

Convolutional Neural Network Based Sinogram Extrapolation for Truncated CT: Preliminary Study

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Purpose:

Evaluate the feasibility of the convolutional neural network based sinogram extrapolation method to extend the field-of-view in truncated computed tomography (CT).

Materials and Methods:

Initial sinogram datasets were collected using forward projections from the public CT dataset. As the training dataset, a hundred channels at both end of detector axis was erased on the initial sinogram. The pixel value of initial/training dataset was normalized as integer with range 0 to 1023. Deep learning convolutional neural network was developed including rectangular kernels and dilated convolution. Network was trained using ADAM optimizer to minimize mean square error (MSE) loss. Network was trained from 2000 pairs of initial/truncated sinogram during 50 epochs. Training results were evaluated using root mean square error (RMSE) and structure similarity (SSIM) for 200 pairs of test dataset.

Results:

In test dataset, mean RMSE and mean SSIM value between network output and initial label was 67.02 and 0.86, respectively. Input sinogram and network output were reconstructed using filtered back projection and visually compared.

Conclusions:

The convolutional neural network can be trained for extrapolating the part of truncated sinogram. The noise of network output will be reduced by upgrading the network structure.

Keywords: Convolutional neural network (CNN), Computed tomography (CT), Extrapolation