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3D Filament Network Segmentation with Multiple Active Contours TING XU, DIMITRIOS VAVYLONIS, XIAOLEI HUANG, Lehigh University — Fluorescence microscopy is frequently used to study two and three dimensional network structures formed by cytoskeletal polymer fibers such as actin filaments and microtubules. While these cytoskeletal structures are often dilute enough to allow imaging of individual filaments or bundles of them, quantitative analysis of these images is challenging. To facilitate quantitative, reproducible and objective analysis of the image data, we developed a semi-automated method to extract actin networks and retrieve their topology in 3D. Our method uses multiple Stretching Open Active Contours (SOACs) that are automatically initialized at image intensity ridges and then evolve along the centerlines of filaments in the network. SOACs can merge, stop at junctions, and reconfigure with others to allow smooth crossing at junctions of filaments. The proposed approach is generally applicable to images of curvilinear networks with low SNR. We demonstrate its potential by extracting the centerlines of synthetic meshwork images, actin networks in 2D TIRF Microscopy images, and 3D actin cable meshworks of live fission yeast cells imaged by spinning disk confocal microscopy.

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