Machine Learning-Based Prognostic Modeling of Thyroid Cancer Recurrence

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INTRODUCTION & AIM

- Thyroid cancer is a common endocrine disease, and many patients face recurrence after treatment.

- Accurate identification of recurrence risk remains challenging due to the heterogeneous nature of clinical, pathological, and treatment-related factors influencing patient outcomes.

- While AI has shown potential in healthcare, building reliable and interpretable models requires careful data preprocessing, algorithm selection, and feature-level explanation.

- This study aims to build ML and NN models for recurrence prediction and use SHAP analysis to improve model interpretability.
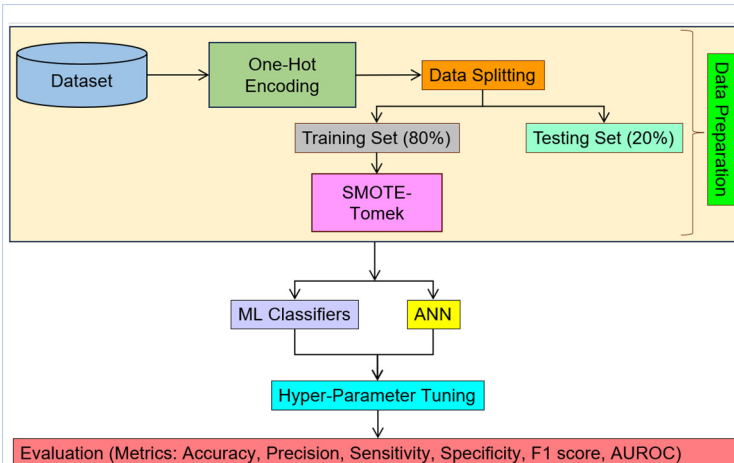
METHOD

Fig. 1. Experimental workflow for Thyroid Cancer Recurrence

RESULTS & DISCUSSION

- Figure 2 shows the confusion matrix of the proposed Extra Trees Classifier (ETC), achieving near-perfect classification with only one misclassification with 98.7% accuracy.

- ETC achieved 99.99% precision, 95.45% sensitivity, 99.99% specificity, 97.67% F1 score, and 99.5% AUROC as shown in Fig. 3, highlighting the model's discriminative ability.

- Figure 4 shows the SHAP feature-group values, indicating that Response, Risk, and Adenopathy were the most influential predictors.

- Demographic features like Age, Gender, and Smoking History contributed less to the recurrence prediction.
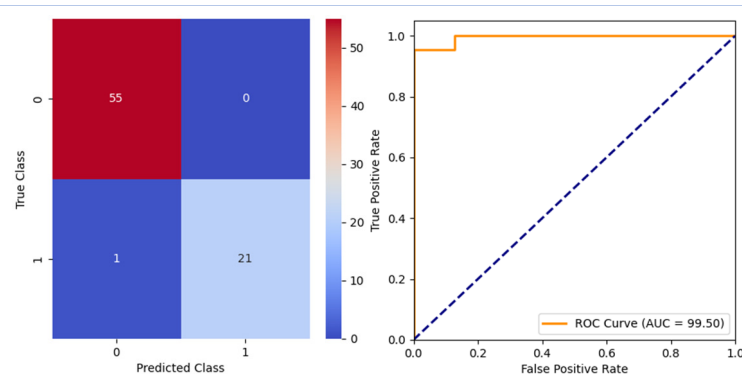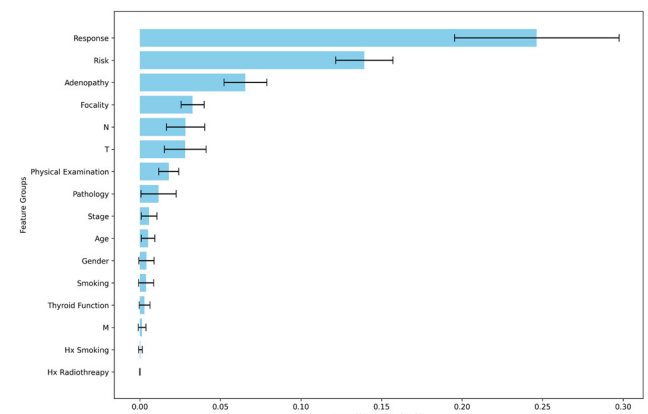

Fig. 2. Confusion Matrix   Fig. 3. AUROC

Fig. 4. Grouped SHAP Feature Values

CONCLUSION AND FUTURE SCOPE

- SHAP-based ETC provides accurate, interpretable thyroid cancer recurrence prediction, identifying post-treatment response, risk, and adenopathy as main drivers.

- Future work will validate diverse demographic datasets and explore clinical deployment to enhance personalized thyroid cancer follow-up and patient care.

KEY REFERENCES

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