THE INTELLIGENT MICROSCOPE  AT THE NANOSCALE: MULTIMODAL MICROSCOPY FROM
FLUORESCENCE TO LABEL-FREE.
Alberto Diaspro

DIFILAB, Dipartimento di Fisica, Università di Genova, Italia.
Nanoscopy,Istituto Italiano di Tecnologia, CHT, Erzelli, Genova, Italia.
Istituto di Biofisica, CNR, Genova, Italia.

Advanced optical microscopes, form suoper resolved methods to quantum
optical microscopy, are analytical instruments able to produce images
that are rich sources of quantitative information towards an
unprecedented insight into the molecular mechanisms that govern and
determine the fate of living cells. Their developments are positioned at
the interface between biology and physics, and today in. More
specifically, multimodal optical microscopy is a growing attitude
boosted by artificial intelligence that makes intelligent the
microscope. In the era of super-resolved fluorescence microscopy,
fluorescence plays a significant role, including its photochemical
parameters, from brightness to lifetime, and non-linear approaches, like
those associated with multi-photon excitation able to exploit intrinsic
fluorescence and SHG/THG. In this framework, polarization methods like
Mueller matrix microscopy expand those contrast mechanisms available for
imaging towards labe-free. The intelligent microscope is AI-guided
through a computational core based on independent component analysis
(ICA) un-supervised machine learning towards supervised deep learning
with the ambitious target to create a robust virtual environment "to see
"what we could not perceive before".  An interesting case study is
related to understanding the visualization of chromatin organization.

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