SUPPLEMENTAL MATERIALS

Supplemental Method

Inverse random transform is a method of constructing 3D volume from rotational 2D scans by integrating over 3-dimensional affine subspace on the natural hypersurface measure. Sinogram is the data derived from Radon transform, it is called Sinogram because of an off-center point source is a sinusoid(1-3)

The input to the model contains two channels – the first channel was the reconstructed 3D DSA volume as described in methods, and the second was the Franghi/Hessian "vesselness" volume as applied on the first input. The Franghi/Hessian vesselness filter is a tubular structure detector which helps to highlight vessel-like structures for the model. The model is a modified 3D U-Net with multiple dense blocks. The model has an encoding and decoding pathway, similar to that in the original U-Net. The encoding pathway is a downsampling network which compresses and encodes spatial information into abstract vectorized feature representations, while the decoding pathway is an upsampling network which transforms the feature-rich but spatially-compact representations into a spatially-accurate segmentation output. 'Skip' connections across layers in opposite encoding-decoding sides of the network are introduced to aid in localizing features and to restore spatial details lost during the downsampling path. Each step of the encoding and decoding pathways is made up of four-layer dense blocks. The dense blocks ensure that maximum information flow between the layers helping the model to learn. The output from the model is a softmax vector which has the same spatial dimensions as the input. A simple thresholding is then performed on the foreground channel of the output to produce a segmentation mask of the predicted aneurysm.

Supplemental Table

Supplemental Table 1 Details of Model Parameters

Input Size: 88x80x80x1	Filter	Output Sizes
4-layer dense block	3x3x3x32 filter 1x1x1 stride 0.7 keep probability	88x80x80x32
Maxpool layer	2x2x2 pool window 2x2x2 stride	44x40x40x32
4-layer dense block	3x3x3x64 filter 1x1x1 stride 0.7 keep probability	44x40x40x64
Maxpool layer	2x2x2 pool window 2x2x2 stride	22x20x20x64
4-layer dense block	3x3x3x128 filter 1x1x1 stride 0.7 keep probability	22x20x20x128
Transpose convolution	3x3x3x64 filter 2x2x2 stride	44x40x40x64
Concatenation	-	44x40x40x128
4-layer dense block	3x3x3x64 filter 1x1x1 stride 0.7 keep probability	44x40x40x64
Transpose convolution	3x3x3x32 filter 2x2x2 stride	88x80x80x32
Concatenation	-	88x80x80x64
4-layer dense block	3x3x3x32 filter 1x1x1 stride 0.7 keep probability	88x80x80x32
4-layer dense block	3x3x3x32 filter 1x1x1 stride 0.7 keep probability	88x80x80x16
Convolution	1x1x1x2 filter 1x1x1 stride	88x80x80x2

1. Helgason S. Groups and Geometric Analysis: Integral Geometry, Invariant Differential Operators, and Spherical Functions: American Mathematical Society, 2000.

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3. Radon J. On the Determination of Functions from Their Integral Values along Certain Manifolds. IEEE Trans Med Imaging 1986;5(4):170-176. doi: 10.1109/tmi.1986.4307775