MACHINE LEARNING AND CONTENT ANALYTICS

FAKE NEWS DETECTION

Py-truth

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Introduction

Business Question 1

Which machine learning algorithms can perform well in detecting fake news?

Business Question 2

How well these algorithms can perform in classify news in a test set?

Business Question 3

Which algorithm performs better for fake news detection?

The project: Based on a dataset of fake and true news and with the help of neural network algorithms we aim to find a way of distinguish fake from real news.

Visions/goals: To help people to be properly informed and have better sense of justment.

Time for Fun!

https://kahoot.it/challenge/02914025?challenge-id=a9396d8e-19dd-493e-acb7-5da3113023ed_1631814219021

Game PIN: 02914025

Methodology

Step 1

Finding Dataset

Step 2

ETL (Extract – Transform – Load) Process

Step 3

Apply Neural Network (NN) Algorithms (Feed Forward NN, Embedding, Doc2vec, Recurrent NN,Bert) and Logistic Regression

Step 4

Evaluate the Models

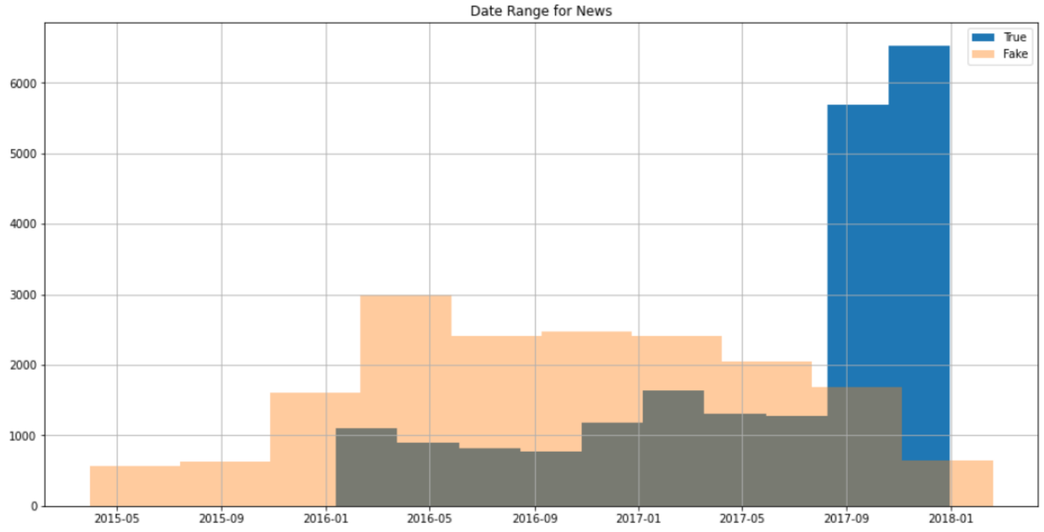
Step 5

Results and Conclusions

Dataset Overview(1)

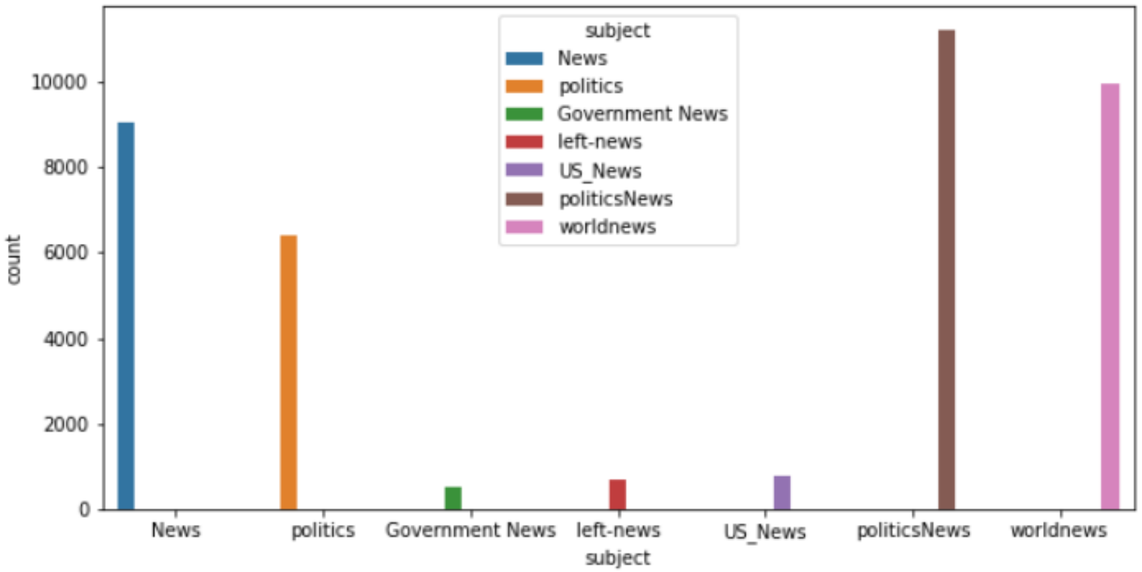
The dataset was found in Kaggle and consisted of nearly 37k news. 20k of them was "True" and the rest 17k were "Fake".

- *Check for missing values*
- *Check for dublicates*

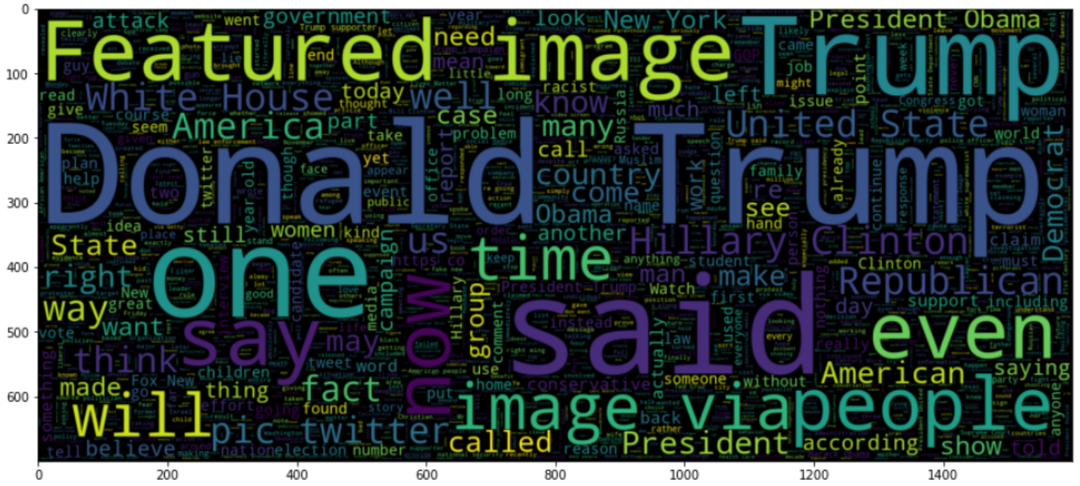


- Balanced Data
- Date Range from 2015-2018

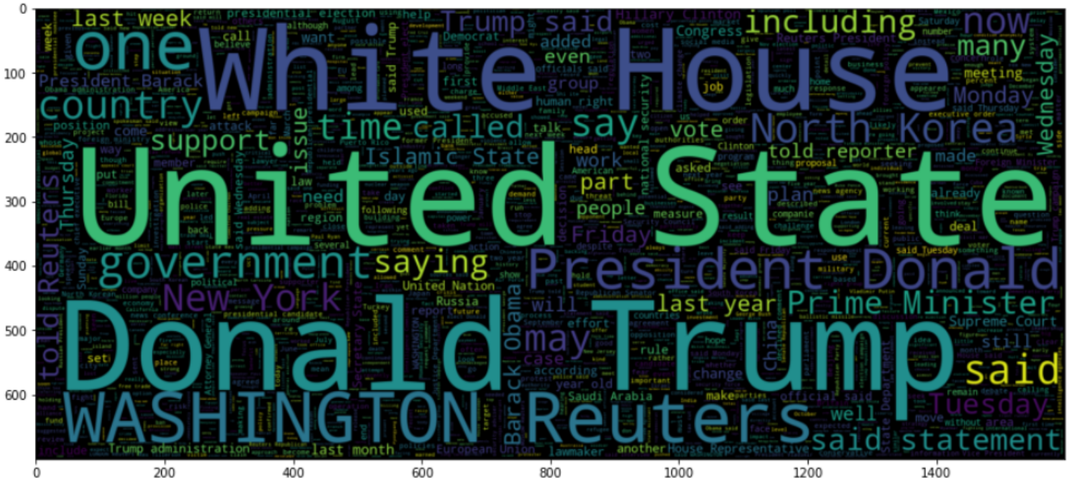
Dataset Overview(2)



Fake News



True News



- Mainly Political Subjects

Data Cleaning

Links

We remove URLs from URLs text column.

Twitter Users

We remove Twitter users and replace them with: *@twitter-handle.*

Capitalization

We make words in *lowercase.*

Numbers

We remove numbers except from 9/11.

(Reuters)

We remove “(reuters)” from the news.

Punctuation

We remove all of the punctuations except for the exclamation point.

Remove “'s”

“'s” need to be removed so that it doesn't become a false indicator of true news.

Date Words

We remove all date words.

Algorithms

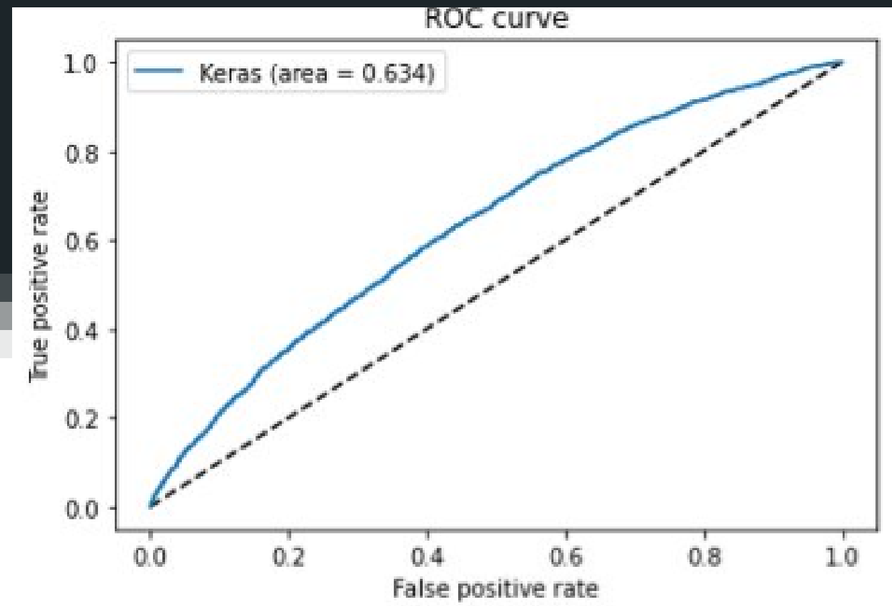
Logistic Regression, Feed Forward Neural Network with Label Encoding, Feed Forward Neural Network with Embeddings, Recurrent Neural Network,Pre-Trained BERT Model

Logistic Regression with Doc2Vec-DBOW

CLASSIFICATION REPORT

	precision	recall	f1-score	support
fake	0.58	0.46	0.51	2617
true	0.62	0.73	0.67	3179
accuracy			0.60	5796
macro avg	0.60	0.59	0.59	5796
weighted avg	0.60	0.60	0.60	5796

ROC CURVE



CONFUSION MATRIX

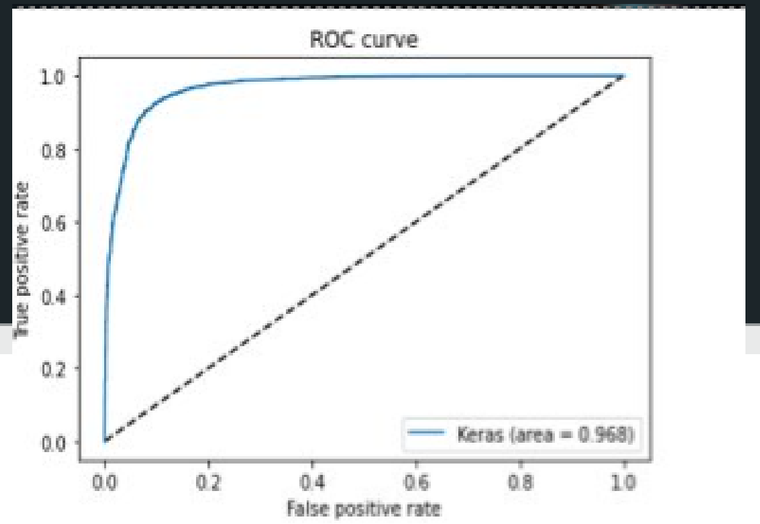
	fake	true
fake	1197	1420
true	870	2309

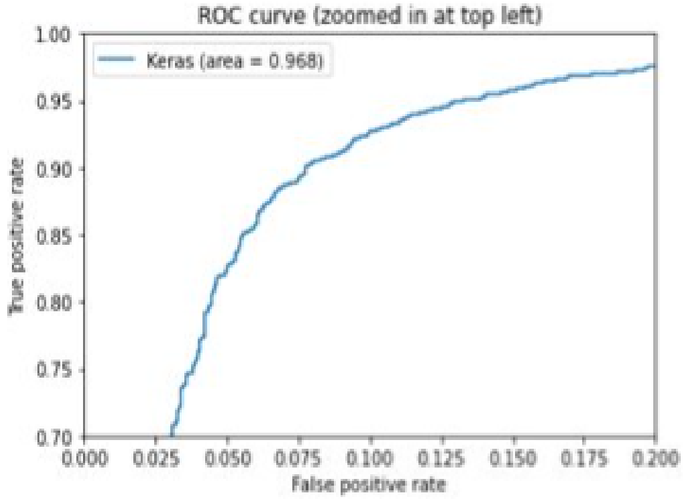
Logistic Regression with Doc2Vec-DM

CLASSIFICATION REPORT

	precision	recall	f1-score	support
fake	0.91	0.89	0.90	2617
true	0.91	0.93	0.92	3179
accuracy			0.91	5796
macro avg	0.91	0.91	0.91	5796
weighted avg	0.91	0.91	0.91	5796

ROC CURVE





CONFUSION MATRIX

	fake	true
fake	2336	281
true	218	2961

Logistic Regression with Doc2Vec-DBWO & DM

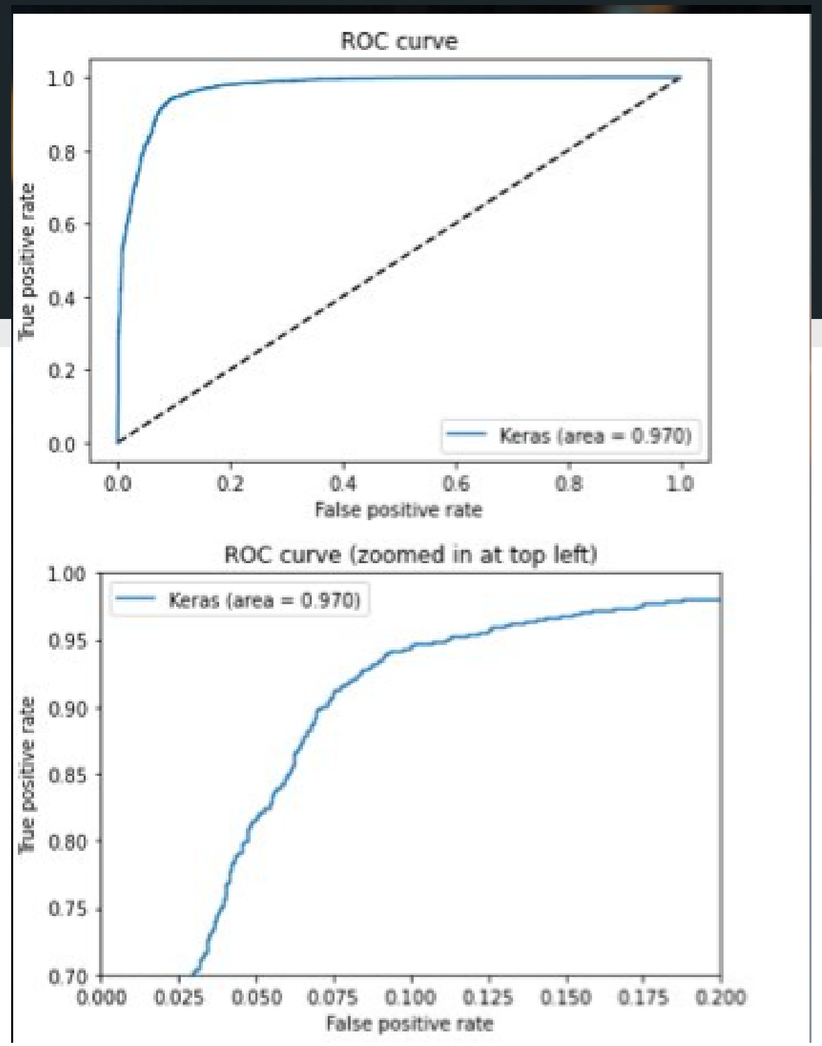
CLASSIFICATION REPORT

	precision	recall	f1-score	support
fake	0.93	0.90	0.91	2617
true	0.92	0.94	0.93	3179
accuracy			0.92	5796
macro avg	0.92	0.92	0.92	5796
weighted avg	0.92	0.92	0.92	5796

CONFUSION MATRIX

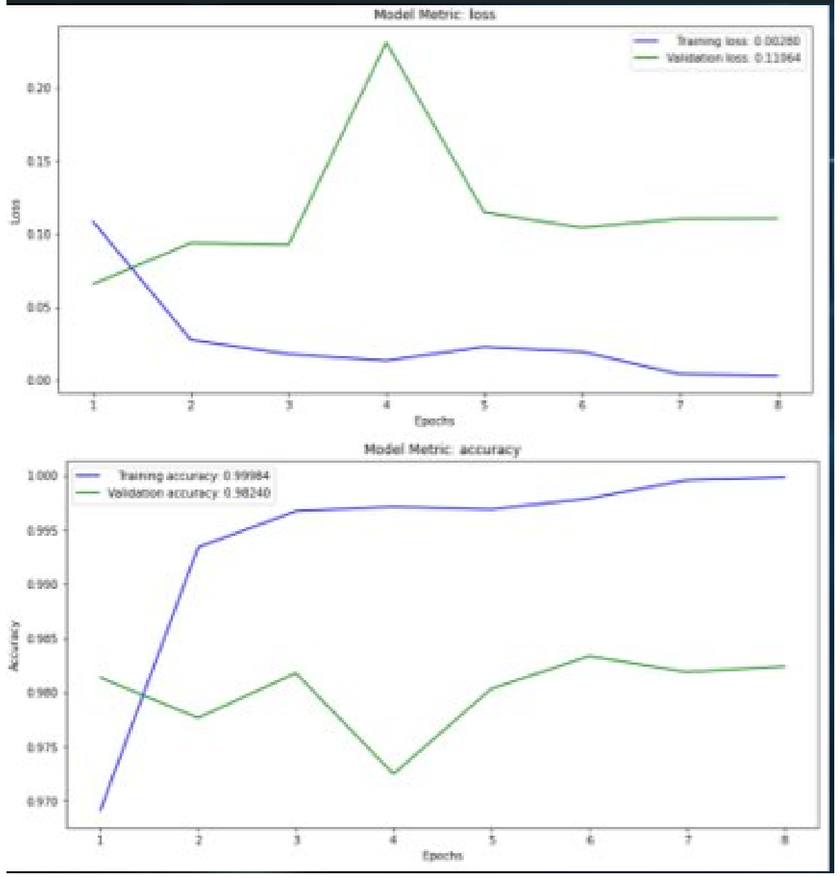
	fake	true
fake	2355	262
true	179	3000

ROC CURVE



Feed Forward Neural Network with Label Encoding

BINARY CROSS ENTROPY LOSS AND ACCURACY



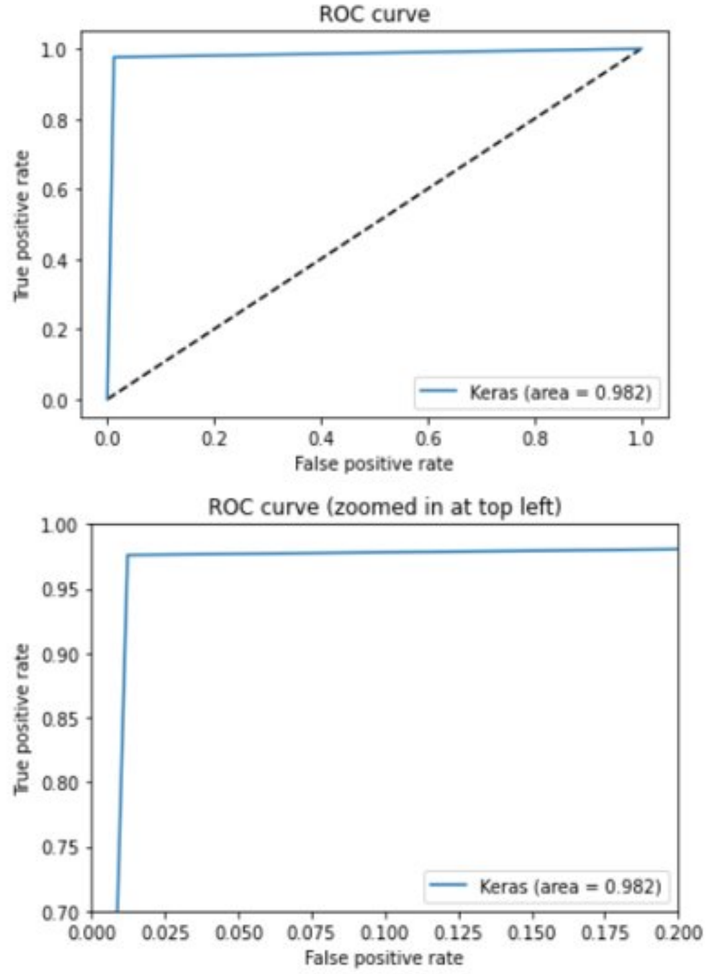
CLASSIFICATION REPORT

	precision	recall	f1-score	support
0	0.97	0.99	0.98	1963
1	0.99	0.98	0.98	2384
accuracy			0.98	4347
macro avg	0.98	0.98	0.98	4347
weighted avg	0.98	0.98	0.98	4347

CONFUSION MATRIX

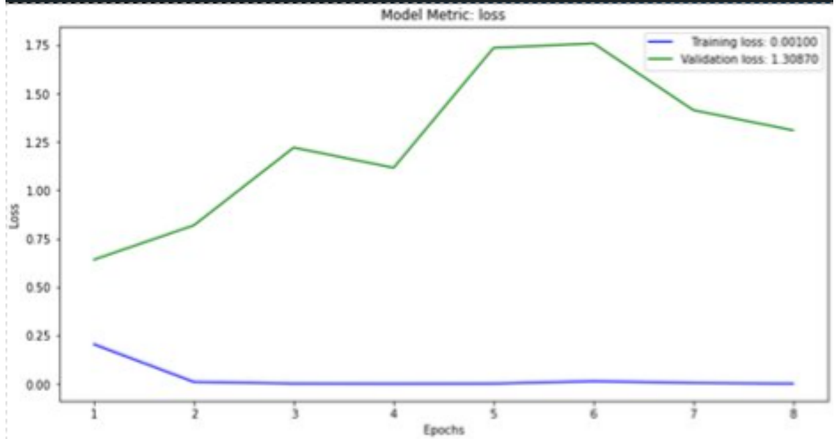
	fake	true
fake	1939	24
true	57	2327

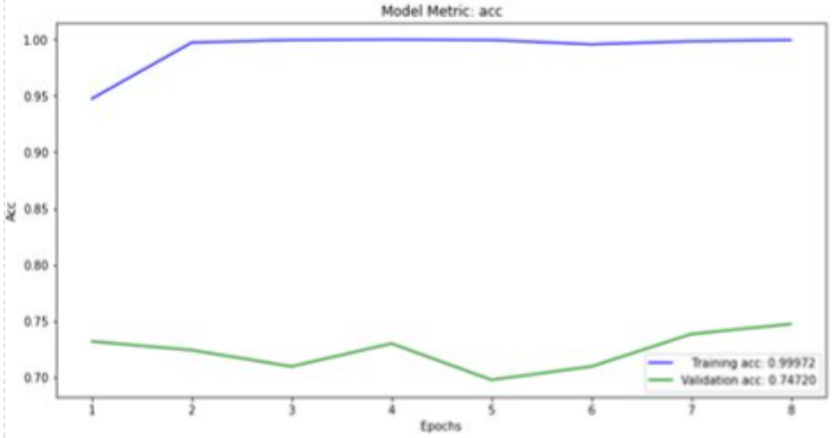
ROC Curve



Feed Forward Neural Network with Embeddings

BINARY CROSS ENTROPY LOSS AND ACCURACY





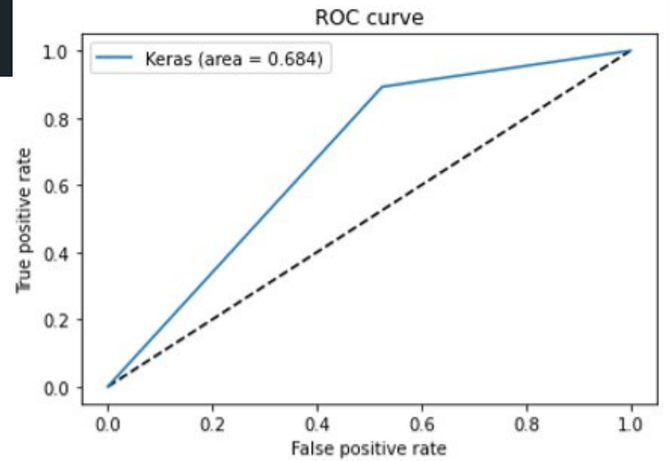
CLASSIFICATION REPORT

	precision	recall	f1-score	support
0	0.78	0.47	0.59	1963
1	0.67	0.89	0.77	2384
accuracy			0.70	4347
macro avg	0.73	0.68	0.68	4347
weighted avg	0.72	0.70	0.69	4347

CONFUSION MATRIX

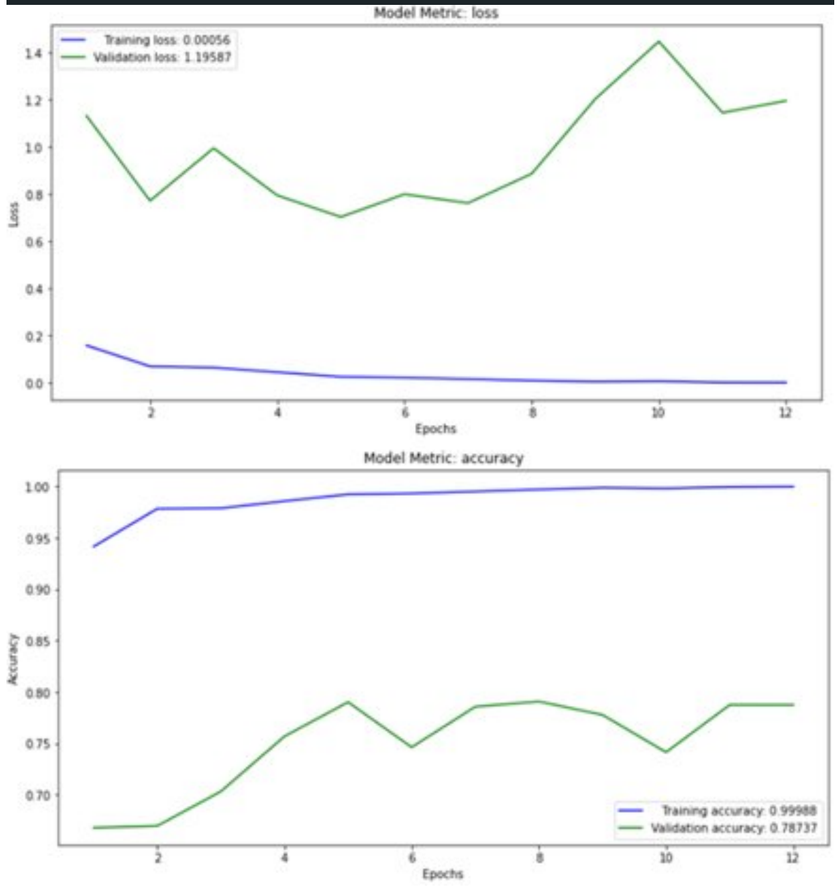
	fake	true
fake	932	1031
true	256	2128

ROC Curve



Recurrent Neural Network

BINARY CROSS ENTROPY LOSS AND ACCURACY



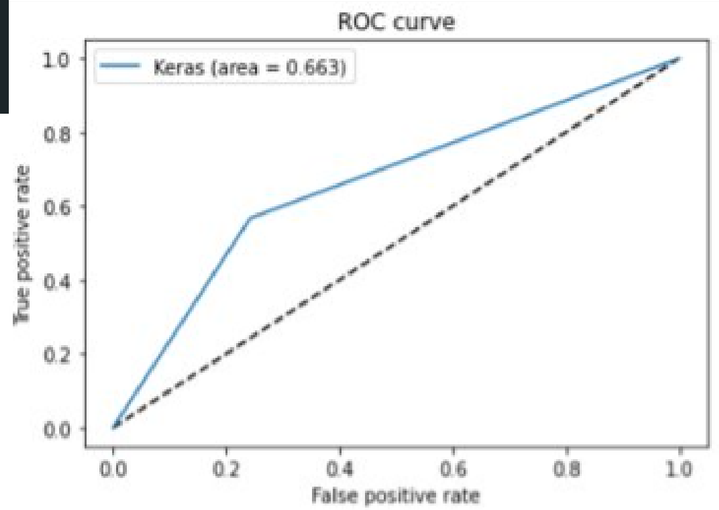
CLASSIFICATION REPORT

	precision	recall	f1-score	support
0	0.59	0.76	0.66	1963
1	0.74	0.57	0.64	2384
accuracy			0.65	4347
macro avg	0.67	0.66	0.65	4347
weighted avg	0.67	0.65	0.65	4347

CONFUSION MATRIX

	fake	true
fake	1487	476
true	1031	1353

ROC Curve

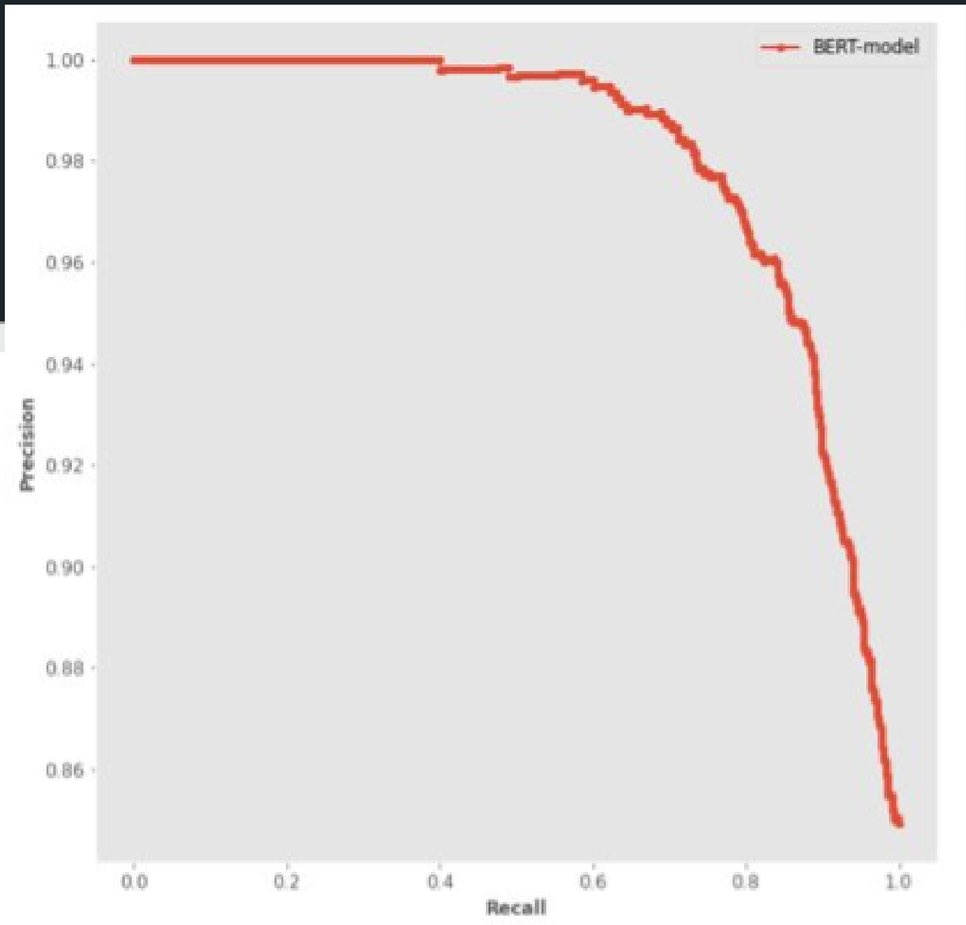


Pretrained BERT model – based on "Title"

CLASSIFICATION REPORT

	precision	recall	f1-score	support
0	0.43	0.84	0.57	220
1	0.97	0.80	0.88	1229
accuracy			0.81	1449
macro avg	0.70	0.82	0.73	1449
weighted avg	0.89	0.81	0.83	1449

PRECISION RECALL CURVE



CONFUSION MATRIX

	0	1
0	185	35
1	241	988

Conclusion

Best model

Feed forward with label encoding – accuracy 98%

Comments

- Effective models – also confirmed through dummy classifier (accuracy 51%)
- Nature of the data also helped in order to have a good training

Future work

- Additional sources for better training
- Greek data for multi-language
- Use 'text' instead of 'title' in BERT model

Time Plan

Phase A

22/06 — Introduction (Pre-Analysis)

25/06 — Our project & Vision/Goals

01/07 — Methodology

11/07 — Members/Roles & Time plan

12/07 — Data Collection and Analysis

21/07 — Data Processing

25/07 — Algorithms and NLP architectures/systems

Phase B

01/08 — Experiments – Setup, Configuration

09/08 — Results & Quantitative Analysis (incl. visualizations)

17/08 — Qualitative & Error Analysis

24/08 — Discussion, Comments/ Notes and Future Work

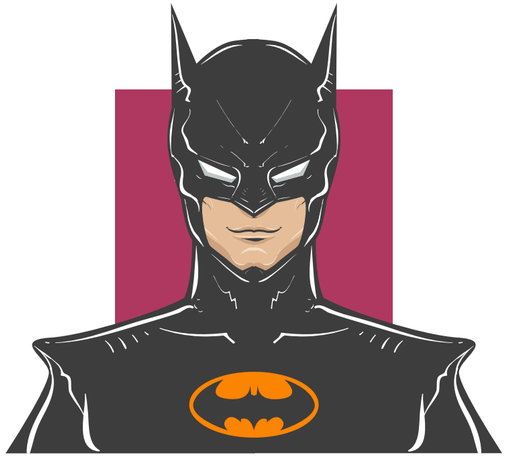
25/08 — Bibliography & Appendices

29/08 — Complete the assignment and the presentation.

We are a super team!

Konstantina Georgiopoulou

Data Processing, Validation & Design

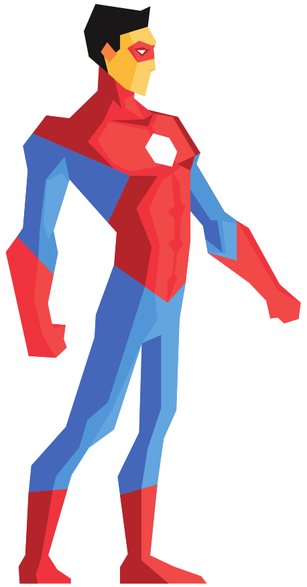


Christos Kallaras

Application Design and Development

Anastasios Theodorou

Project Management and Designing



Stavros Kasiaris

Modeling and Testing

Thank You!