

Artificial defocus for displaying markers in microscopy Z-stacks.

Giusti A, Taddei P, Magli C, Corani G, Gambardella L, Gianaroli L.

Source

Dalle Molle Institute for Artificial Intelligence, Lugano, Switzerland. alessandro@idsia.ch

Abstract

As microscopes have a very shallow depth of field, Z-stacks (i.e. sets of images shot at different focal planes) are often acquired to fully capture a thick sample. Such stacks are viewed by users by navigating them through the mouse wheel. We propose a new technique of visualizing 3D point, line or area markers in such focus stacks, by displaying them with a depth-dependent defocus, simulating the microscope's optics; this leverages on the microscopists' ability to continuously twiddle focus, while implicitly performing a shape-from-focus reconstruction of the 3D structure of the sample. User studies confirm that the approach is effective, and can complement more traditional techniques such as color-based cues. We provide two implementations, one of which computes defocus in real time on the GPU, and examples of their application.