Synthetic CT

A synthetic or pseudo CT image is basically a CT image generated through an MR image instead of using a CT scanner to scan one from scratch. Generating synthetic CT from MR is a simple idea but it requires solving a complex problem that air and bone look almost the same in an MR image.

van der Kolk et al. investigated whether the image quality of a specific deep learning-based synthetic CT (sCT) of the cervical spine is non-inferior to conventional CT.

Paired MRI and CT data were collected from 25 consecutive participants (\geq 50 years) with cervical radiculopathy. The MRI exam included a T1-weighted multiple gradient echo sequence for sCT reconstruction. For qualitative image assessment, four structures at two vertebral levels were evaluated on sCT and compared with CT by three assessors using a four-point scale (range 1-4). The noninferiority margin was set at 0.5 points on this scale. Additionally, acceptable image quality was defined as a score of 3-4 in \geq 80% of the scans. The quantitative assessment included geometrical analysis and voxelwise comparisons.

Qualitative image assessment showed that sCT was non-inferior to CT for overall bone image quality, artifacts, imaging of intervertebral joints and neural foramina at levels C3-C4 and C6-C7, and cortical delineation at C6-C7. Noninferiority was weak to absent for cortical delineation at levels C3-C4 and trabecular bone at both levels. Acceptable image quality was achieved for all structures in sCT and CT, except for trabecular bone in sCT and level C6-C7 in CT. Geometrical analysis of the sCT showed good to excellent agreement with CT. Voxelwise comparisons showed a mean absolute error of 80.05 (± 6.12) HU, dice similarity coefficient (cortical bone) of 0.84 (± 0.04) and structural similarity index of 0.86 (± 0.02) .

This deep learning-based sCT was noninferior to conventional CT for the general visualization of bony structures of the cervical spine, artifacts, and most detailed structure assessments ¹⁾.

1)

van der Kolk BBYM, Slotman DJJ, Nijholt IM, van Osch JAC, Snoeijink TJ, Podlogar M, van Hasselt BAAM, Boelhouwers HJ, van Stralen M, Seevinck PR, Schep NWL, Maas M, Boomsma MF. Bone visualization of the cervical spine with deep learning-based synthetic CT compared to conventional CT: A singlecenter noninferiority study on image quality. Eur J Radiol. 2022 Jun 17;154:110414. doi: 10.1016/j.ejrad.2022.110414. Epub ahead of print. PMID: 35780607.

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