AbstractID: 8980 Title: Inconsistencies in Discrete Space and Continuous Space Lesion Boundary and Area Definitions

PURPOSE: Measurement of the size of anatomic regions of interest is used to diagnose disease, track growth, and evaluate response to therapy. The discrete nature of medical images allows for both continuous and discrete definitions of region boundary. These definitions may, in turn, support several methods of area calculation that give substantially different values. This study investigated several boundary definitions and area calculation methods to quantify these differences.

METHOD/MATERIALS: Two sets of region boundaries were investigated, one defined in continuous space and one defined in discrete space. A total 1,764 manual lung nodule boundaries were obtained from the Lung Image Database Consortium (LIDC) database. Lung nodule area was calculated for each of these discrete-space boundaries based on four area metrics: boundary-excluded pixel counting, boundary-included pixel counting, and two variants of Green's Theorem applied to vertices defined by the center of each boundary pixel. Adrenal gland area was calculated for 71 manual continuous-space adrenal gland boundaries based of four area metrics: Green's Theorem applied to the original continuous boundary, boundary-excluded pixel counting after direct conversion to discrete space, boundary-included pixel counting after direct conversion to discrete space, and pixel counting after pixel-center conversion to discrete space.

RESULTS: Based on the same set of adrenal gland boundaries, mean adrenal gland area ranged from 85.1 $\pm$ 35.4 pixels to 126.2 $\pm$ 42.8 pixels, depending on the method of area calculation. Based on the same set of lung nodule boundaries, mean lung nodule area ranged from 147.0 $\pm$ 212.1 pixels to 208.8 $\pm$ 251.7 pixels, depending on the method of calculation.

CONCLUSIONS: Inconsistent application of region boundary definition and area calculation may substantially impact measurement accuracy. Substantial differences exist among the various area calculation methods supporting the necessity, in both the research and clinical settings, to consistently apply boundary definition and area calculation methods.