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**Q1:** The following 8 rows dataset is the total test part of the main dataset. This test dataset applied to “Model I: and predicted data is available. 5 scores

1. Illustrate the outcome Confusion Matrix and calculate the Precision, Recall, accuracy and F1-Score.
2. Fill the column “Model II Prediction” while you know Recall=Precision=F1-Score and accuracy is (50%).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute 1 | Attribute 2 | Class A is +, B is - | Model I Prediction | Model II Prediction |
| 3 | 3 | A | A | A |
| 5 | 5 | A | A | A |
| 7 | 7 | B | B | B |
| 9 | 4 | A | B | B |
| 12 | 3 | B | A | A |
| 10 | 5 | B | A | A |
| 1 | 7 | A | A | A |
| 11 | 11 | A | B | B |

**A) Confusion Matrix:**

|  |  |  |
| --- | --- | --- |
|  | **A** | **B** |
| **A** | **3** | **2** |
| **B** | **2** | **1** |

**Precision = = = = 0.6**

**Recall = = = = 0.6**

**Accuracy = = = = 0.5**

**F1-Score = = = = 0.6**

**Q2:** The table below shows the probability of being a mine or rock using the Naïve Bayes algorithm for the sonar dataset. Considering the thresholds of 0.15, 0.3, 0.45, 0.6, 0.75 to consider the output as Mine. (When the threshold is 0.15, it means that the obtained class is Mine if the probability of being Mine is 0.15 or more). Find the resulting class column for each threshold. Draw the ROC (Recall vs. FPR), (FPR=FP/(FP+TN)). Which threshold gives a better prediction? 5 scores

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Class | Probability of being Mine | Probability of being Rock | Predicted Class for Threshold  0.15 | Confusion Matrix | Predicted Class for Threshold  0.3 | Confusion Matrix | Predicted Class for Threshold  0.45 | Confusion Matrix | Predicted Class for Threshold  0.6 | Confusion Matrix | Predicted Class for Threshold  0.75 | Confusion Matrix |
| 1 | Mine | 0.1 | 0.9 | Rock | FN | Rock | FN | Rock | FN | Rock | FN | Rock | FN |
| 2 | Mine | 0.8 | 0.2 | Mine | TP | Mine | TP | Mine | TP | Mine | TP | Mine | TP |
| 3 | Rock | 0.65 | 0.35 | Mine | FP | Mine | FP | Mine | FP | Mine | FP | Rock | TN |
| 4 | Rock | 0.4 | 0.6 | Mine | FP | Mine | FP | Rock | TN | Rock | TN | Rock | TN |
| 5 | Rock | 0.2 | 0.8 | Mine | FP | Rock | TN | Rock | TN | Rock | TN | Rock | TN |
| 6 | Mine | 0.35 | 0.65 | Mine | TP | Mine | TP | Rock | FN | Rock | FN | Rock | FN |
| 7 | Rock | 0.5 | 0.5 | Mine | FP | Mine | FP | Mine | FP | Rock | TN | Rock | TN |

**Confusion Matrix Threshold: 0.15**

|  |  |  |
| --- | --- | --- |
|  | **Mine** | **Mine** |
| **Mine** | **2** | **1** |
| **Mine** | **4** | **0** |

**FPR for Threshold 0.15 = = = = 1**

**Recall for Threshold 0.15 = = = = 0.66**

**Confusion Matrix Threshold: 0.3**

|  |  |  |
| --- | --- | --- |
|  | **Mine** | **Mine** |
| **Mine** | **2** | **1** |
| **Mine** | **3** | **1** |

**FPR for Threshold 0.3 = = = = 0.75**

**Recall for Threshold 0.3 = = = = 0.66**

**Confusion Matrix Threshold: 0.45**

|  |  |  |
| --- | --- | --- |
|  | **Mine** | **Mine** |
| **Mine** | **1** | **2** |
| **Mine** | **2** | **2** |

**FPR for Threshold 0.45 = = = = 0.5**

**Recall for Threshold 0.45 = = = = 0.33**

**Confusion Matrix Threshold: 0.6**

|  |  |  |
| --- | --- | --- |
|  | **Mine** | **Mine** |
| **Mine** | **1** | **2** |
| **Mine** | **1** | **3** |

**FPR for Threshold 0.6 = = = = 0.25**

**Recall for Threshold 0.6 = = = = 0.33**

**Confusion Matrix Threshold: 0.75**

|  |  |  |
| --- | --- | --- |
|  | **Mine** | **Mine** |
| **Mine** | **1** | **2** |
| **Mine** | **0** | **4** |

**FPR for Threshold 0.75 = = = = 0**

**Recall for Threshold 0.75 = = = = 0.33**

**ROC:**

**The Predicted Class for Threshold 0.75 is best because it is near to Recall or true positive rate by 0.33 when it has false positive rate 0**

**Q3:** The dataset is divided to 5 folds. And after 5-fold validation, the result of test data has written down in the below table. Calculate the resulted accuracy with its STD, (average of accuracy and Model variance )? 4 Scores

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Testing Folder | Fold 1 | Fold 2 | Fold 3 | Fold 4 | Fold 5 |
| First row Predicted result | True | False | True | False | False |
| Second row Predicted result | True | False | True | False | True |
| Third row Predicted result | True | False | False | False | True |
| Forth row Predicted result | True | False | False | True | True |
| Fifth row Predicted result | True | False | True | True | True |

Fold 1 accuracy = = = 1 = 100%

Fold 2 accuracy = = = 0 = 0%

Fold 3 accuracy = = = 0.6 = 60%

Fold 4 accuracy = = = 0.4 = 40%

Fold 5 accuracy = = = 0.8 = 80%

average of accuracy = = = = 56

|  |  |  |
| --- | --- | --- |
| **accuracy** | **(accuracy -** **average)** | **(accuracy - average)2** |
| 100 | 44 | 1936 |
| 60 | 4 | 16 |
| 40 | -16 | 256 |
| 80 | 24 | 576 |
| 0 | -56 | 3,136 |

= 1936 + 16 + 256 + 576 + 3136 = 5920

STD = = = = 38.4

So average of accuracy = 56 with STD

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