AbstractID: 7311 Title: An external energy field for hemithoracic-cavity segmentation using deformable contours

A snake is a deformable curve used to localize region boundaries. Snake deformation is controlled by two terms: the internal and external energy fields. This study focuses on the generation of a hemithoracic cavity external field (HCEF) for the segmentation of hermithoracic cavities in CT scans.
HCEF construction is a multi-step process. First, the lung parenchyma is segmented using a combination of thresholding and shape descriptors and the trachea is delineated by region growing. Next, bone and contrast-enhanced tissue are segmented by application of a gray-level threshold. This threshold is chosen to exclude disease that demonstrates lower and more diffuse contrast uptake than mediastinal structures. A hemithoracic cavity bounding structure (HCBS) image is created by combining the trachea, lung parenchyma, and bone/mediastinum segmentations. Edge detection is then applied to the HCBS image, and a gradient vector field is calculated in the space external to the HCBS. Finally, a weighted distance transform is applied to the internal space of each HCBS to ensure that the internal energy field of the snake does not invade bounding structures. This method was applied to 20 CT sections and qualitatively evaluated.
In the presence of lung-deforming disease, the interface of the lung parenchyma and soft tissue is not suitable for hemithoracic-cavity segmentation. The HCEF and snake were applied to images of patients with severely deformed lung parenchyma due to mesothelioma. The snake showed excellent results localizing the lateral portion of the hemithoracic cavity and promising results along the mediastinum.
The HCEF was created for the segmentation of the hemithoracic cavities in the presence of lung deforming disease. In contrast to other external fields, the HCEF incorporates knowledge of specific HCBS identified by several independent segmentation steps. This method is designed to be robust in the presence of lung-deforming disease and demonstrates promising qualitative segmentation results.