A CT IMAGING BIOMARKER FOR CD8+ LYMPHOCYTES INFILTRATION STRATIFICATION IN PATIENTS WITH NON-SMALL CELL LUNG CANCER

Authors: Fadila ZERKA[1], Mehdi FELFLI[1], Charles VOYTON[1], Alexandre THINNES[1], Sebastien JACQUES[1], Yan LIU[1], Antoine IANNESSI[1,2]

[1] Median Technologies, Valbonne, France, [2] Centre Antoine Lacassagne, Nice, France.

BACKGROUND

The efficacy of immunotherapy is influenced by the tumor immune microenvironment (TIME), notably the presence of CD8+ T cell infiltration. This infiltration correlates with improved immunotherapy outcomes and overall survival. CT image based radiomics is a non-invasive approach, allowing comprehensive analysis of the entire tumoral tissue. Our study aims to investigate the ability of radiomics features to stratify patients based on CD8+ lymphocyte infiltration levels and identify relevant radiomics features associated with these levels.

RESULTS

Four texture features allowed confidently discriminating CD8+ groups in the three use-cases. The model, trained on discriminative features, achieved a mean area under the curve AUC-ROC of 0.73(±0.08 std) and an AUC-ROC of 0.67 (95% CI: 53%, 80%) on the test set.

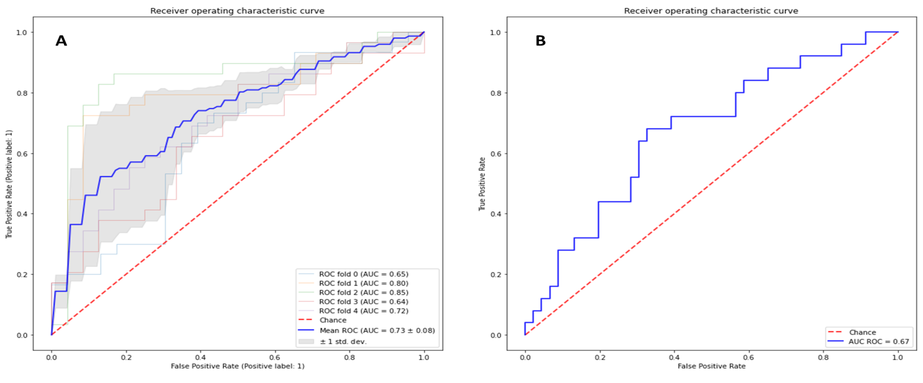

Figure 3 (A) ROC curves of the 5-fold cross validation radiomics-based models; (B) ROC curve for CD8+ infiltration high and low patient prediction in the independent test set.

METHODS

Four publicly available datasets, for patients with non-small cell lung cancer (NSCLC), were collected from TCIA/TCGA (radiogenomics (N=211), radiomics-genomics (N=89), TCGA-LUAD (N=69), and TCGA-LUSC (N=37)). 1246 radiomics features were extracted from each NSCLC lesion using segmentation validated by expert radiologist. Features with near zero variance, highly correlated features (r>0.9), and linear combinations between features were eliminated. Patients were split into two groups (CD8+ high/ CD8+ low). A Student's t-test was used to compare groups with normal distributions, while the Wilcoxon rank sum test was used for features with non-normal distributions. Finally, a logistic regression model with Elastic Net regularization was performed in the TCIA data using a five-fold CV to classify CD8+ cell infiltration level and tested on TCGA data.

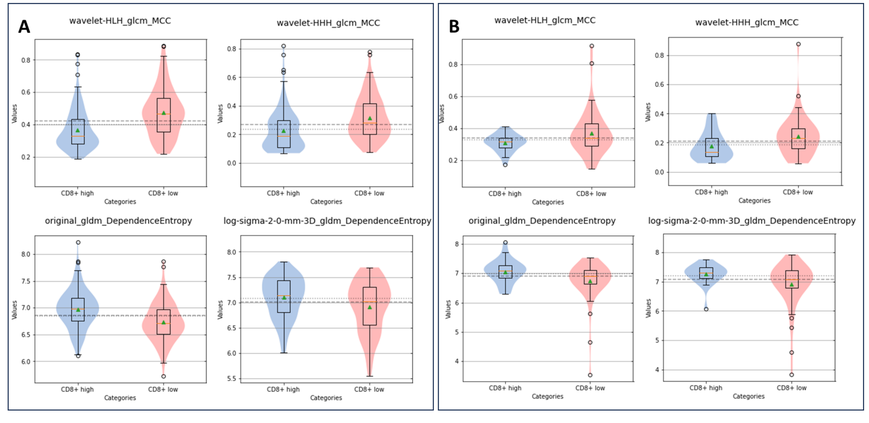

Figure 2 Violin box plots comparing the discriminative features: (A) training cohort, (B) test cohort.

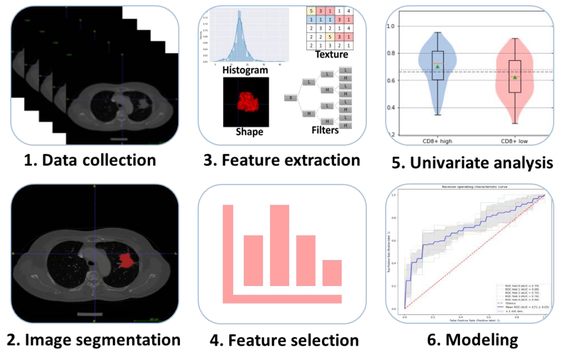

Figure 1 Schematic representation of the radiomics workflow: **Data collection:** CT and RNA-Seq data for patients with NSCLC collected from TCIA/TCGA. **Image segmentation:** Tumors segmented using a semi-automatic tool. **Feature extraction:** Radiomics features were extracted from the segmented tumors. **Feature selection:** The robust radiomics features were selected. **Univariate analysis:** Univariate analysis applied the remaining features to test their ability to stratify patients with CD8+ high vs CD8+ low. **Modeling:** The discriminative radiomics features were used to train the AI model and the performances were validated in the TCGA set.

CONCLUSIONS

CT texture biomarkers can non-invasively differentiate patients with high from low CD8+ lymphocyte infiltration levels. Consequently, these features hold promise as surrogate predictors for patient responses to immunotherapy and aiding clinical decision-making in identifying individuals who are more likely to benefit from such treatments.

Poster presentation at IASLC 2023 NACLC, Chicago, IL, USA | December 1-3, 2023

Contact: fadila.zerka@mediantechnologies.com