Women Fashion Review

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https://github.com/wongkhoon/Coursera/tree/main/Advanced%20Data%20Science%20with%20IBM/Advanced%20Data%20Science%20Capstone

Use Case

Fashion recommendation prediction according to textual review from consumers

Data Source

Name

Women's E-Commerce Clothing Reviews

Source

Kaggle[1]

Reason

- Publicly accessible and available
- Data contains both qualitative and quantitative

EDA

Data Set

String

- Title
- Review
- Division Name
- Department Name
- Class Name

Numeric

- Clothing ID
- Age
- Rating
  (1 Worst, to 5 Best)
- Positive Feedback Count
- Recommended IND
  (1= recommended, 0=not recommended)

Data Set

```
---- ORIGINAL DATA ----

Data shape: Total of 23486 entries, 10 data columns

+----------------+-----+-------------------+
|Recommended IND|count|         proportion|
+----------------+-----+-------------------+
|               1|19314| 82.23622583666865|
|               0| 4172|17.763774163331348|
+----------------+-----+-------------------+

---- Post random sampling without replacement ----

Data shape: Total of 6000 entries, 10 data columns

+----------------+-----+-------------------+
|Recommended IND|count|         proportion|
+----------------+-----+-------------------+
|               1| 4929|              82.15|
|               0| 1071|17.849999999999998|
+----------------+-----+-------------------+
```

Data Set

---- POST-SAMPLING DATA ----

First five entries:

Clothing ID	Age	Title	Review Text	Rating	Recommended IND	Positive Feedback Count	Division Name	Department Name	Class Name
858	39	Shimmer, surprisi...	I ordered this in...	4	1	4	General Petite	Tops	Knits
1065	34	You need to be at...	Material and colo...	3	1	2	General	Bottoms	Pants
1120	32	Super cute and cozy	A flattering, sup...	5	1	0	General	Jackets	Outerwear
949	33	Huge disappointment	I have been waiti...	2	0	0	General	Tops	Sweaters
1003	31	Loved, but returned	The colors weren'...	4	1	0	General	Bottoms	Skirts

only showing top 5 rows

Data Quality Assessment

Duplicates

Two identified

- Removed

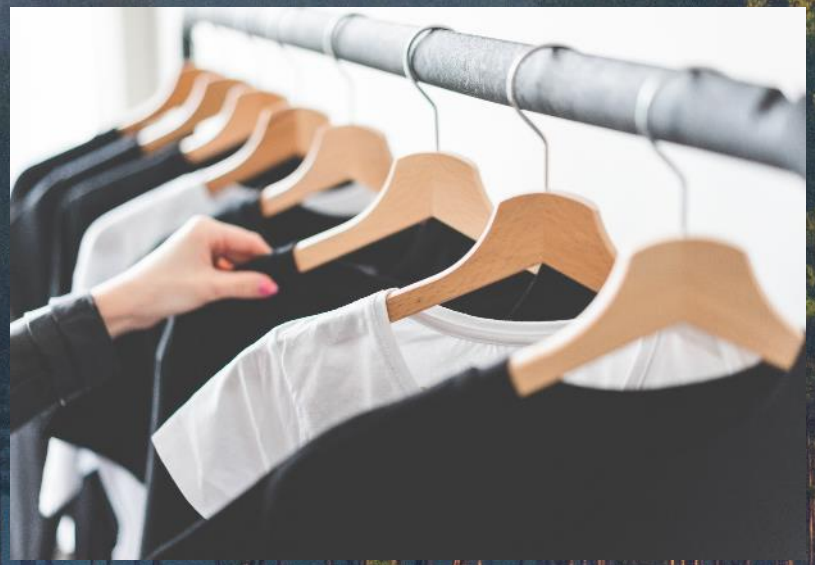
Missing data

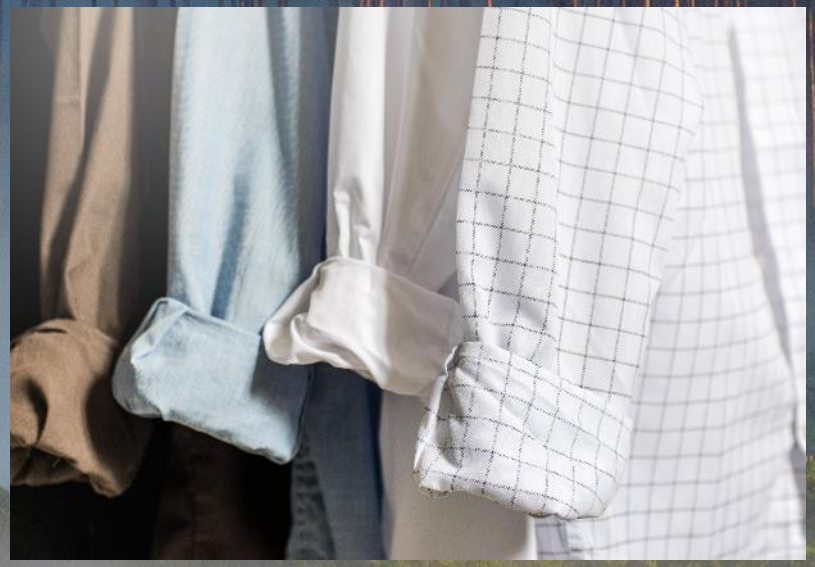
String columns, except for Review and Title

- Imputed by “unknown”

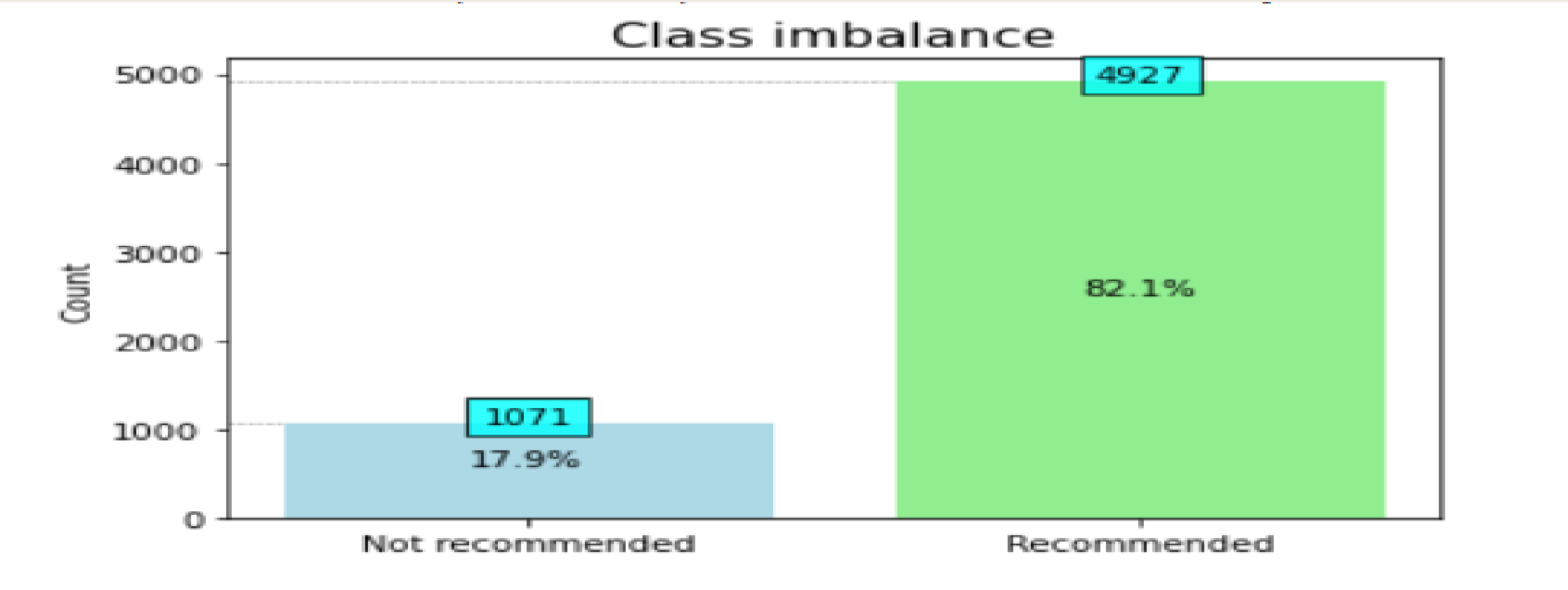
Numeric columns

- No missing





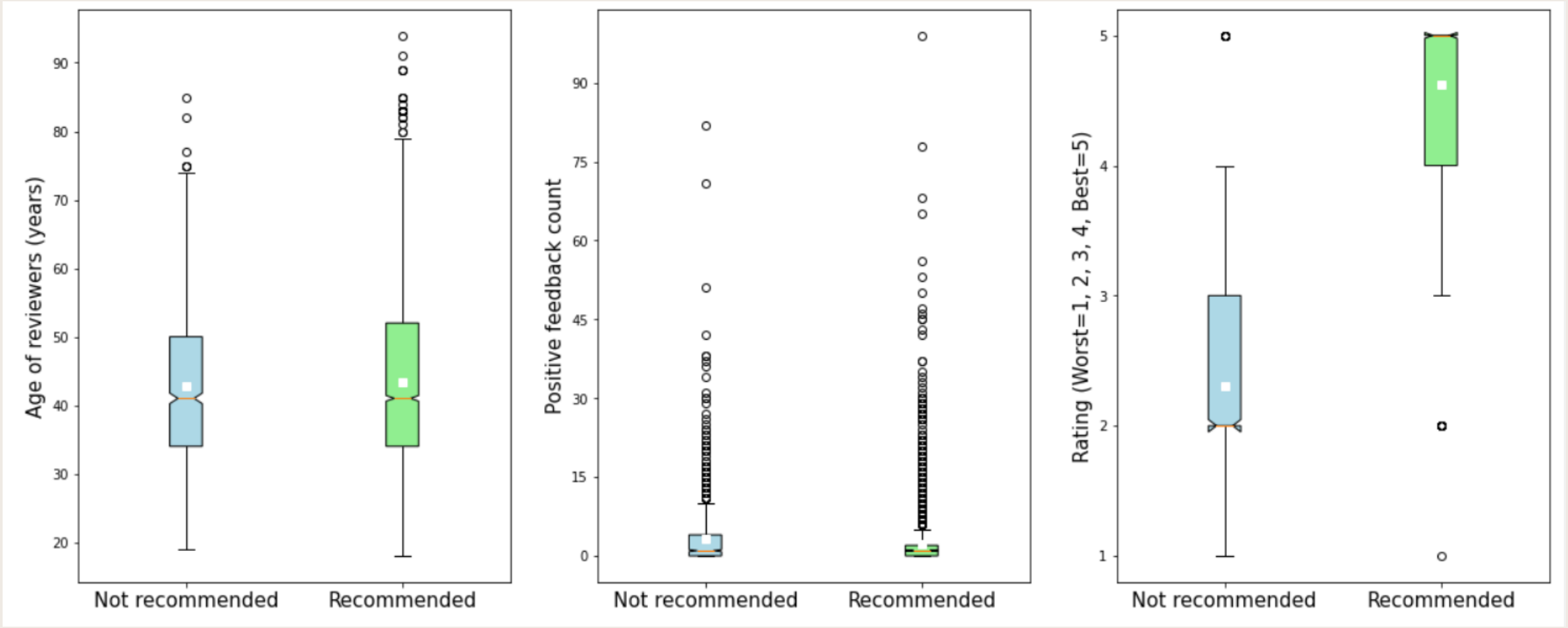
Data Exploration/Visualization



Class Weights

```
# https://scikit-learn.org/stable/modules/generated/sklearn.utils.class_weight.compute_class_weight.html
# Estimate class weights for unbalanced datasets
weight0=train.count()/((train.select('Recommended IND').distinct().count())*(train.filter(train["Recommended IND"] == 0).count()))
weight1=train.count()/((train.select('Recommended IND').distinct().count())*(train.filter(train["Recommended IND"] == 1).count()))
```

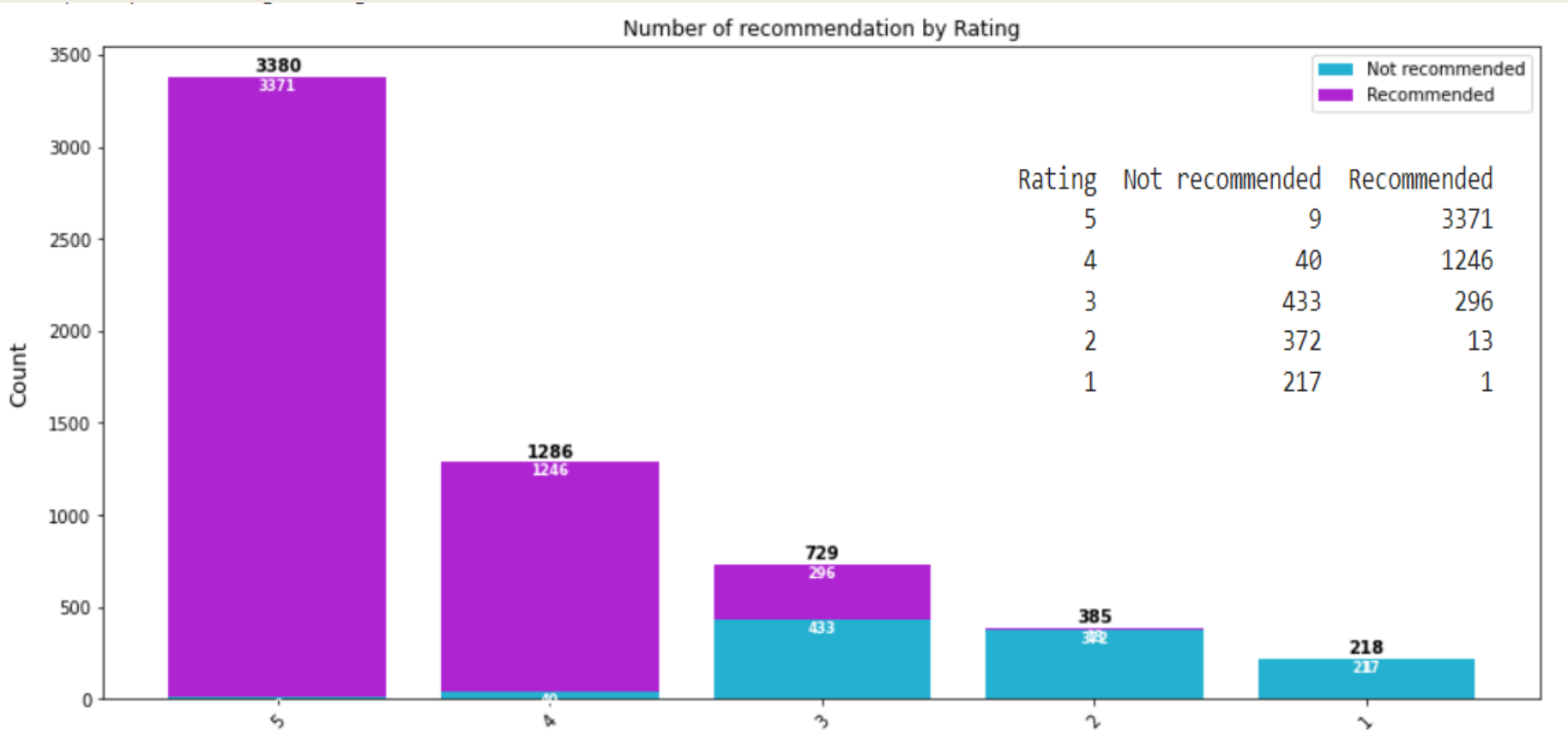
Data Exploration/Visualization



Data Exploration/Visualization

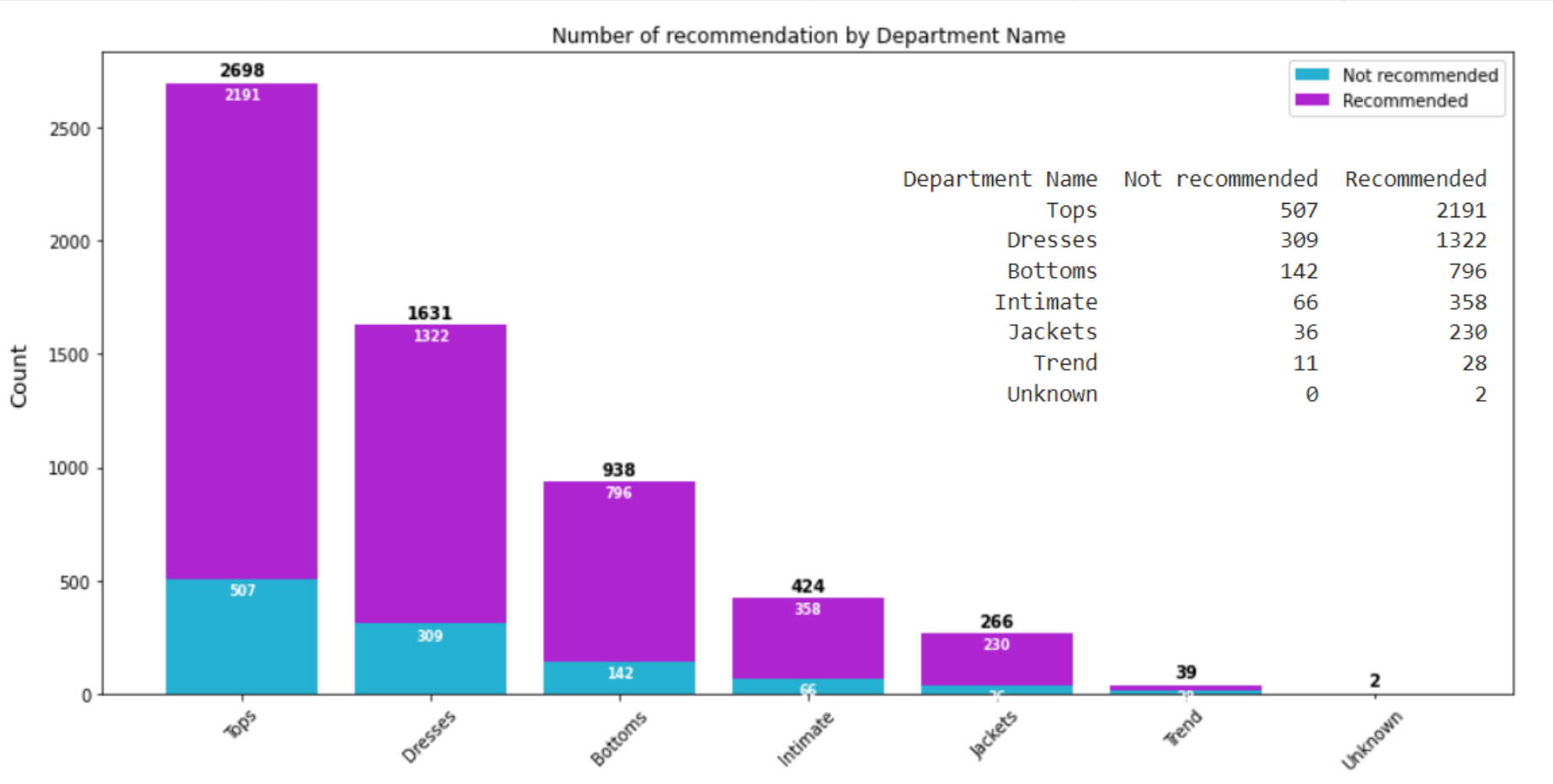
```
Pearson correlation:

Overall between numerical features
Age versus
     Rating                                          :   0.0285
     Positive Feedback Count                         :   0.0556
Rating versus Positive Feedback Count:  -0.0669

Not recommended group
Age versus
     Rating                                          :  -0.0232
     Positive Feedback Count                         :   0.0702
Rating versus Positive Feedback Count:  -0.0155

Recommended group
Age versus
     Rating                                          :   0.0324
     Positive Feedback Count                         :   0.0545
Rating versus Positive Feedback Count:  -0.0102
```

Data Exploration/Visualization



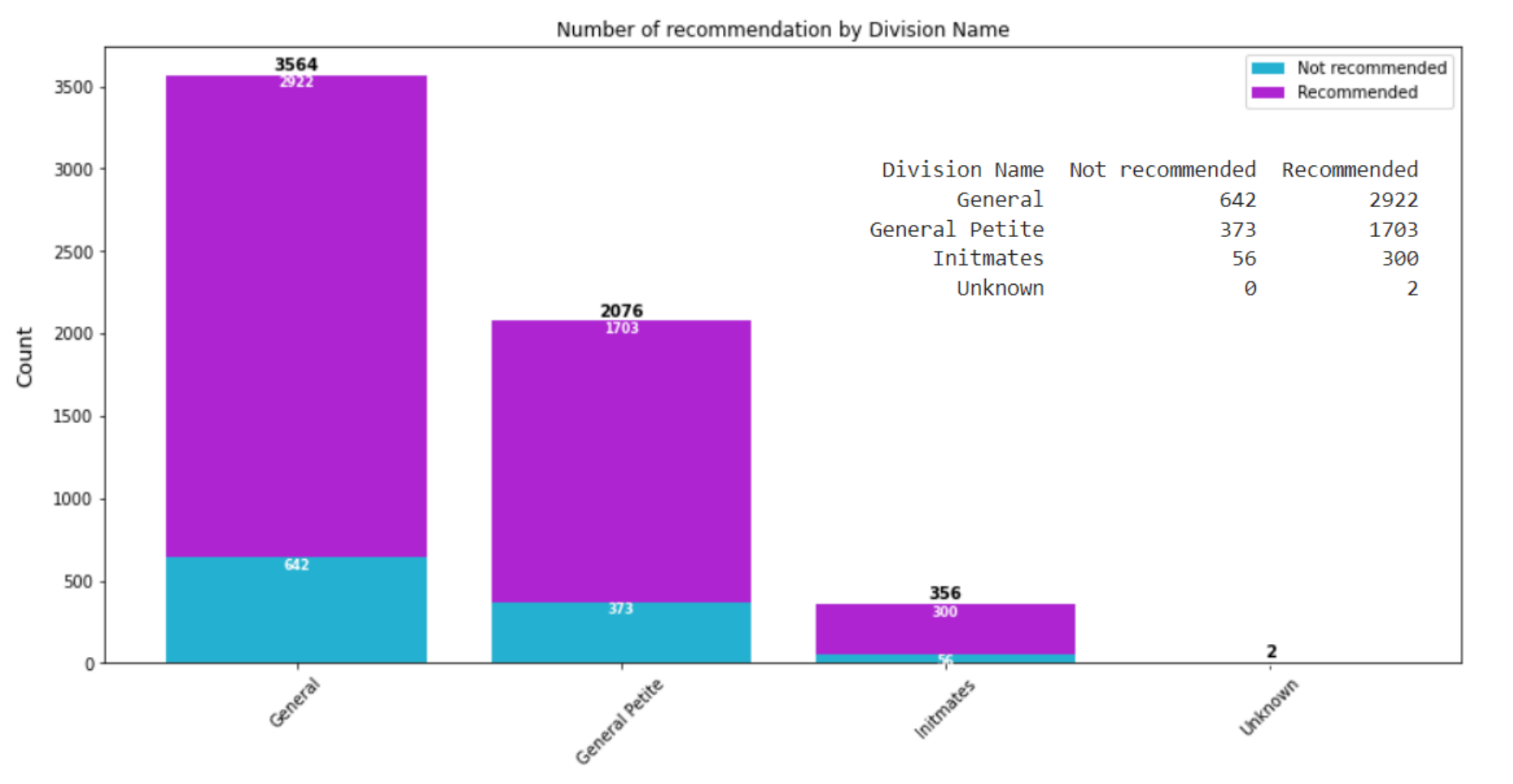
Rating	Not recommended	Recommended
5	9	3371
4	40	1246
3	433	296
2	372	13
1	217	1

Data Exploration/Visualization



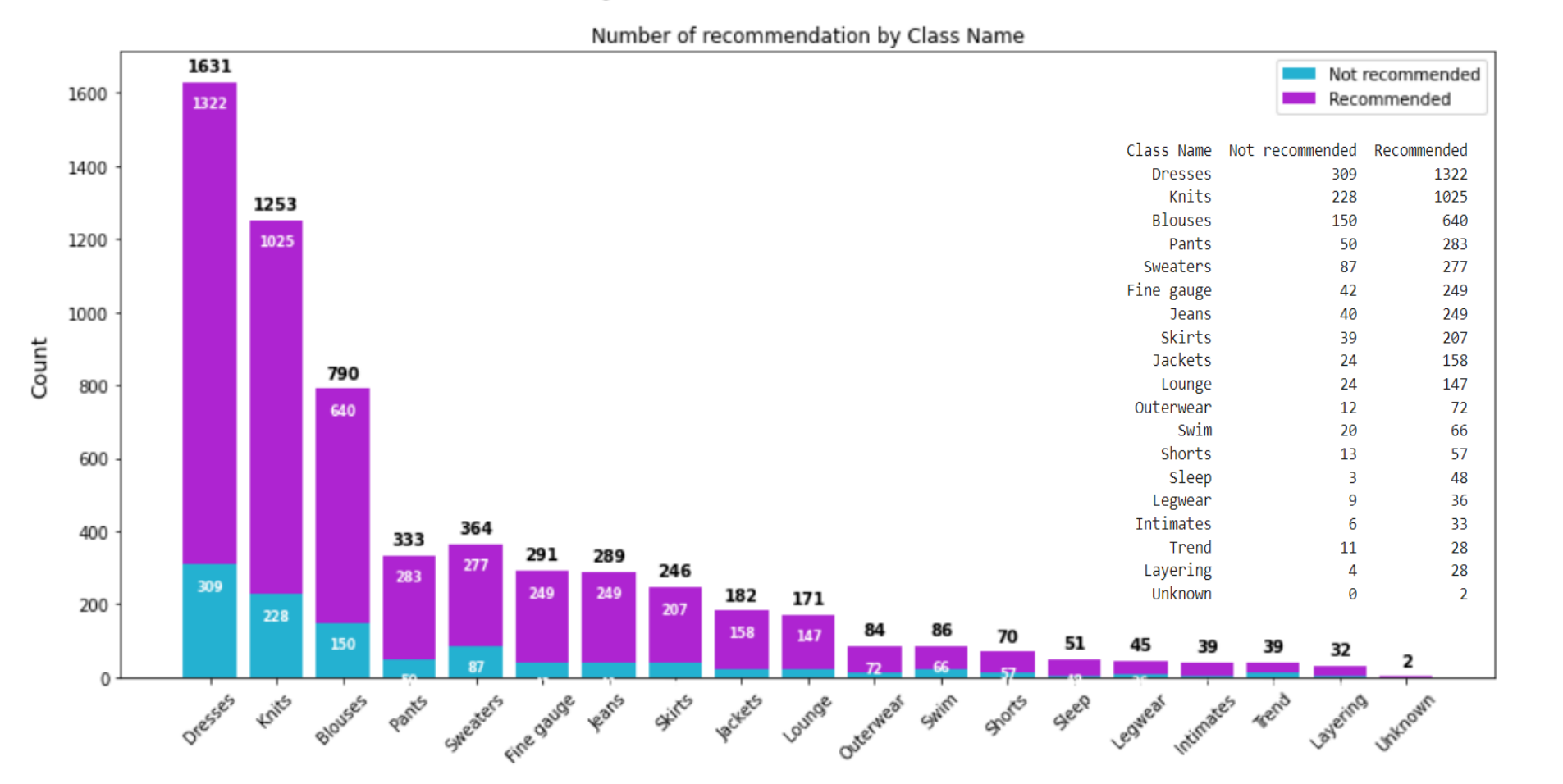
Department Name	Not recommended	Recommended
Tops	507	2191
Dresses	309	1322
Bottoms	142	796
Intimate	66	358
Jackets	36	230
Trend	11	28
Unknown	0	2

Data Exploration/Visualization



Division Name	Not recommended	Recommended
General	642	2922
General Petite	373	1703
Initmates	56	300
Unknown	0	2

Data Exploration/Visualization



Class Name	Not recommended	Recommended
Dresses	309	1322
Knits	228	1025
Blouses	150	640
Pants	50	283
Sweaters	87	277
Fine gauge	42	249
Jeans	40	249
Skirts	39	207
Jackets	24	158
Lounge	24	147
Outerwear	12	72
Swim	20	66
Shorts	13	57
Sleep	3	48
Legwear	9	36
Intimates	6	33
Trend	11	28
Layering	4	28
Unknown	0	2

Feature Engineering

Incorporating both text and non-text features[2]

```
This item comes from {"Department Name} department
and division is {“Division Name”}, and is classifi
ed under {“Class Name”}. There are {"Positive Feed
back Count”} customers who found this review
positive. I am {“Age”} years old. I rate this item
{“Rating”} out of 5 stars.
```

Classification algorithms

Classifiers

Simple logistic regression[3]

- Pyspark 3.3.0
- Baseline model
- Numerical features (Age, rating and Positive Feedback Count)
- Grid search for hyperparameter tuning
- 3-fold cross validation

Logistic regression[3]

- Pyspark 3.3.0
- TF-IDF
- Grid search for hyperparameter tuning
- 3-fold cross validation

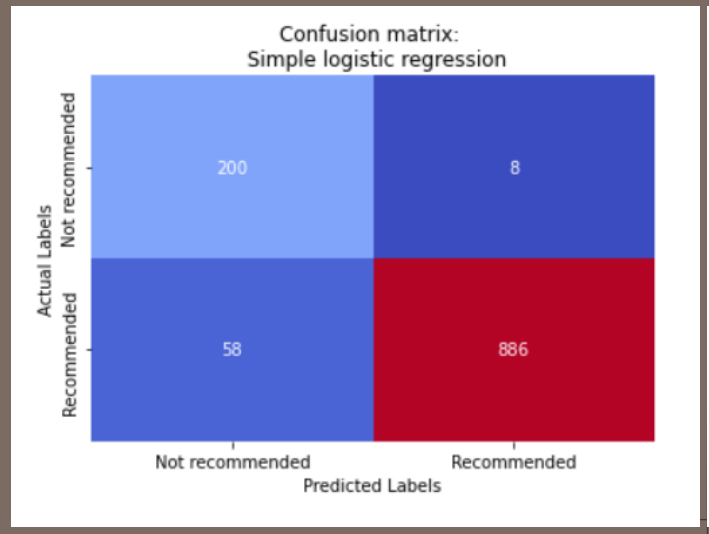
Random forest[3]

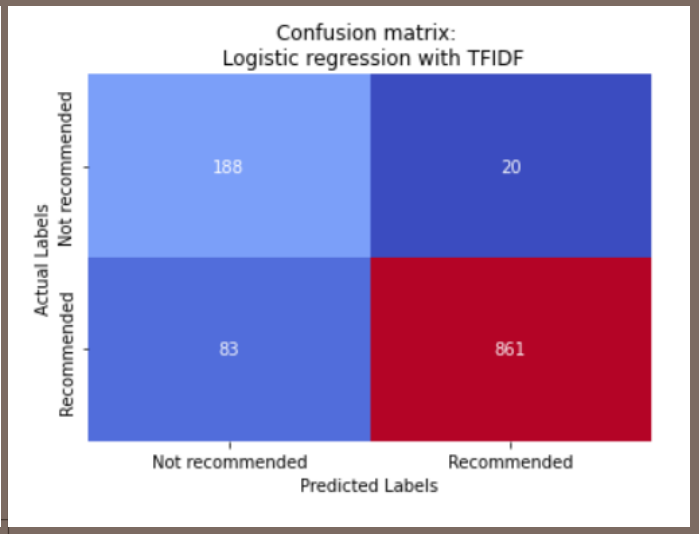
- Pyspark 3.3.0
- TF-IDF
- Grid search for hyperparameter tuning
- 3-fold cross validation

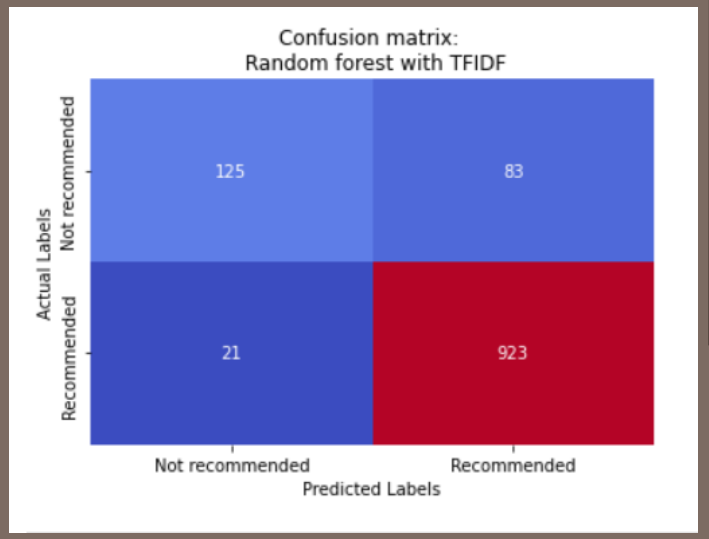
Deep learning

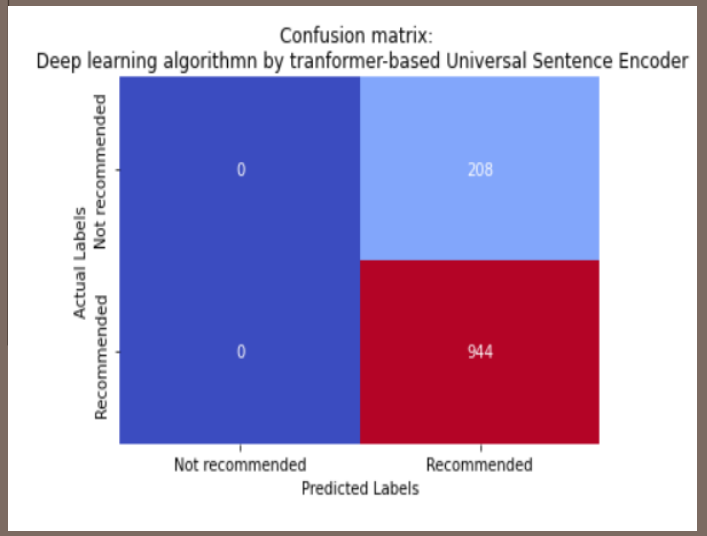
- Spark NLP 4.0.1 [4]
- Transformer-based Universal Sentence Encoder[5, 6, 7]
- Default hyperparameters[8]

Confusion Matrix









Performance metrics

Metrics	Simple Logistic Regression	Logistic Regression (TF-IDF)	Random Forest (TF-IDF)	Deep Learning (Transformer-based Universal Sentence Encoder)
Accuracy	0.94	0.91	0.91	0.82
Precision	0.99	0.98	0.92	0.82
Recall	0.94	0.91	0.98	1.00
F1-score	0.96	0.94	0.95	0.90
Area under the receiver operating characteristic (ROC) curve	0.9794	0.9556	0.9856	0.5000
Area under the precision-recall curve	0.9957	0.9895	0.9906	0.8194
Training time taken (seconds)	82.318608045578	397.9566535949707	9241.370339393616	420.804

Conclusion

Studying online reviews with machine learning models allows businesses to develop their services with ideas and to meet consumer satisfaction through their buying trends and behavior.

Resources/References

1. https://www.kaggle.com/datasets/nicapotato/womens-ecommerce-clothing-reviews
2. https://mccormickml.com/2021/06/29/combining-categorical-numerical-features-with-bert/
3. https://spark.apache.org/docs/latest/ml-tuning.html
4. https://towardsdatascience.com/text-classification-in-spark-nlp-with-bert-and-universal-sentence-encoders-e644d618ca32
5. https://nlp.johnsnowlabs.com/2020/04/17/tfhub_use.html
6. https://nlp.johnsnowlabs.com/docs/en/transformers
7. https://tfhub.dev/google/universal-sentence-encoder-large/5
8. https://nlp.johnsnowlabs.com/api/com/johnsnowlabs/nlp/annotators/classifier/dl/ClassifierDLApproach
9. https://www.coursera.org/learn/advanced-data-science-capstone/home/assignments

Thank you