COMPUTATIONAL SUPER-RESOLUTION MICROSCOPY: HISTORIC REVIEW, CURRENT STATUS, AND FUTURE APPLICATIONS

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ABSTRACT

Many strategies for overcoming the optical diffraction limit (e.g. PALM, STORM, SOFI, STED, SIM) are now widely accepted tools in biological microscopy. However, a more elusive goal is to demonstrate a computational approach that can ***significantly and verifiably increase the resolution (by three or more times) in a conventional microscope,*** while imaging biological samples labeled with ***standard, non-switching*** fluorophores. Although seemingly impossible, such a concept was actually proposed, in principle, in as early as the 1980s. However, it is not until much more recently that we have demonstrated its capability in practice [1-2]. In this talk, we give a brief historic review of this super-resolution technique, present its current state of the art, and discuss some potentially promising uses in the field of biology.

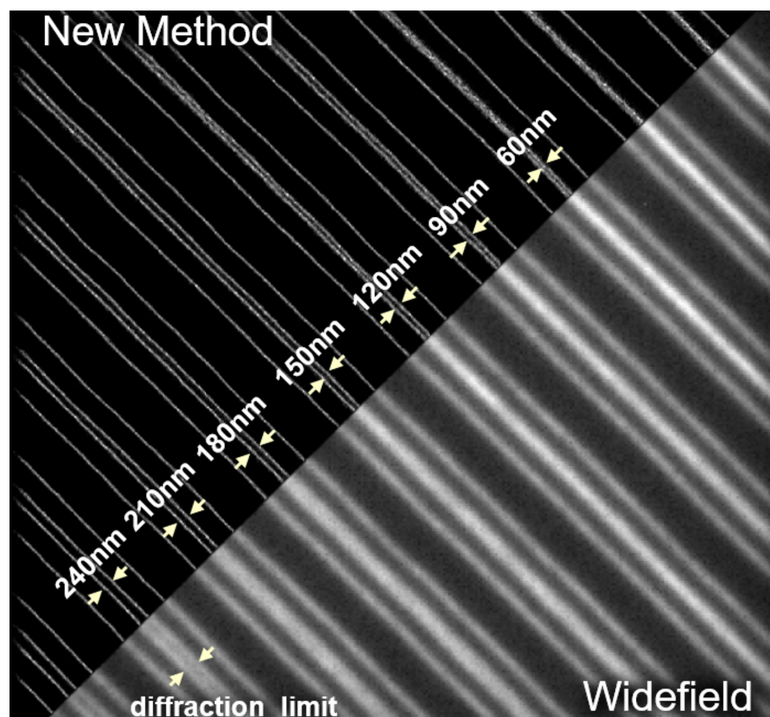

Fig. 1: Argolight fluorescent test slide shows our computational super-resolution approach can achieve 60nm lateral resolution which is nearly ***four times improvemen***t over the 240nm diffraction limit. Objective: NA1.4, 100x.

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[2] Xing, J., Chen, S., Becker, S. R., Yu, J.-Y., and Cogswell, C. J., "ℓ_1-regularized maximum likelihood estimation with focused-spot illumination quadruples the diffraction-limited resolution in fluorescence microscopy." *Opt. Express* **28**, 39413-39429 (2020).