CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP130109

Project Title:
Quantitative Cone-beam CT for Adaptive Radiation Therapy

Award Mechanism:
Individual Investigator

Principal Investigator:
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Entity:
The University of Texas Southwestern Medical Center

Lay Summary:

Approximately 60 percent of cancer patients receive therapeutic radiation at some point during their course of treatment. Daily localization and verification of the tumor and surrounding anatomy, prior to treatment, is critical to the success of high-accuracy radiotherapy, as it decreases the uncertainty treatment margins that must be employed in conventional radiation treatments. Recently, cone-beam computed tomography (CBCT) imaging has been integrated into radiation delivery systems and used for daily patient alignment. CBCT provides a three dimensional picture of the internal anatomy with the patient in the treatment position, making it possible to visualize the target just before the time of treatment with high accuracy. A well-recognized limitation of CBCT, however, is the degradation of the image quality from scatter within the projection images due to the large cone angle employed during acquisition of projection data. The scatter signal degrades the CBCT image quality by decreasing the contrast and by introducing shading artifacts that lead to inaccuracies in reconstructed CT-number. Poor contrast limits the ability to accurately localize low-contrast soft tissues, and inaccuracies in CT numbers hinder highly accurate analysis of actual delivered dose. The goal of the proposed research is to improve the low-contrast performance and the accuracy of CT-number in CBCT. Specifically, we propose a moving-blocker-based scatter correction scheme for CBCT, which is able to simultaneously estimate the scatter signal and reconstruct the entire volume within the field of view from a single CBCT scan. High-quality CBCT will lead to accurate localization of treatment target, and will ensure that the actual dose during each treatment is delivered to the prescribed target volume. This in turn will lead to higher local control rates, lower treatment-related complications and improved outcomes.