



FAKE REVIEW

Fake Review Detection
using neural network

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PROBLEM STATEMENT

Our project addresses the urgent need to detect fake reviews in an era where E-Commerce is booming. As online reviews increasingly influence consumer decisions, ensuring their authenticity is crucial. We aim to enhance trust in eCommerce by developing methods to identify and eliminate fraudulent reviews, securing genuine consumer feedback and maintaining marketplace integrity.



DATASET

MEXWELL · UPDATED 7 MONTHS AGO

▲ 4 New Notebook Download (5 MB) :

Fake Reviews Dataset

40k reviews (50:50) fake and real

Data Card Code (1) Discussion (0) Suggestions (0)

About Dataset

The generated fake reviews dataset, containing 20k fake reviews and 20k real product reviews. OR = Original reviews (presumably human created and authentic); CG = Computer-generated fake reviews.

Citation

Salminen, J., Kandpal, C., Kamel, A. M., Jung, S., & Jansen, B. J. (2022). Creating and detecting fake reviews of online products. Journal of Retailing and Consumer Services, 64, 102771. <https://doi.org/10.1016/j.jretconser.2021.102771>

Usability

10.00

License

Attribution 4.0 International (CC ...)

Expected update frequency

Never

Tags

NLP Ratings and Reviews

Acknowledgement

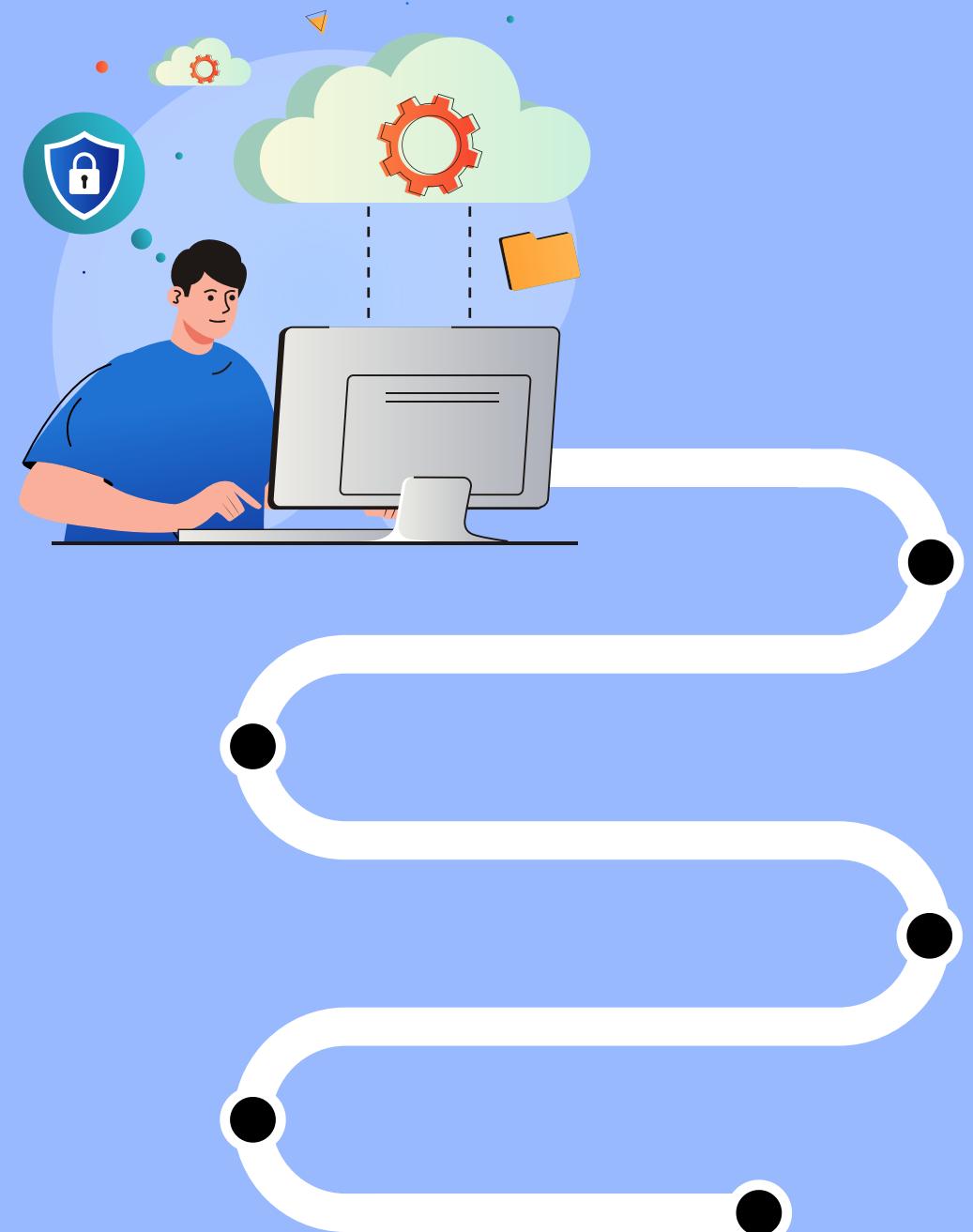
Foto von Brett Jordan auf Unsplash



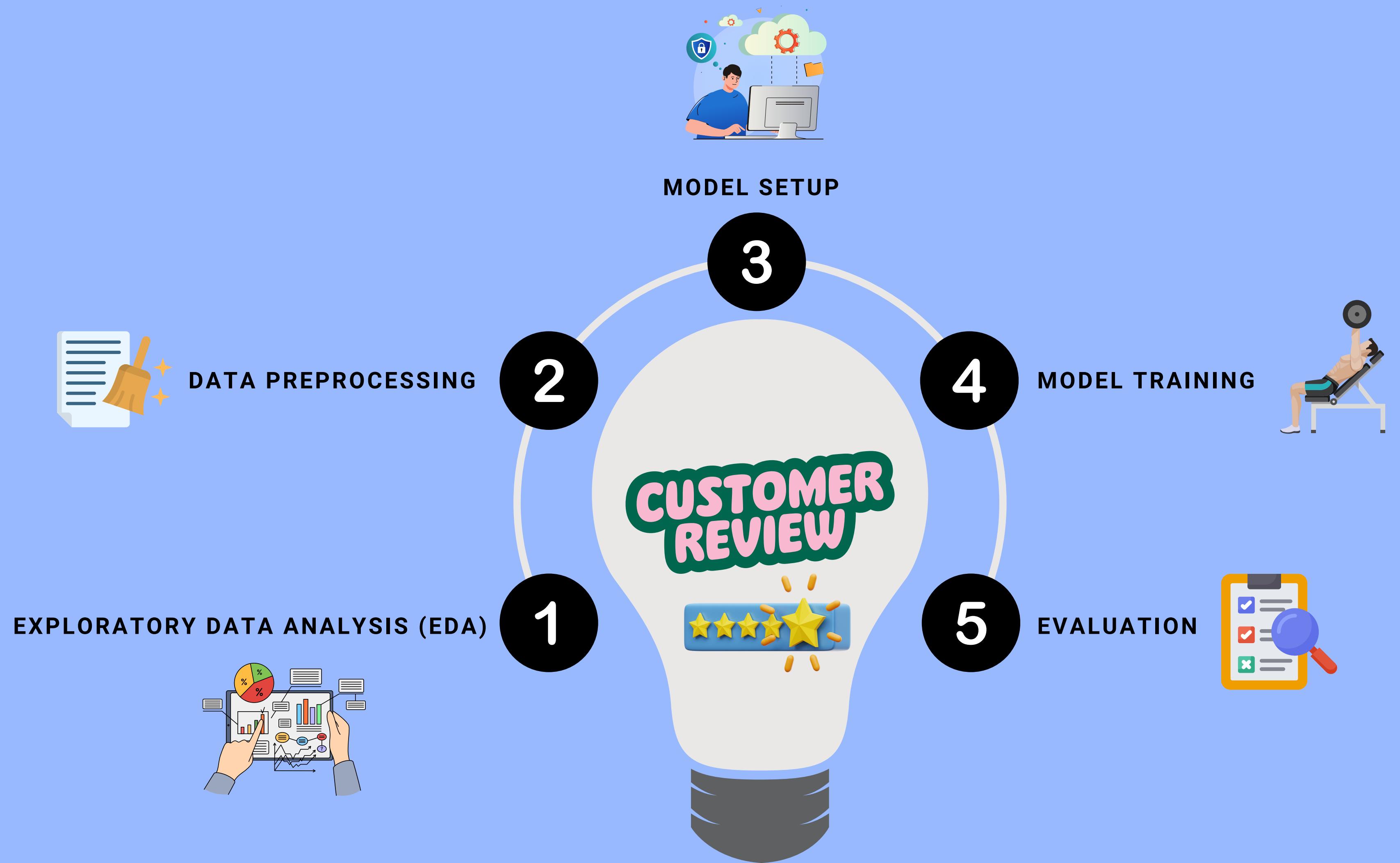
	category	rating	label	text_
0	Home_and_Kitchen_5	5.0	CG	Love this! Well made, sturdy, and very comfor...
1	Home_and_Kitchen_5	5.0	CG	love it, a great upgrade from the original. I...
2	Home_and_Kitchen_5	5.0	CG	This pillow saved my back. I love the look and...
3	Home_and_Kitchen_5	1.0	CG	Missing information on how to use it, but it i...
4	Home_and_Kitchen_5	5.0	CG	Very nice set. Good quality. We have had the s...
...
40427	Clothing_Shoes_and_Jewelry_5	4.0	OR	I had read some reviews saying that this bra r...
40428	Clothing_Shoes_and_Jewelry_5	5.0	CG	I wasn't sure exactly what it would be. It is ...
40429	Clothing_Shoes_and_Jewelry_5	2.0	OR	You can wear the hood by itself, wear it with ...
40430	Clothing_Shoes_and_Jewelry_5	1.0	CG	I liked nothing about this dress. The only rea...
40431	Clothing_Shoes_and_Jewelry_5	5.0	OR	I work in the wedding industry and have to wor...

- Fake Reviews Dataset from Kaggle
- Consist of Category, Rating, Label and Text
- Contain 20k fake reviews and 20k real reviews



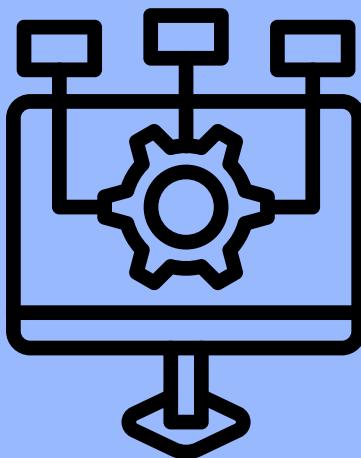


SETTING UP ANALYSIS



INITIAL DATA-DRIVEN INSIGHTS





Parallelized work

Pandarallel library to execute the apply function concurrently, enhancing performance by leveraging multiple CPU cores.

Tokenized the text

pandarallel is a python library for parallelizing your pandas operations. It provides function such as `parallel_apply` to run `apply` in parallel.

```
[3]: import nltk
from nltk.tokenize import word_tokenize
nltk.download('punkt')
data['tokenized_text'] = data['text_'].parallel_apply(word_tokenize)
```

[nltk_data] Downloading package punkt to ...
[nltk_data] Package punkt is already up-to-date!

100.00% [██████████] 2527 / 2527

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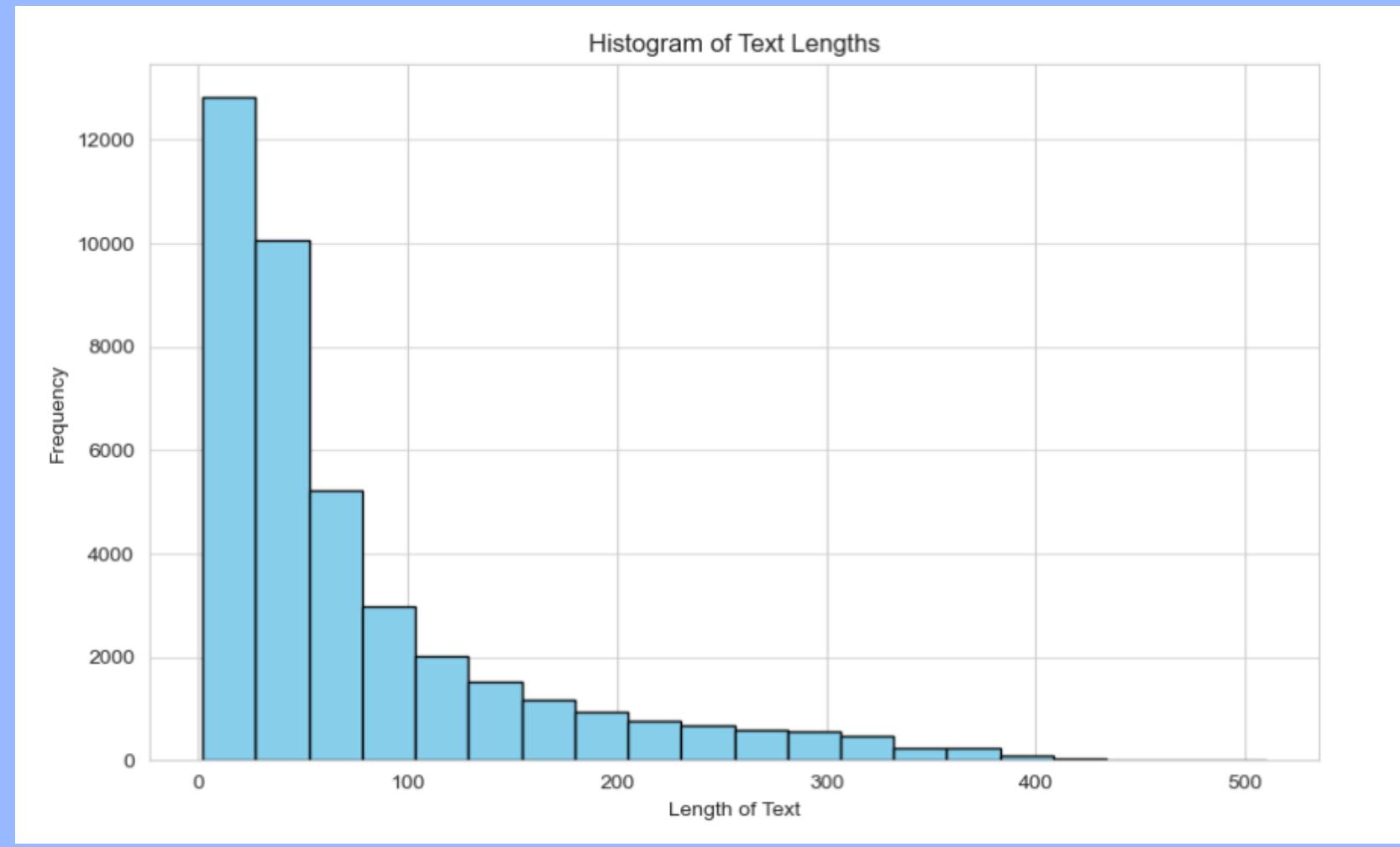
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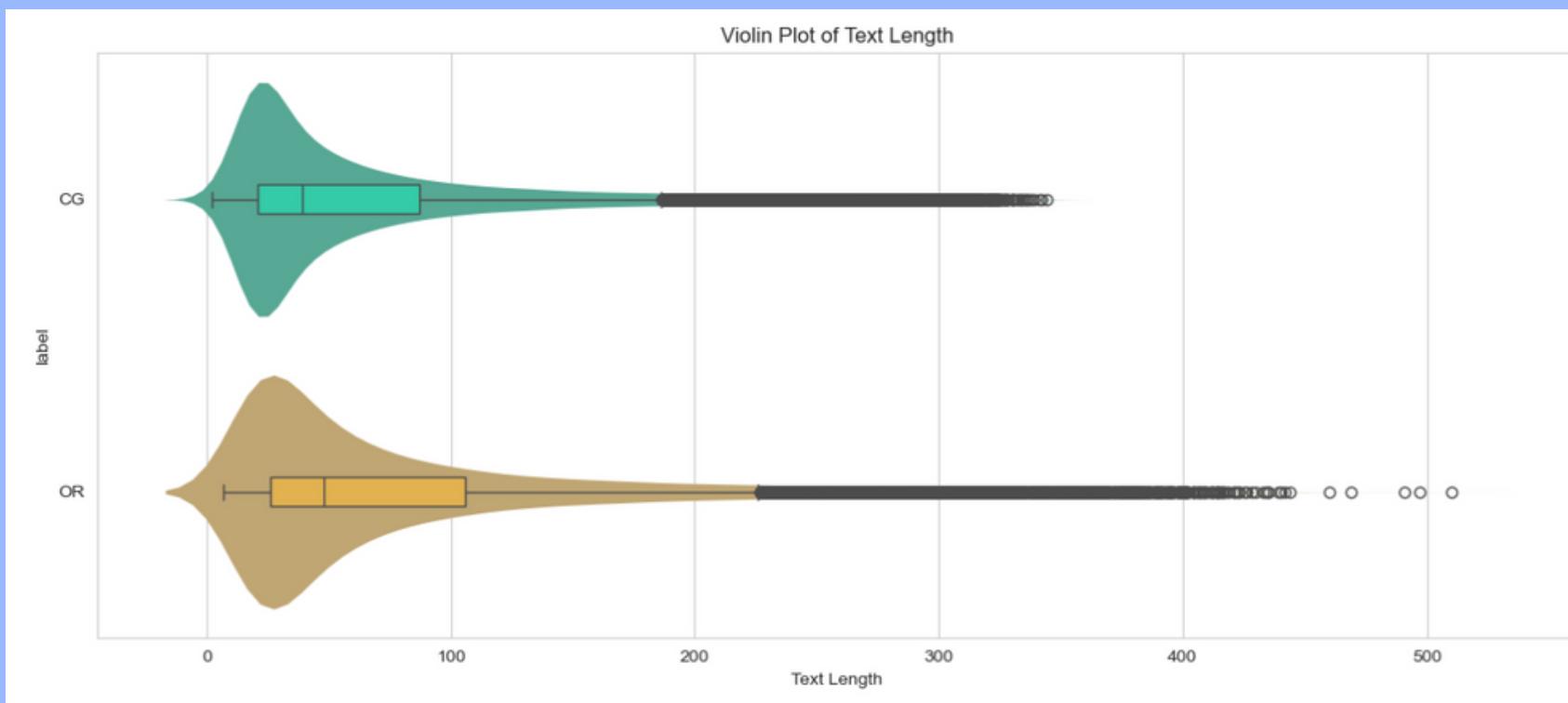
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HISTOGRAM OF MESSAGE LENGTH

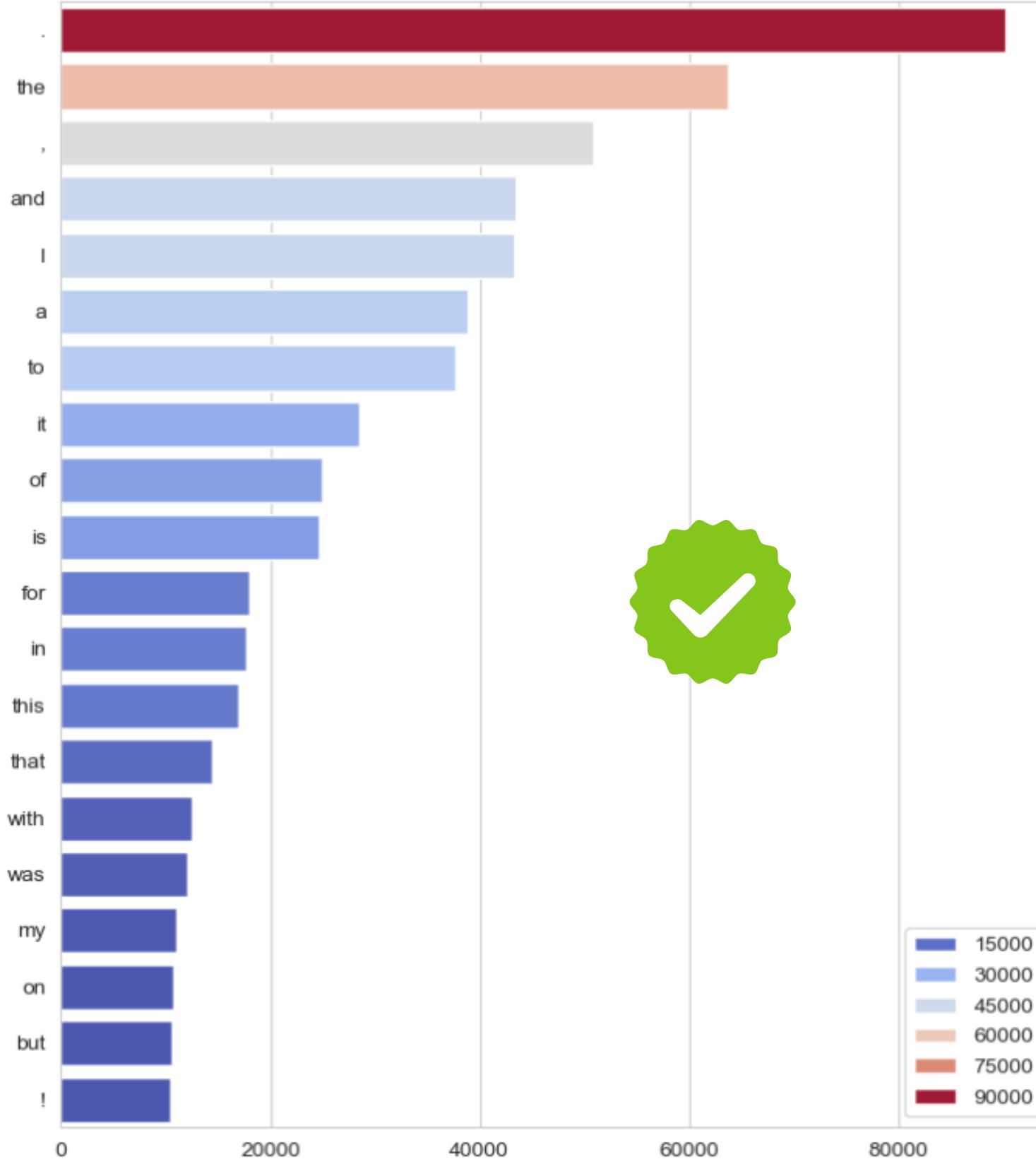


- ✓ Histogram and Violin Plot shows review lengths in dataset.
- ✓ Distribution skewed right, indicating mostly short reviews.
- ✓ Majority under 100 words.
- ✓ Frequency drops sharply for longer reviews.

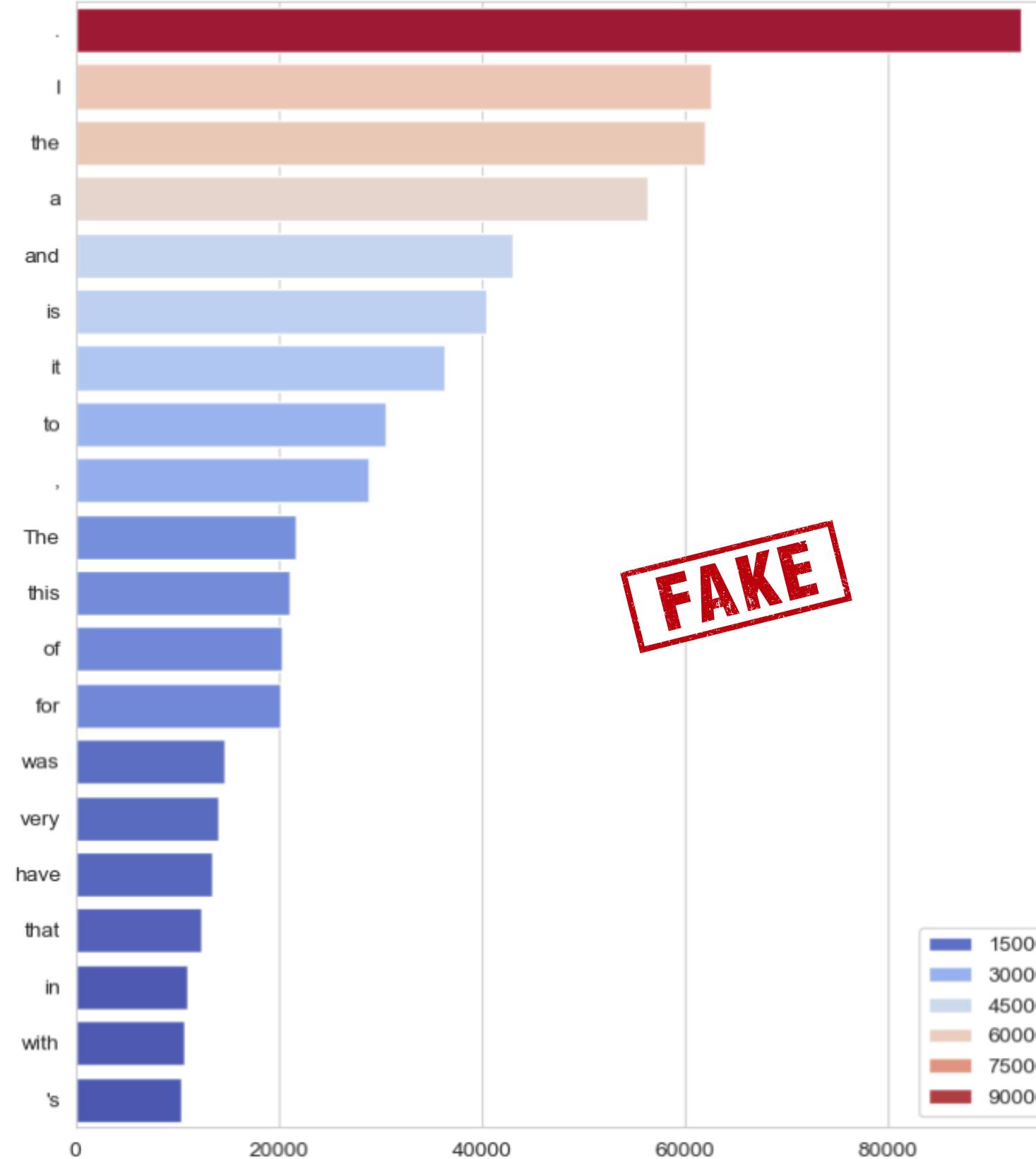


WORD FREQUENCY ANALYSIS

Top Words in Original Reviews (OR)



Top Words in Computer-Generated Reviews (CG)

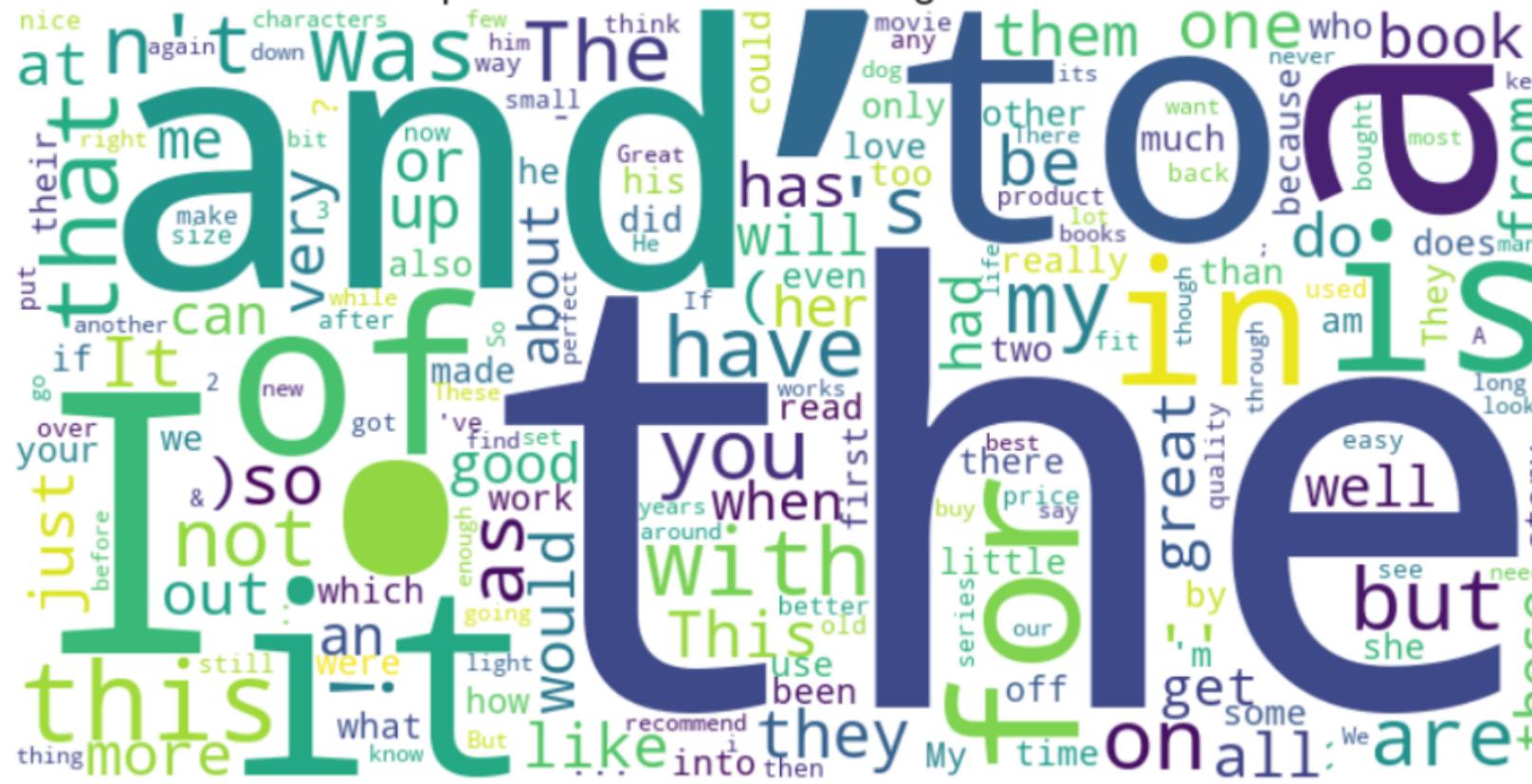


REAL REVIEWS (BEFORE PROCESSING)

FAKE REVIEWS (BEFORE PROCESSING)

COMMON WORDS

Top Common Words in Original Reviews

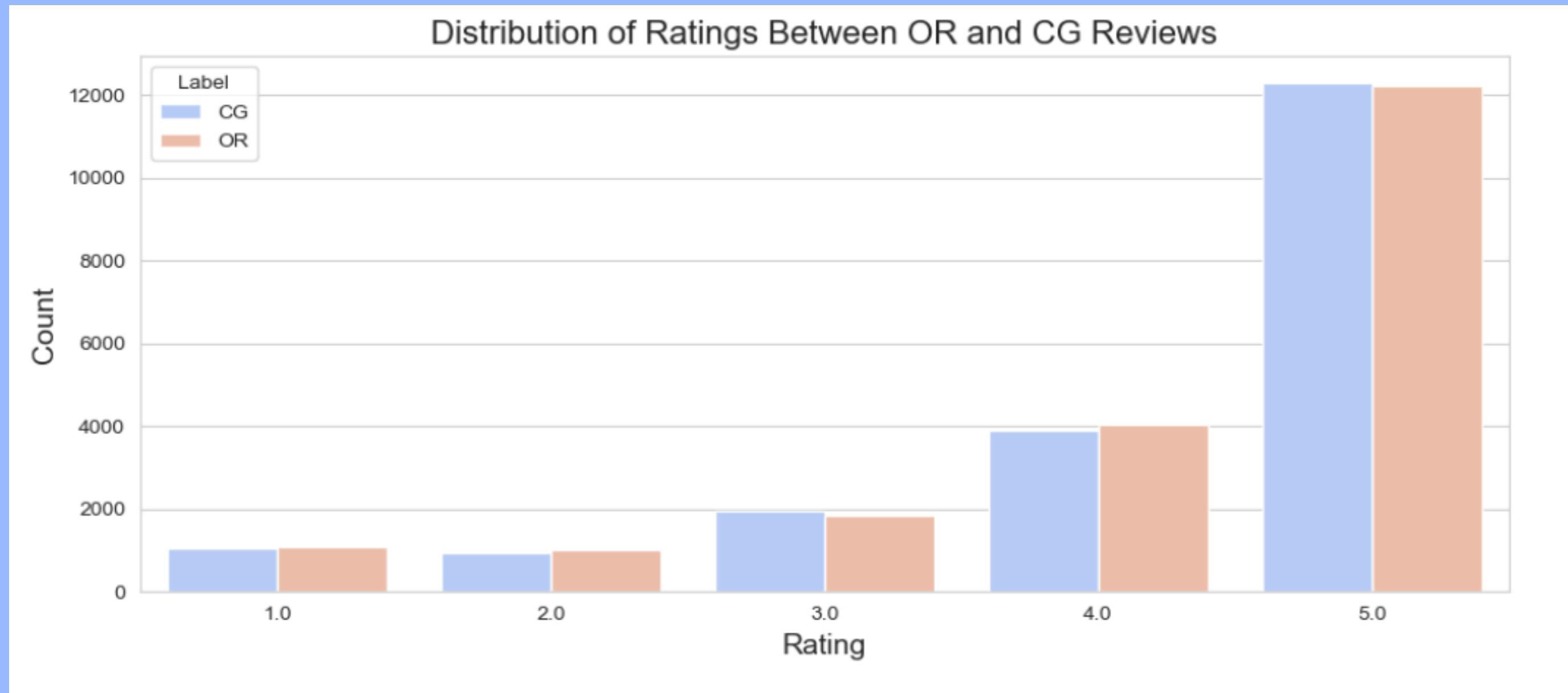


Top Common Words in Computer-Generated Reviews



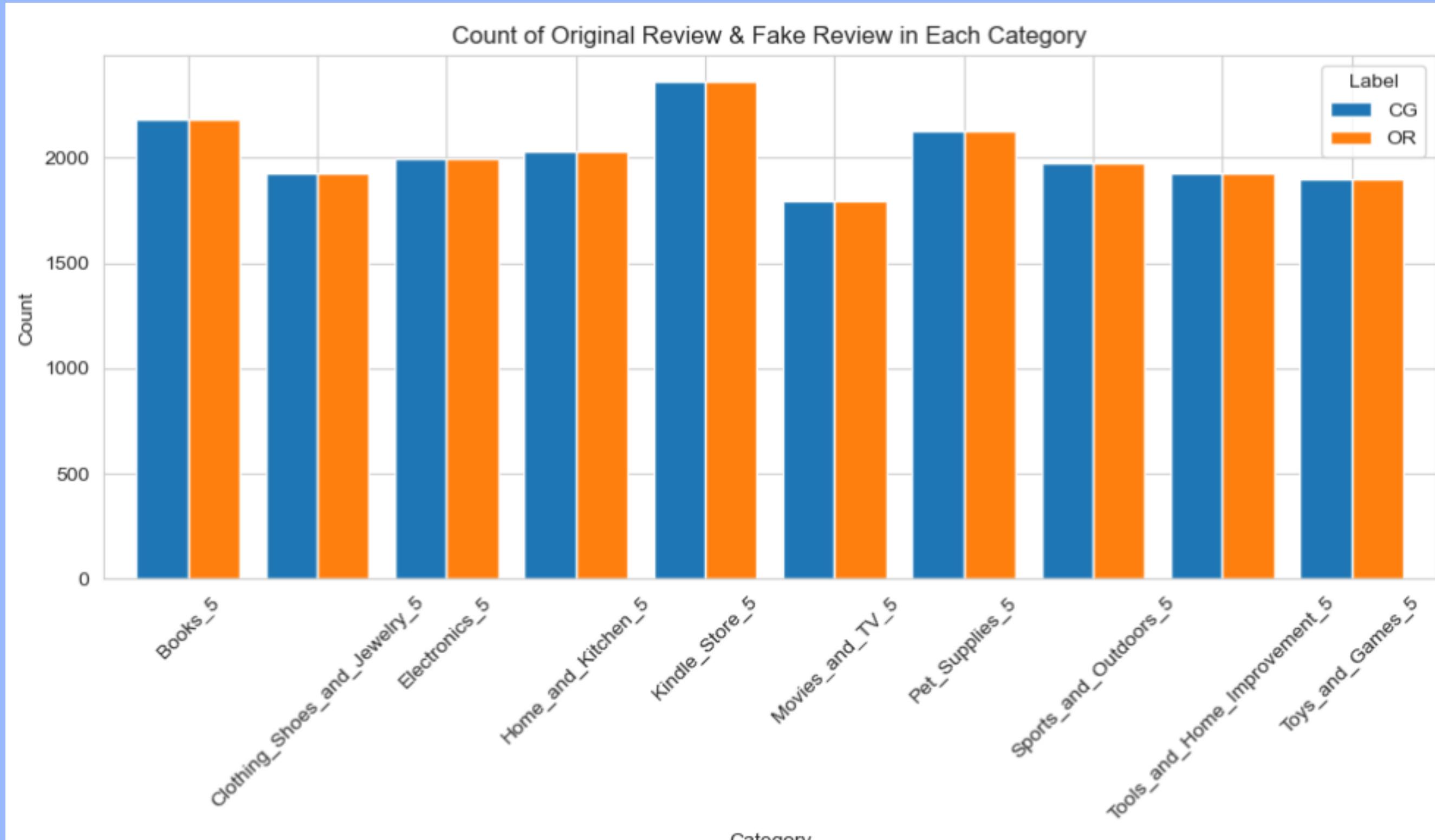
REAL REVIEWS (BEFORE PROCESSING)

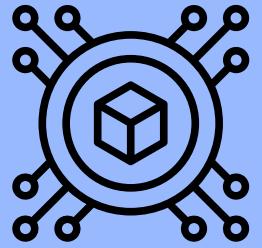
RATINGS DISTRIBUTION



- ✓ Similar distributions
- ✓ Uniform trends observed across all rating levels.

NUMBER OF ORIGINAL & FAKE REVIEW IN EACH CATEGORY

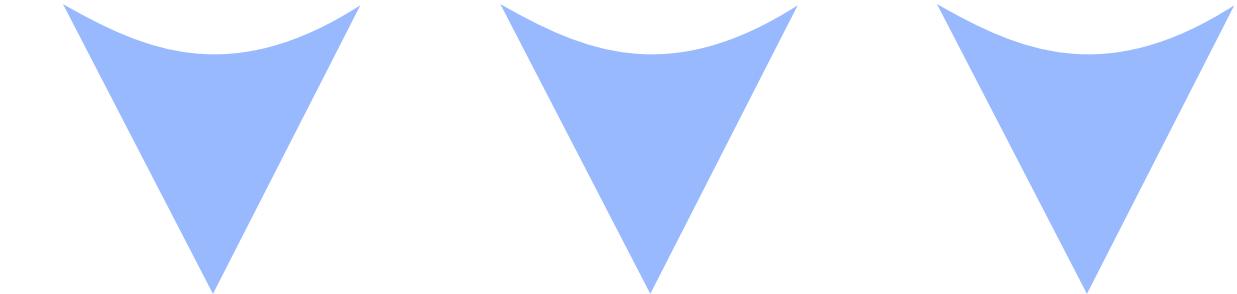




TOKENIZING WORDS

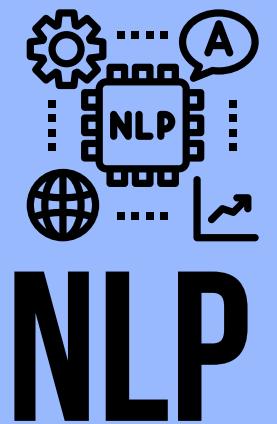
- Breaking down a sentence into individual words
- Clean the dataset
- Remove stop words and other irrelevant information
- Allow the analysis of the data to be more efficient and accurate

```
text_
Love this! Well made, sturdy, and very comfor...
love it, a great upgrade from the original. I...
This pillow saved my back. I love the look and...
Missing information on how to use it, but it i...
Very nice set. Good quality. We have had the s...
```

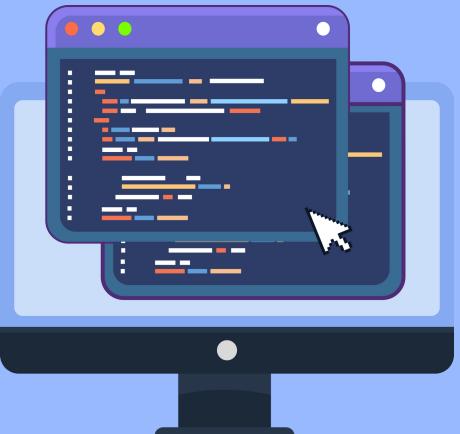


```
tokenized_text
[Love, this, !, Well, made, ,, sturdy, ,, and, ...
[love, it, ,, a, great, upgrade, from, the, or...
[This, pillow, saved, my, back, ., I, love, th...
[Missing, information, on, how, to, use, it, ,...
[Very, nice, set, ., Good, quality, ., We, hav...
```

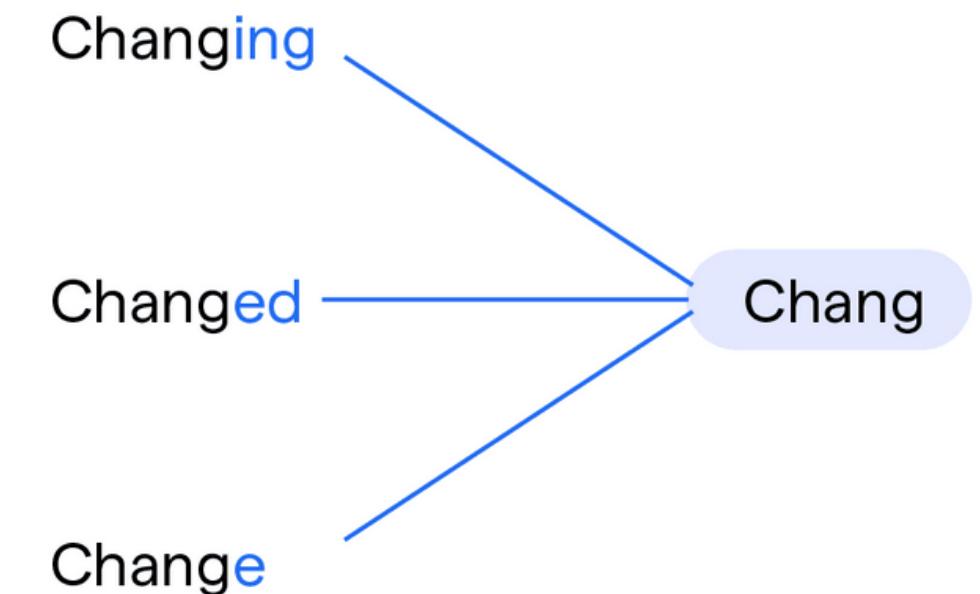




- Stop words removal
- Convert text to lower case
- Remove punctuation
- Stemming

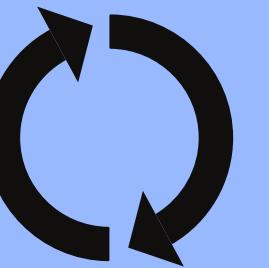


Stemming



Sample text with Stop Words	Without Stop Words
GeeksforGeeks – A Computer Science Portal for Geeks	GeeksforGeeks , Computer Science, Portal ,Geeks
Can listening be exhausting?	Listening, Exhausting
I like reading, so I read	Like, Reading, read



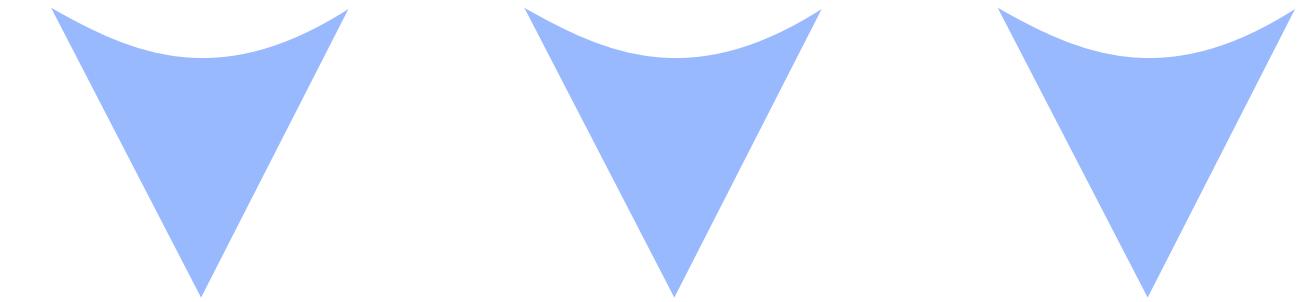


WORD2VEC

- We used Word2Vec to transform text into vectors
- Allow model to understand words meaning in a numerical format
- Vector representation of words



```
tokenized_text_without_stopwords
[love, thi, well, made, sturdi, veri, comfort, ...
[love, great, upgrad, origin, mine, coupl, year]
[thi, pillow, save, back, love, look, feel, th...
[miss, inform, use, great, product, price]
[veri, nice, set, good, qualiti, set, two, month]
```



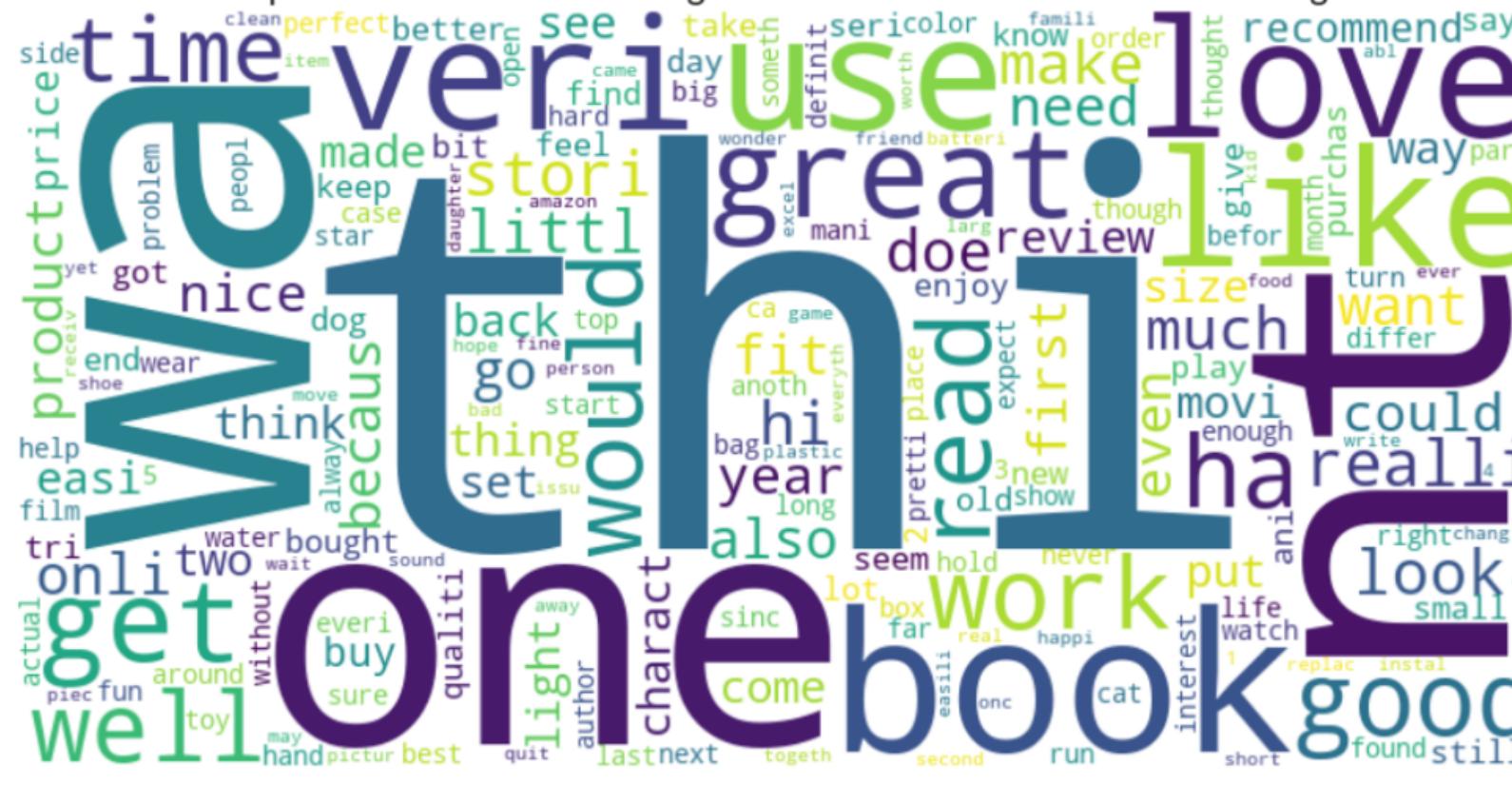
```
vectorized_text_without_stopwords
[0.36146158, -0.61847264, -1.11839, 0.7182733, ...
[-0.44234803, -0.065291576, -0.86585194, 0.406...
[0.23025388, -0.28033006, -0.868494, 0.3366425...
[0.10673118, -0.13800883, -0.36738887, -0.1039...
[0.25670105, -0.25649923, -1.3439211, -0.04342...
```



COMMON WORDS (AFTER PROCESSING)

REAL REVIEWS (AFTER PROCESSING)

Top Common Words in Original Reviews - After NLP Processing



FAKE REVIEWS (AFTER PROCESSING)

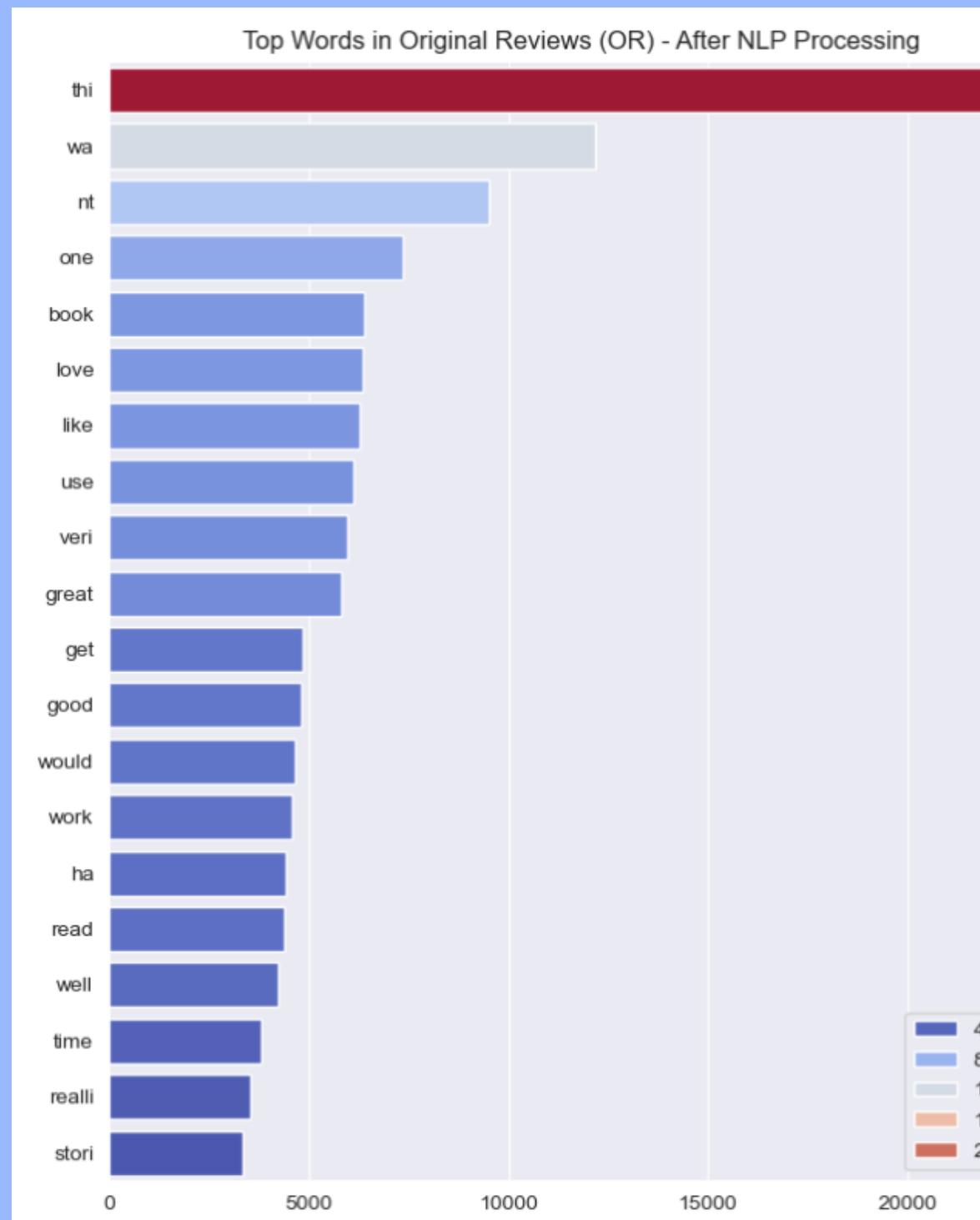
Top Common Words in Computer-Generated Reviews - After NLP Processing



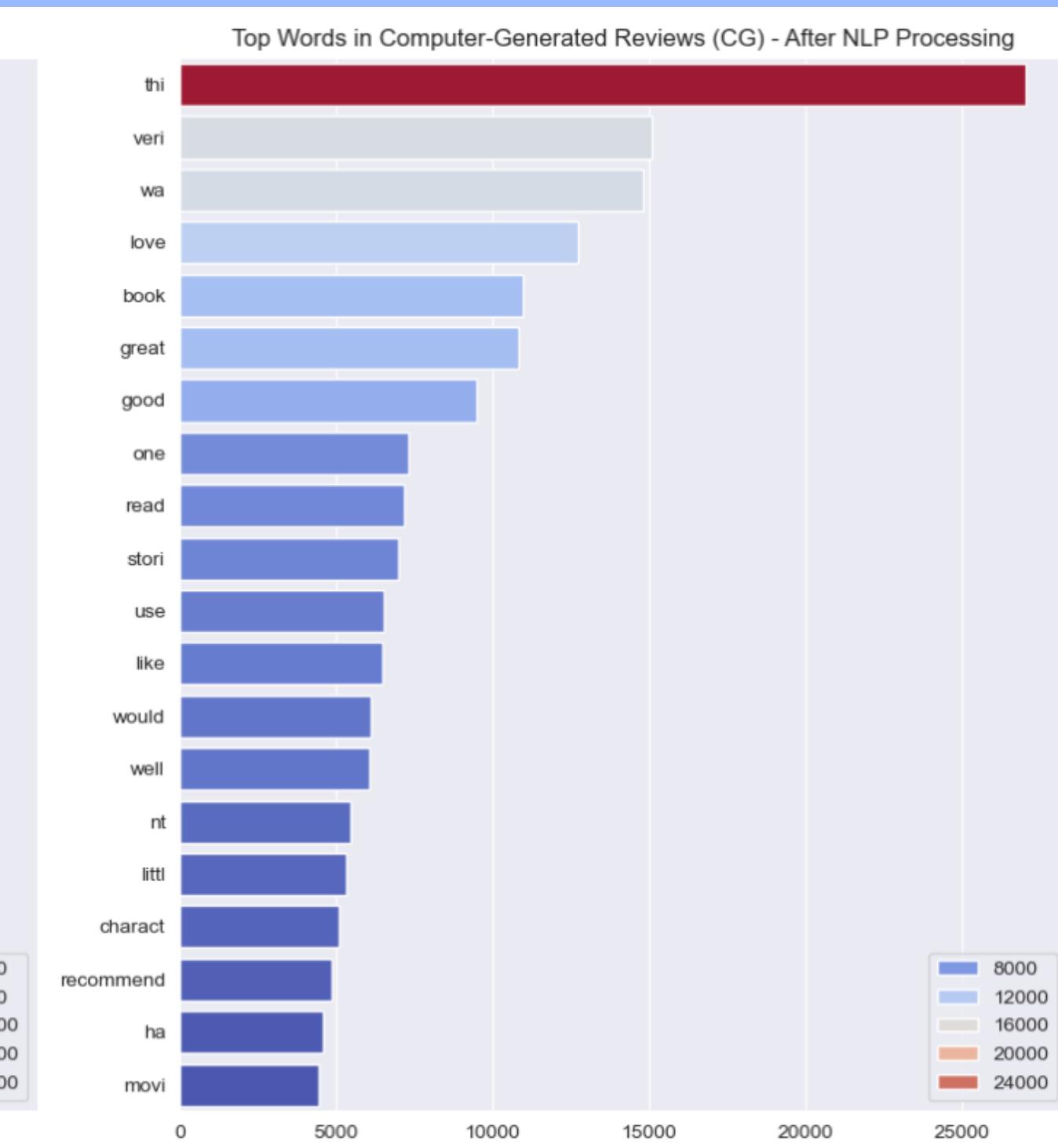


TOP WORDS IN EACH ORIGINAL & FAKE REVIEWS (AFTER PROCESSING)

REAL REVIEWS (AFTER PROCESSING)



FAKE REVIEWS (AFTER PROCESSING)

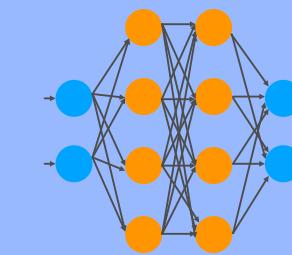




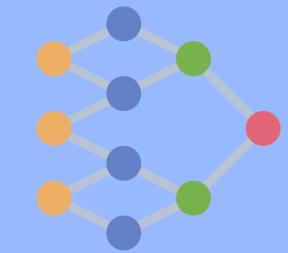
SOLUTIONS



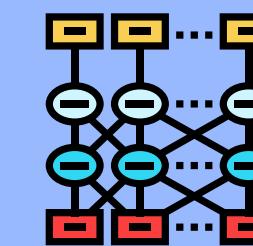
1 Deep Neural Network

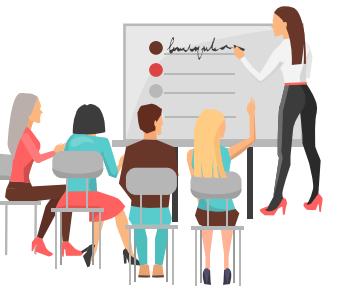


2 LSTM (Sequence-to-vector)

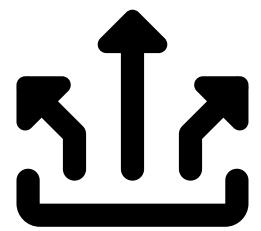
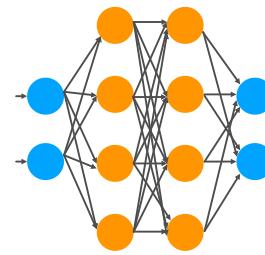
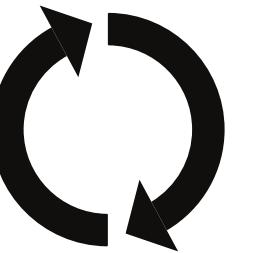
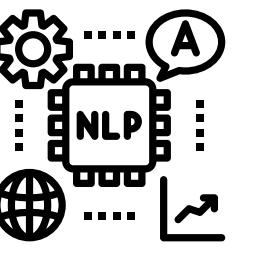
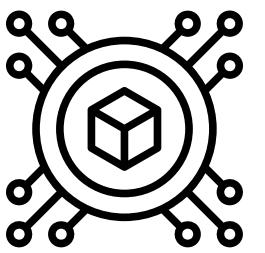
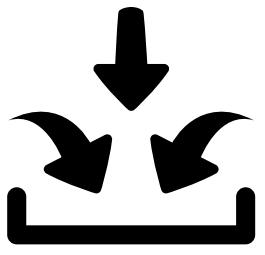


3 BERT



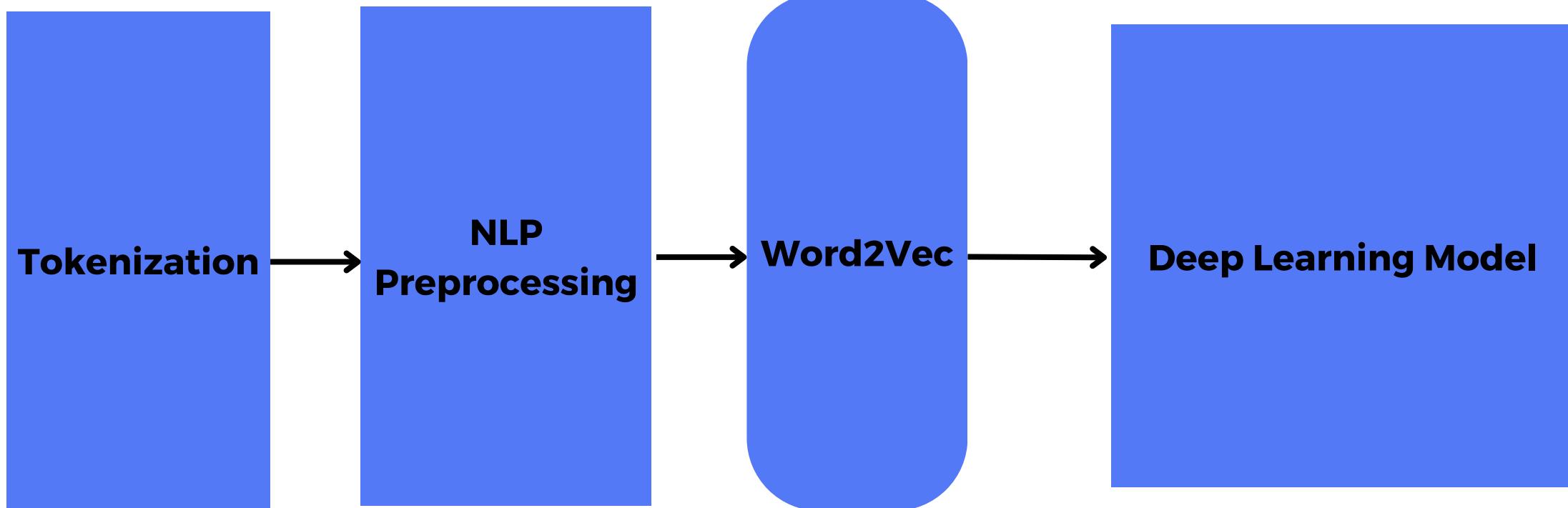


TRAINING PIPELINE (DNN & LSTM)

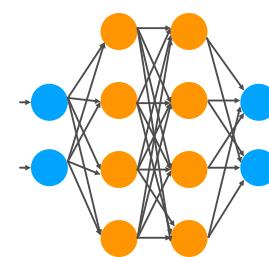


Input Data

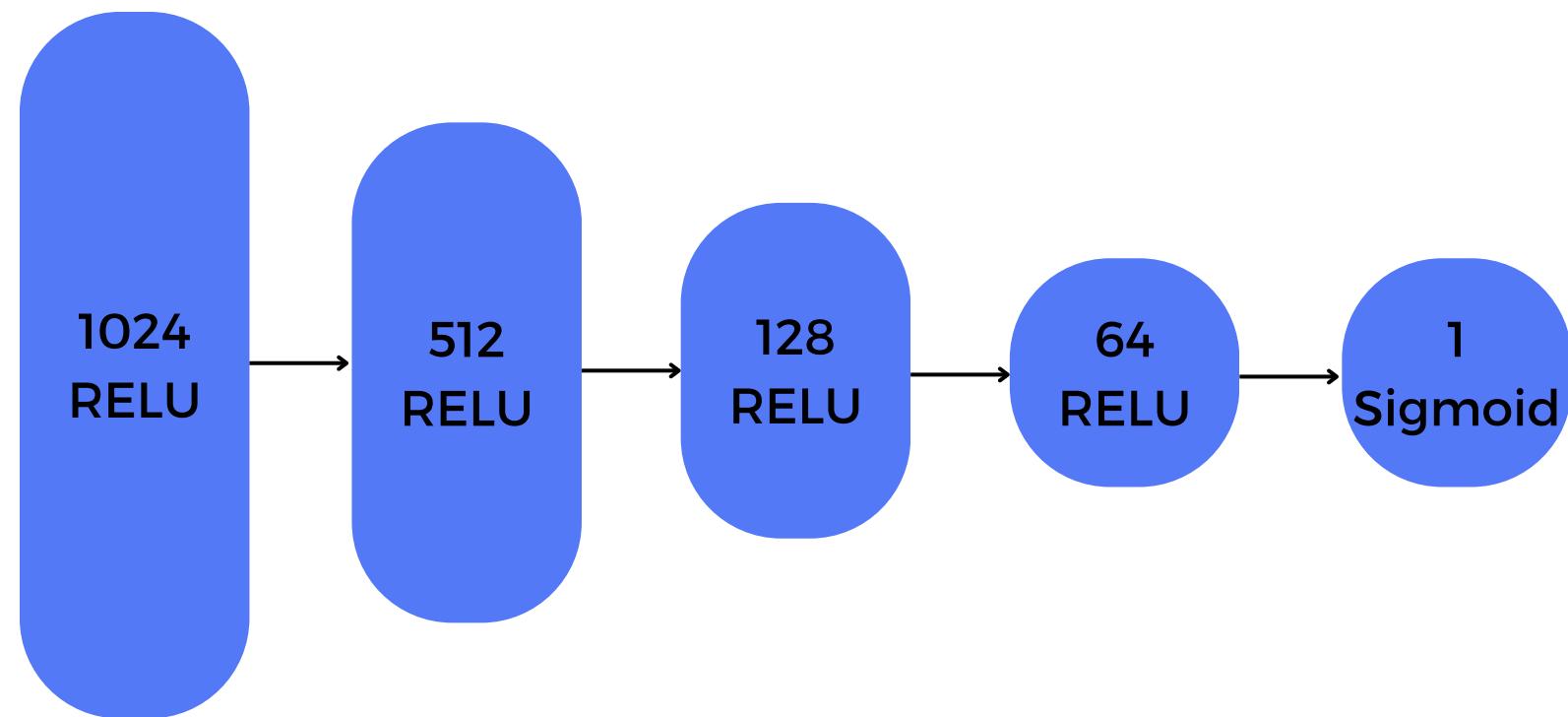
Very nice set. Good quality.
We have had the s...



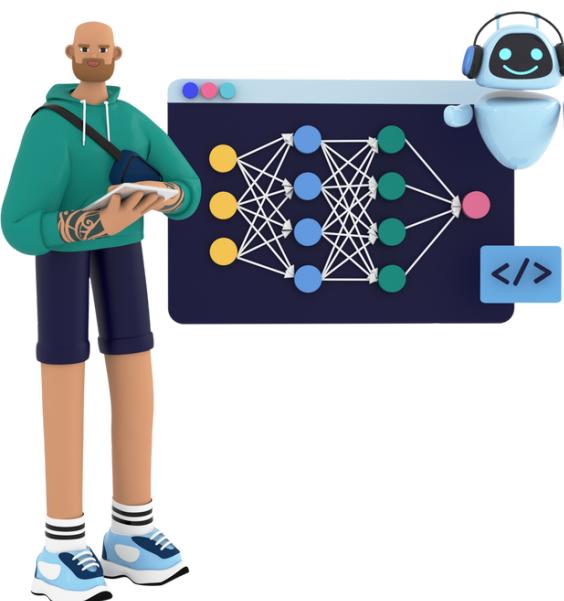
Output



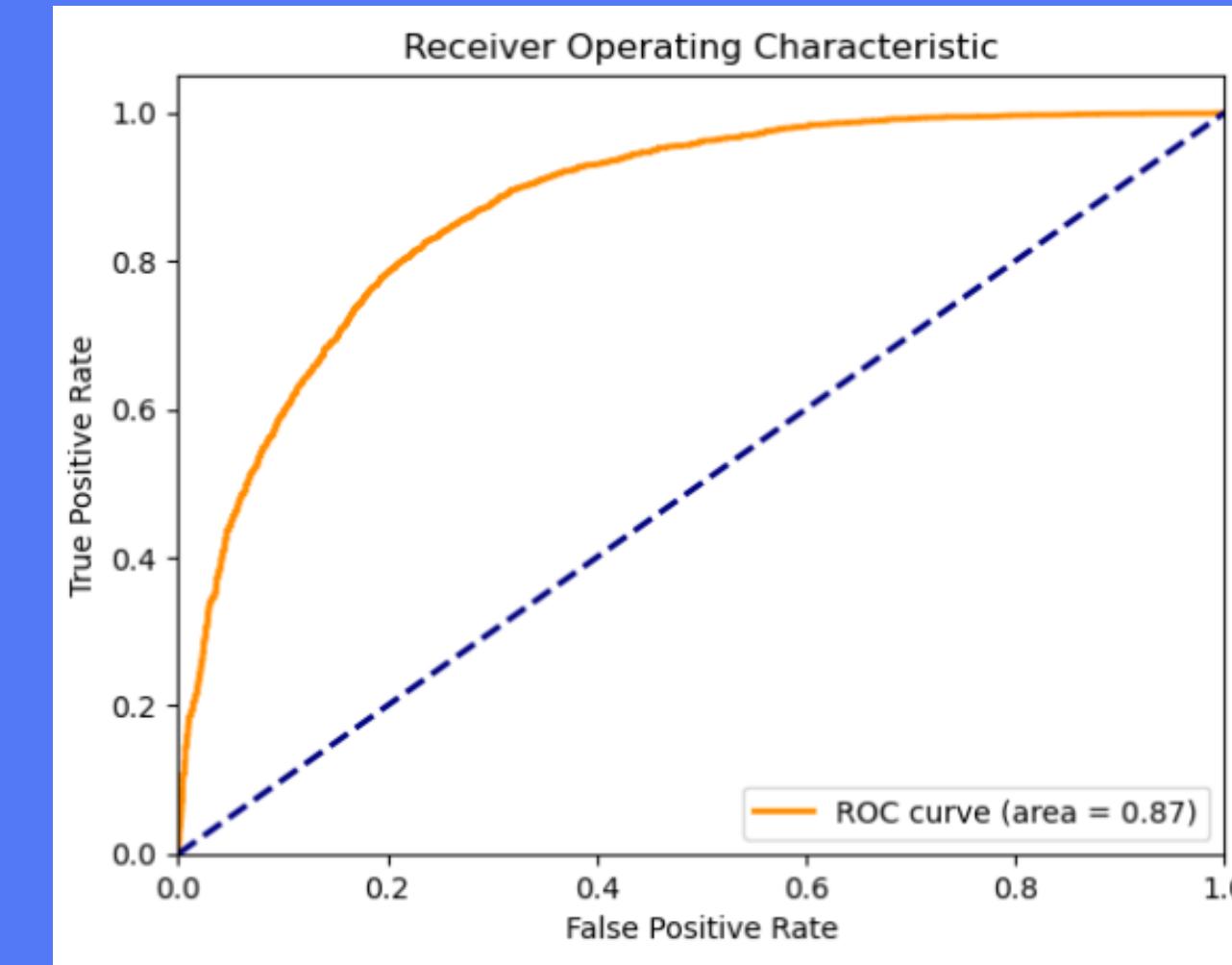
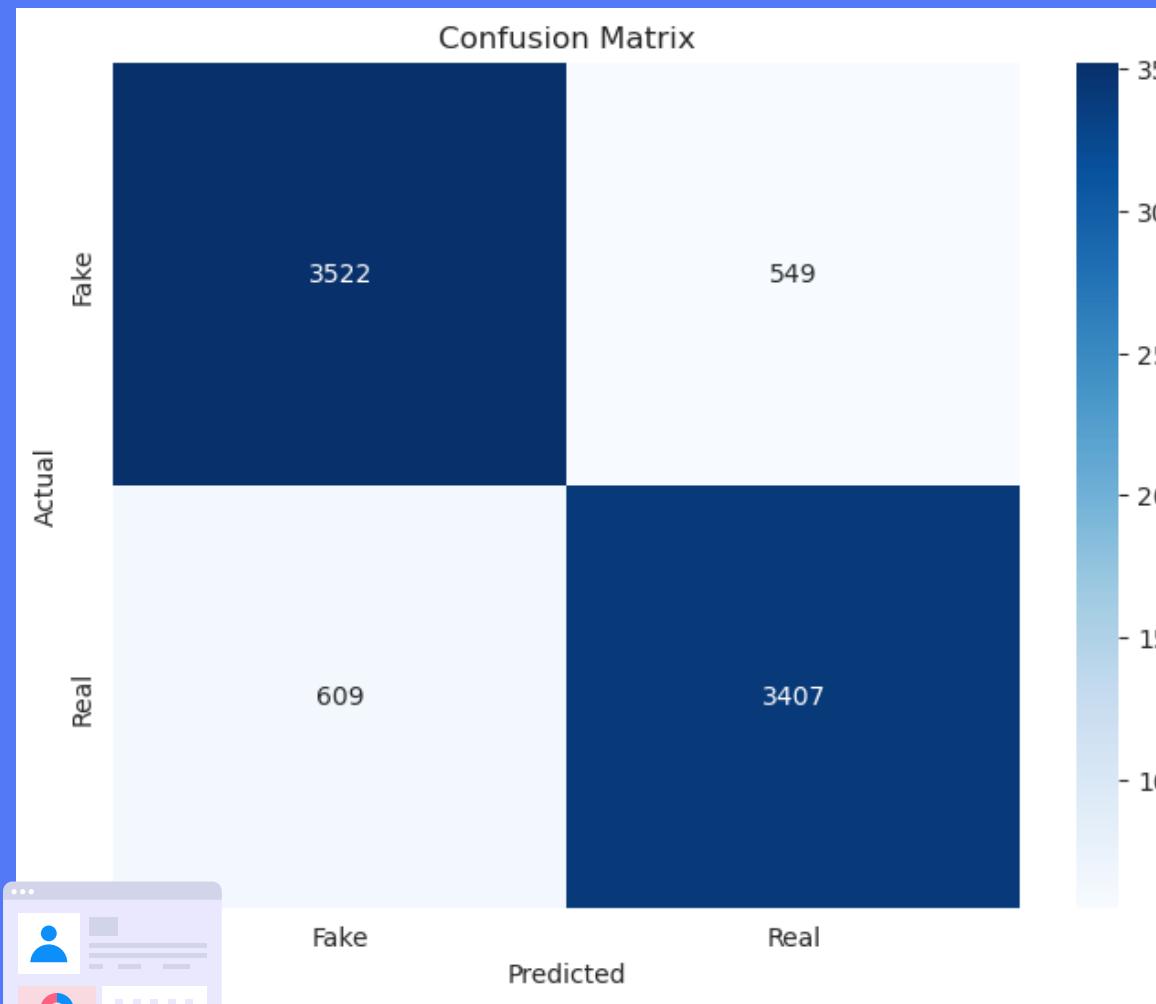
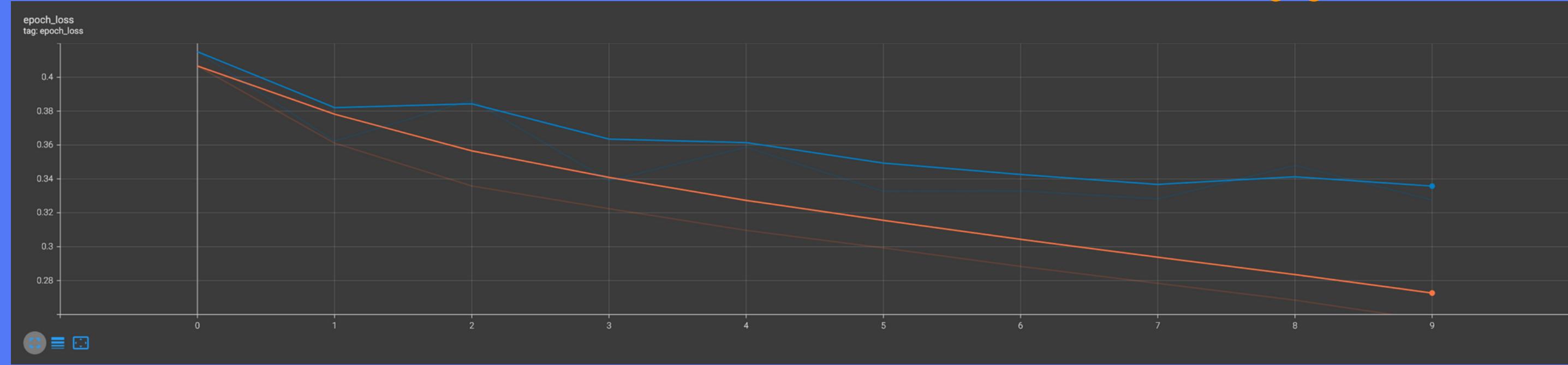
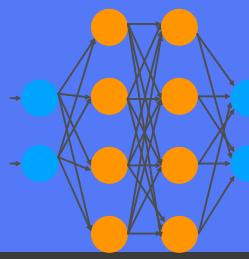
DEEP NEURAL NETWORK



- Only Fixed Length Data
- Take the average size vectors

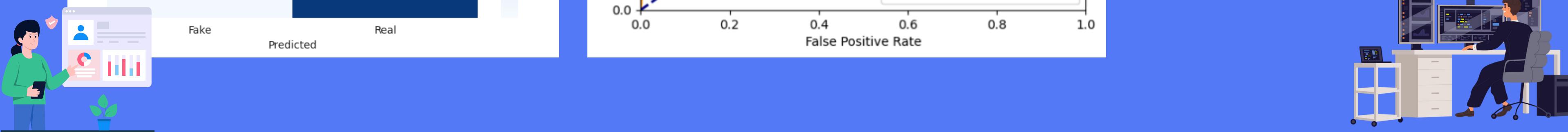


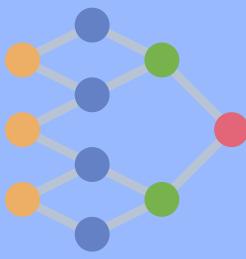
TENSORBOARD (DEEP NEURAL NETWORK)



Precision: 0.8612
Recall: 0.8484
F1 Score: 0.8547
Accuracy: 0.8568

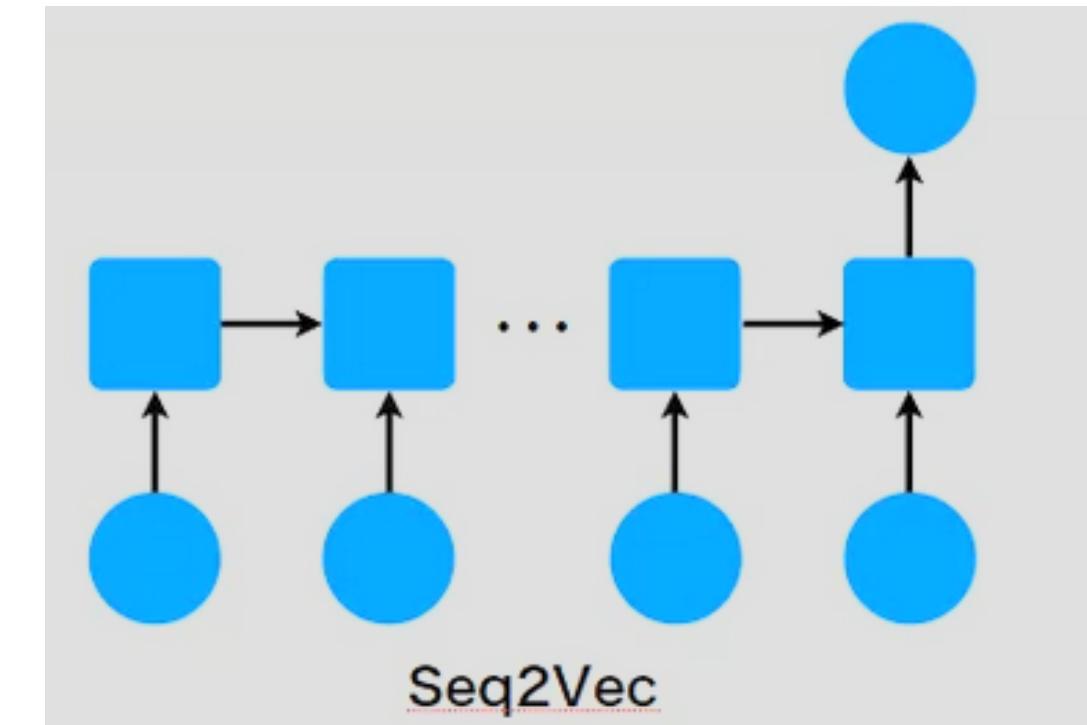
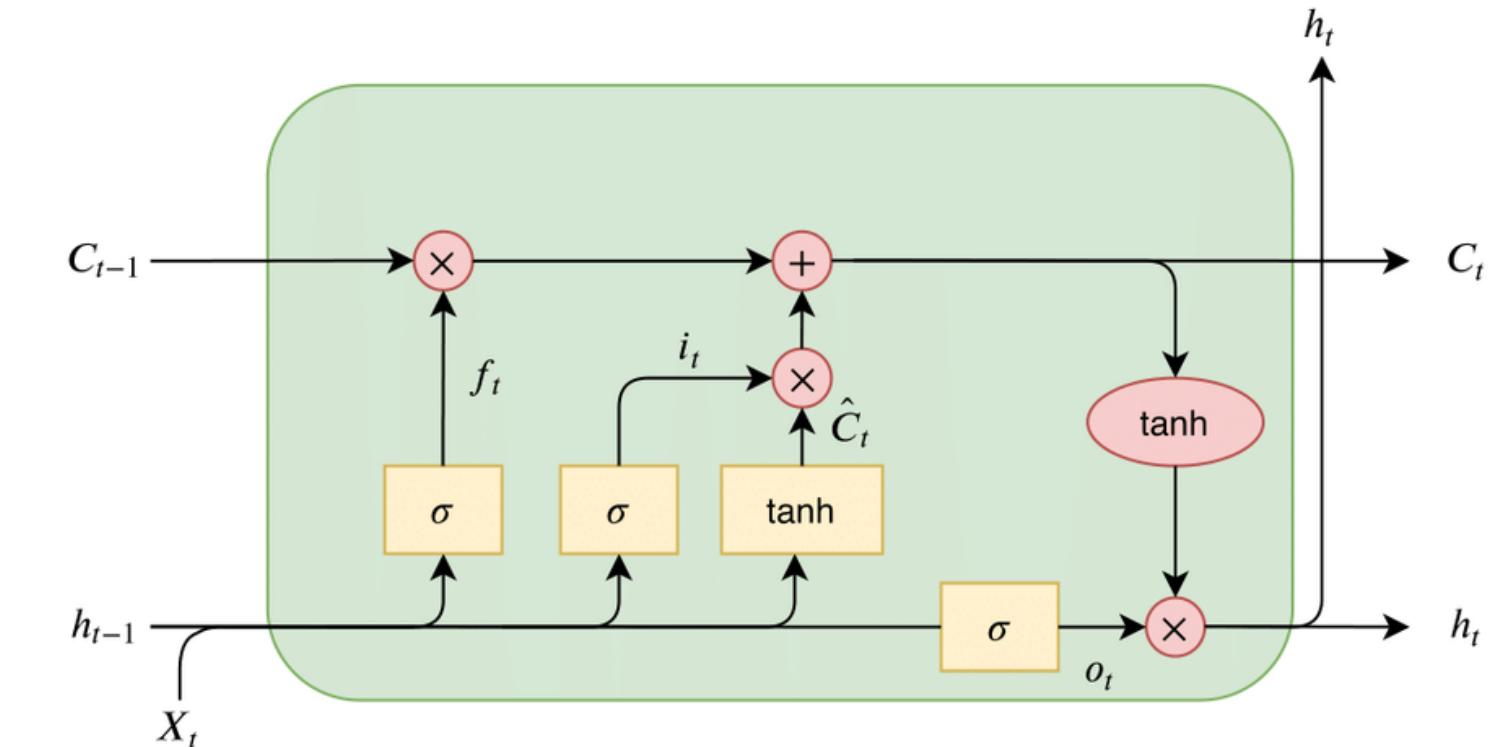
Optimizer: Adam
Loss Function: Binary Cross Entropy
Epoch: 10

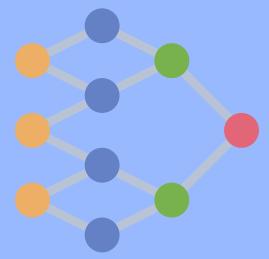




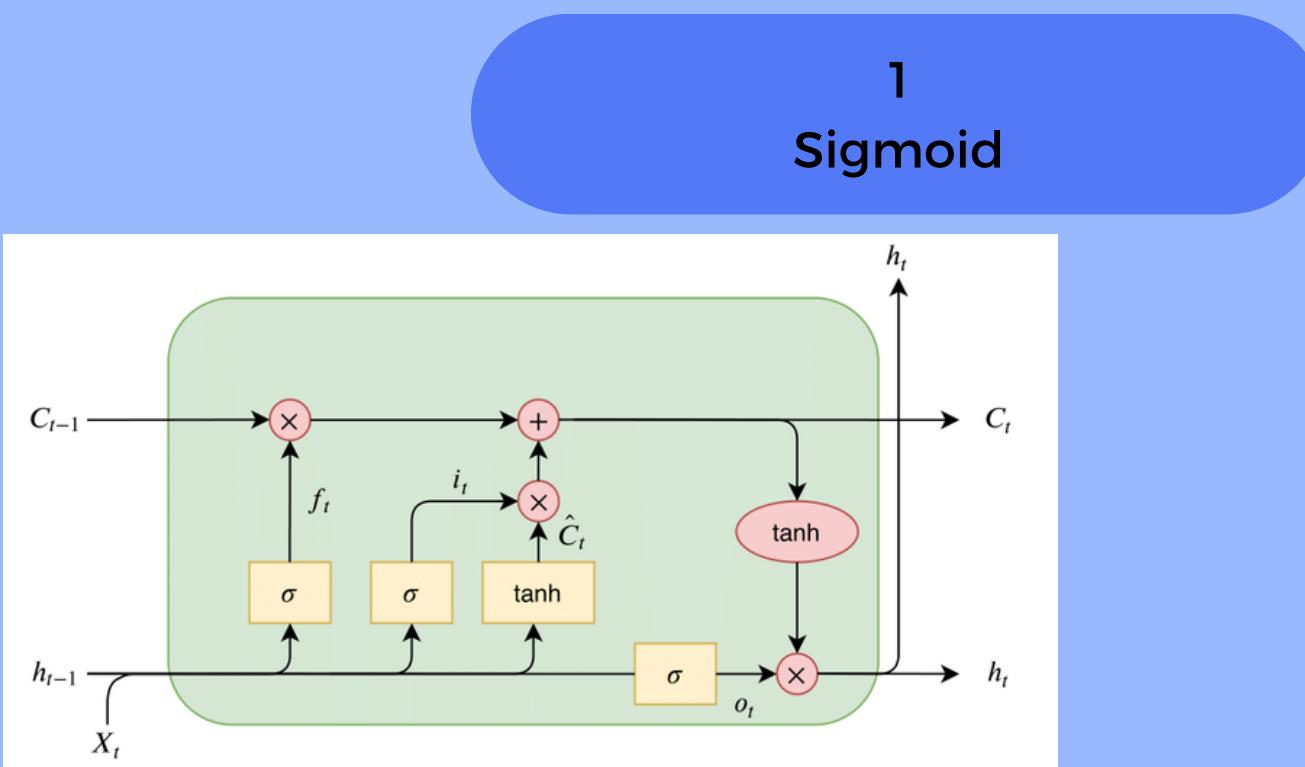
LSTM (SEQUENCE-TO-VECTOR)

- Recurrent neural network
- Able to capture longer dependencies using long-term memory
- Accept variable size data (Seq2Seq), (Vec2Seq), (Seq2Vec)





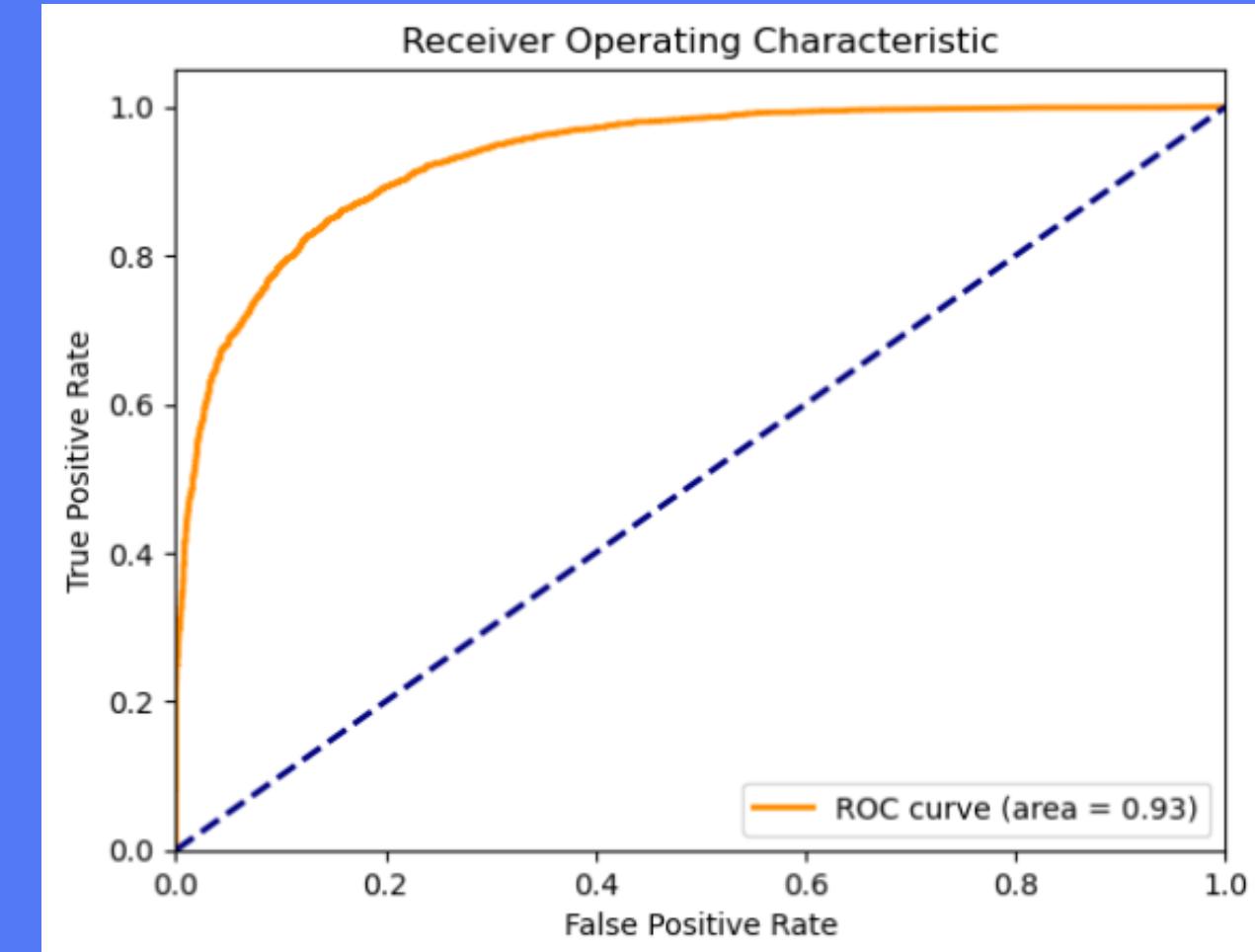
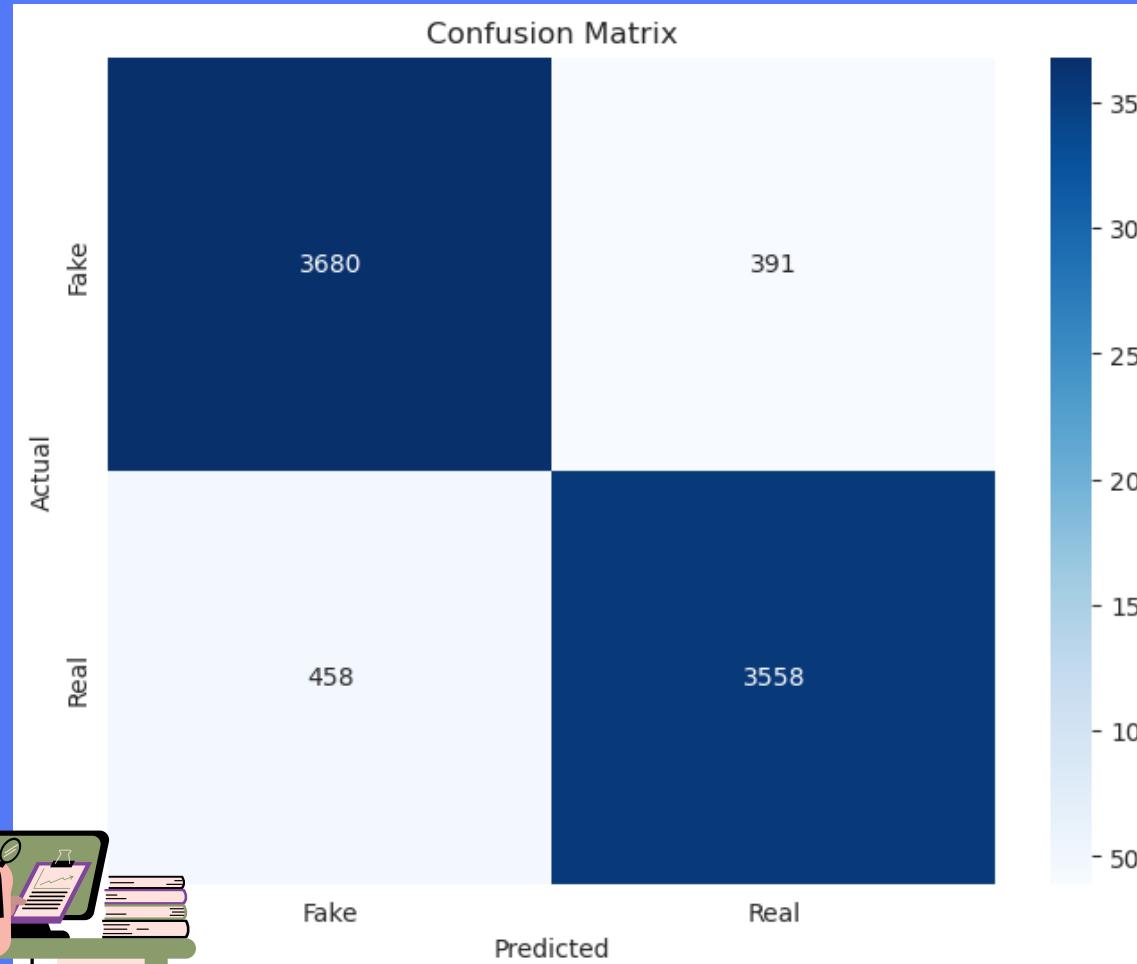
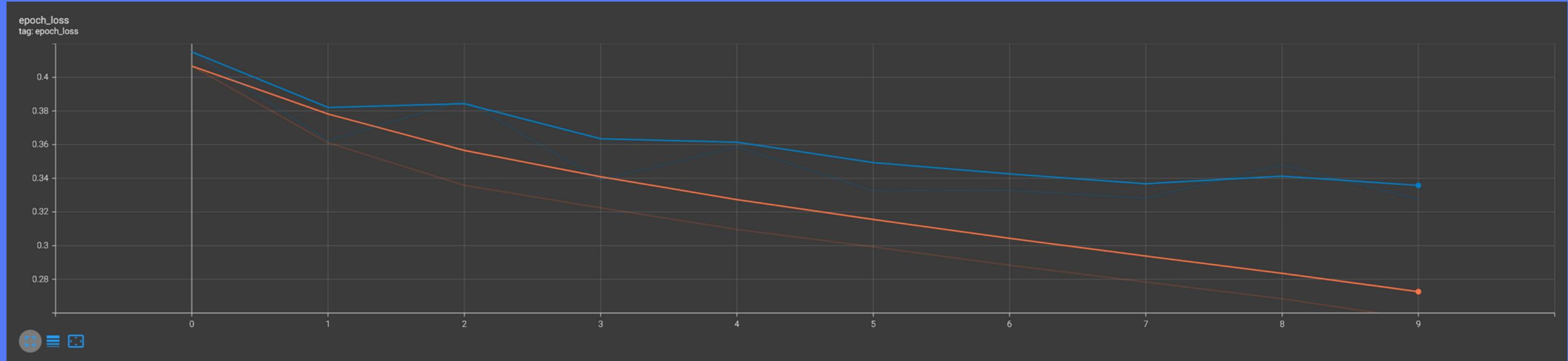
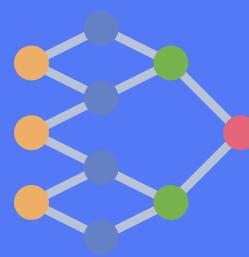
LSTM (SEQUENCE-TO-VECTOR)



- 128 units
- Last hidden output will be fed into a dense layer for prediction

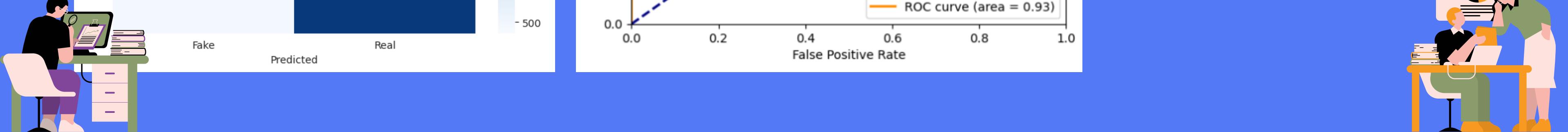


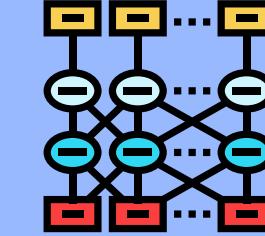
TENSORBOARD (LSTM)



Precision: 0.9010
Recall: 0.8860
F1 Score: 0.8934
Accuracy: 0.8950

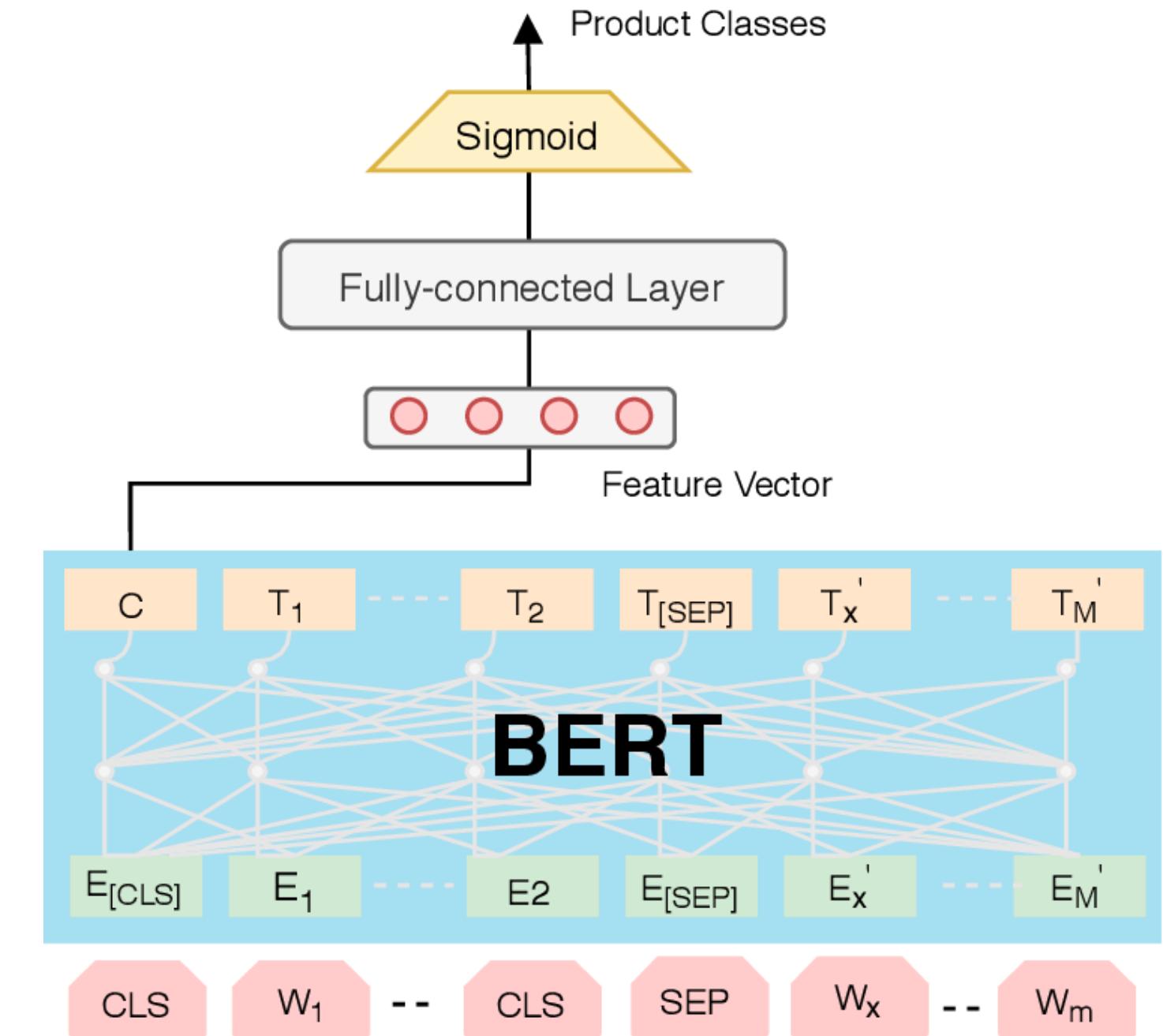
Optimizer: Adam
Loss Function: Binary Cross Entropy
Epoch: 10



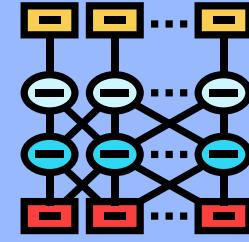


BERT

- Transformer Model
- Large Language Model
- Can be fine-tuned for classification task
- Can capture long-term dependencies better than LSTM
- Bidirectional
- Allow variable size data



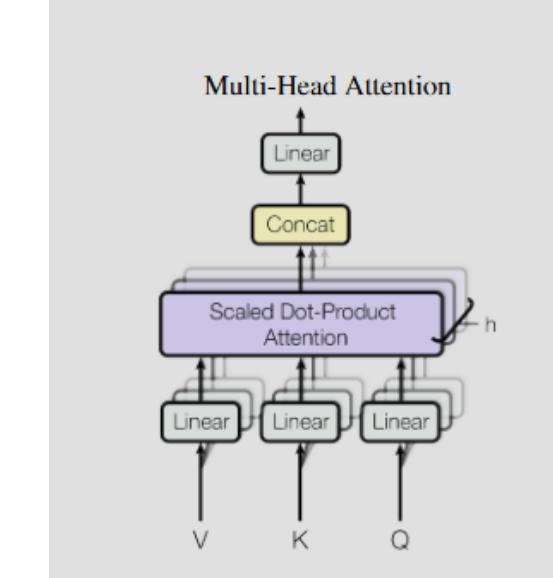
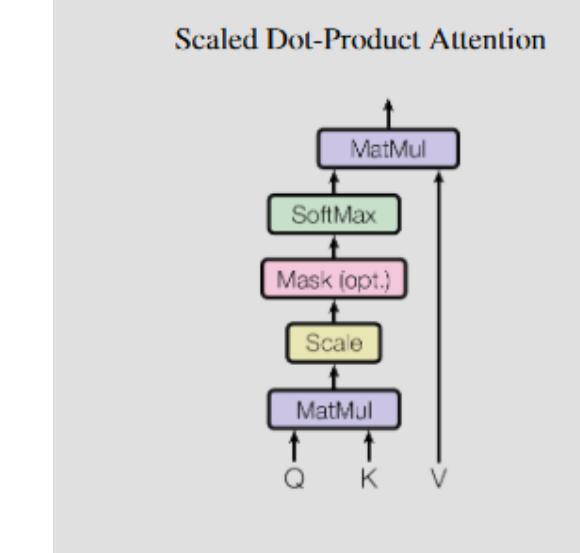
ATTENTION



Self Attention Formula

$$\text{Attention}(Q, K, V) = \text{softmax}\left(\frac{QK^T}{\sqrt{d_k}}\right)V$$

- Scaled Dot-Product Attention
- Multi-Head Attention
- Self Attention

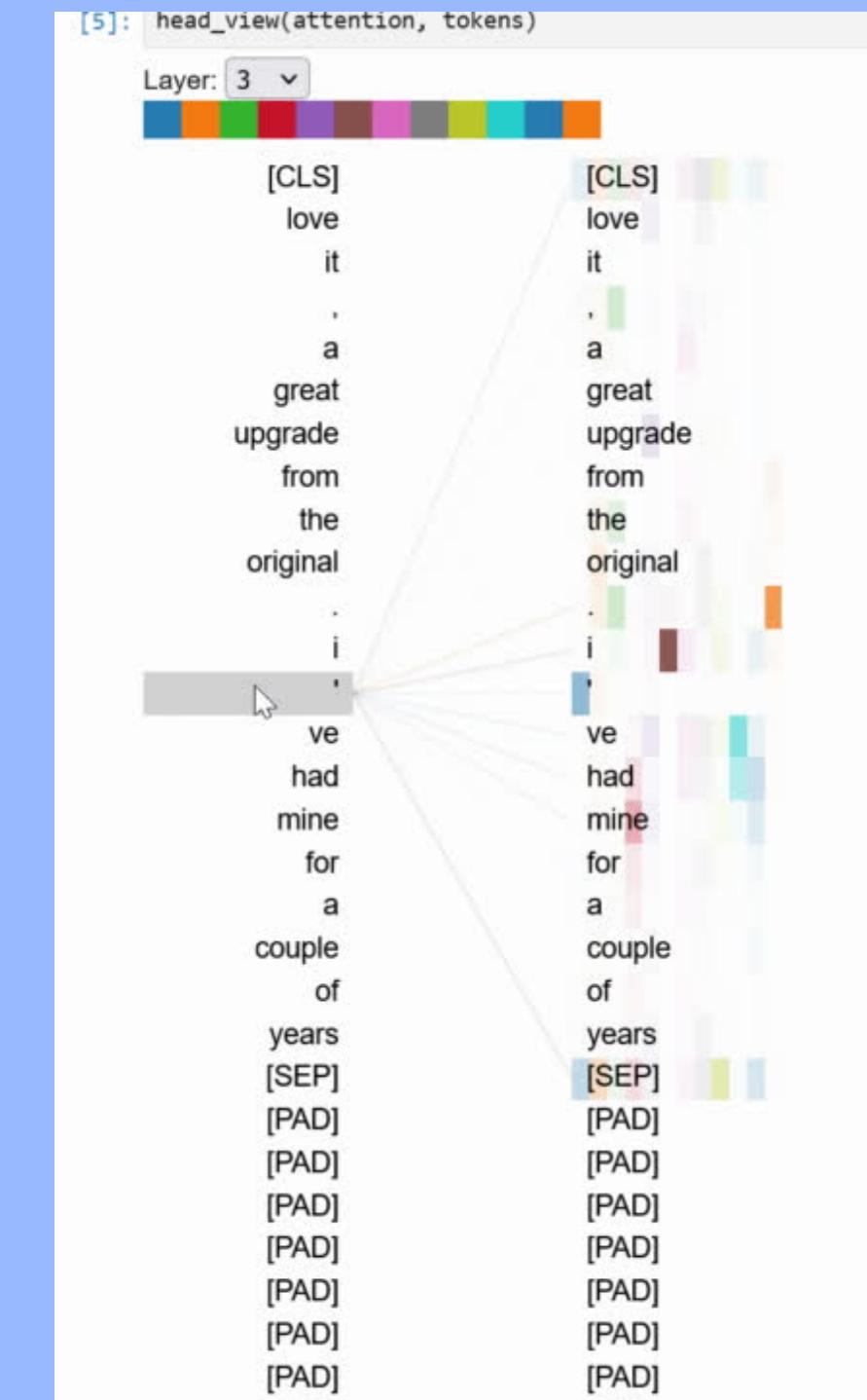
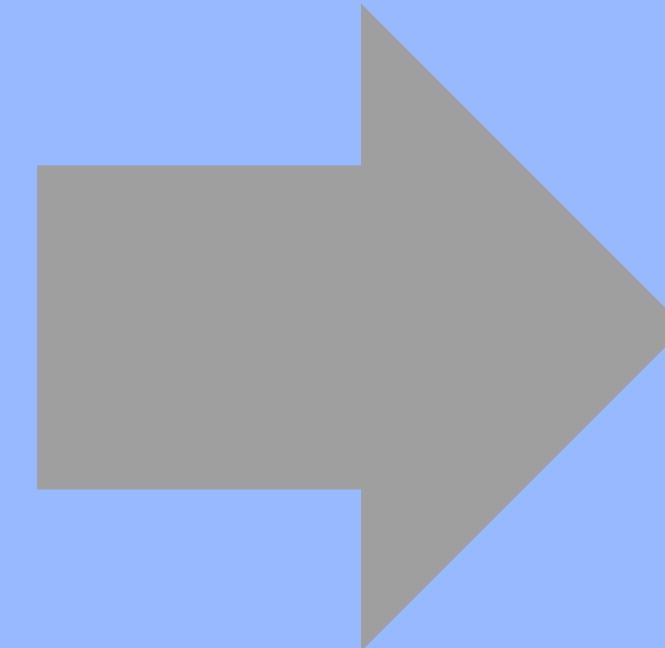


From: Attention Is All You Need

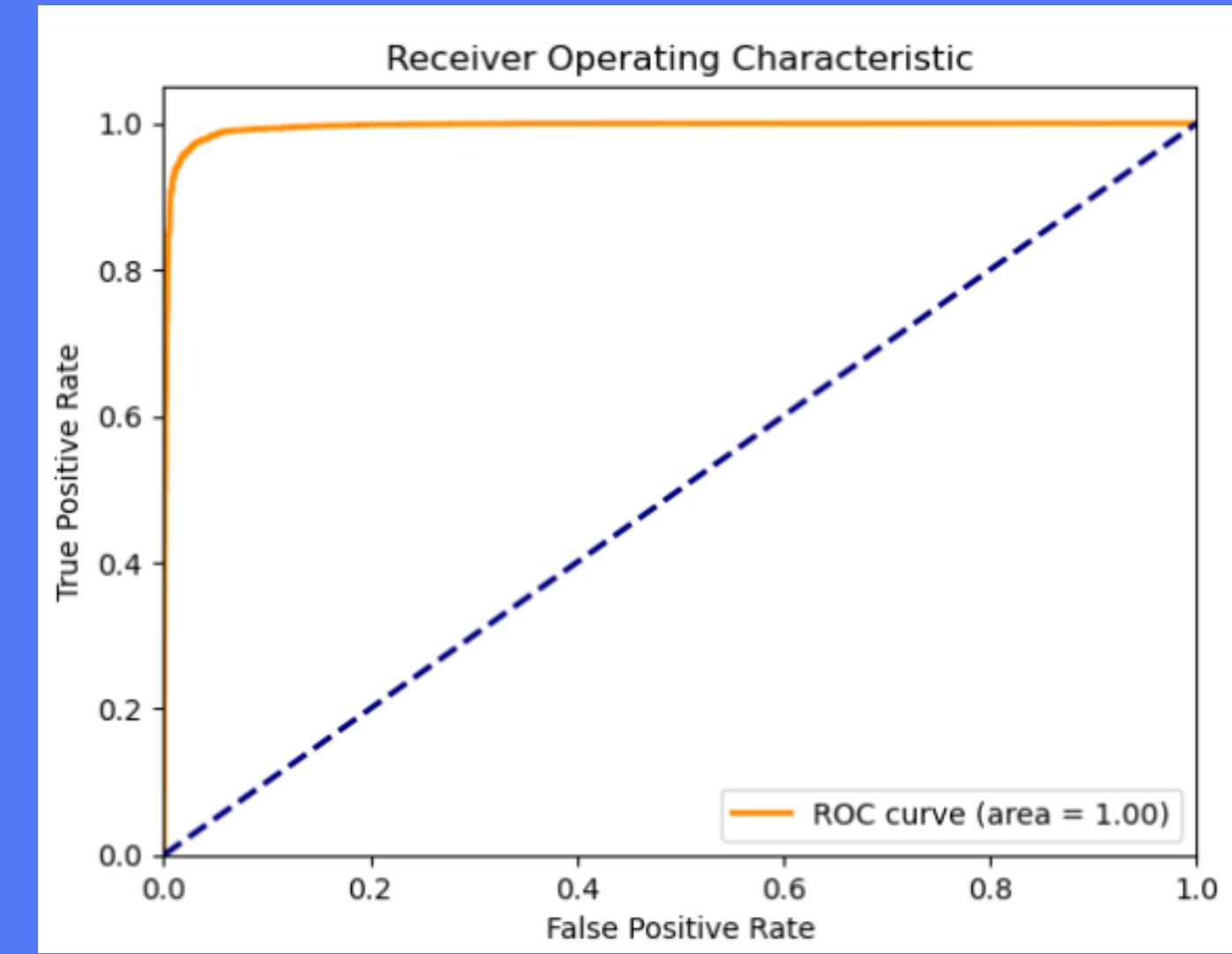
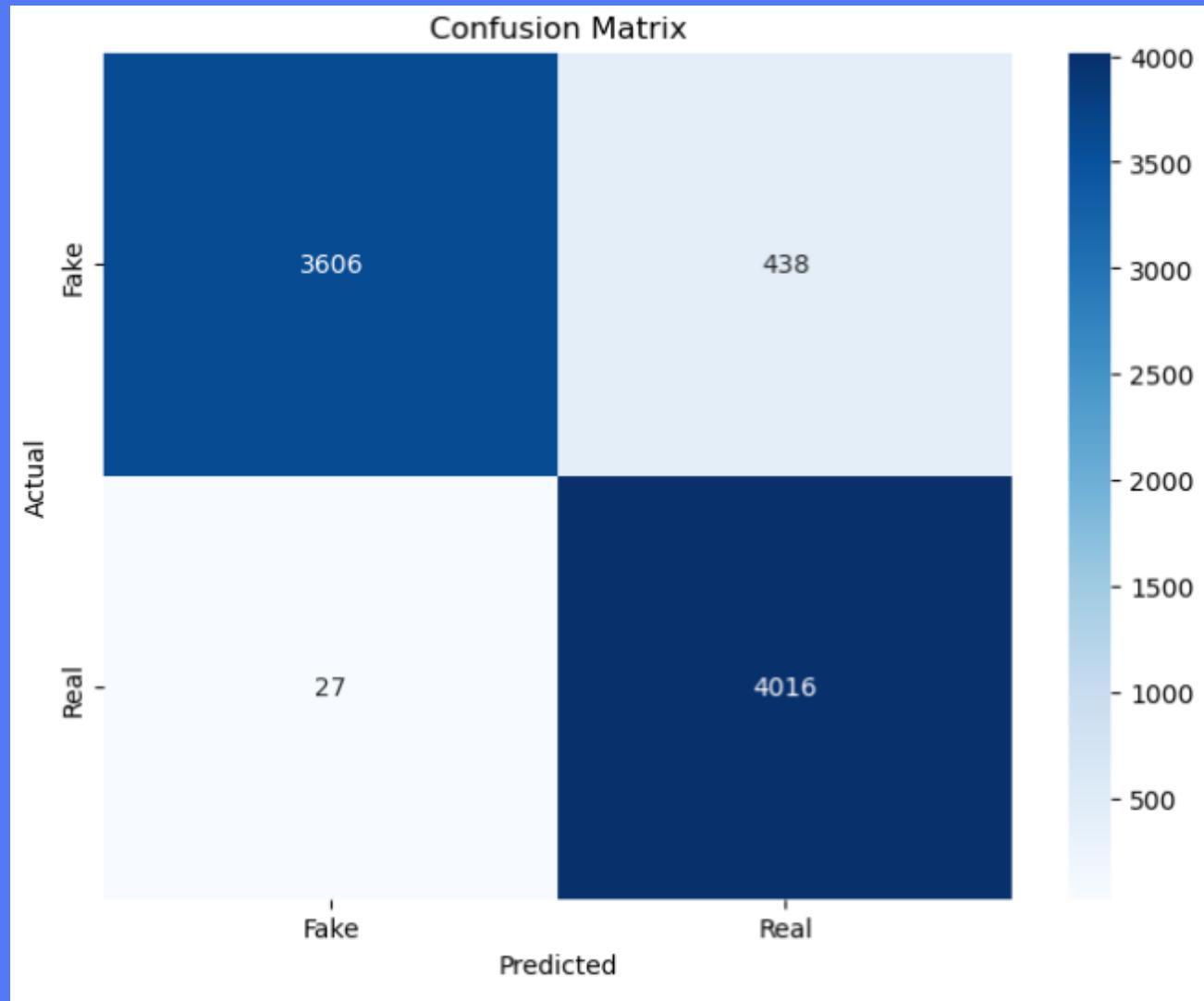
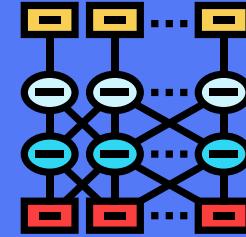


Our BERT Model Attention Score

Input Sentence: love it, a great upgrade from the original. I've had mine for a couple of years



FINE TUNING (BERT-BASE-UNCASED)



Precision: 0.9017
Recall: 0.9933
F1 Score: 0.9453
Accuracy: 0.9425



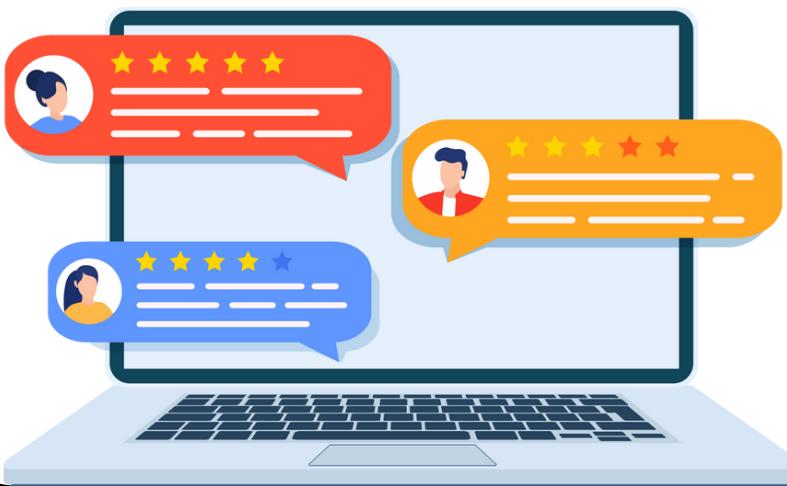
Optimizer: Adam
Loss Function: Binary Cross Entropy
Epoch: 3



CONCLUSION



- The three neural network model we used has proven accurate in detecting fake reviews
- Potential to maintain credibility of digital marketplaces
- By filtering out the fake reviews we ensure that consumer receive genuine reviews





**THANK YOU FOR
LISTENING!**