

## Automatic Staging and Subtype Determination for Non-Small Cell Lung Carcinoma Using PET Image Texture Analysis

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**Abstract :** In this study, our goal was to perform tumor staging and subtype determination automatically using different texture analysis approaches for a very common cancer type, i.e., non-small cell lung carcinoma (NSCLC). Especially, we introduced a texture analysis approach, called Law's texture filter, to be used in this context for the first time. The 18F-FDG PET images of 42 patients with NSCLC were evaluated. The number of patients for each tumor stage, i.e., I-II, III or IV, was 14. The patients had ~45% adenocarcinoma (ADC) and ~55% squamous cell carcinoma (SqCCs). MATLAB technical computing language was employed in the extraction of 51 features by using first order statistics (FOS), gray-level co-occurrence matrix (GLCM), gray-level run-length matrix (GLRLM), and Law's texture filters. The feature selection method employed was the sequential forward selection (SFS). Selected textural features were used in the automatic classification by  $k$ -nearest neighbors ( $k$ -NN) and support vector machines (SVM). In the automatic classification of tumor stage, the accuracy was approximately 59.5% with  $k$ -NN classifier ( $k=3$ ) and 69% with SVM (with one versus one paradigm), using 5 features. In the automatic classification of tumor subtype, the accuracy was around 92.7% with SVM one vs. one. Texture analysis of FDG-PET images might be used, in addition to metabolic parameters as an objective tool to assess tumor histopathological characteristics and in automatic classification of tumor stage and subtype.

**Keywords :** cancer stage, cancer cell type, non-small cell lung carcinoma, PET, texture analysis

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