

Segmentation and Tracking of mitotic chromosomes

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The condensation of chromatin during mitosis allows the visualization of individual chromosomes by light and fluorescence microscopy. While numerous methods exist for studying chromosomes in fixed samples, the segmentation and tracking of chromosomes in living cells remains prohibitive due to both imaging and computational challenges. Imaging at high resolution leads to bleaching and phototoxicity, and algorithms for chromosome segmentation and tracking have not been developed.

Using a super-resolution confocal microscope, we optimized a workflow for high spatial and temporal resolution imaging of mitosis by carefully balancing high resolution and low phototoxicity. We performed manual segmentation of the chromosomes at different stages of mitosis and used the generated dataset to train deep learning models for automatic segmentation and tracking. Using this pipeline, we segmented and tracked all mitotic chromosomes in three different cell lines.