



P1.175: Multi-Temporal Imaging and CT-to PET Translation Based Predictive Model on Neoadjuvant Immunotherapy for Non-Small Cell Lung Cancer Patients

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INTRODUCTION

Challenges in predicting efficacy of neoadjuvant immunotherapy (NIT) : The spatiotemporal heterogeneity (TSH) of tumors continues to complicate reliable patient selection.

Delta radiomics maybe one promising avenue to address the challenges: It captures dynamic changes in imaging features over time, offers a more nuanced representation of TSH.

Paucity of delta radiomics data critically limits research :Positron-emission tomography(PET) uniquely fuses radiomic signatures with intrinsic metabolic information, yielding synergistic predictive power but is expensive, radioactive, and technically complex.

Prior study's solution: CT-to-PET translation (CPT) model was validated for utility in our prior study which can supplement the missing PET modality data.

OBJECTIVE: In order to better identify patients who will benefit from the therapeutic effects, We aim to develop a multimodal predictive model incorporating delta radiomics to assess the efficacy of NIT in NSCLC patientsvia CPT model.

METHODS

Design:

This retrospective study included 219 NSCLC patients who received neoadjuvant immunotherapy followed by surgery. Patients were randomly divided into training (n=158) and validation (n=61) cohorts. Radiomics features and metabolic parameters were extracted from pre- and post-treatment PET/CT.

Delta features representing treatment-induced changes were calculated. Using XGBoost, 12 radiomics models were developed based on different modality and temporal combinations. GANs were employed to generate synthetic PET images from CT, and four combined models (TT, TS, ST, SS) were constructed using real and synthetic PET data for comparative analysis.

For detailed procedures, refer to Figure 1(A).

DISCUSSION AND CONCLUSION

Conclusion

- Multi-temporal radiomics models effectively predict neoadjuvant immunotherapy efficacy in NSCLC. **GAN-synthesized PET** images perform comparably to **real PET**, offering a viable alternative when PET data are unavailable.

- Future Direction for Research**
- Multicenter prospective samples.**

External multicenter validation is needed to rigorously assess model performance and to evaluate its practical feasibility for routine clinical deployment.

REFERENCES & ACKNOWLEDGEMENTS

Key references

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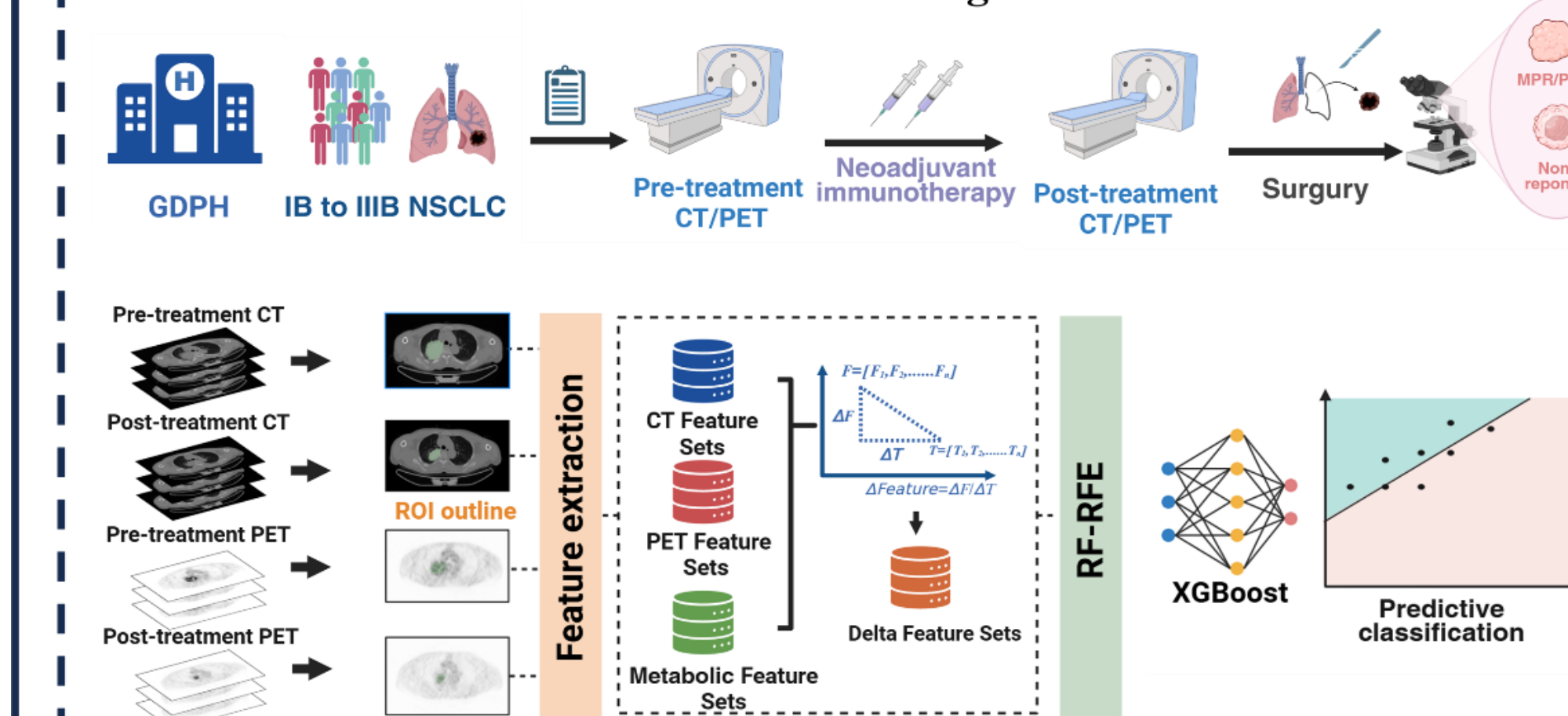
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RESULTS

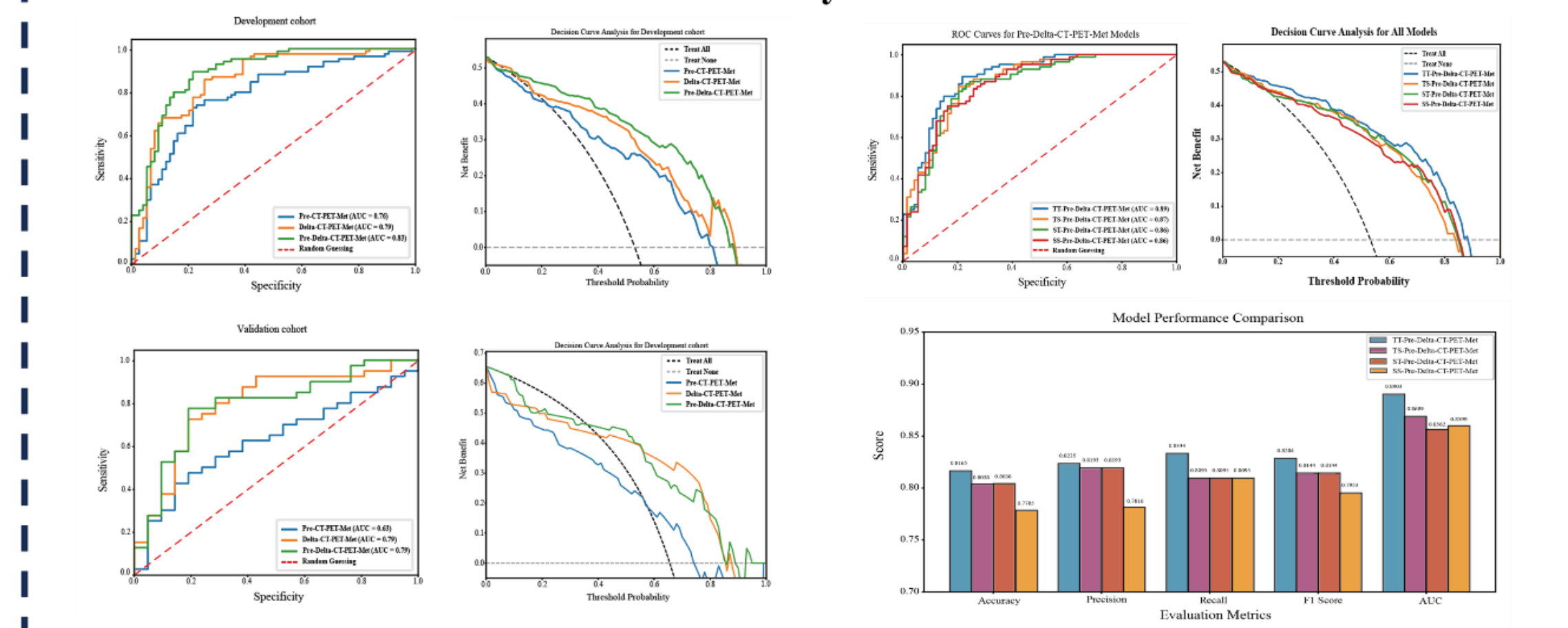
Performance of Predictive Models for The Efficacy of Neoadjuvant Immunotherapy for Non-small Cell Lung Cancer :

- The multimodal model integrating pre-treatment and delta features (Pre-Delta-CT-PET-Met) achieved the best performance (**AUC=0.8903**).
- Models using synthetic PET showed no significant difference from those using real PET (DeLong test, **all $p>0.05$**), with AUCs of **0.8689**, **0.8599**, and **0.8562** for the TS, ST, and SS models, respectively.
- SHAP analysis identified PET texture features related to treatment response, CT radiomics features, and metabolic parameters as key contributors. Rad-score significantly stratified event-free survival (**$p=0.0413$**), while RECIST 1.1 and PD-L1 expression did not.

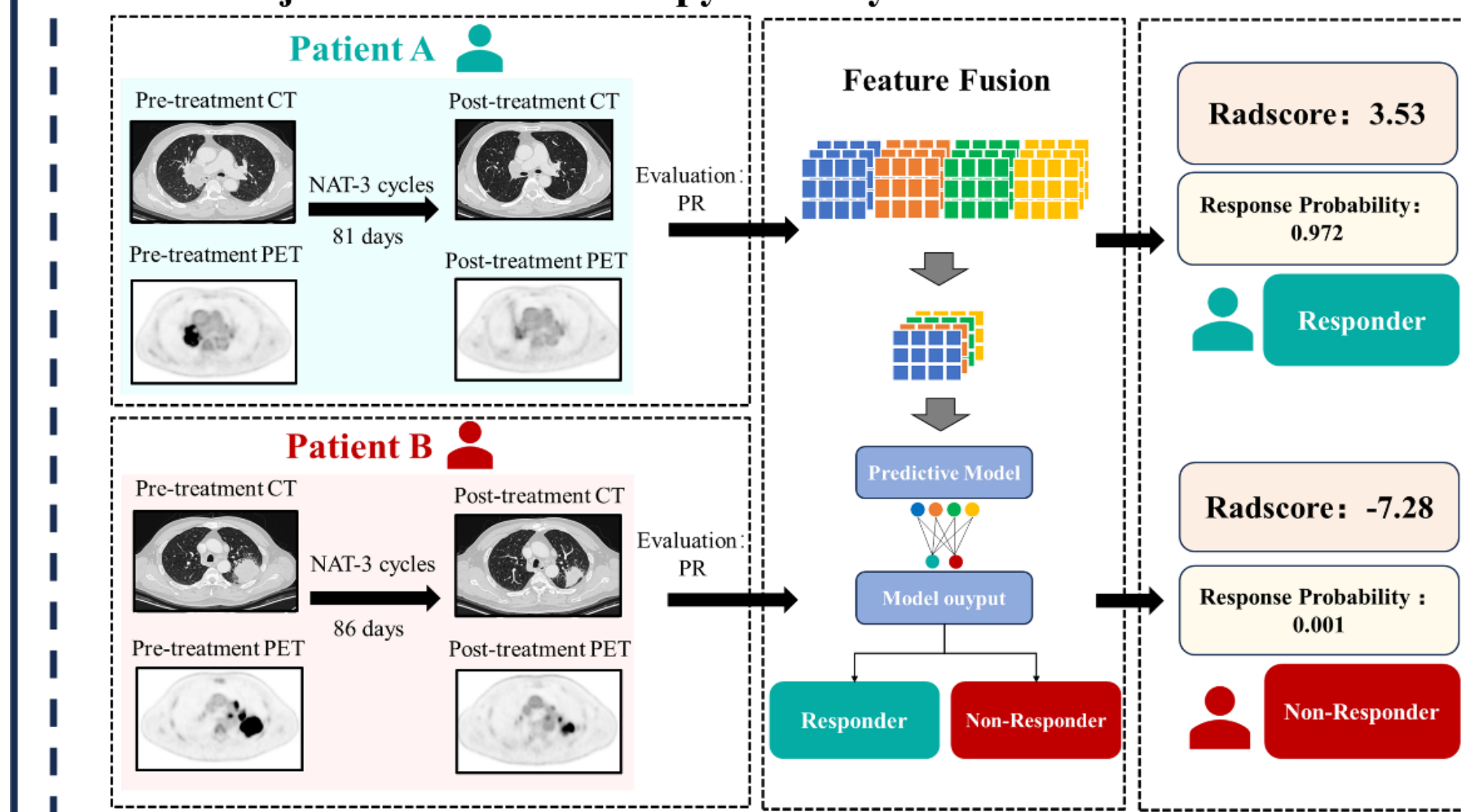
A. Workflow of Neoadjuvant Immunotherapy Cohort Construction and Data Processing.



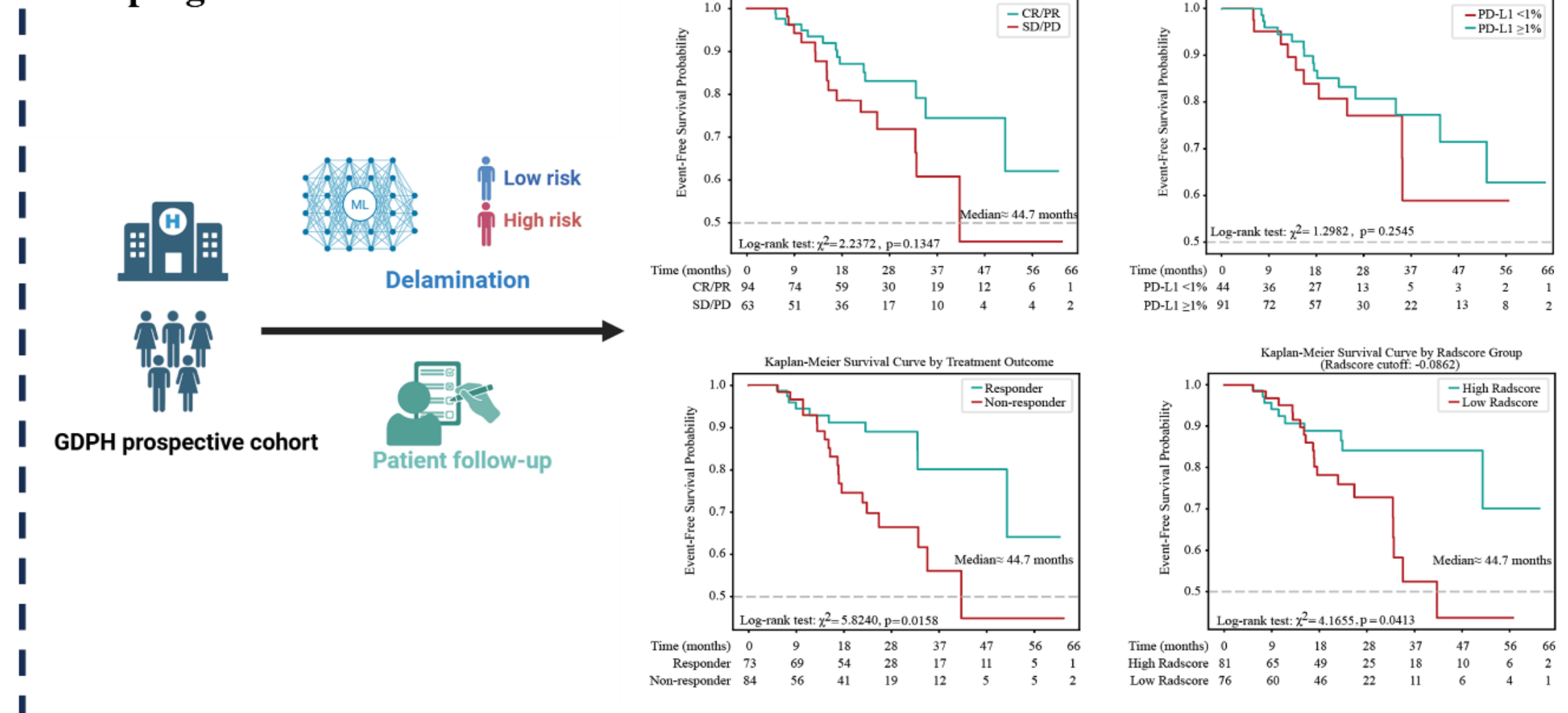
B. Performance of Neoadjuvant Immunotherapy Efficacy Prediction Model Based on Real PET and Synthetic PET.



C. Schematic Diagram of Patient Benefit Prediction Based on the Neoadjuvant Immunotherapy Efficacy Prediction Model.



D. EFS Survival Curves Stratified by RECIST 1.1 Clinical Response Assessment, PD-L1 Expression Level, Clinicopathological Response Assessment, and Rad-Score Grouping of the Prediction Model.



- Figure 1.** Overall Workflow and Results of the Multi-Temporal Neoadjuvant Immunotherapy Efficacy Prediction Study.
- (A).Workflow of Neoadjuvant Immunotherapy Cohort Construction and Data Processing.
- (B).Performance of Neoadjuvant Immunotherapy Efficacy Prediction Model Based on Real PET and Synthetic PET.
- (C). Schematic Diagram of Patient Benefit Prediction Based on the Neoadjuvant Immunotherapy Efficacy Prediction Model.
- (D). EFS Survival Curves Stratified by RECIST 1.1 Clinical Response Assessment, PD-L1 Expression Level, Clinicopathological Response Assessment, and Rad-Score Grouping of the Prediction Model.