Non Invasive Health Monitoring and Predictive Modelling

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AAI 510 Final Project - Summer 2023
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Introduction

Many patients endure invasive procedures that are time-consuming and raise privacy concerns.

Our goal is to use health measurements and predictive modeling to create an accurate and beneficial solution.

We empathize with patients and aim to solve this issue.

Our Solution Overview

Comprehensive health monitoring system:

      Utilizes non-invasive technologies (wearable devices, remote sensing, data analytics).

Data collection:

      Real-time health measurements (vital signs, activity levels, sleep patterns, etc.).

Predictive modeling:

      Advanced algorithms analyze and interpret data for personalized health insights and predictions.

Key Features and Benefits

Non-invasive monitoring:

    Eliminates the need for invasive procedures, enhancing patient comfort.

Time efficiency:

    Early detection of abnormalities reduces the need for time-consuming invasive procedures.

Privacy protection:

    Robust data security measures and compliance with regulations.

Accurate predictive modeling:

    Advanced algorithms and machine learning enable precise predictions.

Patient empowerment:

    Real-time health insights and personalized recommendations for active health management.

Predictive Modeling Considerations

In predictive modeling for medical prediction, false negatives could lead to incorrect predictions about a patient's health, potentially causing healthcare professionals to overlook serious conditions or risks.

Our predictive model ensured minimizing false negatives and enhance better patient outcomes.

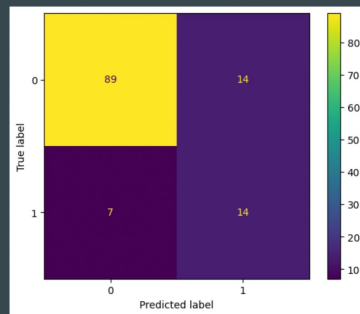## Model Selection & Evaluation - GBT Performance

We perform cross validation on the data to get a sense of how well it performs on unseen data.

Average Scores for Gradient Boosting Classifier -

Accuracy: **0.92**
Precision: **0.95**
Recall: **0.88**
F1-Score: **0.91**

The Performance on the test file showed

Balanced Accuracy Score : **0.76**
Type 1 Errors - 14
Type 2 Errors - 7
True Positives - 14
True Negatives - 89

Model Selection & Evaluation - ET Classifier (Parameters tuned)

We tune our ET Classifier by doing a CV Grid Search to find the best possible parameters. Combined with cross validation we found the best set to be -

'max_features': 0.5,
'min_samples_leaf': 1,
'min_samples_split': 2,
'n_estimators': 500

The Performance on the test file showed

Balanced Accuracy Score : **0.89**
Type 1 Errors - 14
Type 2 Errors - 3
True Positives - 18
True Negatives - 89
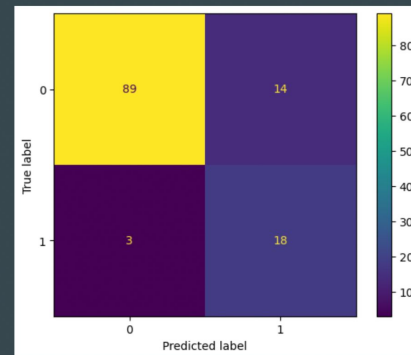
Risks and Mitigations

Operational Risks	Mitigations
Inaccurate predictions.	Regular model validation and updates.
Technological challenges.	Employing robust, scalable, and adaptable technology solutions.

Ethical Risks	Mitigations
Privacy breaches.	Rigorous data encryption and anonymization techniques.
Unintentional bias.	Balanced and representative dataset for training the model.

Regulatory Risks	Mitigations
Non-compliance with healthcare regulations.	Regular audits and staying abreast with changes in healthcare regulations.
Data protection breaches.	Adherence to strict data handling protocols as per GDPR or similar regulations.

Conclusion

Goal: Address challenges in invasive procedures, improve patient experience, and protect privacy.

Commitment: Leveraging health measurements and predictive modeling for an accurate and impactful solution.