# Binary Classification Metrics Report

Based on the given confusion matrix:

|  |  |  |
| --- | --- | --- |
|  | 0: Malignant | 1: Benign |
| 0: Malignant | 36 (TP) | 3 (FN) |
| 1: Benign | 5 (FP) | 70 (TN) |

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## Metrics Calculations

### 1. Accuracy

Accuracy measures the overall correctness of predictions:

Accuracy = (TP + TN) / Total Samples

Accuracy = (36 + 70) / (36 + 3 + 5 + 70) = 106 / 114 ≈ 0.9307 (93.1%)

### 2. Precision

Precision measures the proportion of correct positive predictions:

Precision for Malignant (Class 0): Precision = TP / (TP + FP) = 36 / (36 + 5) ≈ 0.878 (87.8%)

Precision for Benign (Class 1): Precision = TP / (TP + FP) = 70 / (70 + 3) ≈ 0.959 (95.9%)

### 3. Recall (Sensitivity)

Recall measures the proportion of actual positives that are correctly identified:

Recall for Malignant (Class 0): Recall = TP / (TP + FN) = 36 / (36 + 3) ≈ 0.923 (92.3%)

Recall for Benign (Class 1): Recall = TP / (TP + FN) = 70 / (70 + 5) ≈ 0.933 (93.3%)

### 4. Specificity (True Negative Rate)

Specificity measures the proportion of actual negatives that are correctly identified:

Specificity for Malignant (Class 0): Specificity = TN / (TN + FP) = 70 / (70 + 3) ≈ 0.959 (95.9%)

Specificity for Benign (Class 1): Specificity = TN / (TN + FP) = 36 / (36 + 5) ≈ 0.878 (87.8%)

### 5. F1-Score

The F1-score is the harmonic mean of precision and recall:

F1-Score for Malignant (Class 0): F1-Score = 2 \* (Precision \* Recall) / (Precision + Recall) ≈ 0.900 (90.0%)

F1-Score for Benign (Class 1): F1-Score = 2 \* (Precision \* Recall) / (Precision + Recall) ≈ 0.946 (94.6%)

## Summary Table:

|  |  |  |
| --- | --- | --- |
| Metric | Malignant (Class 0) | Benign (Class 1) |
| Precision | 87.8% | 95.9% |
| Recall | 92.3% | 93.3% |
| Specificity | 95.9% | 87.8% |
| F1-Score | 90.0% | 94.6% |
| Accuracy | 93.1% | |