

## Evaluation Report

### Team

Mourya Gottipati - U01099603 - gottipati.22@wright.edu

Niranjan Kumar Ramineni - U01065247 - [ramineni.15@wright.edu](mailto:ramineni.15@wright.edu)

### 1.) Introduction:

This report is based on the evaluation of a Bernoulli Naive Bayes classifier implemented manually and using the scikit-learn library. This classifier was tested on a dataset of documents classified into two categories those are Windows and Hockey.

### 2.) Evaluation Metrics:

The evaluation metrics used here to compare the performance of the classifiers are

**Accuracy:** The ratio of correctly predicted instances to the total instances.

**Precision:** The ratio of correctly predicted positive observations to the total predicted positives.

**Recall:** The ratio of correctly predicted positive observations to the all observations in actual class.

**F1 Score:** The weighted average of Precision and Recall.

### 3.) Classifier Performance:

#### Manual Implementation:

The performance of the manually implemented Naive Bayes Multivariate Bernoulli classifier is

Accuracy= 0.945

Precision= 1.0

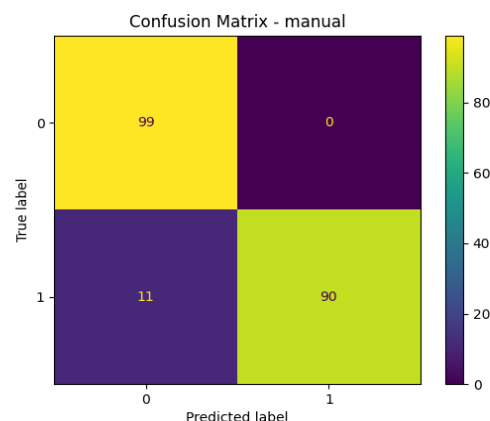
Recall= 0.8910891089108911

F1Score= 0.9424083769633508

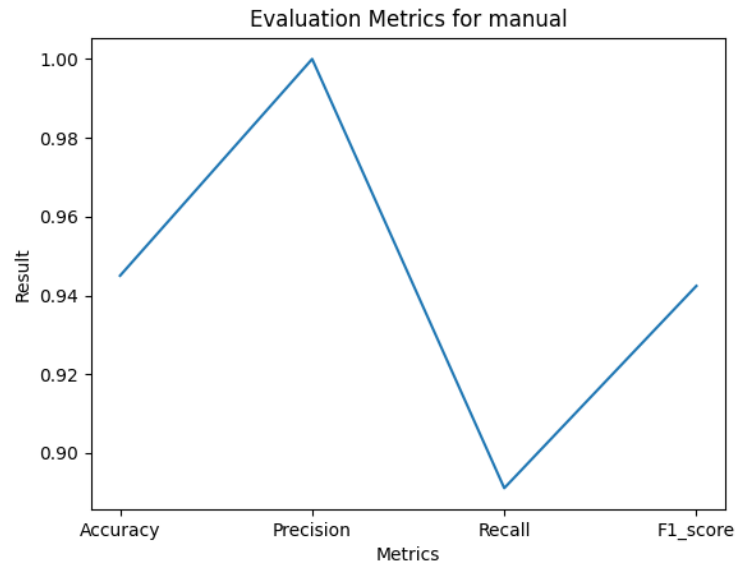
Confusion Matrix= [[99 0]

[11 90]]

#### Confusion Matrix:



### LinePlot:



### Scikit-learn Implementation:

The performance of the Naive Bayes Multivariate Bernoulli classifier using Scikit-learn is

Accuracy= 0.945

Precision= 1.0

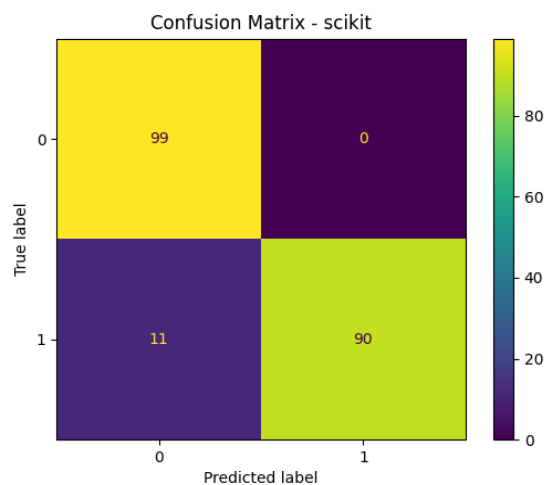
Recall= 0.8910891089108911

F1Score= 0.9424083769633508

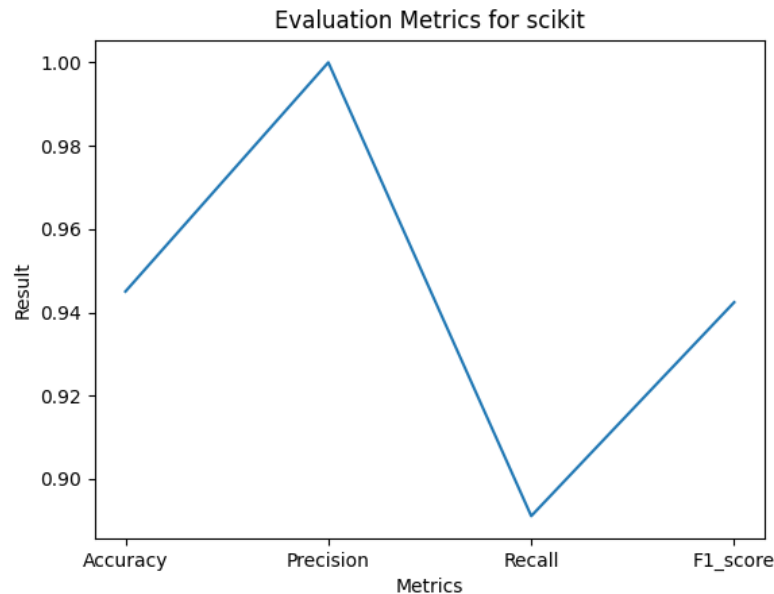
Confusion Matrix= [[99 0]

[11 90]]

### Confusion Matrix:



### **LinePlot:**



Both implementations produce identical results which indicate that the manual implementation is correct and matches the performance of the Scikit-learn implementation.

#### **4.) Comparative Analysis:**

**Accuracy:** 0.945

Both implementations give an accuracy of 94.5%. This high accuracy indicates that the classifiers correctly predict the class labels for most test documents.

**Precision:** 1.0

Both implementations give a perfect precision of 1.0 which means that when the classifier predicts a document as positive it is always correct.

**Recall:** 0.8910891089108911

The recall for both implementations is 0.8911. This indicates that the classifier correctly identifying 89.11% of the positive documents but misses 10.89% of them.

**F1Score:** 0.9424083769633508

The F1 Score, which is the harmonic mean of precision and recall is 0.9424 for both implementations.

**Confusion Matrix:**

[[99 0]

[11 90]]

This matrix indicates that:

→ 99 true negative cases were correctly classified as negative.

- 90 true positive cases were correctly classified as positive.
- 11 false negative cases were incorrectly classified as negative.
- 0 false positive cases were incorrectly classified as positive.

## **5.) Conclusion:**

Results of both the manual and Scikit-learn implementations of the Naive Bayes Multivariate Bernoulli classifier performing identically on the given dataset with high accuracy, perfect precision, and a strong F1 score. This result helps in showcasing the correctness of the manual implementation with Scikit-learn implementation.