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Radiomic Features of Lung Cancer and Their Dependency On CT Image Acquisition Parameters

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Purpose: While image features extracted from CT images are of great importance in aiding diagnosis and personalizing therapy planning for lung cancer patients, they may highly depend on CT acquisition parameters, leading non-reproducible and redundant information. We investigate potential e!ects of CT imaging acquisition parameters on radiomic features.

Methods: CT images from lung cancer patients were retrospectively reconstructed using di!erent reconstruction algorithms (FBP and iterative), kernels, displayed field-of-view, and slice thickness. Excised lung tumors placed in an anthropomorphic chest phantom were prospectively scanned in a CT scanner with di!erent kVs (70kV to 140 kV) and mAs (25 mAs to 250 mAs). We developed a process to investigate the e!ects of acquisition parameters on textural features. First, the texture features of the lung nodules from both in-vivo and ex-vivo CT images were modeled using localized histograms. Second, we aligned the texture features of the di!erent images of the same patient using Grid-based Histogram Matching (GHM), an image alignment method via histogram matching. Third, the aligned images were compared using Kullback-Leibler divergence and Perceptual Hash.

Results: For the same patient, a large set of lung tumor images were generated with di!erent image acquisition parameters. The tumor texture features directly extracted from these images are significantly di!erent from each other. The comparison on the aligned images shows complex results. For the images generated by varying slice thickness or reconstruction kernel, the aligned images can be almost perfectly matched. For the images generated using di!erent kV or mAs, however, the opposite pattern is observed.

Conclusion: Our preliminary study shows that image features are sensitive to some CT acquisition parameter. Further study is needed to test image feature reproducibility and redundancy. The identification of reproducible, non-redundant image features are crucial to multi-center clinical trials in the radiomics of the lung cancer.