Scatter Correction for Cone-beam CT in Radiation Therapy (#5135)

A scatter correction scheme for X-ray CBCT based on CT images in the radiation treatment planning, which has the potential of outperforming all competing scatter correction techniques

Georgia Tech inventors are developing a new scatter correction scheme for X-ray CBCT based on the routinely used diagnostic multi-detector CT (MDCT) images in the radiation treatment planning, which has the potential of outperforming all competing scatter correction techniques. This technology demonstrates that the scatter signal can be obtained using the planning MDCT data due to its 'free' prior information.

To realize the scatter removal scheme, the primary signals of the CBCT projects are simulated via forward projection on MDCT data. The subtraction between the simulated projections from the true CBCT projection provides the scatters signals plus the primary signal difference between the MDCT and the CBCT scans, which is mainly due to the patient geometry deformation. After an accurate patient setup, the deformation only leads to high frequency primary signal perturbations. Based on the dominant-low frequency behavior of scatter signals, accurate scatter estimations are finally achieved via smoothing techniques.

Benefits/Advantages

- Does not modify either the hardware or the imaging protocols of the clinical system
- Effectively reduces the scatter signals in the CBCTY scan, and improves image quality
- Does not require an increase in the dose to the patients
- Does not require an increase in scan time
- While merits of the CBCT are retained, the new method utilizes planned MDCT as information to enhance the quality of the CBCT images
- High computation efficiently

Potential Commercial Applications

- Image-guided radiation therapy

Background/Context for This Invention

For better treatment guidance, cone beam CT (CBCT) scans are increasingly being used in image-guided radiation therapy (IGRT). However, the applications of CBCT are greatly hampered by its poor image quality due to scatter artifacts. In the current clinical practice, CBCT only provides patient geometry information for treatment setup. Quantitative x-ray CT images with high Hounsfield unit (HU) accuracy,

which are particularly important for dose verification and adaptive radiation therapy, are still not achievable using CBCT. Many scatter correction algorithms have been proposed in literature, while a standard practical solution remains unclear.

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More Information

Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/scatter-correction-cone-beam-ct-radiation-therapy

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot