Increasing the imaging depth through computational scattering correction (Conference Presentation)

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ABSTRACT

Imaging depth is one of the most prominent limitations in light microscopy. The depth in which we are still able to resolve biological structures is limited by the scattering of light within the sample. We have developed an algorithm to compensate for the influence of scattering. The potential of algorithm is demonstrated on a 3D image stack of a zebrafish embryo captured with a selective plane illumination microscope (SPIM). With our algorithm we were able shift the point in depth, where scattering starts to blur the imaging and effect the image quality by around 30 µm. For the reconstruction the algorithm only uses information from within the image stack. Therefore the algorithm can be applied on the image data from every SPIM system without further hardware adaption. Also there is no need for multiple scans from different views to perform the reconstruction. The underlying model estimates the recorded image as a convolution between the distribution of fluorophores and a point spread function, which describes the blur due to scattering. Our algorithm performs a space-variant blind deconvolution on the image. To account for the increasing amount of scattering in deeper tissue, we introduce a new regularizer which models the increasing width of the point spread function in order to improve the image quality in the depth of the sample. Since the assumptions the algorithm is based on are not limited to SPIM images the algorithm should also be able to work on other imaging techniques which provide a 3D image volume.

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