# Self-Supervised Edge Detection Reconstruction for Topology-Informed 3D Axon Segmentation and Centerline Detection Supplementary Material

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## A. Canny Method Computational Complexity

The computational bottlenecks of the Canny method are convolutions with fixed size Gaussian and gradient filters [1]. Let the input image size during SSL training be $X \times Y \times Z$. For each slice along the $z$-axis, the best complexity of the Canny method is $O(XY\ln(XY))$, where $\ln$ is the natural logarithm. This complexity can be achieved using Fast Fourier Transform properties. We apply the Canny method to every $z$-slice of the input image, so the best complexity on each input image is $O(XYZ\ln(XY))$.

However, in practice, the edges image only needs to be computed once. One can precompute the edges by applying the Canny method to each $z$-axis slice of the entire SSL training image volume, and then saving the result, which will be a 3D binary image that is the same size as the raw SSL training volume. During SSL training time, one can load the saved edges volume, and then crop it using the same (randomly chosen) coordinates used to crop the raw input image in each training iteration.

## References

[1] John Canny. A computational approach to edge detection. *IEEE Transactions on pattern analysis and machine intelligence*, (6):679–698, 1986. 1