

Department of Digital Systems
MSC in Artificial Intelligence

Fake News Prediction

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Reason for subject selection

- Fake or misleading news can be dangerous
- It is also used for making money via advertising (clickbait)
- Prevalence has increased with the rise of social media
- Social media algorithms have been implicated in the spread of fake news
- Since coronavirus appeared fake news have been on the rise
- Anti-vaccination movement is growing vastly via fake news, meanwhile WHO declared it one of the top ten global threats
- Therefore, vastly reducing fake news is crucial for the society's own good



The data

- Dataset retrieved from kaggle
- Used data from 20800 article news labeled 'Real' or 'Fake'



Bag-of-words model

- Text is changed into vectors of numbers to be processed by machine learning algorithms (feature encoding)
- Describes the occurrence of words within a document
- Transform each document from a corpus of documents into a vector and use it as an input to a machine learning algorithm



Feature extraction with TF-IDF

- Statistical measure that shows how important a word is to a document in an entire corpus of documents
- Term frequency shows the frequency of a word in a document
- $TF = \text{Word occurrence} / \text{vocabulary of document}$
- Inverse document frequency shows the frequency of a word within the corpus of documents.
- $IDF = \log(\text{Entire corpus of documents} / \text{number of documents containing specific word})$
- $TF\text{-}IDF \text{ score} = TF * IDF$
- The higher the score, the more relevant that word is in that particular document
- Sklearn TfidfVectorizer used for different case scenarios



Train test split and cross-validation

- Sklearn `train_test_split` was used for splitting the dataset. Different case scenarios were tested to see which one provided best results.
- But what if the training dataset includes only articles from a specific author. Then our data is biased.
- This is why cross-validation is crucial.
- Cross-validation was implemented with sklearn `Kfold` to check the accuracy on the training data (while splitting) compared to the predicted data.
- This way we can check if our data is biased or not.
- Cross-validations is also used for tuning the hyperparameters of a classifier.



Logistic regression metrics

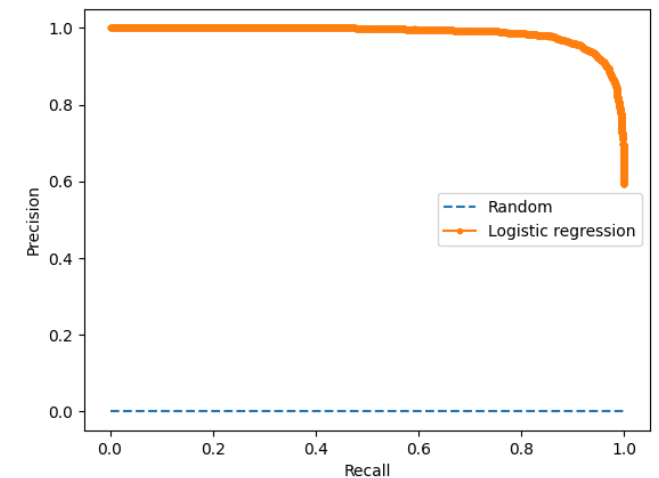
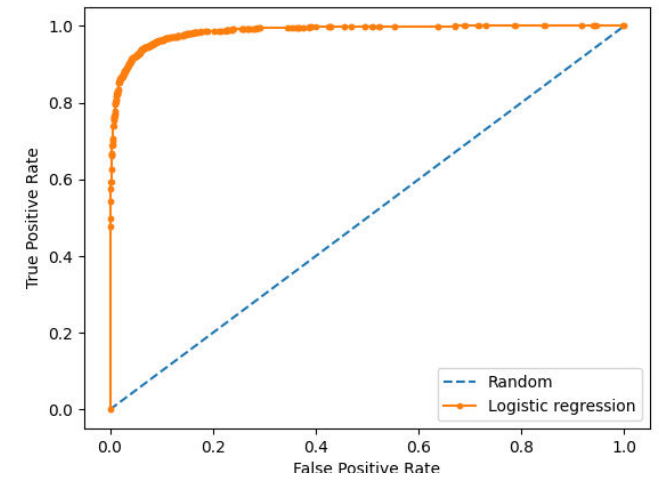
- Cross-validation mean accuracy: 93.2%
- Accuracy: 93.55%
- Confusion matrix:

| | Predicted class | Actual class |
|--|-----------------|--------------|
| | | [[1982 118] |
| | | [150 1910]] |
- Precision: 0.9418
- Recall: 0.9271
- Specificity: 0.9438
- False positive rate: 0.056
- F1-score: 0.9344

Logistic regression

ROC/Precision recall curves

- ROC AUC: 0.9853
- ROC AUC: 0.9857





Naïve Bayes metrics

- Cross-validation mean accuracy: 87.76%
- Accuracy: 87.21%
- Confusion matrix:

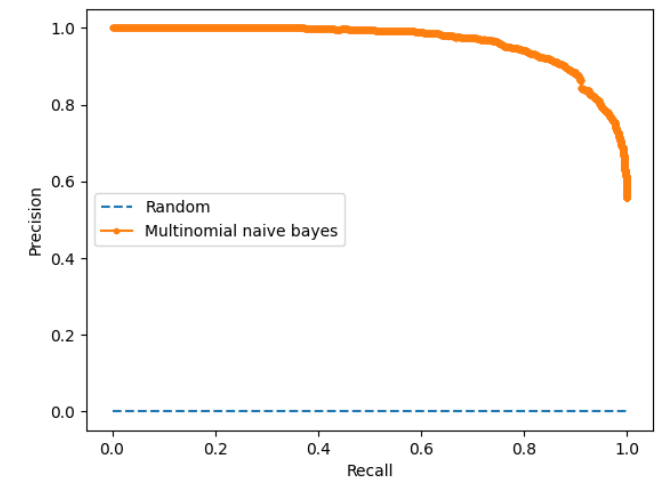
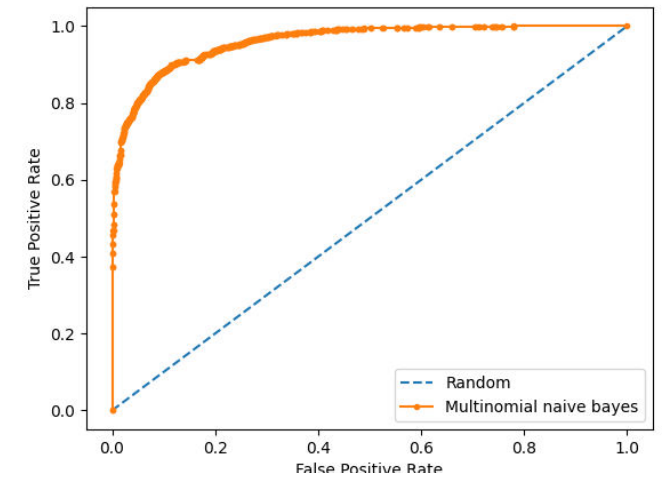
| | Predicted class | Actual class |
|--|-----------------|--------------|
| | | [[1752 348] |
| | | [184 1876]] |
- Precision: 0.8435
- Recall: 0.9106
- Specificity: 0.8342
- False positive rate: 0.1657
- F1-score: 0.8758

Naïve Bayes

ROC/Precision recall curves

- ROC AUC: 0.9601

- ROC AUC: 0.9626





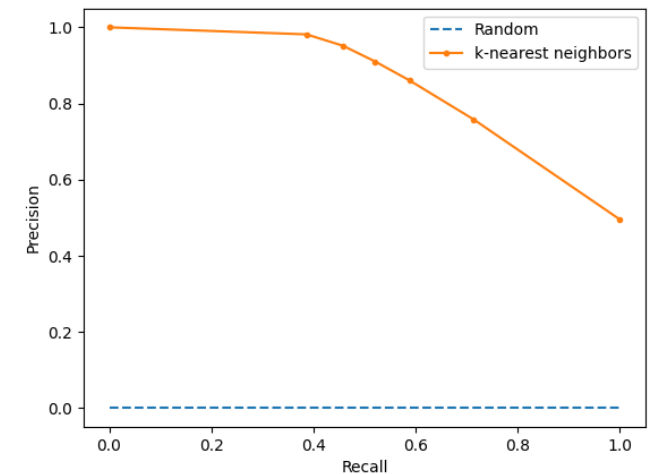
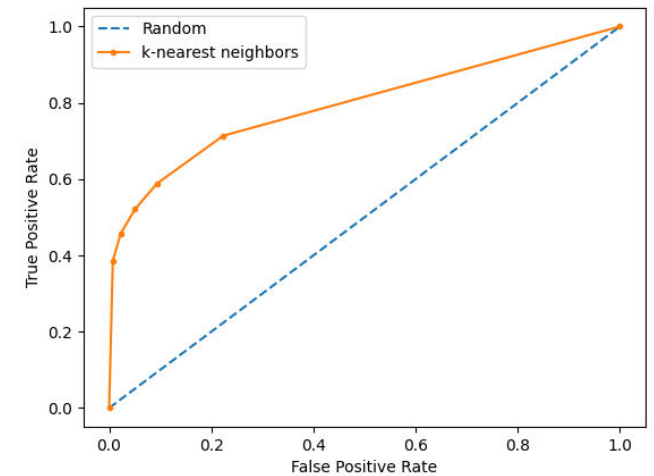
K-nearest neighbor metrics

- Cross-validation mean accuracy: 72.51%
- Accuracy: 73.72%
- Confusion matrix:

| | Predicted class | Actual class |
|--|-----------------|--------------|
| | | [[1994 106] |
| | | [987 1073]] |
- Precision: 0.91
- Recall: 0.5208
- Specificity: 0.9495
- False positive rate: 0.05
- F1-score: 0.6625

K-nearest neighbor ROC/Precision recall curves

- ROC AUC: 0.7953
- ROC AUC: 0.8511





Decision tree metrics

- Cross-validation mean accuracy: 87.6%
- Accuracy: 87.3%
- Confusion matrix:

| | Predicted class | Actual class |
|--|-----------------|--------------|
| | | [[1822 278] |
| | | [250 1810]] |
- Precision: 0.8668
- Recall: 0.8786
- Specificity: 0.8676
- False positive rate: 0.1323
- F1-score: 0.8727

Decision tree

ROC/Precision recall curves

- ROC AUC: 0.8714
- ROC AUC: 0.9012

