Image fusion of two FBP-reconstructed digital tomosynthesis volumes from frontal and lateral acquisitions

J Arvidsson[1], C Söderman[2] and M Båth[1,2]

[1]Department of Medical Physics and Biomedical Engineering, Sahlgrenska University Hospital, Gothenburg, Sweden
[2]Department of Radiation Physics, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

Purpose: Digital tomosynthesis (DTS) has been used in chest imaging as a low radiation dose alternative to computed tomography (CT). DTS can to a certain degree separate overlapping anatomical structures at different depth levels using traditional filtered back projection (FBP) reconstruction schemes. However, the spatial resolution remains limited in the out-of-plane dimension. The aim of this work was to investigate if utilizing information from both a frontal and lateral DTS acquisition will give a more accurate 3D representation of the examined object.

Method: As a first indication of whether a dual-view DTS data acquisition can yield a fair resolution in the three spatial dimensions, a manual registration between two reconstructed DTS volumes, one being a frontal data acquisition and the other a lateral one, was performed. An anthropomorphic chest phantom was scanned using a linear DTS acquisition in frontal and lateral directions, at 120 kVp. The two corresponding volumes where reconstructed, downsampled to a lower resolution and manually co-registered. Being manual, the registration step was subjective and thus included identifying suitable landmarks that could be used to ensure that the correct rigid transformation between the two volumes was found. Finally a CT examination of the phantom, used as a ground truth 3D representation, was manually co-registered to the DTS data. The reconstruction, downsampling and co-registering was performed using both commercial and freely available software.

Major Findings: The resulting co-registered volume gave a more accurate isotropic 3D representation of the examined object than the two original reconstructions. Oblique planes were more accurately reproduced by the co-registered volume whereas coronal and sagittal planes were better reproduced by the original frontally and laterally reconstructed volumes.

Conclusions: The proposed method shows that fusing frontally and laterally reconstructed DTS volumes is possible and yields a more accurate isotropic 3D representation of the examined object than original DTS reconstructions. By utilizing a dual-view DTS acquisition geometry some advantages of including DTS data from orthogonal projection angles were illustrated. The findings are encouraging for further work on reconstruction algorithms using a dual-view DTS acquisition geometry.