

PROBLEM 2 – Baseline Performance

To calculate the precision, recall, and F1-score of a trivial baseline classifier that flags every text as clickbait, use the following formulas.

- $\text{Precision} = \text{True Positives} / (\text{True Positives} + \text{False Positives})$
- $\text{Recall} = \text{True Positives} / (\text{True Positives} + \text{False Negatives})$
- $\text{F1-score} = 2 * (\text{Precision} * \text{Recall}) / (\text{Precision} + \text{Recall})$

The trivial baseline classifier predicts that everything is clickbait, so there are no true negatives or False Negatives, and all samples are considered True Positives. Using the test_data set set, I calculate these metrics directly.

Calculating the precision, recall and F1-score values

- $\text{Precision} = \text{TP} / (\text{TP} + \text{FP}) = \text{TP} / (\text{TP} + 0) = 1.0$ (since $\text{FP} = 0$)
- $\text{Recall} = \text{TP} / (\text{TP} + \text{FN}) = \text{TP} / (\text{TP} + 0) = 1.0$ (since $\text{FN} = 0$)
- $\text{F1-score} = 2 * (\text{Precision} * \text{Recall}) / (\text{Precision} + \text{Recall}) = 2 * (1 * 1) / (1 + 1) = 2 / 2 = 1.0$

The precision, recall, and F1-score for this trivial baseline classifier are all 1.0.

On whether there is another good baseline classifier that would give a higher F1-score depends on the specific dataset and problem.

In some cases, a random classifier might perform similarly to the trivial baseline, but it's unlikely to consistently outperform it. A more advanced baseline might involve simple text-based keyword matching, but its performance would still depend on the characteristics of the dataset one is using.

PROBLEM 8 – Comparing results

Comparing the regular expression classifier with the machine-learning solution, let's consider their model metrics precision, recall, and F1-score.

The Regular Expression Classifier

- Precision = 34.38%
- Recall = 42.78%
- F1-score = 38.12%

Machine Learning Solution (Naive Bayes classifier)

- Precision = 98.98%
- Recall = 99.66%
- F1-score = 99.66%

Trivial Baseline (Flagging Everything as Clickbait)

- Precision = 100%
- Recall = 100%

- F1-score = 100%

Comparison

- The regular expression classifier has the lowest precision, recall, and F1-score among the three. This means that it has a higher rate of false positives and false negatives, making it less accurate in identifying clickbait headlines.
- The machine learning solution, using the Naive Bayes classifier, significantly outperforms the regular expression classifier. It has high precision, recall, and F1-score, indicating that it is very effective in distinguishing clickbait from non-clickbait headlines.
- The trivial baseline classifier, which flags everything as clickbait, achieves perfect precision, recall, and F1-score. However, this result is misleading because it doesn't provide any actual clickbait detection capability. It merely serves as a reference point for the worst-case scenario.

In summary, the machine learning solution with the Naive Bayes classifier is the best-performing model for clickbait detection based on the provided metrics. It achieves high accuracy, precision, and recall. The regular expression-based approach lags in terms of performance but can still serve as a quick and simple solution when time and resources are limited.