**High resolution CT-based characterization analysis of idiopathic pulmonary fibrosis**

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**Introduction**

Idiopathic pulmonary fibrosis (IPF) has been define as the most aggressive and frequent form of idiopathic interstitial pneumonias. It is a chronic and life-threatening disease of unknown cause, occurring primarily in middle-aged and elederly adults. The aetiology of IPF remains elusive, and its progression is variable and unpredictable with fewer tissue-level biomarkers. A successful classification scheme and characterization analysis of IPF disease is therefore strongly needed for developing a robust and consistent IPF assessment and diagnosis system.

**Method**

In this study, we aim to analyze and characterize IPF tissue abnormalities over time using quantitative methods. Tissue regions of HRCT images were classified using CALIPER (Computer-Aided Lung Informatics for Pathology Evaluation and Ratings) software. The classified data was mapped to a statistical shape model, which allows a reliable comparison between different patients or within one patient of different time points. Tissue density was directly calculated from HRCT images, while tissue volume, spatial distribution of abnormalities and region changes over time were analyzed using the classified mapped data through extracting the location information of abnormalities. Principle component analysis (PCA) was applied to compare IPF lung shapes to the old normal ones.

**Result**

The result shows quantitatively that fibrosis usually has a consistently higher tissue density compares to normal region over time, and mainly locates in the lower lobes basally and peripherally. In contrast, emphysema has a lower densit values and appears in upper lobes often. Most IPF patients experience a decresement of lung volume, although there is no significant shape difference between old normal persons and IPF ones. Meanwhile different kind of disease could transform mutually over time.

**Conclusion**

The tissue density, tissue volume, and the location of abnormality are all important indexes for representing a quantitative statistical progression of IPF disease. This quantitative analysis would provide consistent potential tissue-level markers to help with the further modeling of mechanical ventilation/perfusion mismatch and impaired gas exchange.