

Purpose:

To investigate the denoising and feature enhancement of the TomoTherapy® MVCT image. The improvement on the target delineation was evaluated by the contrast to noise ratio (CNR) and by comparison of contouring on original and enhanced images.

Methods:

A texture enhancing anisotropic diffusion approach different from conventional method was implemented. Parameters may be tweaked to achieve the best performance. Over 300 daily MVCT images from 7 head and neck patients were used for the CNR improvement evaluation. The images were segmented into air, fat, muscle, bone and the contrast between muscle and fat was used for CNR calculation. Five physicians contoured the gross tumour volume (GTV) for three head and neck cancer patients on 34 original and enhanced MVCT images. Variation between the targets outlined using original and enhance MVCT studies was quantified by DICE coefficient and the coefficient of variance.

Results:

The CNR improved almost three times (from 3.5-5.5 to 10-17) while the sharp muscle-fat boundary was preserved. Based on volume of agreement between physicians, higher correlation was observed in GTV delineation for enhanced MVCT for patients 1, 2 and 3 by 15%, 3%, and 7%, respectively, while delineation variance among physicians was reduced using enhanced MVCT for 12 of 17 weekly image studies.

Conclusions:

The texture enhancing anisotropic diffusion performs well in reducing MVCT noise while enhancing image features. The improvement of the TomoTherapy® MVCT image CNR helps in target delineation.