AbstractID: 8442 Title: An image-domain based Cone Beam CT scatter correction method

Purpose: Due to a large cone angle, scatter contribution significantly degrades the image quality of cone beam computed tomography (CBCT) by introducing the cupping effect. The objective of this study is to develop a new CBCT scatter correction method in image domain.

Methods and Materials: The hypotheses of the proposed method are that the image intensity of different kind of materials in CBCT image is globally uniform and the cupping effect can be described as a bias field, a low frequency signal across the whole 3-D images. Based on above assumptions, we proposed a maximum *a posteriori* probability (MAP) framework to estimate the bias field contribution. The well-known fuzzy C-mean model is extended to define the likelihood function of the CBCT image. A markov random field model is used to describe the prior probability of the mixture defined in FCM model. The bias field is characterized by a zero mean Gaussian prior probability. An iterated conditional mode-like approach is utilized to maximize the objective function. The corrected CBCT image can be obtained by subtracting the bias field from original CBCT image.

Results: The performance of correcting the cupping effect of CBCT image with the proposed MAP framework was tested using both digital phantoms and clinical CBCT images. In the phantom studies the intensity of higher density material in the simulated CBCT images of contrast phantoms is even lower that that of lower density material due to cupping effect. The corrected CBCT image showed almost same intensity distribution as the original contrast phantom images. For real patient study, compared to the original brain CBCT image, the corrected CBCT image significantly improved the uniformity of intensity distribution of brain soft tissue.

Conclusion: The proposed image-based scatter correction method showed a promising result to reduce the cupping effect commonly encountered in CBCT image.