Purpose: The purpose of this study was to quantify the effect of deformable registration on the values of lung texture features extracted from chest computed tomography (CT) scans.

Methods: Two clinical chest CT scans (slice thickness=1mm, pixel spacing<0.9mm, time between scans: 1 week-3 years) were collected for each of nine patients with no evidence of abnormal lung pathology. Automated lung segmentation was performed, and a deformable registration algorithm ("demons") was employed to register each patient's follow-up scan to their original baseline scan. Deformation accuracy was evaluated through inspection of a difference image and measurement of the mean Euclidean distance between landmarks in the baseline scan and deformed follow-up scan. Over 1,500 spatially-matched region-of-interest (ROI) pairs were extracted from each scan pair. First-order, fractal, Fourier, Laws' filter, and gray-level concurrence texture features (196 total features) were computed for each ROI, and the percent change of each feature between matched ROIs was calculated. Because scans contained normal pathology, we expected texture changes to be introduced primarily by deformation. Fourteen features with a percent change standard deviation less than 10% across patients were identified. Analysis of variance (ANOVA) was performed to determine whether percent changes in texture features between patients were statistically different.

Results: ANOVA showed mean percent changes in texture values to be significantly different between patients for all fourteen features ($p<0.001$); nevertheless, percent changes in texture features between baseline and follow-up deformed scans were consistently small across patients. Twelve of fourteen features selected demonstrated mean percent differences less than 5%. These features were distributed among first-order, fractal, and Laws' filter classes.

Conclusions: For some texture features, deformable registration may be performed without altering the feature value by more than 5% on average. These "invariant" features have potential for use in texture-based evaluation of progressive lung disease using serial scans requiring registration.