Predictive Modeling of Radiation-Induced Toxicities Using Multi-Modal Data and Machine Learning

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Introduction

Radiation therapy (RT) is a key cancer treatment, but radiation-induced toxicities (RITs) can damage healthy tissues. Predicting these toxicities early helps doctors plan safer and more effective treatments. Machine learning (ML) uses data from radiomics, dosiomics, genomics, and clinical features.

Methods

Collected multi-modal data (CT. MRI, PET images, dose maps, genomics, and clinical data.

Extracted radiomic, dosiomic,. genomic, and clinical features.

Preprocessed data (normalization, missing value handling, feature selection!,

Trained ML models such as Random Forest, Gradient Boosting, and Deep Learning.

Validated models using AUC, accuracy, and F1-score metrits.

Conclusion

Using multi-modal data with ML provides accurate and personalized toxicity prediction in radiotherapy. Future work should focus on federated learning, adaptive radiotherapy, and inclusion of more omics data for better generalization.