LEONARDO BARGIOTTI

NEWS CLASSIFIER

DATA MINING AND MACHINE LEARINIG

PROJECT GOALS

News Classifier is an application that exploit text mining to categorize news with the right topic.

The application can work with different dataset, but they must have the same structure, that is: one column for text in input and another one for the true class.

DATASET DESCRIPTION

AG News

- ***Source:*** https://www.kaggle.com/datasets/amanandrai/ag-news-classification-dataset?select=train.csv
- ***Classes:*** "world", "sports", "business", and "science"
- ***Volume***: training samples is 120,000 and testing 7,600.

BBC News

- ***Source:*** https://www.kaggle.com/code/rockystats/bbc-text-classification-word2vec-vs-tf-idf/data
- ***Classes***: "tech", "business", " sport", "entertainment", " politics"
- ***Volume***: dataset samples is 2225.

NEWS CLASSIFICATION

PRE-PROCESSING

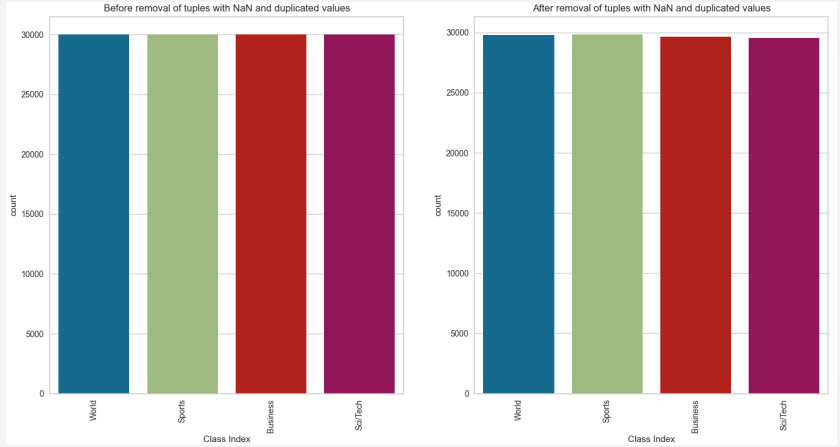
LEARNING PHASE

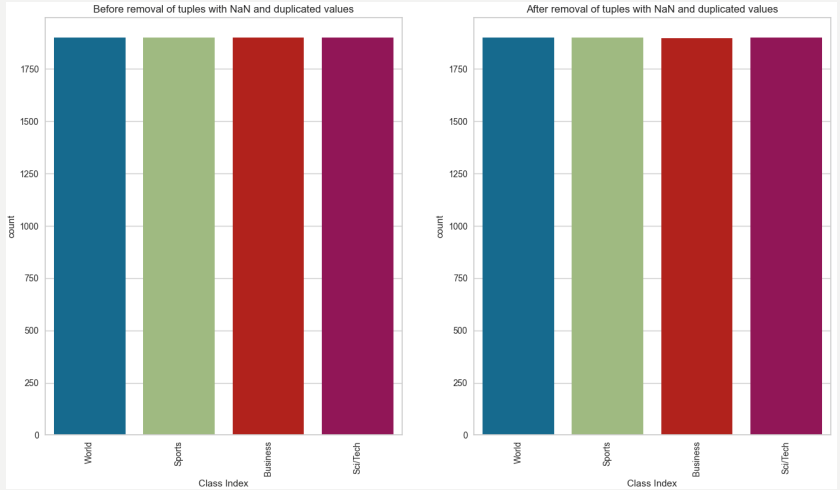
RESULTS

PRE-PROCESSING

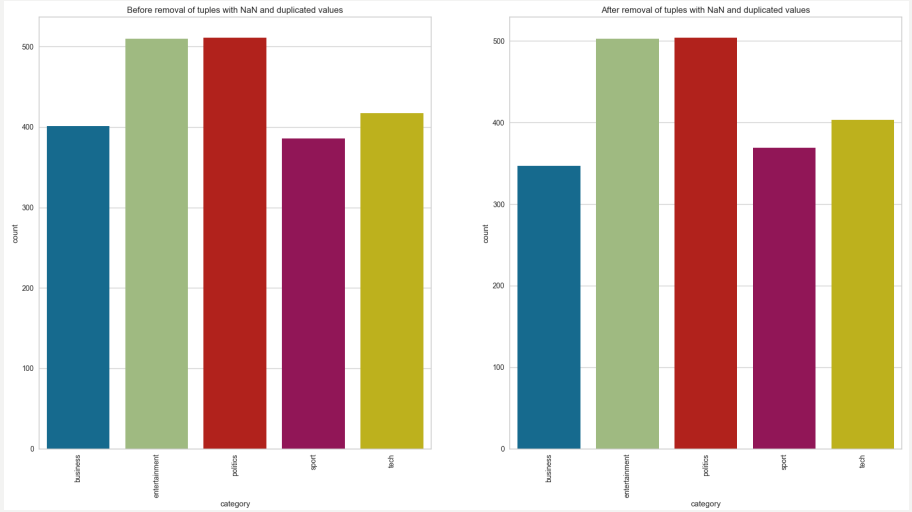
REMOVING DUPLICATES AND MISSING VALUE

AG News





BBC NEWS



TEXT PRE-PROCESS

PRE-PROCESS

- Apply:
  - Lowercase
  - Expanding Contractions
- Removing:
  - Stopwords
  - Digits
  - Punctuation
  - Diactrics
  - HTML Tags
  - URLs
  - Extra Whitespaces

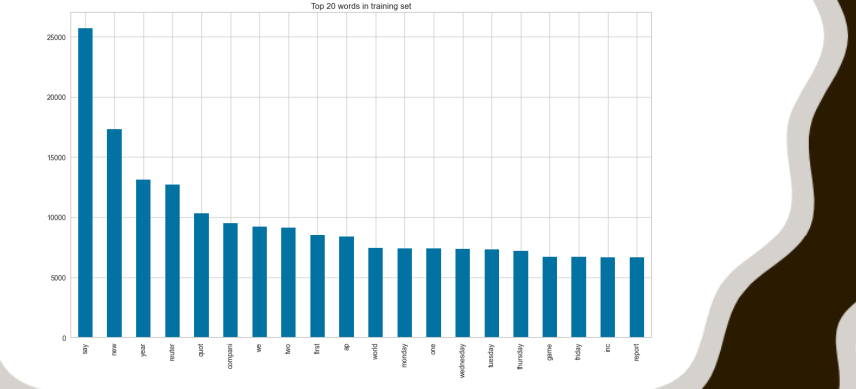
STEMMING

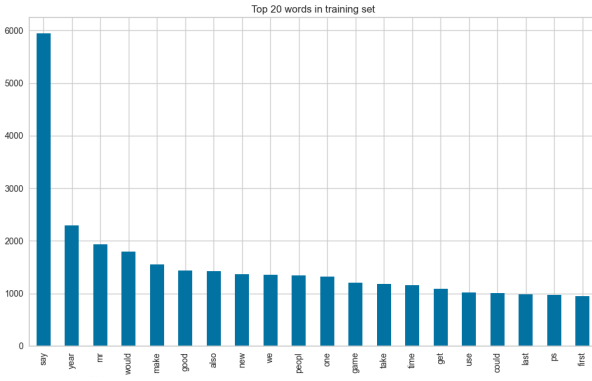
Stemming is the process of reducing words to their root form.

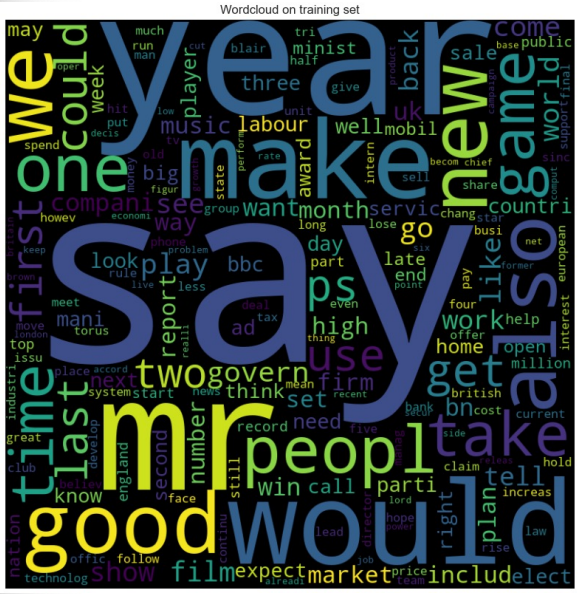
LEMMATIZATION

The goal of lemmatization is the same as for stemming.

Lemmatization, on the other hand, is a tool that performs full morphological analysis to more accurately find the root.







PRE-PROCESSING RESULTS

LEARNING PHASE

CLASSIFICATION

The goal of **TfidfVectorizer** is to convert text data into numerical data that's intended to reflect how important a word is to a document.

Tf is the number of times a term appears in a particular document, **Idf** is a measure of how common or rare a term is across the entire corpus of documents.

The higher is the value, the more relevant the term is in that document.

- Classifiers:
  - MultinomialNB
    - alpha: [1, 0.9, 0.8, 0.7, 0.6, 0.5, , 0.4, 0.3, 0.1, 0.05, 0.01, 0.001, 0.0001, 0.00001]
  - Logistic Regression
    - C : [100, 75, 50, 2515, 10, 5, 3, 1, 0.1, 0.05, 0.01]
    - solver: ['liblinear', 'newton – cg']
  - SGD Classifier
    - eta0: [0.0, 0.03, 0.01, 0.003, 0.001, 0.0003],
    - penalty: ['l1', 'l2', 'elasticnet']
    - alpha: [1, 0.3, 0.1, 0.03, 0.01, 0.003, 0.001, 0.0003, 0.0001]
    - loss: ['log loss', 'modified huber']

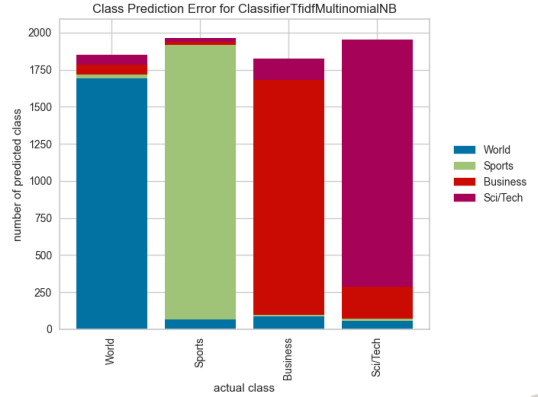
AG News

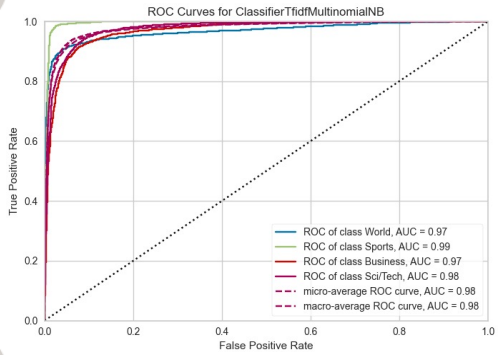
- MultinomialNB
  - alpha: 0.3
  - best score: 0.895
- Logistic Regression
  - C: 3, solver: 'liblinear'
  - best score: 0.9
- SGD Classifier
  - eta0: 0.0, penalty: 'l2', alpha: 0.0001, loss: 'modified huber'
  - best score: 0.901

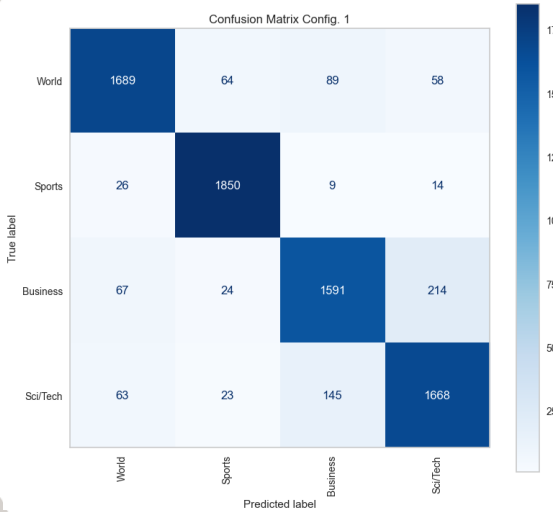
BBC News

- MultinomialNB
  - alpha: 0.7
  - best score: 0.976
- Logistic Regression
  - C: 100, solver: 'liblinear'
  - best score: 0.981
- SGD Classifier
  - eta0: 0.0, penalty: 'l2', alpha: 0.003, loss: 'modified huber'
  - best score: 0.98

RESULTS

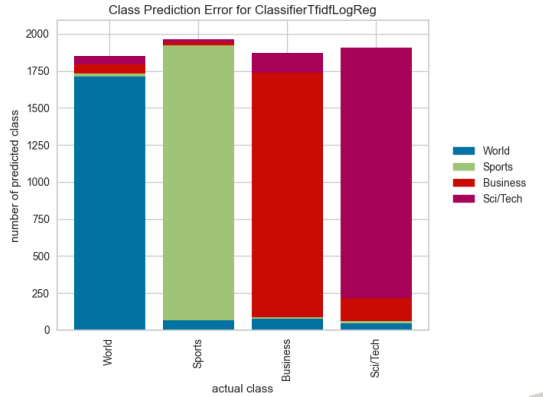


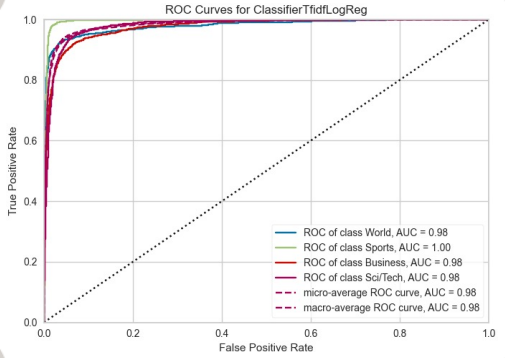


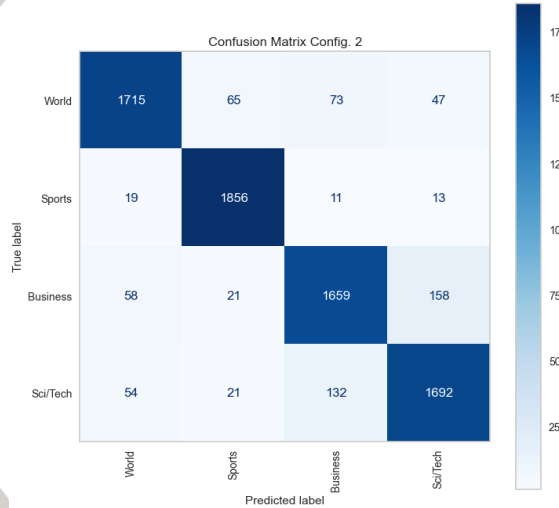


	Precision	Recall	F1-Score	Support
World	0.92	0.89	0.90	1900
Sports	0.94	0.97	0.96	1899
Business	0.87	0.84	0.85	1896
Sci/tech	0.85	0.88	0.87	1899
Accuracy			0.90	7594
Macro Avg	0.89	0.90	0.89	7594
Weighted Avg	0.90	0.90	0.89	7594

MULTINOMIAL NB AG NEWS







	Precision	Recall	F1-Score	Support
World	0.93	0.90	0.92	1900
Sports	0.95	0.98	0.96	1899
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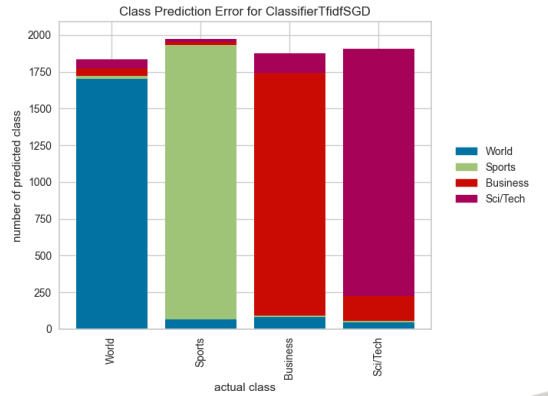
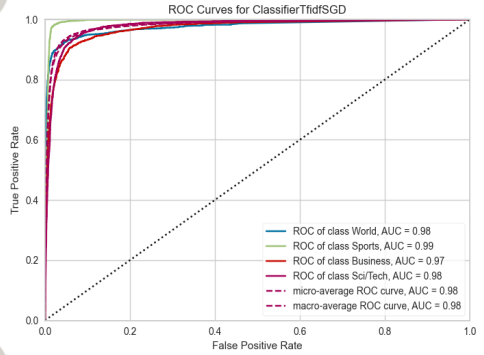
Accuracy			0.91	7594
Macro Avg	0.91	0.91	0.81	7594
Weighted Avg	0.91	0.91	0.91	7594

LOGISTIC REGRESSION AG NEWS





SGD CLASSIFIER AG NEWS

	Precision	Recall	F1-Score	Support
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Sports	0.94	0.98	0.96	1899
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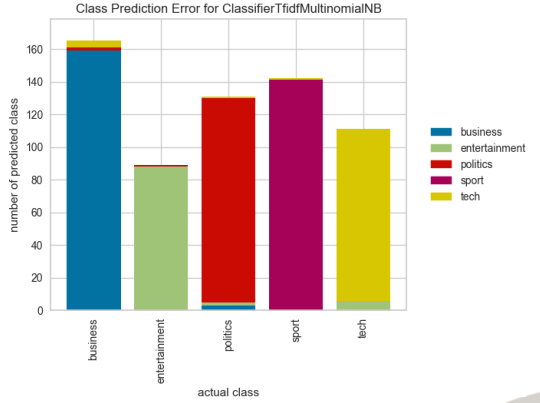
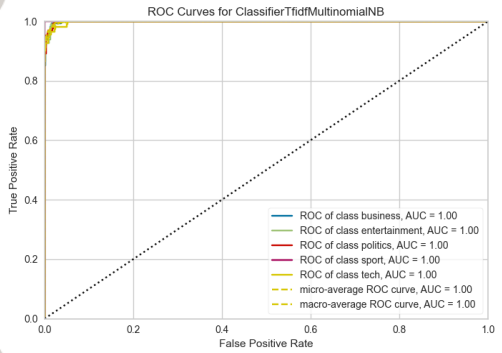
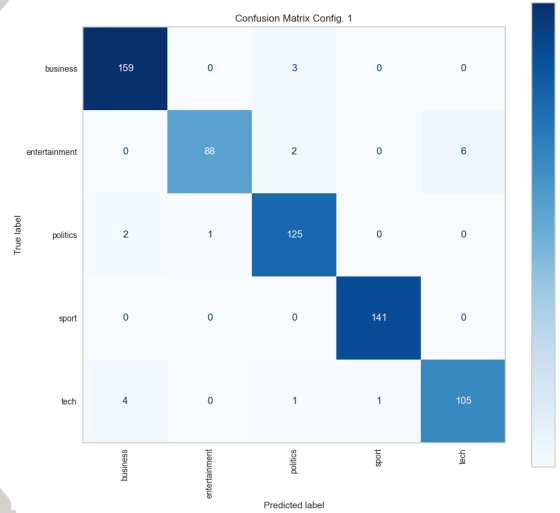
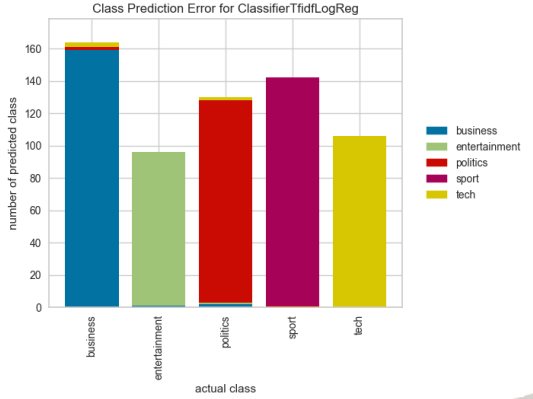


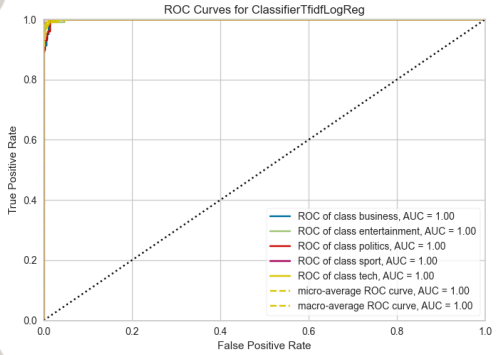


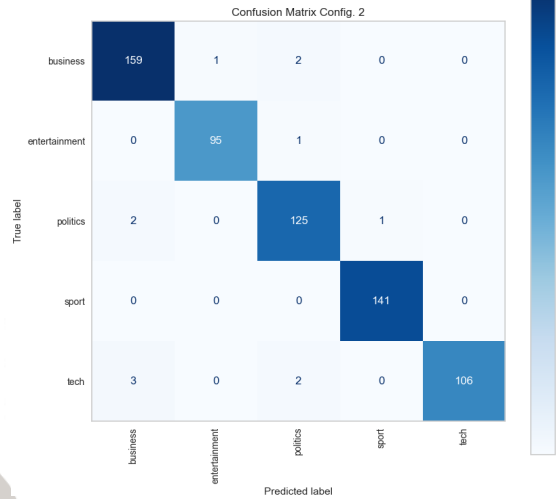


	Precision	Recall	F1-Score	Support
business	0.96	0.98	0.97	162
entertainment	0.99	0.92	0.95	96
politics	0.95	0.98	0.97	128
sport	0.99	1.00	1.00	141
tech	0.95	0.95	0.95	111
Accuracy			0.97	638
Macro Avg	0.97	0.96	0.97	638
Weighted Avg	0.97	0.97	0.97	638

MULTINOMIAL NB BBC NEWS







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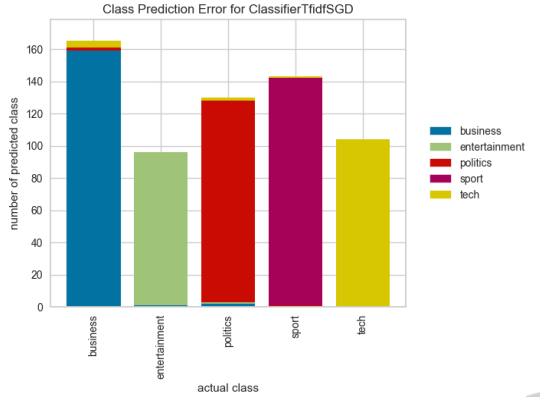
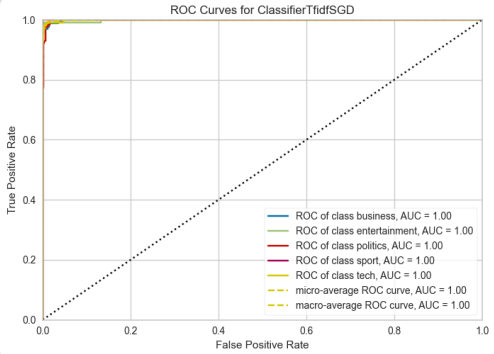
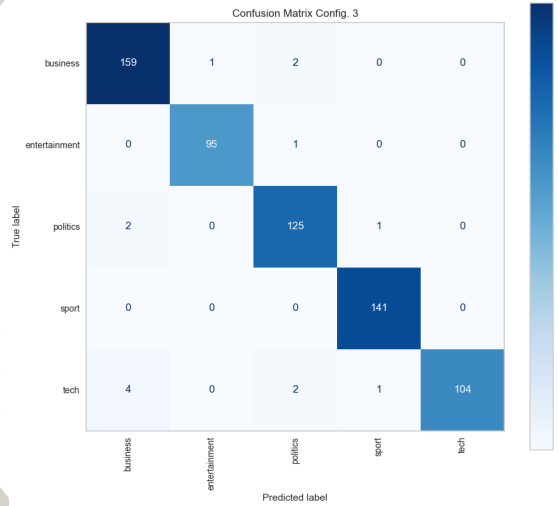
LOGISTIC REGRESSION BBC NEWS







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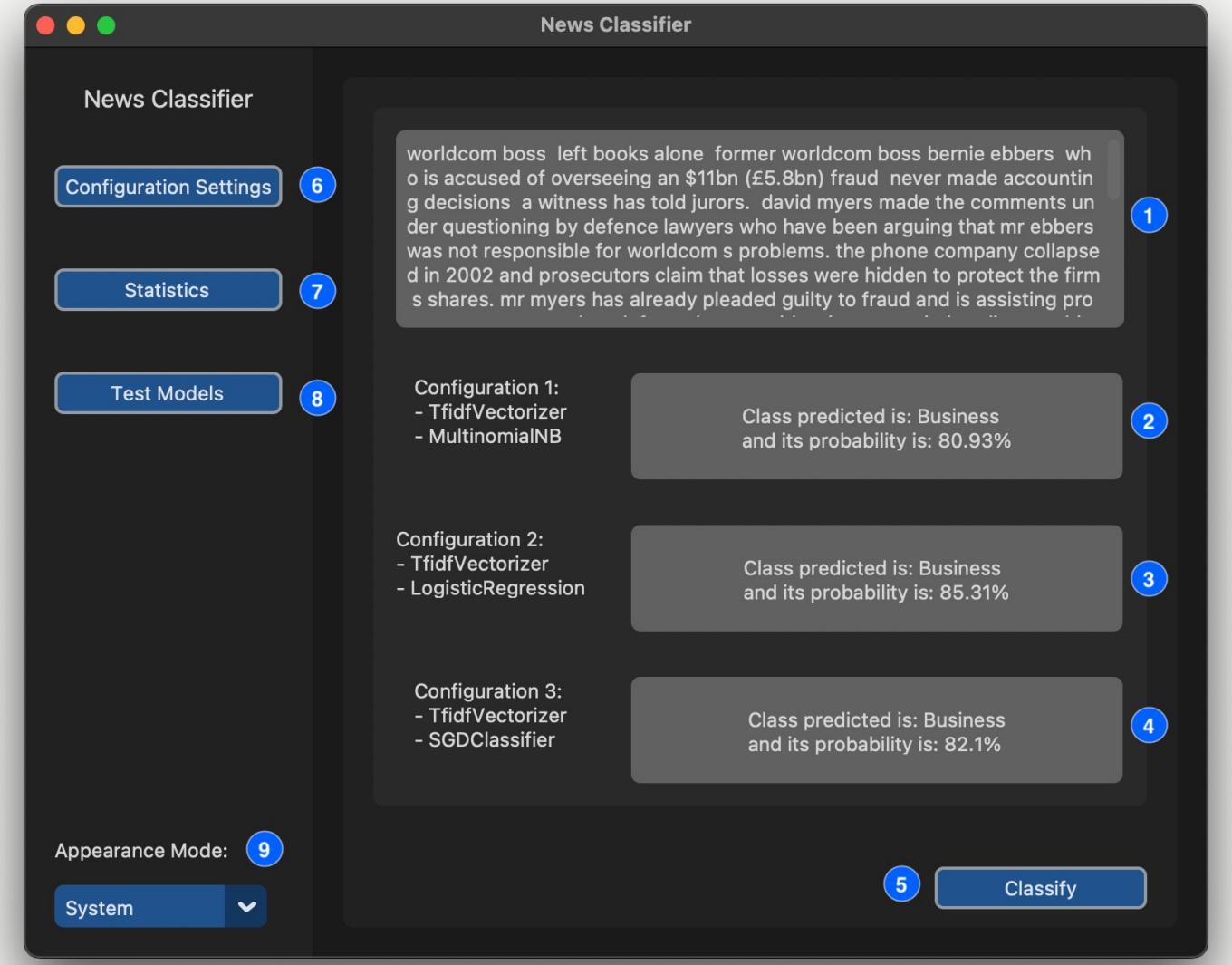
SGD CLASSIFIER BBC NEWS

APPLICATION GUI

APPLICATION HOME



1 Text to classify

2 Class predicted by first classifier

3 Class predicted by second classifier

4 Class predicted by third classifier

5 Button to classify text

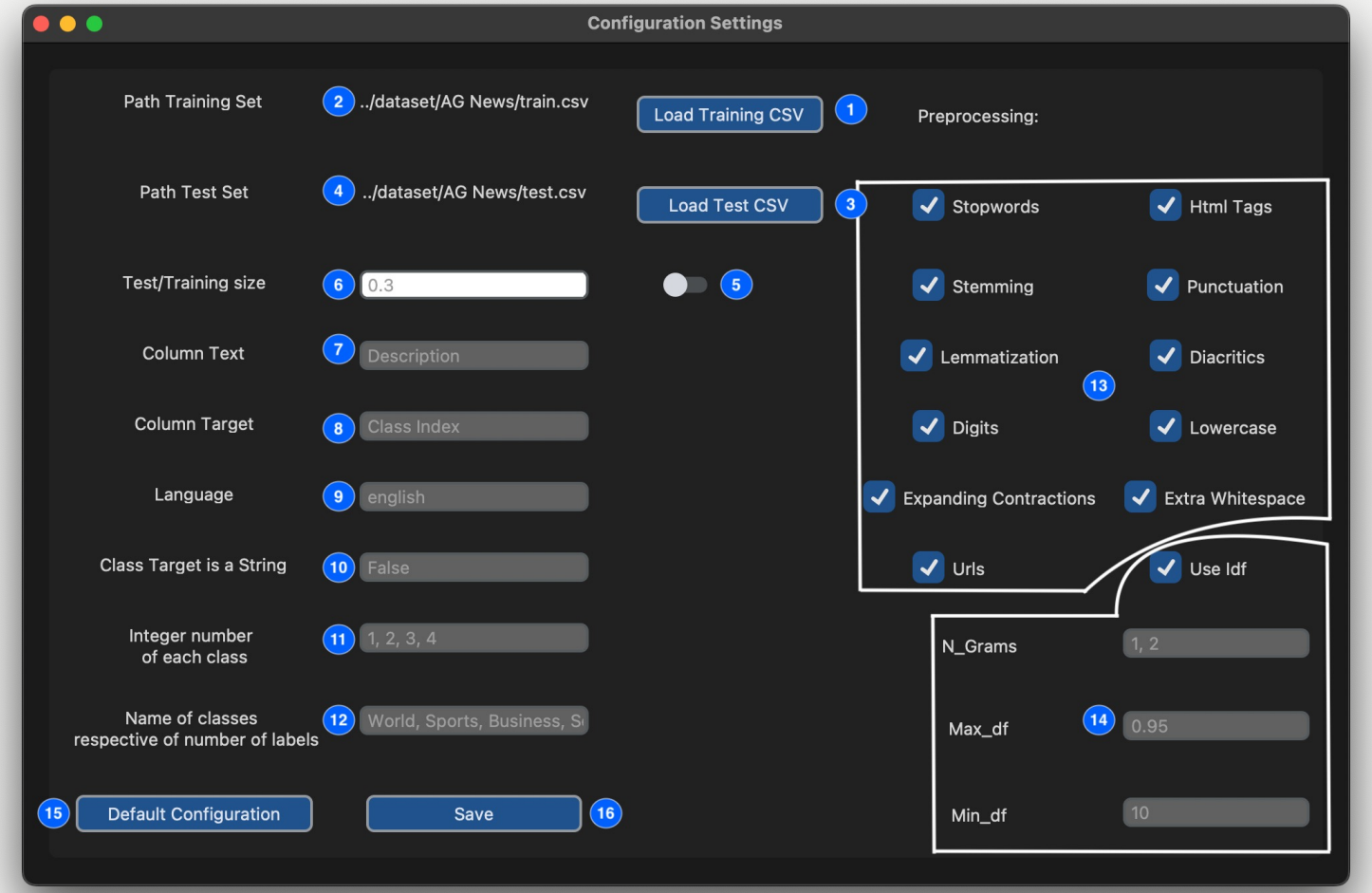
6 Button to change configuration settings

7 Button to see available statistics

8 Button to test models on a different dataset

9 Option menu to change appearance theme

CONFIGURATION WINDOW



1 Button to load training CSV

2 Button to load test CSV

3 Text displays training CSV path

4 Text displays test CSV path

5 Switch for one file dataset

6 Float test/training size

7 CSV column name contains text to classify

8 CSV column name contains classes

9 Text language

10 Boolean

11 List of number of classes

12 List of classes name

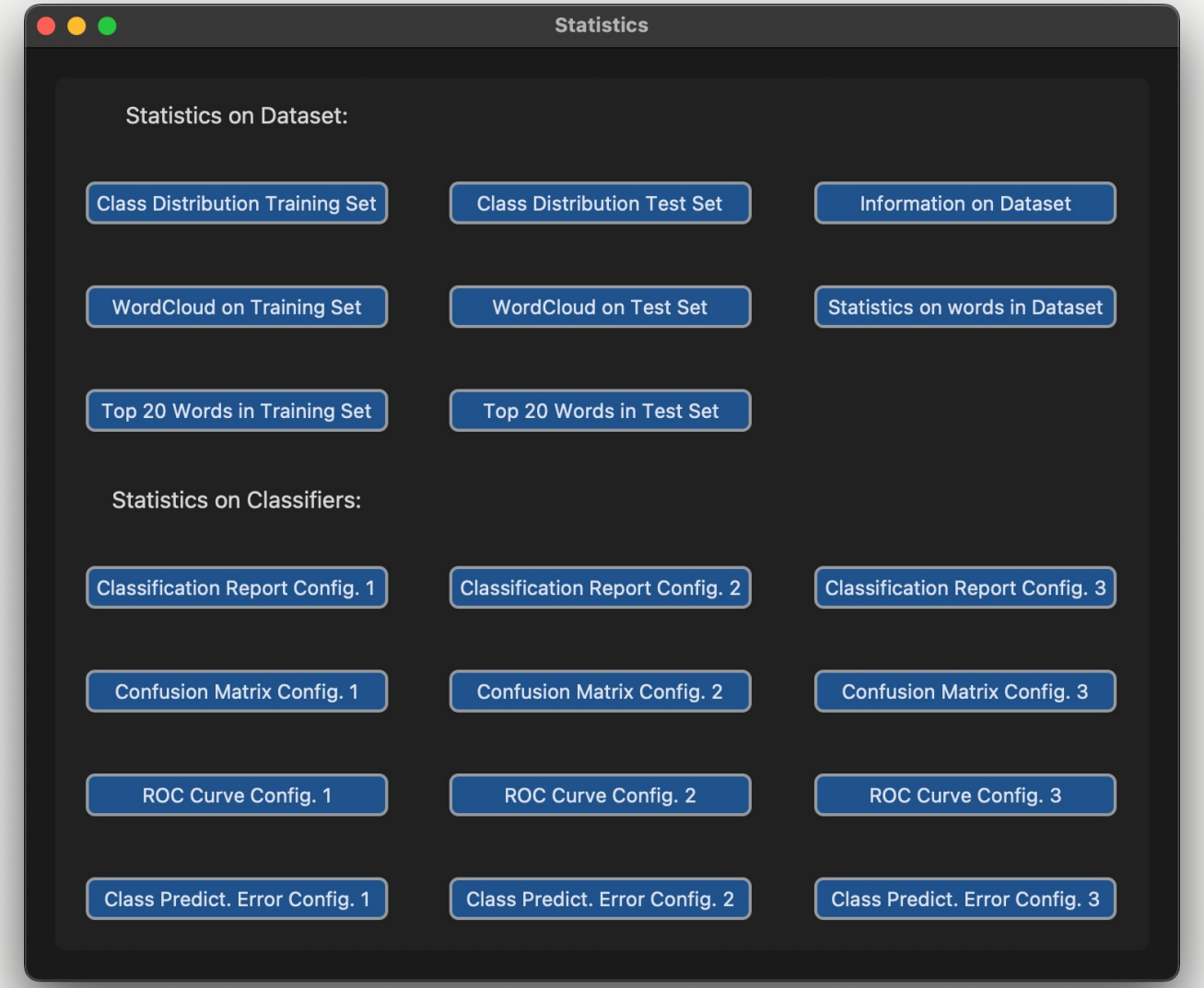
13 Preprocess steps

14 TdidfVectorizer parameters

15 Button to reset configuration

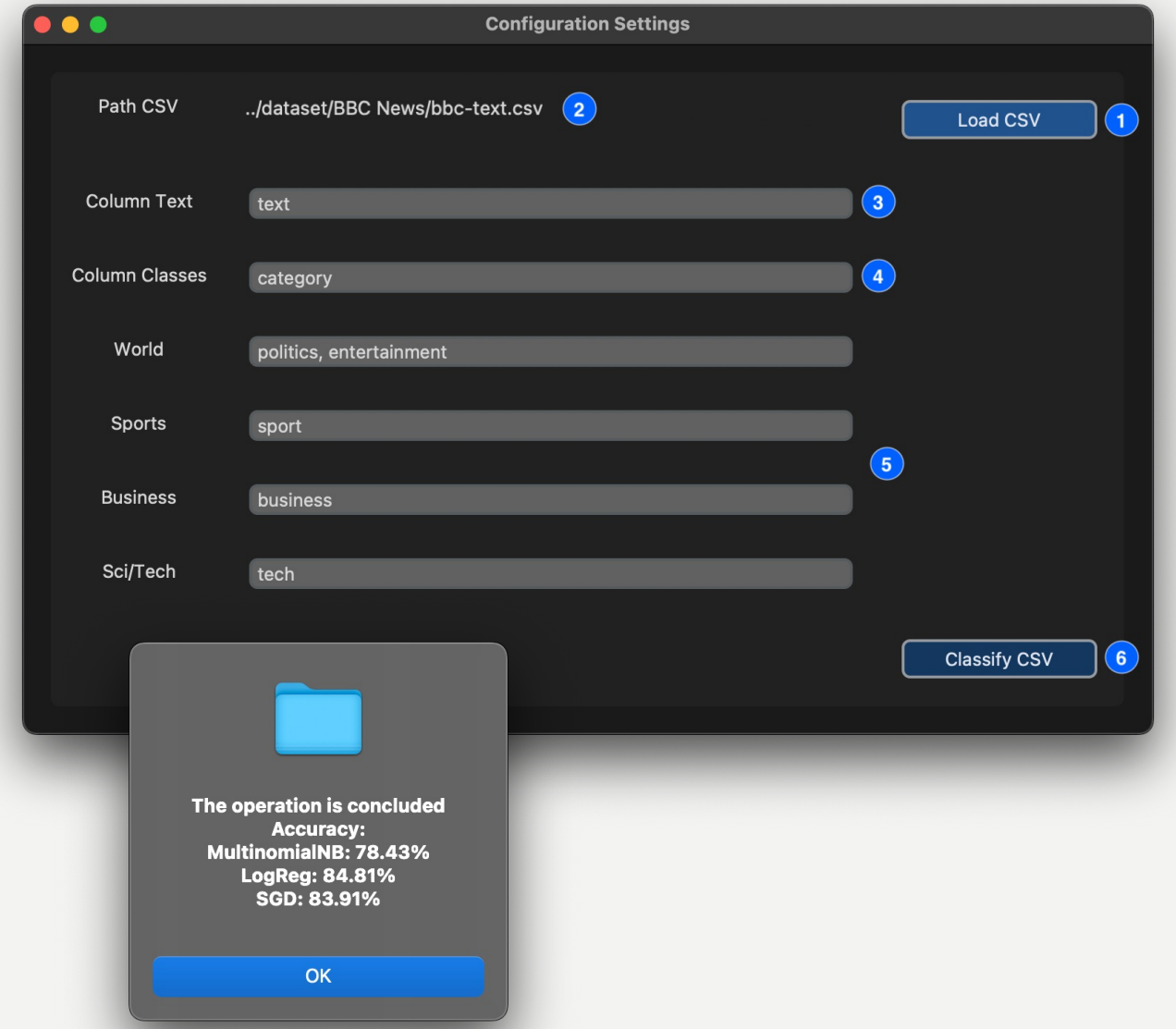
16 Button to save configuration

STATISTICS WINDOW



Each button is associate to the corrispective statistic

TEST MODELS WINDOW



1 Button to load CSV file

2 Text displays path loaded file

3 Text column text to classify

4 CSV column name contains text to classify

5 CSV column name contains classes

6 Button to classify CSV file

New csv file cointains three more columns for each classifier:

1 Class predicted by specific classifier

2 Probability of the class predicted by specific classifier

3 0 if class predicted is the same of the right class, 1 if it's not the same