Segmentation of Lung Lobe Structures using a Novel Artificial Intelligence Framework for Precise Lung Cancer Radiation Therapy

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Being the second most common cancer in both men and women, and having an average 5-year survival rate of only 17.7%, lung cancer is a high-incidence disease with low survival. The currently used Computed Tomography (CT) based treatment planning strategy requires a highly accurate anatomical segmentation of lobe structures for a more optimized radiotherapy treatment plan. However, due to variability in its ability to visually depict lung lobes, there is a subsequent lack of accuracy in therapy delivery and lobectomy. A specific application of the impact of developing a more accurate method of lung structure segmentation and characterization, is that clinicians will be able to more precisely surgically remove the cancer bearing lobe, and administer therapy. In this study, an Artificially Intelligent (AI) framework was developed for segmenting lung lobe structures, in real-time. Since data for training the AI framework did not exist, a set of de-identified CT scans were segmented in a manual approach, using an interactive open-source toolkit. AI framework was based on a deep neural network (DNN) approach, where a chain of carefully arranged neural networks were initiated to learn the segmentation process. Once trained, the DNN enabled computing the lobe segmentation and characterization in real-time. In future work, the neural network can be used by experts to improve treatment planning for lung cancer patients by better sparing the lung lobes that are performing well. Lung lobes will also be used to guide critical steps such as image registration, motion modeling and lung tissue elastography, all of which are currently done using a simplistic lung representation.

Awards Won:
Second Award of $1,500