國立臺北大學商學院統計學系

專題演講

講　題：Parsimonious Imaging Biomarkers for Lung Tumor Classification

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Abstract

Most existing quantitative imaging biomarkers (QIBs) in medical image classification describe local spatial behaviors based on rectangular images. This study develops a novel method to extract QIBs accounting for more global spatial characteristics of imaging, which can also be applied directly to non-rectangular regions of interest. A spatial imputation method utilizes image intensities within each region of interest from patients, based on an expectation-maximization algorithm. It represents image intensities as linear combinations of basis functions. The algorithm learns the spatial covariance structure for intensities, and decomposes the covariance in a way analogous to popular principal component analysis. We then use the "principal component scores" as data-driven QIBs. We find that the novel data-driven features often capture more global spatial characteristics. If there exists important large-scale spatial structure, our proposal is expected to extract much fewer QIBs. The proposed method is demonstrated with medical images from 85 patients with lung tumors. Patients were classified as benign or malignant, subsequently confirmed by pathological results or follow-ups. Only 4 proposed features were found from the data. Out-of-sample sensitivities and specificities in cross validation are quite comparable between the classification results using the proposed feature set and a competing set of 120 commonly used features. The result implies the parsimonious explanatory ability of the data-driven method for noisy images. These larger-spatial-scale QIBs may lead to a better understanding of the spatial patterns they capture.

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