

Low dose CT using Prior Image Knowledge

Department of Nuclear and Quantum Engineering, KAIST

Sajid Abbas, Cho, Seungryoung

PURPOSE

In CT imaging, it is often observed that a patient's organ of interest needs to be imaged multiple times (e.g., CT perfusion or daily cone-beam CT in image-guided radiation therapy). Multiple CT imaging, if not carefully managed in terms of radiation dose, can lead to a serious health problem of the patient. We propose a method that may reduce imaging radiation dose substantially by use of prior image knowledge during the image reconstruction.

MATERIAL AND METHOD

In this work, we used the Shepp-Logan phantom. A modified phantom was also prepared from the original phantom by making a few changes in its ellipsoidal components. We simulated circular cone-beam geometry, and acquired prior image projection data sets from the original phantom at 360 views and another image projection data set from the modified phantom at 20 views at regular intervals. Projection data of the modified phantom were subtracted from the corresponding views of the prior image projection data. Iterative image reconstruction algorithm based on the minimization of the image total-variation (TV) was used to reconstruct the difference image containing the change.

RESULTS

After reconstructing the difference image, it was superimposed on the prior image in order to produce the modified phantom image. Figs. 1 and 2 represent the reconstructed image of the Shepp-Logan Phantom from 360 projection data, and the difference image from 20 projections, respectively.

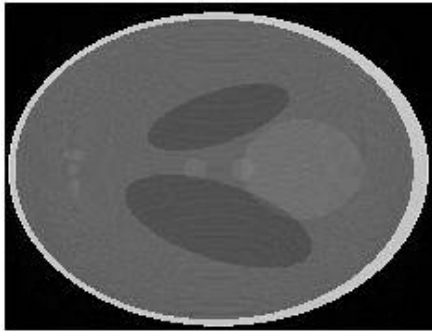


Figure 1

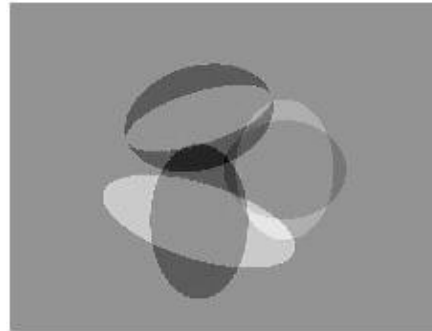


Figure 2

Fig. 3 below shows the modified phantom image reconstructed from 360 projection data for reference. Fig. 4 shows the modified phantom image superimposed by Fig. 2 on Fig. 1.

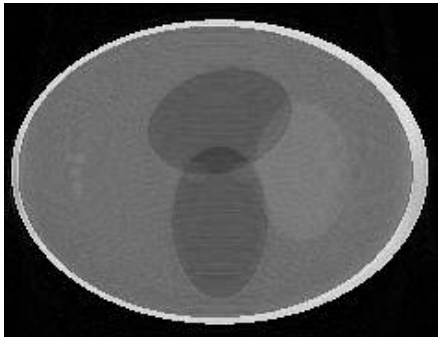


Figure 3

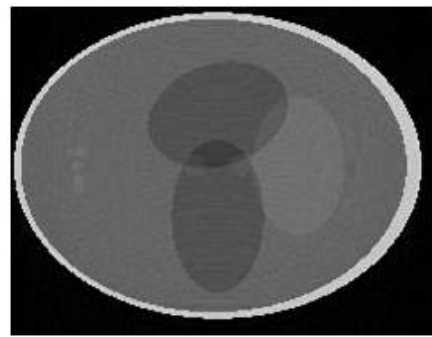


Figure 4

CONCLUSIONS

From the projection data set at only 20 views, we have successfully reconstructed the modified Shepp-Logan phantom by use of the prior image of the original Shepp-Logan phantom. We envision that a substantial dose reduction can be achieved using the proposed technique from this preliminary numerical study. Experimental validation of the proposed method is our ongoing study.

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중심단어: CT imaging, prior image, total-variation