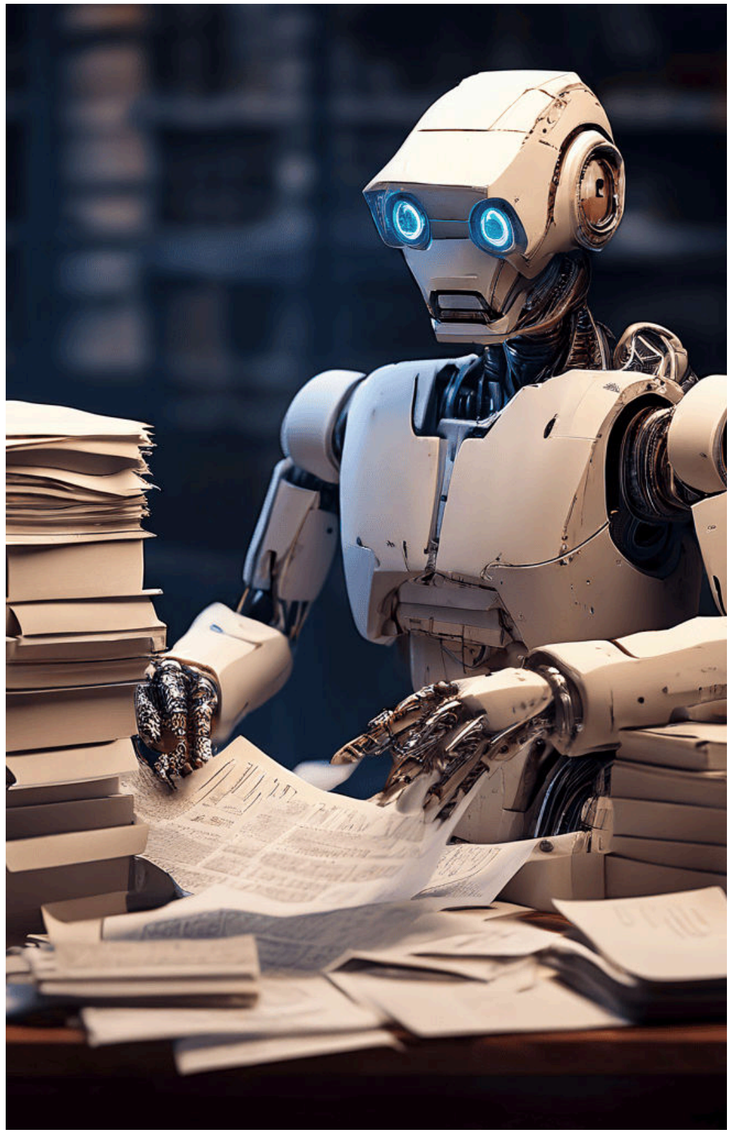
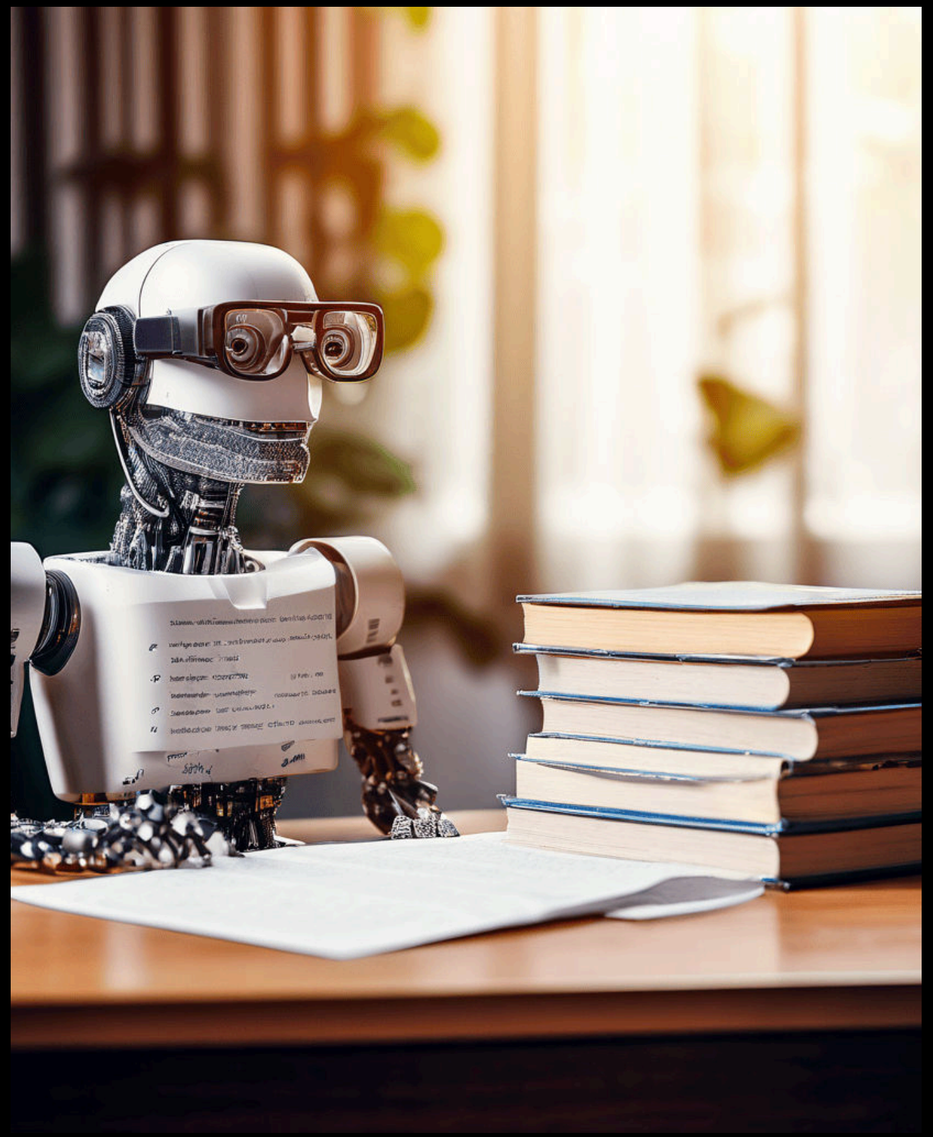


Project: NLP Document Classification

EDA findings & Recommended Models

A project by Konstantinos Soufleros



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- Country: Serbia
- Company: Data Glacier
- Specialization: NLP
- Github: https://github.com/kostas696/DG_Intern/tree/main/week11
- Internship Batch: LISUM30
- Date: 16/04/2024

Introduction

Exploratory Data Analysis (EDA) for 20 Newsgroups Dataset

Objective: Gain insights into the 20 Newsgroups dataset and understand its characteristics for text classification and clustering.

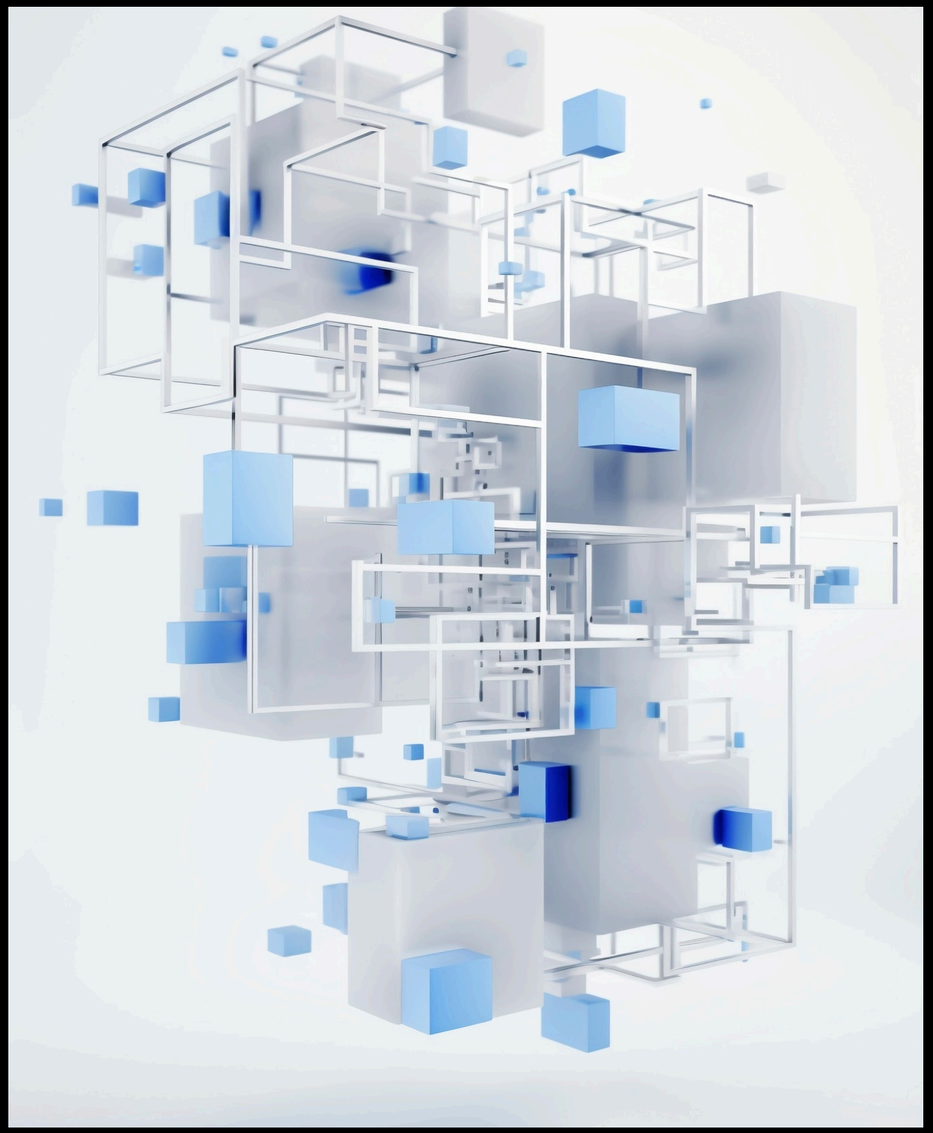
Significance: The 20 Newsgroups dataset, containing approximately 20,000 newsgroup documents, is widely used in machine learning research for text-based applications.

Agenda

- Problem Description
- Data Information
- Data Understanding
- Exploratory Data Analysis (EDA)
- Modeling Recommendation

Problem Description

The problem revolves around analyzing a dataset containing newsgroup documents categorized into various topics. The **primary objective** is to gain insights into the content of these documents, understand the prevalent themes within each newsgroup, and identify any patterns or trends present in the data.



Data Information

Total number of observations: 19997

Total number of newsgroups: 20

Number of observations per newsgroup:
rec.sport.hockey: 1000
sci.med: 1000misc.forsale: 1000
alt.atheism: 1000
rec.sport.baseball: 1000
rec.autos: 1000
comp.sys.ibm.pc.hardware: 1000
rec.motorcycles: 1000
talk.politics.mideast: 1000
talk.politics.misc: 1000
talk.politics.guns: 1000
talk.religion.misc: 1000
comp.windows.x: 1000
sci.space: 1000
comp.graphics: 1000
comp.sys.mac.hardware: 1000
comp.os.ms-windows.misc: 1000
sci.crypt: 1000
soc.religion.christian: 997
sci.electronics: 1000

Size of the data (in bytes): 46132928

This balanced distribution ensures that there is no bias towards any particular category during the analysis.

Data Understanding

The dataset consists of documents from 20 different newsgroups, covering a wide range of topics such as sports, religion, politics, technology, and more. Each document is labeled with its corresponding newsgroup category, providing a structured format for analysis.

The data is structured and tabular, organized into a pandas DataFrame with two columns: 'Newsgroup' and 'Original_Content'.

- No missing values
- Document length variation
- Presence of special characters, numbers, and stopwords.
- Need for preprocessing

Exploratory Data Analysis (EDA)

- Dataset Extraction
- Dataset Exploration
- Data Preprocessing: Removed metadata headers, emails, numbers, and 'GMT' indicators. Tokenized the text and converted words to lowercase. Removed stopwords, punctuation, and single characters. Lemmatized the tokens to their base forms. Use of two methods for preprocessing.
- Visualizations: Generated WordClouds for each newsgroup to visualize common words. Plotted the distribution of document lengths after the preprocessing. Displayed average document lengths per newsgroup.
- Insights: Derived insights from the data exploration process.

Preprocessing with two methods

Original Text
print(df["Original_Content"][1500])

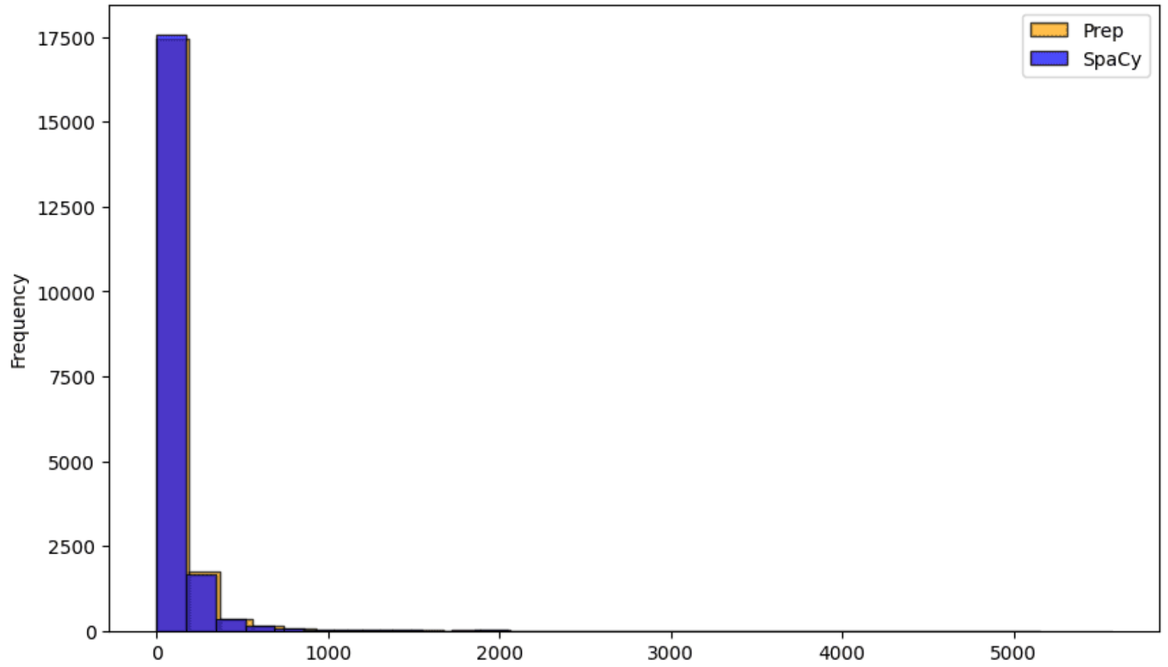
Xref: cantaloupe.srv.cs.cmu.edu sci.research:4033 sci.med:58154 alt.psychoactives:2253 sci.psychology:11783Newsgroups: sci.research,sci.med,alt.psychoactives,sci.psychologyPath: cantaloupe.srv.cs.cmu.edu!crabapple.srv.cs.cmu.edu!fs7.ece.cmu.edu!europa.eng.gtefsd.com!howland.reston.ans.net!zaphod.mps.ohio-state.edu!uwm.edu!ux1.cso.uiuc.edu!usenet.ucs.indiana.edu!jh224-718622.ucs.indiana.edu!userFrom: bshelley@ucs.indiana.edu ()Subject: Xanax...please provide infoMessage-ID: <bshelley-060493181020@jh224-718622.ucs.indiana.edu>Followup-To: sci.research,sci.med,alt.psychoactives,sci.psychologySender: news@usenet.ucs.indiana.edu (USENET News System)Nntp-Posting-Host: jh224-718622.ucs.indiana.eduOrganization: Indiana UniversityDate: Tue, 6 Apr 1993 23:15:26 GMTLines: 9I am currently doing a group research project on the drug Xanax. I wouldbe exponentially gracious to receive any and all information you couldprovideme regarding its usage, history, mechanism of reaction, side effects, andother pertinent information. I don't care how long or how short yourresponse is.Thanks in advance!Brent E. Shelley

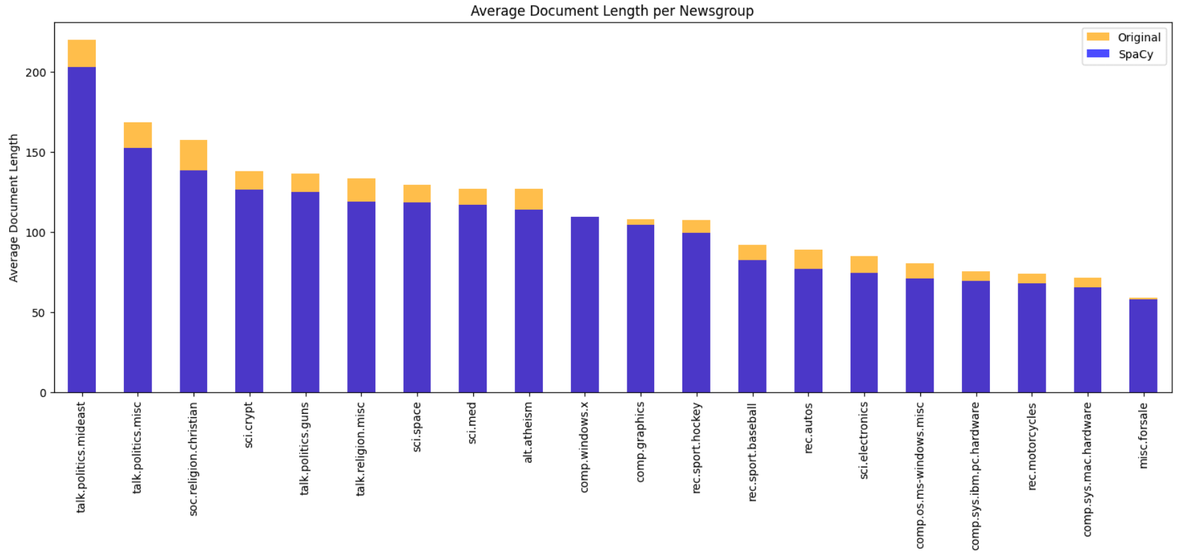
Preprocessing with first method
df["Content_prep"][1500]

'currently group research project drug xanax would exponentially gracious receive information could provide regarding usage history mechanism reaction side effect pertinent information care long short response thanks advance brent shelley'

Preprocessing with SpaCy
df['Content_spacy'][1500]

'currently group research project drug xanax exponentially gracious receive information provide usage history mechanism reaction effect pertinent information care long short response thank advance brent shelley'





Most Common Words in Preprocessed Content:

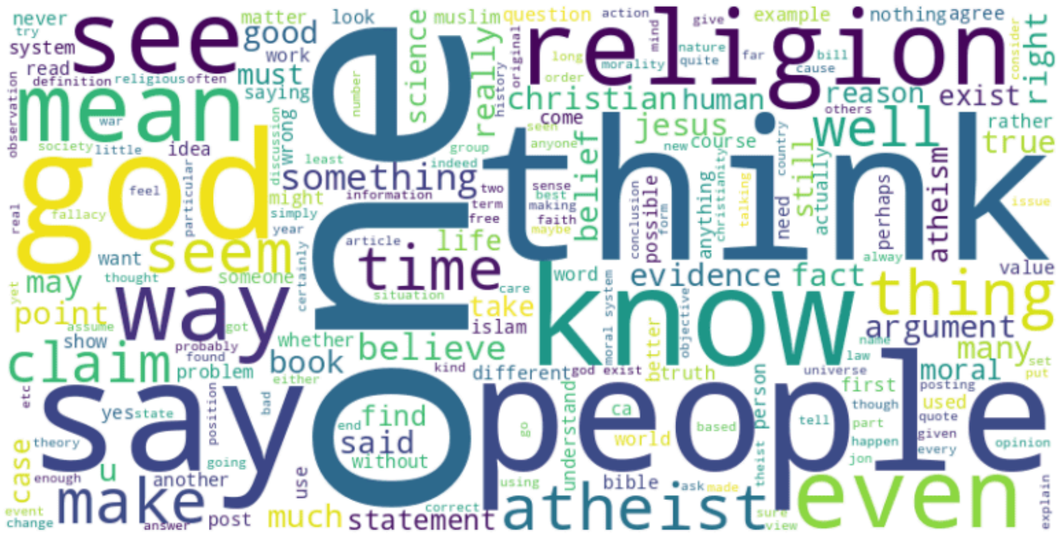
[('would', 16216), ('one', 15072), ('people', 9881), ('like', 9479), ('know', 9084), ('get', 8754), ('time', 7730), ('think', 7646), ('also', 7117), ('could', 6510), ('use', 6416), ('make', 6262), ('say', 5999), ('right', 5878), ('good', 5600), ('year', 5568), ('way', 5507), ('even', 5503), ('system', 5451), ('new', 5370)]

Most Common Words in SpaCy Content:

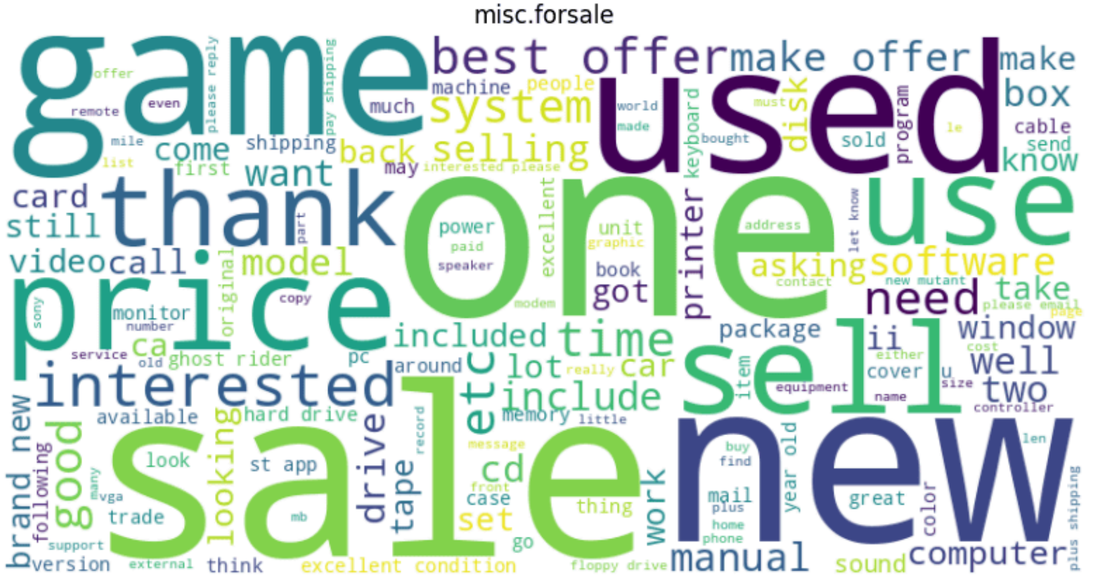
[('know', 10850), ('people', 9919), ('like', 9741), ('think', 9405), ('x', 8369), ('time', 7830), ('good', 7492), ('use', 7267), ('say', 6743), ('work', 6190), ('right', 5832), ('year', 5681), ('want', 5675), ('go', 5671), ('new', 5616), ('way', 5580), ('come', 5368), ('thing', 5339), ('look', 5261), ('find', 5128)]

WordCloud Examples

alt.atheism



misc.forsale



sci.med

rec.sport.hockey

For Technical Users

Modeling Approach

- **Preprocessed Dataset:** Utilized preprocessing techniques including metadata removal, tokenization, lemmatization, and TF-IDF feature representation.
- **Feature Representation**: We will utilize TF-IDF (Term Frequency-Inverse Document Frequency) for feature representation.
- **Model Training and Evaluation**: Train models including Naive Bayes and SVM (Support Vector Machine) with linear kernel. Evaluate models using F1-score and ROC-AUC score.
- **Evaluation Metrics**: F1-score: Measures the balance between precision and recall. ROC-AUC score: Indicates the model's ability to distinguish between classes.

Conclusion

In conclusion, advanced text classification using NLP opens up a world of possibilities for extracting insights from unstructured text data. By leveraging cutting-edge techniques, organizations can unlock valuable information and improve decision-making processes.

Thanks!

Do you have any questions?
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