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## Retinal Vessel Delineation Using a Brain-Inspired Wavelet Transform and Random Forest

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### Abstract

This paper presents a supervised retinal vessel segmentation by incorporating vessel filtering and wavelet transform features from orientation scores (OSs), and green intensity. Through an anisotropic wavelet-type transform, a 2D image is lifted to a 3D orientation score in the Lie-group domain of positions and orientations  $\mathbb{R}^2 \times S^1$ . Elongated structures are disentangled into their corresponding orientation planes and enhanced via multi-orientation vessel filtering. In addition, scale-selective OSs (in the domain of positions, orientations and scales  $\mathbb{R}^2 \times S^1 \times \mathbb{R}^+$ ) are obtained by adding a scale adaptation to the wavelet transform. Features are optimally extracted by taking maximum orientation responses at multiple scales, to represent vessels of changing calibers. Finally, we train a Random Forest classifier for vessel segmentation. Extensive validations show that our method achieves a competitive segmentation, and better vessel preservation with less false detections compared with the state-of-the-art methods.

*Keywords:* Random Forest, retinal image, vessel segmentation, wavelet transform, orientation score (OS).

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