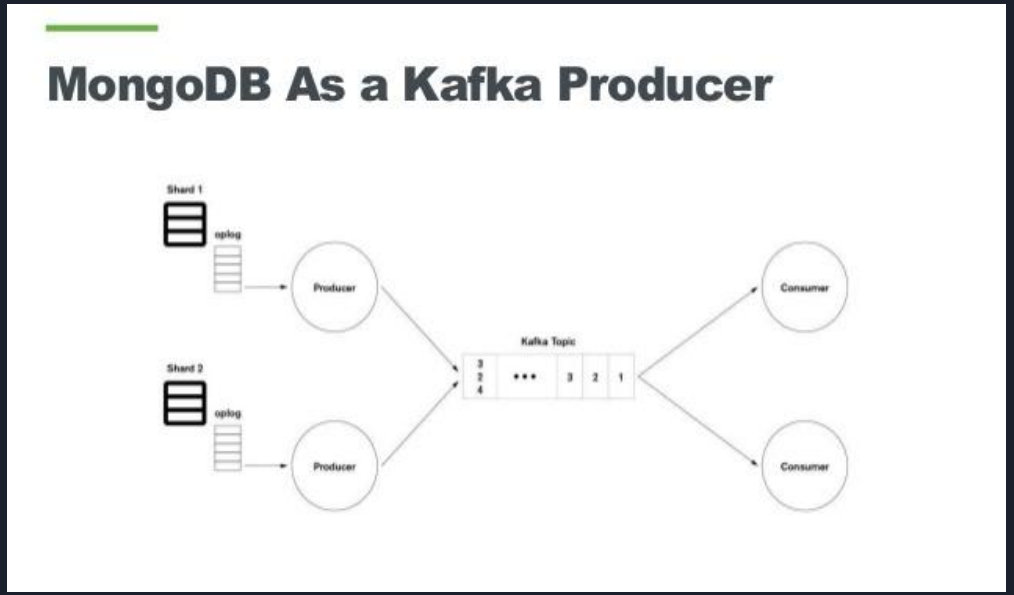


Data Overview



Interconnecting MongoDB

- Reading data in and streaming individual tables off through Kafka
- Streaming in information from Kafka to Spark in order to perform UD Parse
- Writing back to Mongo with Doc2Vec and UDparse value

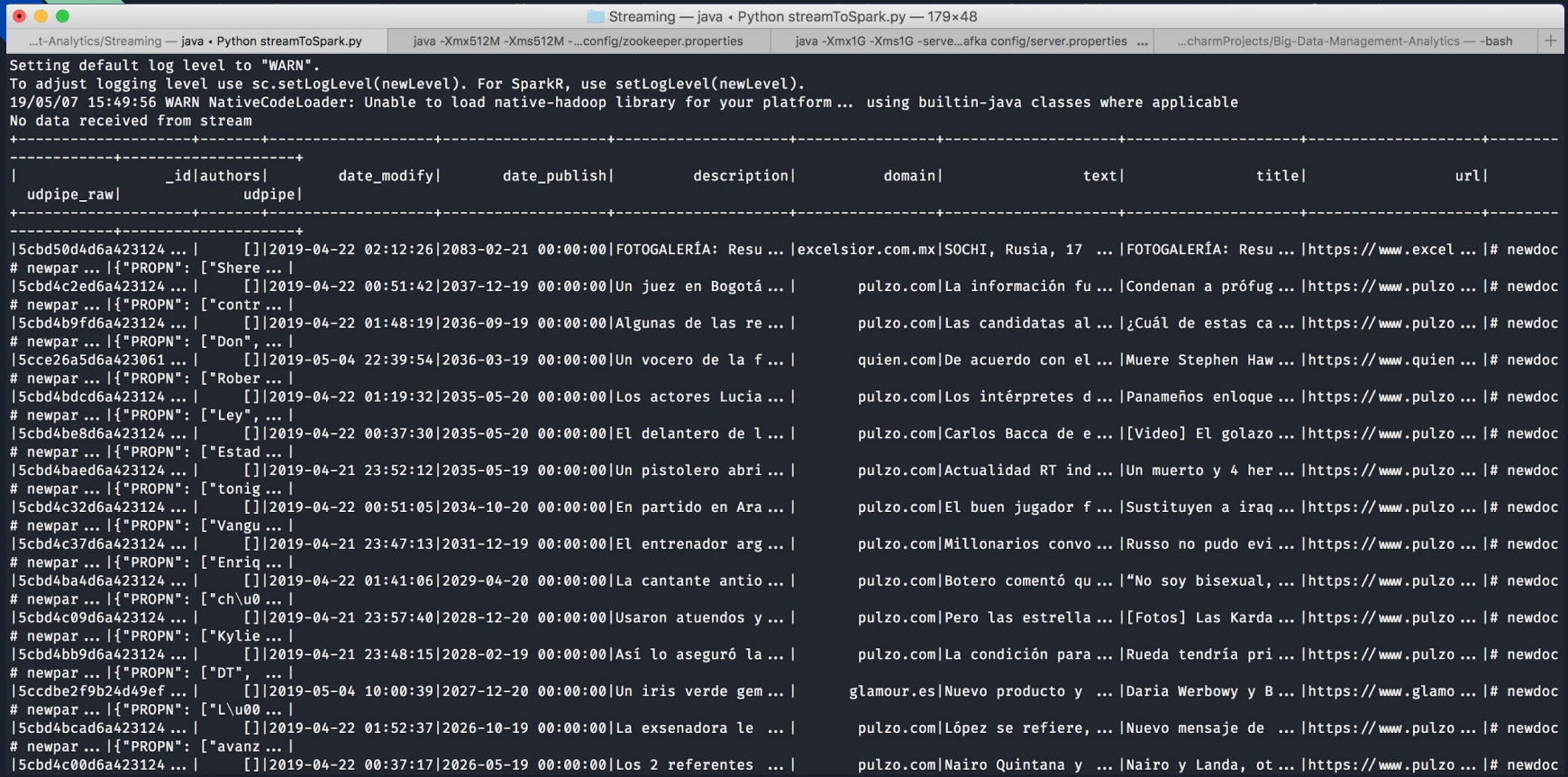


mongoDB

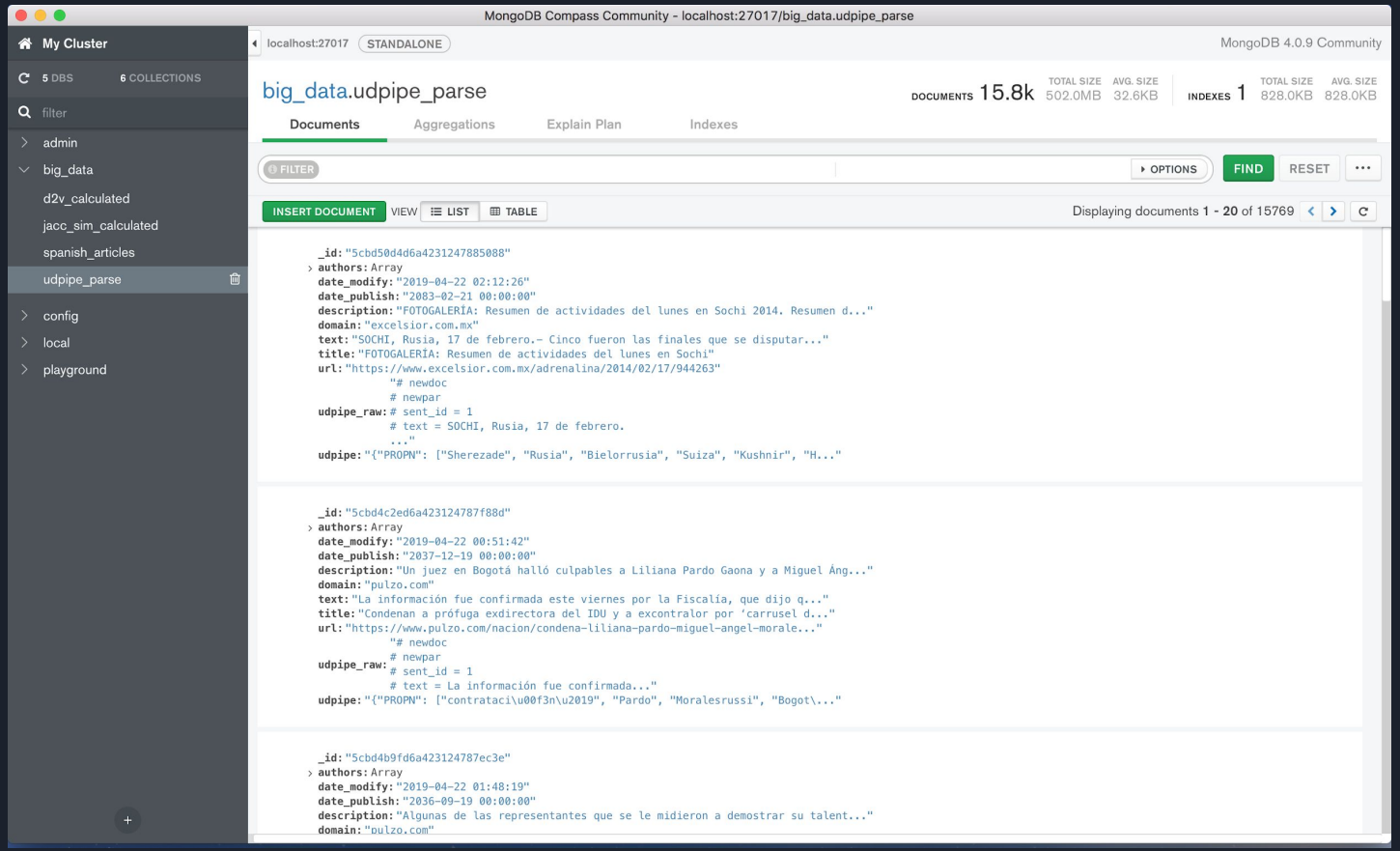
Implementation of UD Parse

- Installed ufal.udpipe package and loaded a pre-trained Spanish model (AnCora)
- Stored the articles in a Spark dataframe
- Wrote a user-defined function to parse the text for each article
- Wrote the parse to its own column in the dataframe
- Extracted important parts-of-speech from the parse and stored in a dictionary
- Wrote the POS dictionary to its own column in the dataframe
- Wrote the dataframe with UD parse columns back to MongoDB

UD Parse at Run-Time

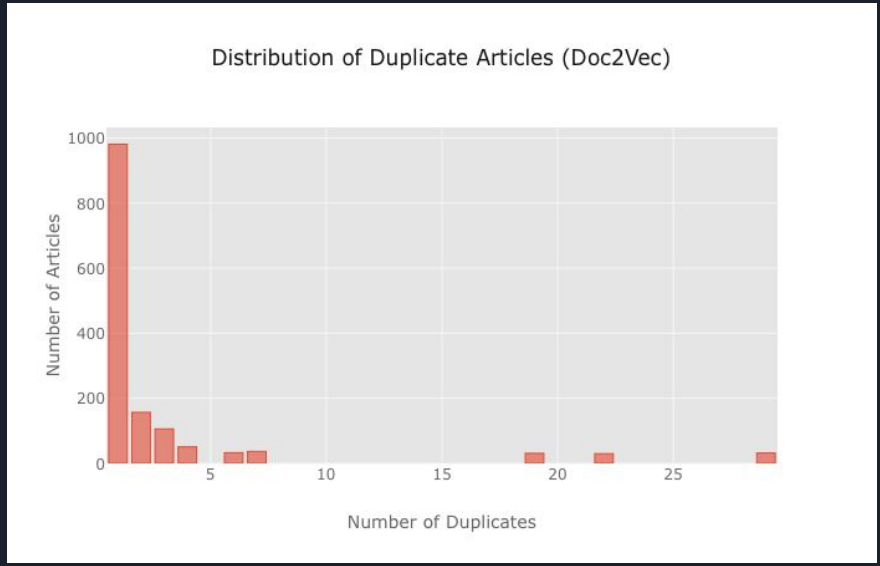


UD Parse saved back to Mongo



Doc2Vec Implementation

- Model trained on 78,154 articles from 2019
- Vectors for new articles inferred from model
- Cosine similarity calculated between vectors
- Threshold: 60%



Doc2Vec Pipeline

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Processing https://www.abc.es/internacional/abci-akihito-modernizador-monarquia-mas-antigua-mundo-201904300145_noticia.html [1/585] - 16:11:14
Processing https://www.abc.es/sociedad/abci-trafico-activa-operativo-especial-para-puente-mayo-comunidad-madrid-201904300130_noticia.html [2/585] - 16:11:15
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Jaccard Similarity Performance on 2 articles that are known to be similar

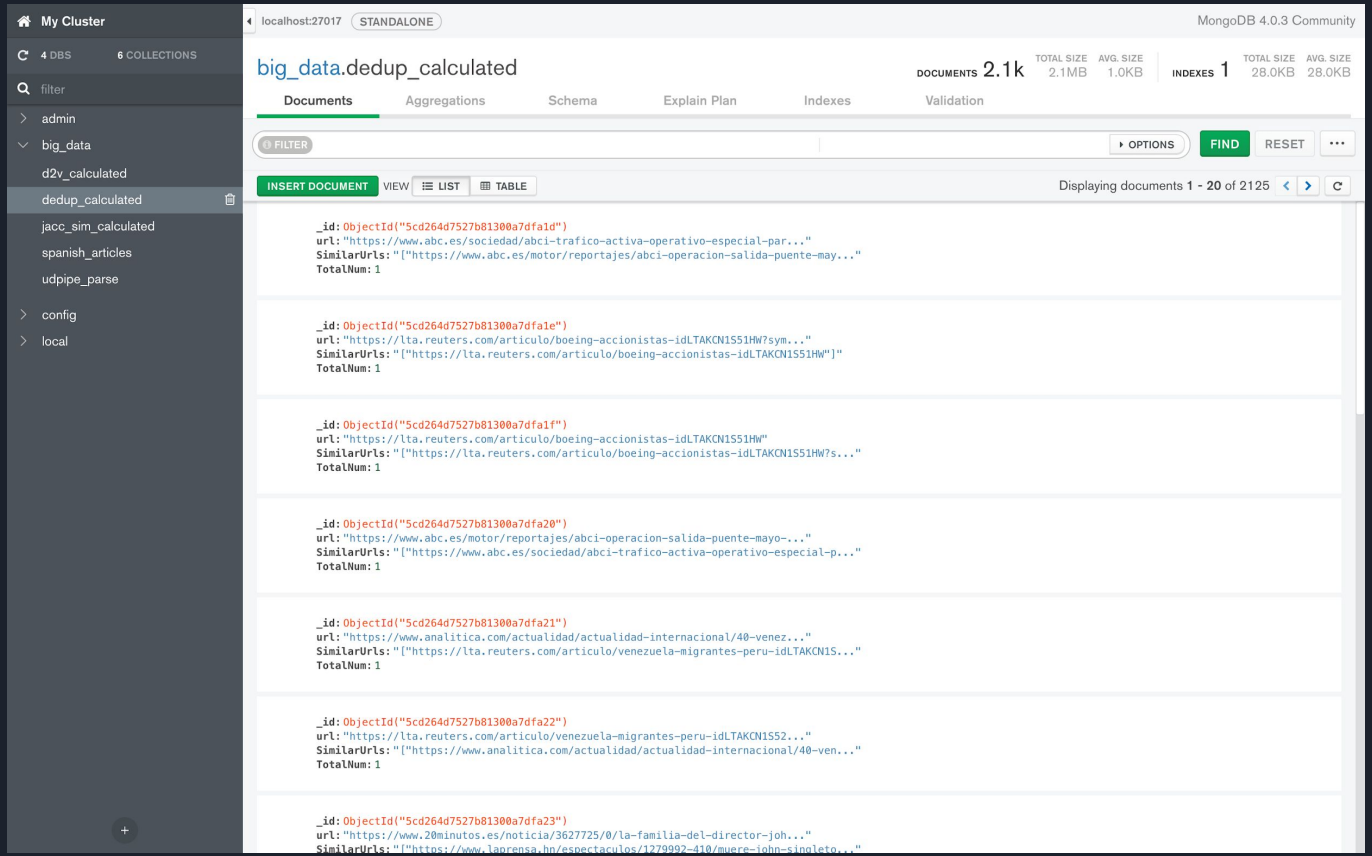
Article 1:
https://www.abc.es/sociedad/abci-chimpance-mece-bebe-lugar-matarlo-201905071807_noticia.html

Article 2:
https://elpais.com/elpais/2019/05/06/ciencia/1557142204_604164.html#?ref=rss&format=simple&link=link

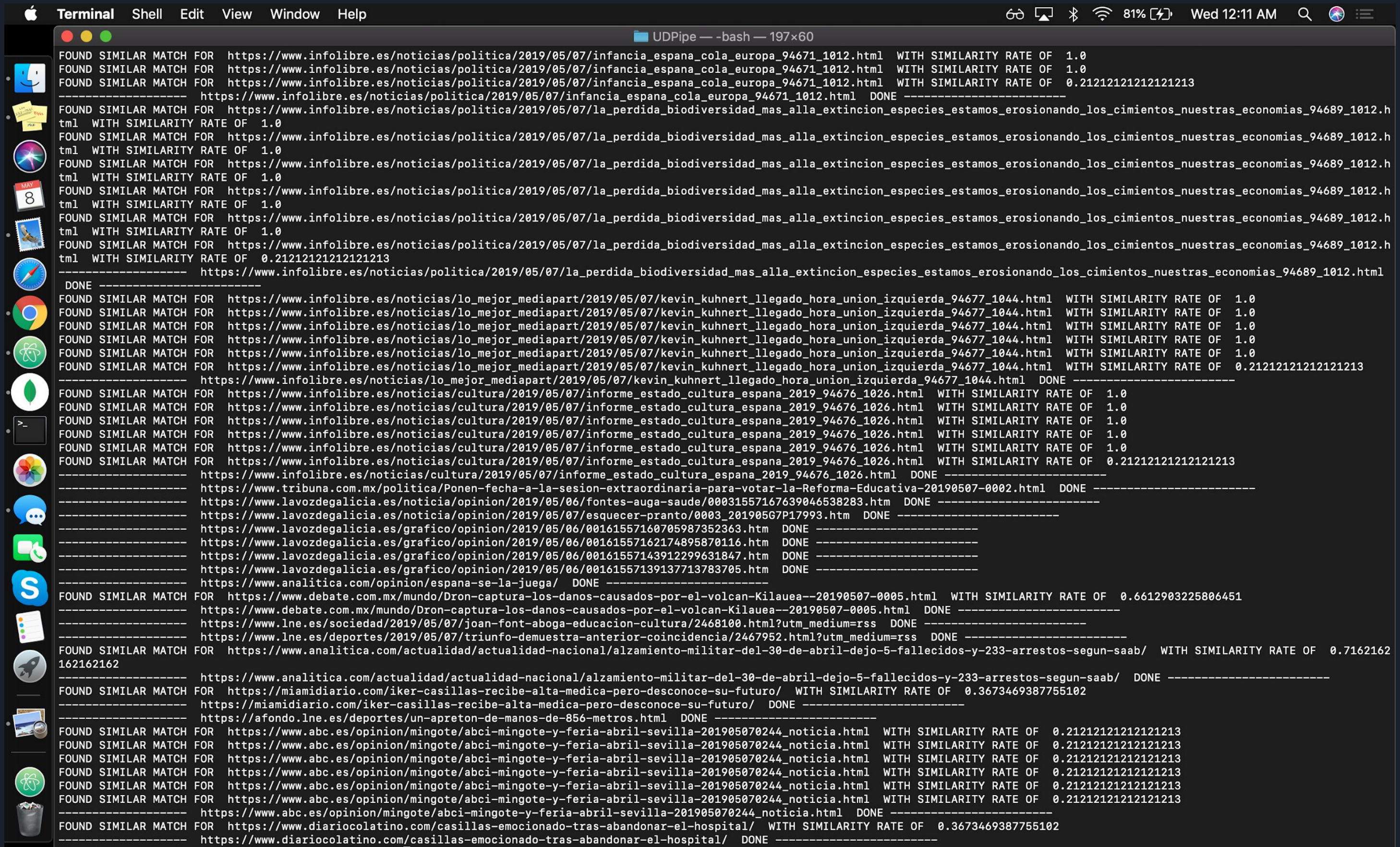
The Jaccard Similarity for the proper nouns of these two resulted in 35.714%

If two articles were not in the same context, had low resulting similarity ratios.

Results from De-Duplication



DeDuplication Algorithm at Runtime



Future Work

- Take article length into consideration (crawler grabs 1-2 word “articles” which are actually video/audio clips)
- Automate News Please crawler
- Train new models frequently to keep vocabulary up to date
- Integrate Doc2Vec with Spark
- Use a better measure of similarity for UDParse output

Challenges

- Crawler Design
- Implementation of UD Parse
- Interconnecting MongoDB with Kafka as well as Spark
- Measuring similarity using UD Parse output
- Similarity measures for deduplication

Challenge: Similarity measures for deduplication

- Doc2Vec model training takes 20 minutes for 1500 articles
- Doc2Vec models can’t be trained with new data
- Comparing 2 articles from the training data does not require too much time after training the model
- Comparing 2 articles not in the training data takes too much time
- Articles with drastically different lengths can get similar scores
- 2 duplicate articles can have a similarity rating varying from 60% to 100%. We had to fix a lower bound on the similarity rating approximation to 60%.

Related Literature

- Solaimani et al. implement a distributed workflow for political event coding by using Apache Spark, MongoDB, Stanford CoreNLP, and PETRARCH [1].
- Mustafa performs deduplication by performing word embeddings and DBSCAN, then with a notion of cluster *purity* determines how much overlap two articles have in the topics they discuss [2]. If clusters are mostly pure, i.e. belonging to one article or the other, then they are likely not duplicates. If clusters are mostly impure, i.e. with points belonging to both articles, then they are likely duplicates.

References

[1] M. Solaimani, R. Gopalan, L. Khan, P. T. Brandt and B. Thuraisingham, "Spark-Based Political Event Coding," 2016 IEEE Second International Conference on Big Data Computing Service and Applications (BigDataService), Oxford, 2016, pp. 14-23.

[2] A. M. Mustafa, "Novel Class Detection and Cross-Lingual Duplicate Detection Over Online Data Stream." Order No. 10970248, The University of Texas at Dallas, Ann Arbor, 2018.

[3] models.doc2vec – Doc2vec paragraph embeddings
https://radimrehurek.com/gensim/models/doc2vec.html

[4] Universal Dependency https://universaldependencies.org