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